# 5 EN-DC with at least one NR cell in FR2

## 5.0 General

This clause contains test scenarios for E-UTRA and NR dual connectivity with E-UTRA as PCell and NR as PSCell. At least one NR cell is in Frequency Range 2.

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

## 5.1 Void

## 5.2 Void

## 5.3 RRC\_CONNECTED state mobility

### 5.3.1 Void

### 5.3.2 RRC connection mobility control

#### 5.3.2.1 Void

#### 5.3.2.2 Random access

##### 5.3.2.2.1 EN-DC FR2 contention based random access

Editor's note: This test case is incomplete for Test 2, 3 and 7. The following aspects are either missing or not yet determined:

- The settable window for first preamble uplink power and the uplink calibration process are FFS.

- The test requirement for absolute uplink power is FFS.

- The test requirement for relative uplink power is FFS.

- The uncertainty value and test requirement for PRACH timing are in [ ]

- The results of the TT analysis are provisional until the corresponding MU values are agreed

5.3.2.2.1.1 Test purpose

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits.

5.3.2.2.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC with FR2.

5.3.2.2.1.3 Minimum conformance requirement

The random access procedure is used when establishing the layer 1 communication between the UE and NG-RAN. The random access is as defined in TS 38.213 [8] clause 7.4 and the control of the RACH transmission is as defined in TS 38.321 [12] clause 5.1.

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula as defined in TS 38.213 [8] clause 7.4 and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as defined in TS 38.101-2 [3] Table 6.3.4.2-1. The relative power applied to additional preambles shall have an accuracy as specified in TS 38.101-2 [3] Tables 6.3.4.3-1 and 6.3.4.3-2.

The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in TS 38.321 [12] clause 5.1.4.

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2 in TS 38.321 [12].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [12].

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [12].

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

The normative reference for this requirement is TS 38.133 [6] clause 6.2.2.

5.3.2.2.1.4 Test description

5.3.2.2.1.4.1 Initial conditions

This test can be run in the configurations defined in Table 5.3.2.2.1.4.1-1.

Table 5.3.2.2.1.4.1-1: Supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Test Config Index | Description |
| 5.3.2.2.1-1 | 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| 5.3.2.2.1-2 | 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations. | | |

Before the test procedure, Downlink and Uplink calibrations are carried out to derive signalled parameter values. This is necessary to ensure that the test case operates within the specified ranges. The detail of the calibration process is implementation dependent, but shall derive the values of ΔDL and ΔUL according to the following principles:

With the UE configured to report SS-RSRP, the ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value RSRP\_x, x is treated as a positive integer value.

With the UE configured to send a first PRACH preamble, ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied at the Reference point, and with signalled values *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm.

Configure the test equipment and the DUT according to the parameters in Table 5.3.2.2.1.4.1-2.

Table 5.3.2.2.1.4.1-2: Initial conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.3.2.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.3.2.2.1.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.1.5-1.

3. Downlink signals for NR cell are initially set up according to clause C.2.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.1.4.2 Test procedure

For this test two cells are used, an E-UTRA serving cell (PCell) and an NR FR2 PSCell. For the NR PSCell, the System Simulator shall not explicitly assign a random access preamble via dedicated signalling in the downlink.

1. Ensure the UE is in state E-UTRA RRC\_CONNECTED with generic procedure parameters *Connectivity* E-UTRA/EPC with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Table 5.3.2.2.1.5-1.

3. The test system shall send a RRCReconfiguration message to the UE to add NR PSCell, then the UE shall trigger a random access procedure.

4. Test 1: Correct behaviour when transmitting Random Access Preamble

4.1. The UE shall send a preamble to the System Simulator. The System Simulator shall check that the Random Access Preamble belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured rsrp-ThresholdSSB.

5. Test 2: Correct behaviour when receiving Random Access Response

5.1. Repeat steps 1-3.

5.2. The UE shall send preambles to the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response containing Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

5.3. As the received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires.

5.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator.

5.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3.

5.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.1.5. Measure the relative power and timing applied to additional preambles (last 4 preambles) and it shall not exceed the values specified in 5.3.2.2.1.5.

6. Test 3: Correct behaviour when not receiving Random Access Response

6.1. Repeat steps 1-3.

6.2. The UE shall send preambles to the System Simulator. The System Simulator shall not respond to the first 4 preambles.

6.3. As no Random Access Response was received within the RA Response window, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires.

6.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator.

6.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3.

6.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.1.5. Measure the relative power and timing applied to additional preambles (last 4 preambles) and it shall not exceed the values specified in 5.3.2.2.1.5.

7. Test 4: Correct behaviour when receiving an UL grant for msg3 retransmission

7.1. Repeat steps 1-3.

7.2. The UE shall send a preamble to the System Simulator. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble.

7.3. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3 including C-RNTI MAC control element.

7.4. The System Simulator shall send PDCCH addressed to the Temporary C-RNTI after receiving the msg3.

7.5. The UE shall re-transmit the msg3 including C-RNTI MAC control element.

7.6. The System Simulator shall check if UE re-transmit the msg3.

8. Test 5: Correct behaviour when receiving a successful UE Contention Resolution

8.1. Repeat steps 1-3.

8.2. The UE shall send a preamble to the System Simulator. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble.

9.3. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3 including C-RNTI MAC control element.

9.4. The System Simulator shall send a PDCCH addressed to the C-RNTI.

9.5. The UE shall send PUSCH according to the received PDCCH addressed to the C-RNTI.

10. Test 7: Correct behaviour when contention Resolution timer expires

10.1. Repeat steps 1-3.

10.2. The UE shall send a preamble to the System Simulator. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble.

10.3. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3.

10.4. The System Simulator shall not send a response.

10.5. As there was no response, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the Contention Resolution Timer expires and then after the backoff timer expires.

10.6. Measure the power and timing of the first preamble after the Contention Resolution Timer and backoff timer expire and it shall not exceed the values specified in 5.3.2.2.1.5.

5.3.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3.1 with the following exceptions:

Table 5.3.2.2.1.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions |  |
| Common exceptions to the contents of TS 38.508-1 [14] | Table 4.6.3-115 with SSB-Index 0  Table 4.6.3-120 with SSB-Index 0 |

Table 5.3.2.2.1.4.3-1: *FrequencyInfoUL-SIB* for Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-62 | | | |
| Information Element | Value/remark | Comment | Condition |
| FrequencyInfoUL-SIB SEQUENCE { |  |  |  |
| p-Max | 23 | 23 dBm |  |
| } |  |  |  |

Table 5.3.2.2.1.4.3-2: RACH-ConfigCommon for Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon::= SEQUENCE { |  |  |  |
| rach-ConfigGeneric | RACH-ConfigGeneric |  |  |
| totalNumberOfRA-Preambles | 48 |  |  |
| ssb-perRACH-OccasionAndCB-PreamblesPerSSB CHOICE { |  |  |  |
| oneFourth | n48 |  | FR2 |
| } |  |  |  |
| groupBconfigured SEQUENCE { |  |  |  |
| numberOfRA-PreamblesGroupA | 48 |  |  |
| } |  |  |  |
| ra-ContentionResolutionTimer | sf48 |  |  |
| rsrp-ThresholdSSB | RSRP\_69 +ΔDL | ΔDL is derived from the downlink calibration process |  |
| prach-RootSequenceIndex CHOICE { |  |  |  |
| I139 | 0 |  |  |
| } |  |  |  |
| msg1-SubcarrierSpacing | kHz 120 |  |  |
|  |  |  |  |
| } |  |  |  |

Table 5.3.2.2.1.4.3-3: RACH-ConfigGeneric for Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| prach-ConfigurationIndex | 190 |  | FR2 |
| msg1-FDM | one |  | FR2 |
| zeroCorrelationZoneConfig | 11 |  |  |
| preambleReceivedTargetPower | -100 |  |  |
| preambleTransMax | n6 |  |  |
| powerRampingStep | dB2 |  |  |
| ra-ResponseWindow | sl10 |  |  |
| } |  |  |  |

Table 5.3.2.2.1.4.3-4: *ServingCellConfigCommonSIB* for Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-169 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| ssb-PositionsInBurst SEQUENCE { |  |  |  |
| inOneGroup | ‘1100 0000'B |  |  |
| } |  |  |  |
| ss-PBCH-BlockPower | 20 +ΔUL | ΔUL is derived from the uplink calibration process |  |
| } |  |  |  |

5.3.2.2.1.5 Test requirement

Table 5.3.2.2.1.5-2 defines the primary level settings for contention based random access test in FR2 for NR Standalone. Tables 5.3.2.2.1.5-3, 5.3.2.2.1.5-4 and 5.3.2.2.1.5-5 define the Absolute power limits, Relative power limits and uplink timing error limits respectively, and all include test tolerances.

Table 5.3.2.2.1.5-1: General test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| SSB Configuration | Config 1,2 |  | SSB.1 FR2 | As defined in A.3.2 |
| CSI-RS for tracking | Config 1,2 |  | TRS.2.1 TDD |  |
| Duplex Mode for Cell 2 | Config 1,2 |  | TDD |  |
| TDD Configuration | Config 1,2 |  | TDDConf.3.1 | As defined in A.1.5 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 24 |  |
| OCNG Pattern Note 1 | |  | OP.3 | As defined in A.2.1 |
| PDSCH Reference Channel Note 2 | Config 1,2 |  | SR.3.1 TDD | As defined in A.1.1 |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | As defined in A.1.2 |
| RMC CORESET Reference Channel | Config 1,2 |  | CCR.3.1 TDD | As defined in A.1.3 |
| NR RF Channel Number | |  | 1 |  |
| EPRE ratio of PSS to SSS | | dB | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH\_DMRS | | dB |
| EPRE ratio of PDCCH\_DMRS to SSS | | dB |
| EPRE ratio of PDCCH to PDCCH\_DMRS | | dB |
| EPRE ratio of PDSCH\_DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH\_DMRS | | dB |
| *ss-PBCH-BlockPower* | | dBm/ SCS | +20 +ΔUL | As defined in TS 38.331 [13].  ΔUL is derived from the uplink calibration process Note 3 |
| Configured UE transmitted power () | | dBm | maximum value configurable for certain power class | As defined in clause 6.2.4 of TS 38.101-2 [3] |
| PRACH Configuration | |  | PRACH.1 FR2 | As defined in A.7.2, with exceptions as defined below |
| *rsrp-ThresholdSSB* | | dBm | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| *preambleReceivedTargetPower* | | dBm | -100 | As defined in TS 38.331 [13] |
| NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.  NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.  NOTE 3: The ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.  NOTE 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value. | | | | |

Table 5.3.2.2.1.5-2: OTA-related test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| AoA setup | |  | Setup 1 | As defined in A.9.1 |
| Assumption for UE beamsNote 2 | |  | Rough |  |
| SSB with index 0 | Es Note1 | dBm/SCS | -80.6 | Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -80.6 |
| Es/IotBB | dB | 21.09 |  |
| Io | dBm/95.04 MHz | -56.01 | Io in symbols containing SSB index 0 |
| SSB with index 1 | Es Note1 | dBm/SCS | -95.0 | Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -95.0 |
| Es/IotBB | dB | 6.69 |  |
| Io | dBm/95.04 MHz | -70.41 | Io in symbols containing SSB index 1 |
| Propagation Condition | | - | AWGN |  |
| NOTE 1: No artificial noise is applied in this test.  NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

Test 1: Correct behaviour when transmitting Random Access Preamble

- The Random Access Preamble shall be one of the Random Access Preambles associated with SSB index 0.

Test 2: Correct behaviour when receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.1.5-3.

- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.1.5-4.

- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.1.5-5.

Test 3: Correct behaviour when not receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.1.5-3.

- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.1.5-4.

- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.1.5-5.

Test 4: Correct behaviour when receiving an UL grant for msg3 retransmission

- The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

Test 5: Correct behaviour when receiving a successful UE Contention Resolution

- The UE shall send PUSCH according to the PDCCH addressed to the C-RNTI.

Test 7: Correct behaviour when contention resolution timer expires

- The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the back off time expires if the contention resolution timer expires.

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.1.5-3.

- The transmit timing of the PRACH transmission shall be within the accuracy specified in Table 5.3.2.2.1.5-5.

Table 5.3.2.2.1.5-3 Absolute power tolerance Test requirements

|  |  |
| --- | --- |
| Conditions | Tolerance |
| Normal | ± FFS dB |

Table 5.3.2.2.1.5-4 Relative power tolerance Test requirements

|  |  |  |
| --- | --- | --- |
| Measured power | Power step P (dB) | PRACH (dB) |
| Measured power of both PRACHs being compared > (PmaxNote1 – 6dB) | 2 ≤ ΔP < 3 | ± (4+FFS). |
| Measured power of either PRACHs being compared ≤ (PmaxNote1 – 6dB) | ± (6+FFS) |
| NOTE 1: Pmax is the Min peak EIRP defined in clause 6.2.1 of TS 38.101-2 [3], selected according to power class and operating band. | | |

Table 5.3.2.2.1.5-5: Te Timing error Test requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals s(KHz) | Te |
| 2 | 120 | 120 | 224+[48]\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [7] | | | |

##### 5.3.2.2.2 EN-DC FR2 non-contention based random access

Editor's note: This test case is incomplete for Test 3 and 4. The following aspects are either missing or not yet determined:

- The settable window for first preamble uplink power and the uplink calibration process are FFS.

- The test requirement for absolute uplink power is FFS.

- The test requirement for relative uplink power is FFS.

- The uncertainty value and test requirement for PRACH timing are in [ ]

- The results of the TT analysis are provisional until the corresponding MU values are agreed

5.3.2.2.2.1 Test purpose

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits.

5.3.2.2.2.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC with FR2. Additionally Test 2 is applicable to UE that supports CSI-RS based Random Access Preamble which requires UE to support csi-RS-CFRA-ForHO.

5.3.2.2.2.3 Minimum conformance requirement

The random access procedure is used when establishing the layer 1 communication between the UE and NG-RAN. The random access is as defined in TS 38.213 [8] clause 7.4 and the control of the RACH transmission is as defined in TS 38.321 [12] clause 5.1.

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula as defined in TS 38.213 [8] clause 7.4 and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as defined in TS 38.101-2 [3] Table 6.3.4.2-1. The relative power applied to additional preambles shall have an accuracy as specified in TS 38.101-2 [3] Tables 6.3.4.3-1 and 6.3.4.3-2.

The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in TS 38.321 [12] clause 5.1.4.

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [12].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *cfra-csirs-DedicatedRACH-Threshold* amongst the associated CSI-RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [12].

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [12] for the next available PRACH occasion, and transmit the preamblewith the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [12] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE's C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [12].

The normative reference for this requirement is TS 38.133 [6] clause 6.2.2.

Non-contention based random access procedure is not initialized for Other SI requested from UE or for beam failure recovery, so the requirements related to those features are omitted.

5.3.2.2.2.4 Test description

5.3.2.2.2.4.1 Initial conditions

This test can be run in the configurations defined in Table 5.3.2.2.2.4.1-1.

Table 5.3.2.2.2.4.1-1: Supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Test Config Index | Description |
| 5.3.2.2.2-1 | 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| 5.3.2.2.2-2 | 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | | |

Before the test procedure, Downlink and Uplink calibrations are carried out to derive signalled parameter values. This is necessary to ensure that the test case operates within the specified ranges. The detail of the calibration process is implementation dependent, but shall derive the values of ΔDL and ΔUL according to the following principles:

With the UE configured to report SS-RSRP, the ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value RSRP\_x, x is treated as a positive integer value.

With the UE configured to send a first PRACH preamble, ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied at the Reference point, and with signalled values *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm.

Configure the test equipment and the DUT according to the parameters in Table 5.3.2.2.2.4.1-2.

Table 5.3.2.2.2.4.1-2: Initial conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.3.2.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.3.2.2.2.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.2.5-1.

3. Downlink signals for NR cell are initially set up according to clause C.2.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.2.4.2 Test procedure

For this test two cells are used, an E-UTRA serving cell (PCell) and an NR FR2 PSCell. For the NR PSCell, the System Simulator shall not explicitly assign a random access preamble via dedicated signalling in the downlink.

1. Ensure the UE is in state E-UTRA RRC\_CONNECTED with generic procedure parameters *Connectivity* E-UTRA/EPC with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Table 5.3.2.2.2.5-1.

3. SS sends a RRCReconfiguration to trigger a contention-free random access procedure according to Table 5.3.2.2.2.4.3-2.

4. Test 1: Correct behaviour when transmitting SSB-based Random Access Preamble

4.1. The UE shall send a preamble to the System Simulator. The System Simulator shall check that the Random Access Preamble has the Preamble Index associated with the SSB with index 0, that it arrives on a PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and that the selected PRACH occasion belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

5. Test 2: Correct behaviour when transmitting CSI-RS-based Random Access Preamble

5.1. Set the parameters according to Table 5.3.2.2.2.5-1 Subtest 2.

5.2. Repeat steps 1-3

5.3. The UE shall send a preamble to the System Simulator. The System Simulator shall check that the Random Access Preamble has the Preamble Index associated with the CSI-RS configured, that it arrives on a PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and that the selected PRACH occasion belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.

6. Test 3: Correct behaviour when receiving Random Access Response

6.1. Repeat steps 1-3

6.2. The UE shall send preambles to the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response containing Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.3. As the received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power.

6.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator.

6.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE may stop monitoring for Random Access Response(s).

6.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.2.5. Measure the relative power and timing applied to additional preambles (last 2 preambles) and it shall not exceed the values specified in 5.3.2.2.2.5.

7. Test 4: Correct behaviour when not receiving Random Access Response

7.1. Repeat steps 1-3.

7.2. The UE shall send preambles to the System Simulator. The System Simulator shall not respond to the first 2 preambles.

7.3. As no Random Access Response was received within the RA Response window configured in *RACH-ConfigCommon*, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power.

7.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator.

7.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE may stop monitoring for Random Access Response(s).

7.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.2.5. Measure the relative power and timing applied to additional preambles (last 2 preambles) and it shall not exceed the values specified in 5.3.2.2.2.5.

5.3.2.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3.1 with the following exceptions:

Table 5.3.2.2.2.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions |  |
| Common exceptions to the contents of TS 38.508-1 [14] | Table 4.6.3-115 with SSB-Index 0  Table 4.6.3-120 with SSB-Index 0 |

Table 5.3.2.2.2.4.3-1: RACH-ConfigCommon for Non-Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon::= SEQUENCE { |  |  |  |
| rach-ConfigGeneric | RACH-ConfigGeneric |  |  |
| totalNumberOfRA-Preambles | 48 |  |  |
| groupBconfigured SEQUENCE { |  |  |  |
| numberOfRA-PreamblesGroupA | 48 |  |  |
| } |  |  |  |
| rsrp-ThresholdSSB | RSRP\_69 +ΔDL | ΔDL is derived from the downlink calibration process | Subtest 1 |
| prach-RootSequenceIndex CHOICE { |  |  |  |
| I139 | 0 |  |  |
| } |  |  |  |
| msg1-SubcarrierSpacing | kHz 120 |  |  |
|  |  |  |  |
| } |  |  |  |

Table 5.3.2.2.2.4.3-2: RACH-ConfigDedicated for Non-Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-129 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigDedicated::= SEQUENCE { |  |  |  |
| cfra SEQUENCE { |  |  |  |
| occasions SEQUENCE { |  |  |  |
| ssb-perRACH-Occasion | oneFourth |  |  |
| } |  |  |  |
| resources CHOICE { |  |  |  |
| ssb SEQUENCE { |  |  |  |
| ssb-ResourceList SEQUENCE (SIZE(1..maxRA-SSB-Resources)) OF { | 1 entry |  |  |
| ssb[1] | 0 |  |  |
| ra-PreambleIndex[1] | 50 |  | Subtest 1 |
| } |  |  |  |
| ra-ssb-OccasionMaskIndex | 1 |  | Subtest 1 |
| } |  |  |  |
| csirs SEQUENCE { |  |  |  |
| csirs-ResourceList SEQUENCE (SIZE(1..maxRA- CSIRS -Resources)) OF { |  |  |  |
| ra-OccasionList | 1 |  | Subtest 2 |
| ra-PreambleIndex[1] | 50 |  | Subtest 2 |
| } |  |  |  |
| rsrp-ThresholdCSI-RS | RSRP\_69 +ΔDL | ΔDL is derived from the downlink calibration process | Subtest 2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.2.4.3-3: RACH-ConfigGeneric for Non-Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| prach-ConfigurationIndex | 190 |  | FR2 |
| msg1-FDM | one |  | FR2 |
| zeroCorrelationZoneConfig | 11 |  |  |
| preambleReceivedTargetPower | -100 |  |  |
| preambleTransMax | n6 |  |  |
| powerRampingStep | dB2 |  |  |
| ra-ResponseWindow | sl10 |  |  |
| } |  |  |  |

Table 5.3.2.2.2.4.3-4: *ServingCellConfigCommon* for Non-Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| ssb-PositionsInBurst SEQUENCE { |  |  |  |
| inOneGroup | ‘1100 0000'B |  |  |
| } |  |  |  |
| ss-PBCH-BlockPower | 20 +ΔUL | ΔUL is derived from the uplink calibration process |  |
| } |  |  |  |

Table 5.3.2.2.2.4.3-5: CellGroupConfig for Non-Contention Based Random Access

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | ServCellIndex |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| newUE-Identity | 1 |  |  |
| rach-ConfigDedicated CHOICE { |  |  |  |
| uplink | RACH-ConfigDedicated |  |  |
| } |  |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| firstActiveDownlinkBWP-Id | BWP-Id |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| srs-Config | SRS-Config |  |  |
| } |  |  |  |
| firstActiveUplinkBWP-Id | BWP-Id |  |  |
| } |  |  |  |
| } |  |  |  |

5.3.2.2.2.5 Test requirement

Table 5.3.2.2.2.5-2 defines the primary level settings for non-contention based random access test in FR2 for NR Standalone. Tables 5.3.2.2.2.5-3, 5.3.2.2.2.5-4 and 5.3.2.2.2.5-5 define the Absolute power limits, Relative power limits and uplink timing error limits respectively, and all include test tolerances.

Table 5.3.2.2.2.5-1: General test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Test-2 | Comments |
| SSB Configuration | Config 1,2 |  | SSB.1 FR2 | SSB.1 FR2 | As defined in A.3.2 |
| CSI-RS Configuration | Config 1,2 |  | N/A | CSI-RS.3.1 TDD | As defined in A.1.4 |
| Duplex Mode for Cell 2 | Config 1,2 |  | TDD | TDD |  |
| TDD Configuration | Config 1,2 |  | TDDConf.3.1 | TDDConf.3.1 | As defined in A.1.5 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 24 | 100: NRB,c = 24 |  |
| OCNG Pattern Note 1 | |  | OP.3 | OP.3 | As defined in A.2.1. |
| PDSCH Reference Channel Note 2 | Config 1,2 |  | SR3.1 TDD | SR3.1 TDD | As defined in A.1.1. |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | CR.3.1 TDD | As defined in A.1.2 |
| RMC CORESET Reference Channel | Config 1,2 |  | CCR.3.1 TDD | CCR.3.1 TDD | As defined in A.1.3 |
| NR RF Channel Number | |  | 1 | 1 |  |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH\_DMRS | | dB |
| EPRE ratio of PDCCH\_DMRS to SSS | | dB |
| EPRE ratio of PDCCH to PDCCH\_DMRS | | dB |
| EPRE ratio of PDSCH\_DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH\_DMRS | | dB |
| ss-PBCH-BlockPower | | dBm/ SCS | +20 +ΔUL | +20 +ΔUL | As defined in TS 38.331 [13].  ΔUL is derived from the uplink calibration process Note 3 |
| Configured UE transmitted power () | | dBm | maximum value configurable for certain power class | maximum value configurable for certain power class | As defined in clause 6.2.4 in TS 38.101-2 [3] |
| PRACH Configuration | |  | PRACH.2 FR2 | PRACH.3 FR2 | As defined in A.7.2, with exceptions as defined below. |
| rsrp-ThresholdSSB | | dBm | RSRP\_69 +ΔDL | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| preambleReceivedTargetPower | | dBm | -100 | -100 | As defined in TS 38.331 [13] |
| NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.  NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.  NOTE 3: The ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.  NOTE 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value. | | | | | |

Table 5.3.2.2.2.5-2: OTA-related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Test-2 | Comments |
| AoA setup | |  | Setup 1 | Setup 1 | As defined in A.9.1 |
| Assumption for UE beamsNote 2 | |  | Rough | Rough |  |
| SSB with index 0 | Es Note1 | dBm/SCS | -80.6 | -80.6 | Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -80.6 | -80.6 |
| Es/IotBB | dB | 21.09 | 21.09 |  |
| Io | dBm/95.04 MHz | -56.01 | -56.01 | Io in symbols containing SSB index 0 |
| SSB with index 1 | Es Note1 | dBm/SCS | -95.0 | -95.0 | Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -95.0 | -95.0 |
| Es/IotBB | dB | 6.69 | 6.69 |  |
| Io | dBm/95.04 MHz | -70.41 | -70.41 | Io in symbols containing SSB index 1 |
| Propagation Condition | | - | AWGN | AWGN |  |
| NOTE 1: No artificial noise is applied in this test.  NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | | |

Test 1: Correct behaviour when transmitting SSB-based Random Access Preamble

- The Random Access Preamble shall be one of the Random Access Preambles associated with SSB index 0.

- The Random Access Preamble shall arrive on a PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0.

- The selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

Test 2: Correct behaviour when transmitting CSI-RS-based Random Access Preamble

- The Random Access Preamble shall have the Preamble Index associated with the CSI-RS configured.

- The Random Access Preamble shall arrive on a PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured.

- The selected PRACH occasion belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.

Test 3: Correct behaviour when receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.2.5-3.

- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.2.5-4.

- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.2.5-5.

Test 4: Correct behaviour when not receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.2.5-3.

- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.2.5-4.

- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.2.5-5.

Table 5.3.2.2.2.5-3 Absolute power tolerance Test requirements

|  |  |
| --- | --- |
| Conditions | Tolerance |
| Normal | ± FFS dB |

Table 5.3.2.2.2.5-4 Relative power tolerance Test requirements

|  |  |  |
| --- | --- | --- |
| Measured power | Power step P (dB) | PRACH (dB) |
| Measured power of both PRACHs being compared > (PmaxNote1 – 6dB) | 2 ≤ ΔP < 3 | ± (4+FFS). |
| Measured power of either PRACHs being compared ≤ (PmaxNote1 – 6dB) | ± (6+FFS) |
| NOTE 1: Pmax is the Min peak EIRP defined in clause 6.2.1 of TS 38.101-2 [3], selected according to power class and operating band. | | |

Table 5.3.2.2.2.5-5: Te Timing error Test requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals s(KHz) | Te |
| 2 | 120 | 120 | 224+[48]\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [7] | | | |

##### 5.3.2.2.3 EN-DC FR2 2-step contention based random access

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- TT analysis and test requirements are missing.

- Test procedure is FFS

5.3.2.2.3.1 Test purpose

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the MsgA PRACH and MsgA PUSCH power settings and timing are within specified limits.

5.3.2.2.3.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC with FR2 and twoStepRACH-r16.

5.3.2.2.3.3 Minimum conformance requirement

Same as in clause 4.3.2.2.3.3

The normative reference for this requirement is TS 38.133 [6] clause 6.2.2 and A.5.3.2.2.3.

5.3.2.2.3.4 Test description

5.3.2.2.3.4.1 Initial conditions

This test can be run in the configurations defined in Table 5.3.2.2.3.4.1-1.

Table 5.3.2.2.3.4.1-1: Supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Test Config Index | Description |
| 5.3.2.2.3-1 | 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| 5.3.2.2.3-2 | 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | | |

Before the test procedure, Downlink and Uplink calibrations are carried out to derive signalled parameter values. This is necessary to ensure that the test case operates within the specified ranges. The detail of the calibration process is implementation dependent, but shall derive the values of ΔDL and ΔUL according to the following principles:

With the UE configured to report SS-RSRP, the ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value RSRP\_x, x is treated as a positive integer value.

With the UE configured to send a first PRACH preamble, ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied at the Reference point, and with signalled values *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm.

Configure the test equipment and the DUT according to the parameters in Table 5.3.2.2.3.4.1-2.

Table 5.3.2.2.3.4.1-2: Initial conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.3.2.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.3.2.2.3.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.3.5-1.

3. Downlink signals for NR cell are initially set up according to clause C.2.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.3.4.2 Test procedure

For this test two cells are used, an E-UTRA serving cell (PCell) and an NR FR2 PSCell. For the NR PSCell, the System Simulator shall not explicitly assign a random access preamble via dedicated signalling in the downlink.

1. Ensure the UE is in state E-UTRA RRC\_CONNECTED with generic procedure parameters *Connectivity* E-UTRA/EPC with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Table 5.3.2.2.3.5-1.

3. The test system shall send a RRCReconfiguration message to the UE to add NR PSCell, then the UE shall trigger a random access procedure.

FFS

5.3.2.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3.1 with the following exceptions:

Table 5.3.2.2.3.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |
| Common exceptions to the contents of TS 38.508-1 [14] | FFS |

5.3.2.2.3.5 Test requirement

Table 5.3.2.2.3.5-2 defines the primary level settings for contention based random access test in FR2 for NR Standalone. The test requirements are FFS.

Table 5.3.2.2.3.5-1: General test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| SSB Configuration | Config 1,2 |  | SSB.1 FR2 | As defined in A.3.2 |
| Duplex Mode for Cell 2 | Config 1,2 |  | TDD |  |
| TDD Configuration | Config 1,2 |  | TDDConf.3.1 | As defined in A.1.5 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 24 |  |
| OCNG Pattern Note 1 | |  | OP.3 | As defined in A.2.1 |
| PDSCH Reference Channel Note 2 | Config 1,2 |  | SR.3.1 TDD | As defined in A.1.1 |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | As defined in A.1.2 |
| RMC CORESET Reference Channel | Config 1,2 |  | CCR.3.1 TDD | As defined in A.1.3 |
| NR RF Channel Number | |  | 1 |  |
| EPRE ratio of PSS to SSS | | dB | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH\_DMRS | | dB |
| EPRE ratio of PDCCH\_DMRS to SSS | | dB |
| EPRE ratio of PDCCH to PDCCH\_DMRS | | dB |
| EPRE ratio of PDSCH\_DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH\_DMRS | | dB |
| *ss-PBCH-BlockPower* | | dBm/ SCS | +20 +ΔUL | As defined in TS 38.331 [13].  ΔUL is derived from the uplink calibration process Note 3 |
| Configured UE transmitted power () | | dBm | maximum value configurable for certain power class | As defined in clause 6.2.4 of TS 38.101-2 [3] |
| MsgA Configuration | |  | FR2 MsgA configuration 1 | As defined in FFS, with exceptions as defined below |
| *msgA-RSRP-ThresholdSSB* | | dBm | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| msgA-PreambleReceivedTargetPower | | dBm | -100 | As defined in TS 38.331 [13] |
| NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.  NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.  NOTE 3: The ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.  NOTE 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value. | | | | |

Table 5.3.2.2.3.5-2: OTA-related test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| AoA setup | |  | Setup 1 | As defined in A.9.1 |
| Assumption for UE beamsNote 2 | |  | Rough |  |
| SSB with index 0 | Es Note1 | dBm/SCS | -80.6 | Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -80.6 |
| Es/IotBB | dB | 21.09 |  |
| Io | dBm/95.04 MHz | -56.01 | Io in symbols containing SSB index 0 |
| SSB with index 1 | Es Note1 | dBm/SCS | -95.0 | Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -95.0 |
| Es/IotBB | dB | 6.69 |  |
| Io | dBm/95.04 MHz | -70.41 | Io in symbols containing SSB index 1 |
| Propagation Condition | | - | AWGN |  |
| NOTE 1: No artificial noise is applied in this test.  NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

##### 5.3.2.2.4 EN-DC FR2 2-step non-contention based random access

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- TT analysis and test requirements are missing.

- Test procedure is FFS

5.3.2.2.4.1 Test purpose

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the MsgA PRACH and MsgA PUSCH power settings and timing are within specified limits.

5.3.2.2.4.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC with FR2 and twoStepRACH-r16.

5.3.2.2.4.3 Minimum conformance requirement

Same as in clause 4.3.2.2.4.3

The normative reference for this requirement is TS 38.133 [6] clause 6.2.2 and A.5.3.2.2.4.

5.3.2.2.4.4 Test description

5.3.2.2.4.4.1 Initial conditions

This test can be run in the configurations defined in Table 5.3.2.2.4.4.1-1.

Table 5.3.2.2.4.4.1-1: Supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Test Config Index | Description |
| 5.3.2.2.4-1 | 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| 5.3.2.2.4-2 | 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | | |

Before the test procedure, Downlink and Uplink calibrations are carried out to derive signalled parameter values. This is necessary to ensure that the test case operates within the specified ranges. The detail of the calibration process is implementation dependent, but shall derive the values of ΔDL and ΔUL according to the following principles:

With the UE configured to report SS-RSRP, the ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value RSRP\_x, x is treated as a positive integer value.

With the UE configured to send a first PRACH preamble, ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied at the Reference point, and with signalled values *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm.

Configure the test equipment and the DUT according to the parameters in Table 5.3.2.2.4.4.1-2.

Table 5.3.2.2.4.4.1-2: Initial conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.3.2.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.3.2.2.4.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.4.5-1.

3. Downlink signals for NR cell are initially set up according to clause C.2.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.4.4.2 Test procedure

For this test two cells are used, an E-UTRA serving cell (PCell) and an NR FR2 PSCell. For the NR PSCell, the System Simulator shall not explicitly assign a random access preamble via dedicated signalling in the downlink.

1. Ensure the UE is in state E-UTRA RRC\_CONNECTED with generic procedure parameters *Connectivity* E-UTRA/EPC with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Table 5.3.2.2.4.5-1.

3. The test system shall send a RRCReconfiguration message to the UE to add NR PSCell, then the UE shall trigger a random access procedure.

FFS

5.3.2.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3.1 with the following exceptions:

Table 5.3.2.2.4.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |
| Common exceptions to the contents of TS 38.508-1 [14] | FFS |

5.3.2.2.4.5 Test requirement

Table 5.3.2.2.4.5-2 defines the primary level settings for non-contention based random access test in FR2 for NR Standalone. The test requirements are FFS.

Table 5.3.2.2.4.5-1: General test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| SSB Configuration | Config 1,2 |  | SSB.1 FR2 | As defined in A.3.2 |
| Duplex Mode for Cell 2 | Config 1,2 |  | TDD |  |
| TDD Configuration | Config 1,2 |  | TDDConf.3.1 | As defined in A.1.5 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 24 |  |
| OCNG Pattern Note 1 | |  | OP.3 | As defined in A.2.1 |
| PDSCH Reference Channel Note 2 | Config 1,2 |  | SR.3.1 TDD | As defined in A.1.1 |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | As defined in A.1.2 |
| RMC CORESET Reference Channel | Config 1,2 |  | CCR.3.1 TDD | As defined in A.1.3 |
| NR RF Channel Number | |  | 1 |  |
| EPRE ratio of PSS to SSS | | dB | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH\_DMRS | | dB |
| EPRE ratio of PDCCH\_DMRS to SSS | | dB |
| EPRE ratio of PDCCH to PDCCH\_DMRS | | dB |
| EPRE ratio of PDSCH\_DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH\_DMRS | | dB |
| *ss-PBCH-BlockPower* | | dBm/ SCS | +20 +ΔUL | As defined in TS 38.331 [13].  ΔUL is derived from the uplink calibration process Note 3 |
| Configured UE transmitted power () | | dBm | maximum value configurable for certain power class | As defined in clause 6.2.4 of TS 38.101-2 [3] |
| MsgA Configuration | |  | FR2 MsgA configuration 2 | As defined in FFS, with exceptions as defined below |
| *msgA-RSRP-ThresholdSSB* | | dBm | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| msgA-PreambleReceivedTargetPower | | dBm | -100 | As defined in TS 38.331 [13] |
| NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.  NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.  NOTE 3: The ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.  NOTE 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value. | | | | |

Table 5.3.2.2.4.5-2: OTA-related test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test-1 | Comments |
| AoA setup | |  | Setup 1 | As defined in A.9.1 |
| Assumption for UE beamsNote 2 | |  | Rough |  |
| SSB with index 0 | Es Note1 | dBm/SCS | -80.6 | Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -80.6 |
| Es/IotBB | dB | 21.09 |  |
| Io | dBm/95.04 MHz | -56.01 | Io in symbols containing SSB index 0 |
| SSB with index 1 | Es Note1 | dBm/SCS | -95.0 | Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB* |
| SSB\_RP | dBm/SCS | -95.0 |
| Es/IotBB | dB | 6.69 |  |
| Io | dBm/95.04 MHz | -70.41 | Io in symbols containing SSB index 1 |
| Propagation Condition | | - | AWGN |  |
| NOTE 1: No artificial noise is applied in this test.  NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

#### 5.3.2.3 Void

## 5.4 Timing

### 5.4.1 UE transmit timing

#### 5.4.1.0 Minimum Conformance Requirements

##### 5.4.1.0.1 Minimum conformance requirements for UE transmit timing accuracy

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 5.4.1.0.1-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS or it is the PRACH transmission.

The UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus . The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. *N*TA for PRACH is defined as 0.

 (in *Tc* units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in TS 38.133 [6] clause 7.3 was applied. *N*TA for other channels is not changed until next timing advance is received. The value ofdepends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). is defined in Table 5.4.1.0.1-2.

Table 5.4.1.0.1-1: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals (KHz)** | **SCS of uplink signals (KHz)** | **Te** |
| 1 | 15 | 15 | 12\*64\*Tc |
| 30 | 10\*64\*Tc |
| 60 | 10\*64\*Tc |
| 30 | 15 | 8\*64\*Tc |
| 30 | 8\*64\*Tc |
| 60 | 7\*64\*Tc |
| 2 | 120 | 60 | 3.5\*64\*Tc |
| 120 | 3.5\*64\*Tc |
| 240 | 60 | 3\*64\*Tc |
| 120 | 3\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

Table 5.4.1.0.1-2: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR1 FDD band without LTE-NR coexistence case or FR1 TDD band without LTE-NR coexistence case | 25600 (Note 1) |
| FR1 FDD band with LTE-NR coexistence case | 0 (Note 1) |
| FR1 TDD band with LTE-NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| NOTE: The UE identifies  based on the information n-TimingAdvanceOffset according to [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to clause 4.2 in [3] and the value 39936 of  can also be provided for a FDD serving cell.NOTE 2: Void | |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in TS 38.133 [6] clause 7.3 is applied.

When the transmission timing error between the UE and the reference timing exceeds ±Te, the UE is required to adjust its timing to within ±Te. The reference timing shall be  before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be Tq.

2) The minimum aggregate adjustment rate shall be Tp per second.

3) The maximum aggregate adjustment rate shall be Tq per 200ms.

where the maximum autonomous time adjustment step Tq and the aggregate adjustment rate Tp are specified in Table 5.4.1.0.1-3.

Table 5.4.1.0.1-3: Tq Maximum Autonomous Time Adjustment Step and Tp Minimum Aggregate Adjustment rate

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of uplink signals (KHz)** | **Tq** | **Tp** |
| 1 | 15 | 5.5\*64\*Tc | 5.5\*64\*Tc |
| 30 | 5.5\*64\*Tc | 5.5\*64\*Tc |
| 60 | 5.5\*64\*Tc | 5.5\*64\*Tc |
| 2 | 60 | 2.5\*64\*Tc | 2.5\*64\*Tc |
| 120 | 2.5\*64\*Tc | 2.5\*64\*Tc |
| NOTE: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

The normative reference for this requirement is TS.38.133 [6] clause 7.1.2.

#### 5.4.1.1 EN-DC FR2 UE transmit timing accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.4.1.1.1 Test purpose

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2

5.4.1.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC FR2.

5.4.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.4.1.0.1.

The normative reference for this requirement is TS.38.133 [6] clause A.5.4.1.1

5.4.1.1.4 Test Description

5.4.1.1.4.1 Initial Conditions

This test can be run in one of the configurations defined in Table 5.4.1.1.4.1-1.

Table 5.4.1.1.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz |
| 2 | LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz |
| NOTE: The UE is only required to be tested in one of the supported test configurations in FR2 depending on UE capability. | |

Configure the test equipment and the DUT according to the parameters in Table 5.4.1.1.4.1-2

Table 5.4.1.1.4.1-2: Initial conditions for EN-DC FR2 transmit timing accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.4.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5 4.1.1.4.3.

2. 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.6.1.1-1. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2.

3. Downlink signals for NR cell are initially set up according to clause C.1.2 and C.1.3.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.4.1.1.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR FR2 cell (PSCell). The downlink timing of the PSCell is changed and the changes in UE transmit timing are observed. The transmit timing is verified by the UE transmitting SRS used as a measurement reference facilitating the SS timing estimation.

The test sequence shall be carried out in RRC\_CONNECTED for every test case. Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction.

Following will be the test sequence for this test

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [6] clause 4.5.

2. Set up E-UTRA PCell according to parameters given in Table A.6.1.1-1 and setup NR PSCell according to parameters given in Table 5.4.1.1.4.1-1.

3. The SS shall transmit an RRCConnectionReconfiguration message configuring the UE with the message content defined in clause 5.4.1.1.4.3.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex I.1 - I.3. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Rx beam selection to complete.

6. After connection set up with the cell and during 2 seconds before DL timing adjustment, the test equipment shall monitor all SRS transmissions and verify that, for each received SRS, the timing of the NR cell is within (NTA + NTA\_offset) ×Tc ± Te of the first detected path of DL SSB.

a. The NTA offset value (in Tc units) is 13792 for FR2

b. The Te values depend on the DL and UL SCS for which the test is being run and are given in Table 5.4.1.1.5-4.

7. The test system shall adjust the timing of the DL path by values given in Table 5.4.1.1.4.2-1

Table 5.4.1.1.4.2-1: Adjustment Value for DL Timing

|  |  |  |
| --- | --- | --- |
| SCS of SSB signals (KHz) | Adjustment Value | |
|  | Test1 | Test2 |
| 240 | +8\*64Tc | +4\*64Tc |

8. The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Table 5.4.1.1.5-5. This will only be done for Test1. The test system samples the UE Transmit Timing once per SRS transmission (as per configured SRS periodicity). To check Rule 1, the SS shall check that the maximum time adjustment step size Tq between one SRS transmission to next consecutive SRS transmission of a valid UL slot is within Rule 1 as specified in clause 5.4.1.0.1 and Table 5.4.1.0.1-3. To check that the minimum adjustment rate is within Rule 2 as specified in clause 5.4.1.0.1 and Table 5.4.1.0.1-3, the SS shall measure the change in SRS transmission timing over a 1 + offset seconds sliding window (offset in ms to the next consecutive SRS transmission), with step size p (where p is the periodicity of SRS) , as long as the resulting slot is a valid UL slot. To check that the maximum adjustment rate is within Rule 3 as specified in clause 5.4.1.0.1 and Table 5.4.1.0.1-3, the SS shall measure the change in SRS transmission timing over a 200ms – offset sliding window of previous SRS transmission, with step size p (where p is the periodicity of SRS) , as long as the resulting slot is a valid UL slot. The three rules apply until the UE transmit timing offset is within the limits specified in 5.4.1.0.1 and Table 5.4.1.0.1-3 with respect to the first detected path (in time) of the corresponding downlink frame of Cell 1. The test system will wait till evaluation interval of T seconds is met to ensure UE transmit timing is stable at the end of the step, where T=.DL\_timing\_change[Ts]/5.5Ts and DL\_timing\_change is specified in Table 5.4.1.1.4.2-1.

9. After the UE transmit timing is within the limits specified in step 7, and during 2 seconds, the test system shall monitor all SRS transmissions and verify that, for each received SRS, the UE transmit timing offset stays within (NTA + NTA\_offset) ×Tc ± Te of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

NOTE: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.1.1 in TS 38.521-2 [3].

5.4.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.4.1.1.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.9-1 |

Table 5.4.1.1.4.3-1: *SRS-Config* : Additional test requirement for UE transmit timing accuracy for EN-DC FR2 UE

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SRS-Config ::= SEQUENCE { |  |  |  |
| srs-ResourceSetToAddModList SEQUENCE (SIZE(0..maxNrofSRS-ResourceSets)) OF SEQUENCE { |  |  |  |
| SRS-ResourceSet[1] SEQUENCE { |  | entry 1 |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SEQUENCE { |  |  |  |
| SRS-Resource[1] SEQUENCE { |  | entry 1 |  |
| freqHopping SEQUENCE { |  |  |  |
| c-SRS | 17 |  |  |
| } |  |  |  |
| groupOrSequenceHopping | Neither |  |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| periodicityAndOffset-p CHOICE { |  |  |  |
| sl1 | 0 |  | Test 1 |
| sl2560 | 4 |  | Test 2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.4.1.1.4.3-2: *DRX-Config* : Additional test requirement for UE transmit timing accuracy Test 2 for EN-DC FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= CHOICE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms6 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms1 |  |  |
| drx-HARQ-RTT-TimerDL | 56 |  |  |
| drx-HARQ-RTT-TimerUL | 56 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms320 | 0 |  |  |
| } |  |  |  |
| shortDRX |  | NOT PRESENT |  |
| } |  |  |  |

5.4.1.1.5 Test Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 5.4.1.1.5-4.

The UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus . The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. *N*TA for PRACH is defined as 0.

 (in *Tc* units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance was applied. *N*TA for other channels is not changed until next timing advance is received. The value ofdepends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). is defined in Table 5.4.1.1.5-5.

Table 5.4.1.1.5-1: Cell Specific Test Parameters for UL Transmit Timing test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Test1** | **Test2** | **Band Group** |
| SSB ARFCN |  | 1,2 | Freq1 | Freq1 |  |
| Duplex Mode |  | 1,2 | TDD | |  |
| TDD configuration |  | 1,2 | TDDConf.3.1 | |  |
| BWchannel | MHz | 1,2 | 100: NRB,c = 66 | |  |
| Initial BWP Configuration |  | 1,2 | DLBWP.0.1  ULBWP.0.1 | |  |
| Dedicated BWP Configuration |  | 1,2 | DLBWP.1.1  ULBWP.1.1 | |  |
| TRS Configuration |  | 1,2 | TRS.2.1 TDD | |  |
| PDSCH/PDCCH TCI State |  | 1,2 | TCI.State.2 | |  |
| DRx Cycle | ms | 1,2 | N/A | DRX.8Note5 |  |
| PDSCH Reference measurement channel |  | 1,2 | SR.3.3 TDD | |  |
| RMSI CORESET Reference Channel |  | 1,2 | CR.3.2 TDD | |  |
| Dedicated CORESET Reference Channel |  | 1,2 | CCR.3.7 TDD | |  |
| OCNG Patterns |  | 1,2 | OP.1 | |  |
| SSB Configuration |  | 1,2 | SSB.4 FR2 | |  |
| SMTC Configuration |  | 1,2 | SMTC.1 | |  |
| PDSCH/PDCCH subcarrier spacing | kHz | 1,2 | 120 | |  |
| EPRE ratio of PSS to SSS | dB | 1,2 | 0 | 0 |  |
| EPRE ratio of PBCH DMRS to SSS |  |
| EPRE ratio of PBCH to PBCH DMRS |  |
| EPRE ratio of PDCCH DMRS to SSS |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |
| EPRE ratio of PDSCH DMRS to SSS |  |
| EPRE ratio of PDSCH to PDSCH |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |
| Propagation condition |  | 1,2 | AWGN | |  |
| SRS Config |  | 1,2 | Config1Note6 | Config2Note6 |  |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: Void  NOTE 4: Void  NOTE 5: DRx related parameters are given in Table A.3.3.5-1 or Table A.5-1  NOTE 6: SRS configs are given in Table A. 5.4.1.1.5-2 | | | | | |

Table 5.4.1.1.5-2: SRS Configuration for Timing Accuracy Test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field | Config1 | Config 2 | Comments |
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 |  |
| srs-ResourceIdList | 0 | 0 |  |
| resourceType | Periodic | Periodic |  |
| Usage | Codebook | Codebook |  |
| SRS-Resource | SRS-ResourceId | 0 | 0 |  |
| nrofSRS-Ports | Port1 | Port1 |  |
| transmissionComb | n2 | n2 |  |
| combOffset-n2 | 0 | 0 |  |
| cyclicShift-n2 | 0 | 0 |  |
| resourceMapping  startPosition | 0 | 0 |  |
| resourceMapping  nrofSymbols | n1 | n1 |  |
| resourceMapping  repetitionFactor | n1 | n1 |  |
| freqDomainPosition | 0 | 0 |  |
| freqDomainShift | 0 | 0 |  |
| freqHopping  c-SRS | 17 | 17 | Matches NRB,c |
| freqHopping  b-SRS | 0 | 0 |  |
| freqHopping  b-hop | 0 | 0 |  |
| groupOrSequenceHopping | Neither | Neither |  |
| resourceType | Periodic | Periodic |  |
| periodicityAndOffset-p | sl1,0 | sl2560,4 | Offset to align with DRx periodicity |
| sequenceId | 0 | 0 | Any 10 bit number |

Table 5.4.1.1.5-3: OTA related test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** | **Test 2** |
| Angle of arrival configuration |  | Setup 1 defined in A.9.1 | |
| Assumption for UE beamsNote 6 |  | Fine | |
| Note1 | dBm/15kHzNote4 | -112 | |
| Note1 | dBm/SCSNote3 | -100 | |
|  | dB | 4 | |
| SS-RSRPNote2 | dBm/SCS Note4 | -96 | |
|  | dB | 4 | |
| IoNote2 | dBm/95.04 MHz Note4 | -68.5 | |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: Void  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | |

Table 5.4.1.1.5-4: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals ( kHz)** | **SCS of uplink signals ( kHz)** | **Te** |
| 2 | 120 | 60 | N/A |
| 120 | N/A |
| 240 | 60 | N/A |
| 120 | 3.75\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

Table 5.4.1.1.5-5: Tq Maximum Autonomous Time Adjustment Step and Tp Minimum Aggregate Adjustment rate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency Range | SCS of uplink signals (KHz) | The Maximum timing change in one adjustment Tq | The Minimum aggregate adjustment rate Tp | The Maximum aggregate adjustment rate Tq |
| 2 | 120 | 3.125\*64\*Tc | -1.225\*64\*Tc | +3.725\*64\*Tc |
| NOTE: Tc is the basic timing unit defined in TS 38.211 [6] | | | |  |

Table 5.4.1.1.5-6: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR2 | 13792 |
| NOTE 1: The UE identifies  based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to clause 4.2 in TS 38.213 [3] and the value 39936 of  can also be provided for a FDD serving cell.  NOTE 2: Void | |

### 5.4.2 UE timer accuracy

FFS.

### 5.4.3 Timing advance

#### 5.4.3.0Minimum conformance requirements

##### 5.4.3.0.1 Minimum conformance requirements for timing advance adjustment accuracy

The timing advance is initiated from gNB with MAC message that implies and adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [12].

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 5.4.3.0.3-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS38.213 [8].

Table 5.4.3.0.3-1: UE Timing Advance adjustment accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sub Carrier Spacing, SCS kHz | 15 | 30 | 60 | 120 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | ±128 Tc | ±32 Tc |

The normative reference for this requirement is TS.38.133 [6] clause A.5.4.3.

#### 5.4.3.1 EN-DC FR2 timing advance adjustment accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.4.3.1.1 Test purpose

The purpose of the test is to verify UE timing advance adjustment delay and accuracy requirement defined in clause 7.3 of TS 38.133 [6].

5.4.3.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC.

5.4.3.1.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 5.4.3.0.1.

The normative reference for this requirement is TS.38.133 [6] clause A.5.4.3.1.

5.4.3.1.4 Test description

5.4.3.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2 [17].

This test shall be tested using any of the test configurations in Table 5.4.3.1.4.1-1.

Table 5.4.3.1.4.1-1: EN-DC FR2 timing advance adjustment accuracy supported test configurations

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

Configure the test equipment and the DUT according to the parameters in Table 5.4.3.1.4.1-2

Table 5.4.3.1.4.1-2: Initial conditions for EN-DC FR2 timing advance adjustment accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, E.1.2, and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and clause 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.4.3.1.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

Table 5.4.3.1.4.1-3: General test parameters for timing advance

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF channel number |  | Cell 1: 1  Cell 2: 2 | 1 for E-UTRAN PCell  2 for NR PSCell |
| Initial DL BWP |  | DLBWP.0.1 | As specified in Table A.3.9.2.1-1 of TS 38.133 [6] |
| Dedicated DL BWP |  | DLBWP.1.1 | As specified in Table A.3.9.2.2-1 of TS 38.133 [6] |
| Initial UL BWP |  | ULBWP.0.1 | As specified in Table A.3.9.3.1-1 of TS 38.133 [6] |
| Dedicated UL BWP |  | ULBWP.1.1 | As specified in Table A.3.9.3.2-1 of TS 38.133 [6] |
| Timing Advance Command (*TA*) value during T1 |  | 31 | *NTA\_new = NTA\_old* for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command (*TA*) value during T2 |  | 39 | *NTA\_new = NTA\_old + 1024\*Tc* (based on equation in TS 38.213 [3] clause 4.2) |
| T1 | s | 5 |  |
| T2 | s | 5 |  |

1. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.1.

2. Downlink signals for NR cell are initially set up according to clause C.1.2, C.1.3.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.4.3.1.4.2 Test Procedure

The test consists of two cells, a single E-UTRA cell (PCell), and a single NR cell (PSCell). Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). The test consists of two successive time periods, with time durations of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in Table 5.4.3.1.5-1 and Table 5.4.3.1.5-2, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG. The UE Time Alignment Timer (timeAlignmentTimer IE), described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. Message content are defined in clause 5.4.3.1.2.3.

2. Set the parameters according to values in Tables 5.4.3.1.4.1-3 and Table 5.4.3.1.5-1 as appropriate. Propagation conditions are set according to clause C.2.2.

3. SS shall transmit an RRCConnectionReconfiguration message.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in Clause 6.1.3.4 in TS 38.321. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

6. During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value of 39 as specified in table 5.4.3.1.4.1-3.

7. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

8. As specified in Clause 7.3.2.1 of TS 38.133 [6], the UE adjusts its uplink timing at slot n+k+1 for a timing advance command received in slot n. This delay shall be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

9. The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

10. The result from the SRS and adjustment of the timing advance in step 7) is used to measure that the UE adjusts the timing of its transmission with a relative accuracy better than or equal to value specified in Table 5.4.3.0.3-1 to the signalled timing advance value compared to the timing of preceding uplink transmission.

11. If the UE adjust the timing of its transmission within a relative accuracy greater than or equal to value specified in Table 5.4.3.0.3-1 to the signalled timing advance value compared to the timing of preceding uplink transmission then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.

12. The SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

13. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

14. If any of the above Reconfiguration in Step 12 or 13 fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

15. Repeat steps 3-14 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.4.3.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 7.3, with the following exceptions:

Table 5.4.3.1.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.9-1 |

Table 5.4.3.1.4.3-1: srs-Config setup

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1, Table 4.6.3-182 | | | |
| Information Element | Value/remark | Comment | Condition |
| SRS-Config ::= SEQUENCE { |  |  |  |
| srs-ResourceSetToAddModList SEQUENCE (SIZE(0..maxNrofSRS-ResourceSets)) OF SEQUENCE { | 1 entry |  |  |
| SRS-ResourceSet[1] SEQUENCE { |  | entry 1 |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SEQUENCE { | 1 entry |  |  |
| SRS-Resource[1] SEQUENCE { |  | entry 1 |  |
| freqHopping SEQUENCE { |  |  |  |
| c-SRS | 16 |  |  |
| } |  |  |  |
| groupOrSequenceHopping | Neither |  |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { | Periodic |  |  |
| periodicityAndOffset-p CHOICE { |  |  |  |
| sl5 | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.4.3.1.5 Test Requirement

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where *k* = 11.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in Table 5.4.3.1.5-3.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90% with a confidence level of 95%.

Table 5.4.3.1.5-1, Table 5.4.3.1.5-1a and Table 5.4.3.1.5-2 define the primary level settings.

Table 5.4.3.1.5-1: Cell specific test parameters for timing advance

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test1 | |
| T1 | T2 |
| Duplex mode |  | TDD | |
| TDD configuration |  | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | |
| BWP BW | MHz | 100: NRB,c = 66 | |
| DRx Cycle | ms | Not Applicable | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | |
| CORESET Reference Channel |  | CR.3.1 TDD | |
| TRS configuration |  | TRS.2.1 TDD | |
| PDSCH/PDCCH TCI state |  | TCI.State.2 | |
| OCNG Patterns |  | OCNG pattern 1 | |
| SMTC configuration |  | SMTC.1 FR2 | |
| SSB configuration |  | SSB.3 FR2 | |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 kHz | |
| PUCCH/PUSCH subcarrier spacing | kHz | 120 kHz | |
| EPRE ratio of PSS to SSS | dB | 0 | |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |
| Propagation condition | - | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.4.3.1.5-1a: OTA specific test parameters for timing advance

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | |
|  |  | T1 | T2 |
| Angle of arrival configuration |  | Setup 1 | |
| Assumption for UE beamsNote 6 |  | Fine | |
| Note1 | dBm/15kHzNote4 | -112 | |
| Note1 | dBm/SCSNote3 | -103 | |
|  | dB | 4 | |
| SS-RSRPNote2 | dBm/SCS Note4 | -99 | |
|  | dB | 4 | |
| IoNote2 | dBm/95.04 MHz Note4 | -68.53 | |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | |

Table 5.4.3.1.5-2: Sounding Reference Symbol Configuration for timing advance

|  |  |  |
| --- | --- | --- |
| Field | Value | Comment |
| c-SRS | 16 | Frequency hopping is disabled |
| b-SRS | 0 |
| b-hop | 0 |
| freqDomainPosition | 0 | Frequency domain position of SRS |
| freqDomainShift | 0 |
| groupOrSequenceHopping | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | sl5=4 | Once every 5 slots |
| pathlossReferenceRS | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | Codebook | Codebook based UL transmission |
| startPosition | 0 | resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | n1 |
| repetitionFactor | n1 |
| combOffset-n2 | 0 | transmissionComb setting |
| cyclicShift-n2 | 0 |
| nrofSRS-Ports | port1 | Number of antenna ports used for SRS transmission |
| NOTE: For further information see clause 6.3.2 in TS 38.331 [13]. | | |

Table 5.4.3.1.5-3: UE Timing Advance adjustment accuracy

|  |  |  |
| --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 60 | 120 |
| UE Timing Advance adjustment accuracy | ±128 Tc | ±72 Tc |

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95%.

## 5.5 Signaling characteristics

### 5.5.1 Radio link monitoring

The requirements in this clause apply for radio link monitoring on PSCell in EN-DC operation mode. The UE shall monitor the downlink link quality based on the reference signal in the configured RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell and PSCell as specified in TS 38.213 [8]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Qout and Qin for the purpose of monitoring downlink radio link quality of the cell.

#### 5.5.1.0 Minimum conformance requirements

##### 5.5.1.0.1 Minimum conformance requirements for out-of-sync SSB-based RLM

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB [ms] period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB [ms] evaluation period. The requirements in this clause apply for each SSB based RLM-RS resource configured for PSCell, provided that the SSB configured for RLM is transmitted within UE active DL BWP during the entire evaluation period defined in Table 5.5.1.0.1-1.

TEvaluate\_out\_SSB is defined in Table 5.5.1.0.1-1 for FR2.

Table 5.5.1.0.1-1: Evaluation period TEvaluate\_out for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) |
| no DRX | max(200,ceil(10\*P\*N)\*TSSB) |
| DRX cycle≤320 | max(200,ceil(15\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle>320 | ceil(10\*P\*N)\*TDRX |
| NOTE: TSSB is the periodicity of SSB configured for RLM. TDRX is the DRX cycle length. | |

For FR2,

- P=1/(1 – TSSB/TSMTCperiod), when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- P is 1/(1- TSSB/MGRP - TSSB/TSMTCperiod), when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- P is 1/(1- TSSB /MGRP)\*3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- P is 1/{1- TSSB /min (TSMTCperiod ,MGRP)}, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- TSSB /MGRP)\*3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

The normative reference for this requirement is TS 38.133 [6] clauses 8.1.2.

##### 5.5.1.0.2 Minimum conformance requirements for in-sync SSB-based RLM

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB [ms] period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_SSB [ms] period becomes better than the threshold Qin\_SSB within TEvaluate\_in\_SSB [ms] evaluation period.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-1 for FR1.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 with scaling factor N=8.

For FR2,

- , when RLM-RS is not overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when the RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- , when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- , when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- , when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- , when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1

- if all of the reference signals configured for RLM outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped by with the SSB symbols indicated by SSB-ToMeasure and 1 symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured;

- Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signalling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

Longer evaluation period would be expected if the combination of RLM-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 5.5.1.0.2-1: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR2

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Max(200, Ceil(10\*P\*N)\*TSSB) | Max(100, Ceil(5\*P\*N)\*TSSB) |
| DRX cycle≤320 | Max(200, Ceil(15\*P\*N)\*Max(TDRX,TSSB)) | Max(100, Ceil(7.5\*P\*N)\*Max(TDRX,TSSB)) |
| DRX cycle>320 | Ceil(10\*P\*N)\*TDRX | Ceil(5\*P\*N)\*TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

Figure 5.5.1.2.4-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

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

##### 5.5.1.0.3 Minimum conformance requirements for out-of-sync CSI-RS based RLM

[TS38.133, clause 8.1.3.1]

The requirements apply for each CSI-RS based RLM-RS resource configured for PSCell, provided that the CSI-RS configured for RLM are actually transmitted within UE active DL BWP during the entire evaluation period specified in TS 38.133, clause 8.1.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 5.5.1.0.3-1: PDCCH transmission parameters for out-of-sync

|  |  |
| --- | --- |
| Attribute | Value for BLER Configuration #0 |
| 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 | 4dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 4dB |
| Bandwidth (MHz) | 48 |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

[TS38.133, clause 8.1.3.2]

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_CSI-RS [ms] period becomes worse than the threshold Qout\_CSI-RS within TEvaluate\_out\_CSI-RS [ms] evaluation period.

- TEvaluate\_out\_CSI-RS is defined in Table 5.5.1.0.3-2 for FR2 with N=1. The requirements of TEvaluate\_out\_CSI-RS applies provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements doesn't apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR2,

- P=1, when RLM-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=1/(1 – TCSI-RS/MGRP) , when RLM-RS is partially overlapped with measurement gap and RLM-RS is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- P=1/(1 – TCSI-RS /TSMTCperiod), when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P is 1/(1- TCSI-RS /MGRP - TCSI-RS /TSMTCperiod), when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5\*TSMTCperiod

- P is 1/(1- TCSI-RS /MGRP)\* 3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5\*TSMTCperiod

- P is 1/{1- TCSI-RS /min (TSMTCperiod ,MGRP)}, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- TCSI-RS /MGRP)\* 3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

If the high layer in TS 38.331 [2] signalling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

NOTE: The overlap between CSI-RS RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration. Longer evaluation period would be expected if the combination of RLM-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

The value of Mout used in Table 5.5.1.0.3-2 is defined as:

- Mout = 20 if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* set to 3 and over the bandwidth ≥ 24 PRBs.

Table 5.5.1.0.3-2: Evaluation period TEvaluate\_out\_CSI-RS for FR2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_out\_CSI-RS (ms)** |
| no DRX | max(200, ceil(Mout×P×N)×TCSI-RS) |
| DRX ≤ 320ms | max(200, ceil(1.5×Mout×P×N)× max(TDRX, TCSI-RS)) |
| DRX > 320ms | ceil(Mout×P×N) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10 ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | |

[TS38.133, clause 8.1.3.3]

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM/BFD/CBD/L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM/BFD/L1-RSRP measurement, or in the same symbol as SSB for CBD when beam failure is detected, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM/BFD/CBD/L1-RSRP measurement,

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

- The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or

- The other CSI-RS is configured in q1 and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

[TS38.133, clause 8.1.4 and 8.1.5]

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM-RS resources to a second configuration of RLM-RS resources that is different from the first configuration, for each RLM-RS resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM-RS resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

The transmitter power of the UE in the monitored cell shall be turned off within 40ms after expiry of T310 timer as specified in TS 38.331.

[TS38.133, clause 8.1.6]

When the downlink radio link quality on all the configured RLM-RS resources is worse than Qout, Layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331.

The out-of-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213. Two successive indications from Layer 1 shall be separated by at least TIndication\_interval.

When DRX is not used TIndication\_interval is max(10ms, TRLM-RS,M), where TRLM,M is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to TSSB specified in clause 8.1.2 if the RLM-RS resource is SSB, or TCSI-RS specified in clause 8.1.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, TIndication\_interval is max(10ms, 1.5\*DRX\_cycle\_length, 1.5\*TRLM-RS,M) if DRX cycle\_length is less than or equal to 320ms, and TIndication\_interval is DRX\_cycle\_length if DRX cycle\_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and Layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.1.3, 8.1.4, 8.1.5 and 8.1.6.

##### 5.5.1.0.4 Minimum conformance requirements for in-sync CSI-RS based RLM

[TS38.133, clause 8.1.3.1]

The requirements apply for each CSI-RS based RLM-RS resource configured for PSCell, provided that the CSI-RS configured for RLM are actually transmitted within UE active DL BWP during the entire evaluation period specified in TS 38.133 clause 8.1.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 5.5.1.0.4-1: PDCCH transmission parameters for in-sync

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER Configuration #0** |
| DCI payload size | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 4 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | [0]dB |
| Bandwidth (MHz) | 48 |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

[TS38.133, clause 8.1.3.2]

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_CSI-RS [ms] period becomes better than the threshold Qin\_CSI-RS within TEvaluate\_in\_CSI-RS [ms] evaluation period.

- TEvaluate\_in\_CSI-RS is defined in Table 5.5.1.0.4-2 for FR2 with N=1. The requirements of TEvaluate\_in\_CSI-RS applies provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements doesn't apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR2,

- P=1, when RLM-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=1/(1 – TCSI-RS/MGRP) , when RLM-RS is partially overlapped with measurement gap and RLM-RS is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- P=1/(1 – TCSI-RS /TSMTCperiod), when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P is 1/(1- TCSI-RS /MGRP - TCSI-RS /TSMTCperiod), when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5\*TSMTCperiod

- P is 1/(1- TCSI-RS /MGRP)\* 3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5\*TSMTCperiod

- P is 1/{1- TCSI-RS /min (TSMTCperiod ,MGRP)}, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- TCSI-RS /MGRP)\* 3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

If the high layer in TS 38.331 [2] signalling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

NOTE: The overlap between CSI-RS RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration. Longer evaluation period would be expected if the combination of RLM-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

The values of Min used in Table 5.5.1.0.4-2 are defined as:

- Min = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* set to 3 and over the bandwidth ≥ 24 PRBs.

Table 5.5.1.0.4-2: Evaluation period TEvaluate\_in\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | max(100, ceil(Min×P×N) × TCSI-RS) |
| DRX ≤ 320ms | max(100, ceil(1.5×Min×P×N)× max(TDRX, TCSI-RS)) |
| DRX > 320ms | ceil(Min×P×N) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10 ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | |

[TS38.133, clause 8.1.3.3]

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM/BFD/CBD/L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM/BFD/L1-RSRP measurement, or in the same symbol as SSB for CBD when beam failure is detected, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM/BFD/CBD/L1-RSRP measurement,

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

- The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or

- The other CSI-RS is configured in q1 and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

[TS38.133, clause 8.1.4 and 8.1.5]

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM-RS resources to a second configuration of RLM-RS resources that is different from the first configuration, for each RLM-RS resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM-RS resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

The transmitter power of the UE in the monitored cell shall be turned off within 40ms after expiry of T310 timer as specified in TS 38.331 [2].

[TS38.133, clause 8.1.6]

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Qin, Layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A Layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from Layer 1 shall be separated by at least TIndication\_interval.

When DRX is not used TIndication\_interval is max(10ms, TRLM-RS,M), where TRLM,M is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to TSSB specified in clause 8.1.2 if the RLM-RS resource is SSB, or TCSI-RS specified in clause 8.1.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, TIndication\_interval is max(10ms, 1.5\*DRX\_cycle\_length, 1.5\*TRLM-RS,M) if DRX cycle\_length is less than or equal to 320ms, and TIndication\_interval is DRX\_cycle\_length if DRX cycle\_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and Layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.1.3, 8.1.4, 8.1.5 and 8.1.6.

##### 5.5.1.0.5 Minimum conformance requirements for UE scheduling restrictions during radio link monitoring

The following scheduling restriction applies due to radio link monitoring on an FR2 serving PCell and/or PSCell.

- If the RLM-RS is CSI-RS which is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON,

- There are no scheduling restrictions due to radio link monitoring based on the CSI-RS.

- Otherwise

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on FR2 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cell(s) in the bands due to radio link monitoring performed on FR2 serving PCell or PSCell in different bands, provided that UE is capable of independent beam management on this FR2 band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for RLM; and

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for RLM.

##### 5.5.1.0.6 Requirements for UE configured with Relaxed Measurement Criteria

Same requirements apply as in clause 4.5.1.0.5.

5.5.1.0.6.1 Minimum requirement of SSB based radio link monitoring for UE fulfilling relaxed measurement criteria

[TS 38.133, clause 8.1.2.4]

This clause contains minimum requirements for relaxed radio link monitoring based on SSB.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB\_Relax [ms] period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB\_Relax [ms] evaluation period.

TEvaluate\_out\_SSB\_Relax is defined in Table 5.5.1.0.6.1-1 for FR2 with scaling factor N=8.

The value of P is defined in clause 5.5.1.0.12.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 5.5.1.0.6.1-1: Evaluation period TEvaluate\_out\_SSB\_Relax for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_out\_SSB\_Relax (ms) |
| Max(TDRX,TSSB) ≤80ms | Max(200× K4 NOTE3, Ceil(15 × K2 NOTE2 × P × N) × Max(TDRX,TSSB)) |
| 80ms < Max(TDRX,TSSB) ≤160ms | Ceil(15 × P × N) × Max(TDRX,TSSB) |
| NOTE 1: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length and no longer than 80ms.  NOTE 2: K2 = 2.  NOTE 3: K4 = K2, if K2 ≤ 2; otherwise K4 = 1. | |

#### 5.5.1.1 EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions- Usage of 2 antenna ports in CSI-RS 3.1 TDD implies SS transmitting signal on both polarizations. Potential signal imbalance impact to the test verdict is under investigation

5.5.1.1.1 Test purpose

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the PSCell configured with SSB-based RLM RS in non-DRX mode. This test will partly verify the NR cell radio link monitoring requirements in TS 38.133 [6] clause 8.1.2.

5.5.1.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC.

5.5.1.1.3 Minimum conformance requirement

The minimum requirements are specified in clause 5.5.1.0.1. DRX configuration is not used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.1.

5.5.1.1.4 Test description

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 as defined in 38.133 [6]. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.1.4-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states and Figure 5.5.1.1.4-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. 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. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms).

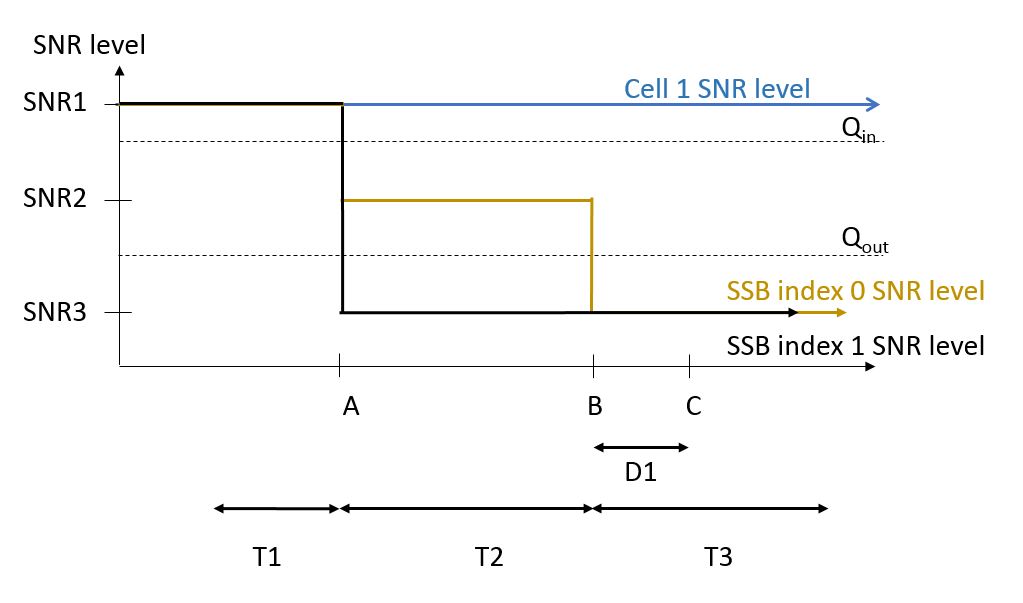


Figure 5.5.1.1.4-1: SNR variation for out-of-sync testing



Figure 5.5.1.1.4-2: Time multiplexed downlink transmissions

5.5.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2 [18].

This test shall be tested using any of the test configurations in Table 5.5.1.1.4.1-1.

Table 5.5.1.1.4.1-1: EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.1-1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.1.1-2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to pass in one of the supported test configurations in FR2 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.1.4.1-2

Table 5.5.1.1.4.1-2: Initial conditions for EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.1.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

PDCCH transmission parameters are given in Table 5.5.1.1.4.1-4

Table 5.5.1.1.4.1-3: Void

1. Message contents are defined in clause 5.5.1.1.4.3.

2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2

3. The test parameters are given in Table 5.5.1.1.4.1-4 below.

4. Downlink signals for NR cell are initially set up according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.1.1.4.1-4: General test parameters for FR2 out-of-sync testing in non-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, 2 |  | TDD |
| BWchannel | | Config 1, 2 |  | 100: NRB,c = 66 |
| Data RBs allocated | | Config 1, 2 |  | 24 |
| 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 |  | PRACH.1 FR2 |
| SSB index assigned as RLM RS | | Config 1, 2 |  | 0,1 |
| OCNG parameters | | |  | OP.5 |
| 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 | | |  | *OFF* |
| Gap pattern ID | | |  | *gp0* |
| 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 | 9.68 |
| T3 | | | s | 9.68 |
| D1 | | | s | 9.64 |
| 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 5.5.1.1.4.1-5: Measurement gap configuration for out-of-sync tests in non-DRX mode

|  |  |
| --- | --- |
| Field | Test 1 |
| Value |
| gapOffset | 0 |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap). | |

5.5.1.1.4.2 Test Procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.5.1.1.4.1-4.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 5.5.

1a. The SS shall transmit an *RRCConnectionReconfiguration* message configuring the UE for inter-frequency measurements.

1b. The UE shall transmit *RRCReconfigurationComplete* message.

2. Set the parameters according to T1 in Table 5.5.1.1.4.4-1 for subtest 1 and 2. Propagation conditions are set according to Annex C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.1.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.1.5-1. T3 starts.

5. If the SS:  
  
a) detects uplink power in each subframe configured for CQI transmission (according to configured CQI periodicity on PUCCH [format 2]) during the period from time point A to time point B

and  
  
b) does not detect any uplink power from time point C (D1 seconds after the start of T3) until T3 expires,  
  
the number of successful tests is increased by one.

6. Otherwise the number of failed tests is increased by one and proceed to Step 10.

7. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.1.4.4-1.

8. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.

9. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].

11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.1.1.4.3-0: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED  Table H.3.1-3 with Condition INTER-FREQ MO (where ssbFrequency is set to the ARFCN value of carrier center of Adjacent range)  Table H.3.1-4 with A3-offset = 0  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-4 with condition gapUE  Table H.3.4-5 with condition BFD  Table H.3.5-4  Table H.3.1-8 with Condition SSB RLM |

Table 5.5.1.1.4.3-1: Void

Table 5.5.1.1.4.3-2: RLF-TimersAndConstants

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| UE-TimersAndConstants ::= SEQUENCE { |  |  |  |
| t310 | ms0 |  |  |
| n310 | n1 |  |  |
| t311 | ms1000 |  |  |
| n311 | n1 |  |  |
| } |  |  |  |

Table 5.5.1.1.4.3-3: Void

5.5.1.1.5 Test Requirement

Table 5.5.1.1.5-1 defines the cell specific primary level settings.

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 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%.

Table 5.5.1.1.5-1: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | | |
| T1 | T2 | T3 | T1 | T2 | T3 |
| AoA setup | |  | Setup 3 defined in A.9.3 | | | | | |
| AoA1 | | | AoA2 | | |
| Assumption for UE beamsNote 5 | |  | Rough | | | Rough | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | | Not sent | | |
| 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 |
| 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 | 4.1  Note 6 | -3.9Note 6 | -15 |
| ssb-Index 1 SNR | Config 1, 2 |  | Not sent | | | 4.1  Note 6 | -15 | -15 |
|  | Config 1, 2 | dBm/ 15kHz | -94.8 | | | -94.8 | | |
| Time multiplexing of the downlink transmissions from each AoA | |  | Defined in Figure 5.5.1.1.4-2 | | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | TDL-A 30ns 75Hz | | |
| Note 1: OCNG shall be used such that 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 38.133 [6] A.3.6.  Note 5: Information about types of UE beam is given in 38.133 [6] 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 | | | | | | | | |

#### 5.5.1.2 EN-DC FR2 radio link monitoring in-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

- Usage of 2 antenna ports in CSI-RS 3.1 TDD implies SS transmitting signal on both polarizations. Potential signal imbalance impact to the test verdict is under investigation5.5.1.2.1 Test Purpose

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. This test will partly verify the FR2 PSCell radio link monitoring requirements in clause 8.1 of TS 38.133 [3].

5.5.1.2.2 Test Applicability

This test applies to all types of E-UTRA UEs Release 15 and forward supporting EN-DC FR2.

5.5.1.2.3 Minimum Conformance Requirements

The minimum requirements are specified in clause 5.5.1.0.2. DRX configuration is not used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.2.

5.5.1.2.4 Test Description

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 five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.1.2.4-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states and Figure 5.5.1.2.4-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. 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 5ms.

A diagram of a cell phone

Description automatically generated with low confidence

Figure 5.5.1.2.4-1: SNR variation for in-sync testing



Figure 5.5.1.2.4-2: Time multiplexed downlink transmissions

5.5.1.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table [5.3.5-1] and Table 5.3.5-1 of 38.521-2 [18].

This test shall be tested using any of the test configurations in Table 5.5.1.2.4.1-1.

Table 5.5.1.2.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.2-1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.1.2-2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to pass in one of the supported test configurations in FR2 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.2.4.1-2.

Table 5.5.1.2.4.1-2: Initial conditions for EN-DC FR2 radio link monitoring in-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.3.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

PDCCH transmission parameters are given in Table 5.5.1.2.4.1-4.

Table 5.5.1.2.4.1-3: Void

1. Message contents are defined in clause 5.5.1.2.4.3.

2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2

3. The general test parameters are given in Table 5.5.1.2.5-4 below.

4. Downlink signals for NR cell are initially set up according to clause C.1.

Table 5.5.1.2.4.1-4: General test parameters for FR2 in-sync testing in non-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, 2 |  | TDD |
| BWchannel | | Config 1, 2 |  | 100: NRB,c = 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 |
| CORESET Reference Channel | | Config 1, 2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | | Config 1, 2 |  | CCR.3.1 TDD |
| SSB Configuration | | Config 1, 2 |  | SSB.1 FR2 |
| SMTC Configuration | | Config 1, 2 |  | SMTC.3 |
| PDSCH/PDCCH subcarrier spacing | | Config 1, 2 |  | 120 KHz |
| PRACH Configuration | | Config 1, 2 |  | PRACH.1 FR2 |
| SSB index assigned as RLM RS | | Config 1, 2 |  | 0,1 |
| OCNG parameters | | |  | OP.2 |
| CP length | | |  | Normal |
| In sync transmission parameters | DCI format | |  | 1-0 |
| Number of Control OFDM symbols | |  | 2 |
| Aggregation level | | CCE | 4 |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | | dB | 0 |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | | dB | 0 |
| DMRS precoder granularity | |  | REG bundle size |
| REG bundle size | |  | 6 |
| 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 | | |  | *OFF* |
| Gap pattern ID | | |  | N.A. |
| Layer 3 filtering | | |  | *Enabled* |
| T310 timer | | | ms | 4000 |
| T311 timer | | | ms | 1000 |
| N310 | | |  | 1 |
| N311 | | |  | 1 |
| CSI-RS for CSI reporting | | Config 1, 2 |  | CSI-RS.3.1 TDD |
| TCI states for PDCCH/PDSCH | | |  | TCI.State.2 |
| CSI-RS for tracking | | Config 1, 2 |  | TRS.2.1 TDD |
| reportConfigType | | |  | periodic |
| reportQuantity | | |  | cri-RI-PMI-CQI |
| CSI reporting periodicity | | | slot | 40 |
| CSI reporting offset | | | slot | 4 |
| T1 | | | s | 0.2 |
| T2 | | | s | 0.2 |
| T3 | | | s | 1.88 |
| T4 | | | s | 0.2 |
| T5 | | | s | 3.84 |
| D1 | | | s | 3.8 |
| 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. | | | | |

5.5.1.2.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.5.1.2.4.1-4.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 4.5.

2. Set the parameters according to T1 in Table 5.5.1.2.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

3. When T1 expires, the SS shall change the SNR value to T2 as specified in Table 5.5.1.2.5-1. T2 starts.

4. When T2 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.2.5-1. T3 starts.

5. When T3 expires, the SS shall change the SNR value to T4 as specified in Table 5.5.1.2.5-1. T4 starts.

6. When T4 expires, the SS shall change the SNR value to T5 as specified in Table 5.5.1.2.5-1. T5 starts.

7. If the SS detects uplink power in each subframe according the configured CQI reporting mode (PUCCH 2-0) during the period from time point A to time point F (D1 seconds after the start of time duration T5) the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

8. Repeat steps 2-7 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.2.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions.

Table 5.5.1.2.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.4-1  Table H.3.5-4  Table H.3.1-8 with Condition SSB RLM |

Table 5.5.1.2.4.3-2: Void

Table 5.5.1.2.4.3-3: *RLF-TimersAndConstant*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| t310 | ms4000 |  |  |
| n310 | n1 |  |  |
| n311 | n1 |  |  |
| t311-v1530 | ms1000 |  |  |
| } |  |  |  |

Table 5.5.1.2.4.3-4: Void

5.5.1.2.5 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90% with a 95% confidence interval.

Table 5.5.1.2.5-1: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | | | | | | |
| T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 3 defined in A.9.3 | | | | | | | | | |
| AoA1 | | | | | AoA2 | | | | |
| Assumption for UE beamsNote 5 | |  | Rough | | | | | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | | Not sent | | | | |
| 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 |
| 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 | 4.1  Note 6 | -3.9Note 6 | -15 | -15 | -15 |
| ssb-Index 1 SNR | Config 1, 2 |  | Not sent | | | | | 4.1  Note 6 | -15 | -15 | -4.5 | 4.1  Note 6 |
|  | Config 1, 2 | dBm/ 15kHz | -94.8 | | | | | -94.8 | | | | |
| Time multiplexing of the downlink transmissions from each AoA | |  | Defined in Figure 5.5.1.2.4-2 | | | | | | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | | | TDL-A 30ns 75Hz | | | | |
| Note 1: OCNG shall be used such that 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 38.133 [6] 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 | | | | | | | | | | | | |

#### 5.5.1.3 EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in DRX mode

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.5.1.3.1 Test purpose

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the PSCell configured with SSB-based RLM RS when DRX is used. This test will partly verify the NR cell radio link monitoring requirements in TS 38.133 [6] clause 8.1.2.

5.5.1.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC.

5.5.1.3.3 Minimum conformance requirement

The minimum requirements are specified in clause 5.5.1.0.1. DRX configuration is used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.3.

5.5.1.3.4 Test description

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 as defined in 38.133 [6]. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.3.4-1 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.

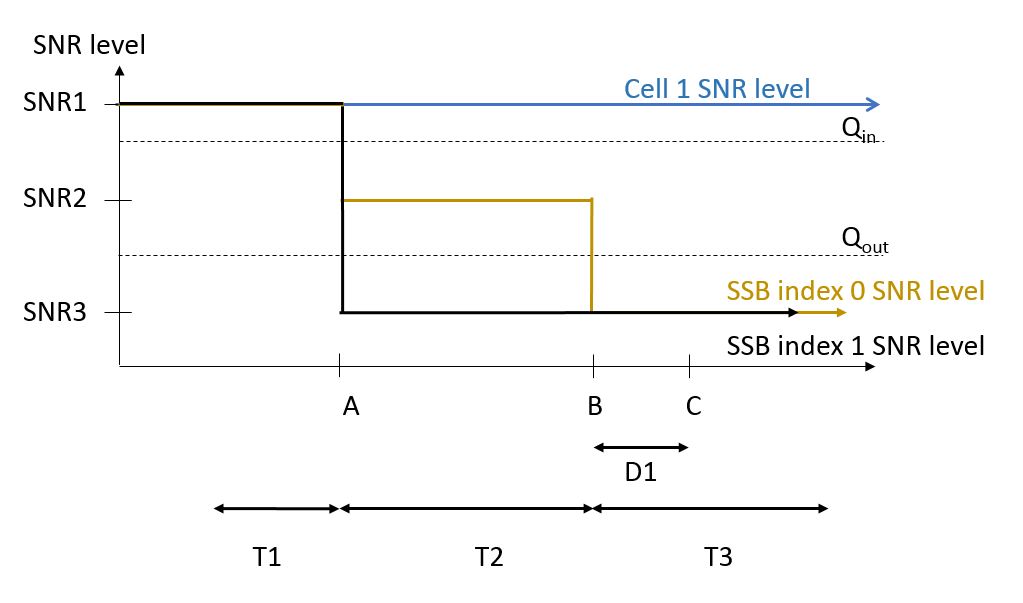


Figure 5.5.1.3.4-1: SNR variation for out-of-sync testing

5.5.1.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2 [18].

This test shall be tested using any of the test configurations in Table 5.5.1.3.4.1-1.

Table 5.5.1.3.4.1-1: EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.3-1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.1.3-2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to pass in one of the supported test configurations in FR2 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.3.4.1-2

Table 5.5.1.3.4.1-2: Initial conditions for EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.3.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

PDCCH transmission parameters are given in Table 5.5.1.3.4.1-4

Table 5.5.1.3.4.1-3: Void

1. Message contents are defined in clause 5.5.1.3.4.3.

2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2

3. The test parameters are given in Table 5.5.1.3.4.1-4 below.

4. Downlink signals for NR cell are initially set up according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.1.3.4.1-4: General test parameters for FR2 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, 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 |  | PRACH.1 FR2 |
| SSB index assigned as RLM RS | | Config 1, 2 |  | 0,1 |
| 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 | 14.48 |
| D1 | | | s | 14.44 |
| 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. | | | | |

5.5.1.3.4.2 Test Procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.5.1.3.4.1-4.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 5.5.

2. Set the parameters according to T1 in Table 5.5.1.3.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.3.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.3.5-1. T3 starts.

5. If the SS:  
  
a) detects uplink power in the On-Duration part of every DRX cycle in each subframe configured for CQI transmission (according to configured CQI periodicity on PUCCH [format 2]) during the period from time point A to time point B

and  
  
b) does not detect any uplink power from time point C (D1 after the start of T3) until T3 expires,  
  
the number of successful tests is increased by one.

6. Otherwise the number of failed tests is increased by one and proceed to Step 10.

7. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.3.4.4-1.

8. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.

9. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].

11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.3.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 5.5.1.3.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.4-1  Table H.3.1-8 with Condition SSB RLM  Table H.3.7-1 with condition DRX.3 |

Table 5.5.1.3.4.3-2: Void

Table 5.5.1.3.4.3-3: RLF-TimersAndConstants

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| UE-TimersAndConstants ::= SEQUENCE { |  |  |  |
| t310 | ms0 |  |  |
| n310 | n1 |  |  |
| t311 | ms1000 |  |  |
| n311 | n1 |  |  |
| } |  |  |  |

Table 5.5.1.3.4.3-4: Void

Table 5.5.1.3.4.3-5: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.5-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig ::= CHOICE { |  |  |  |
| slots40 | 4 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList SEQUENCE (SIZE (1..maxNrofBWPs)) OF{ |  |  |  |
| PUCCH\_CSI\_Resource[0] SEQUENCE { |  |  |  |
| uplinkBandwidthPartId | BWP-Id |  |  |
| pucch\_Resource | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.1.3.5 Test Requirement

Table 5.5.1.3.5-1 defines the cell specific primary level settings.

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 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%.

Table 5.5.1.3.5-1: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
| T1 | T2 | T3 |
| AoA setup | |  | Setup 1 defined in A.9.1 | | |
| 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 | 0 | | |
| 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 |
| ssb-Index 0 SNR | Config 1, 2 | dB | 3.3Note 6 | -4.7Note 6 | -15.4 |
| ssb-Index 1 SNR | Config 1, 2 | 3.3Note 6 | -15.4 | -15.4 |
|  | Config 1, 2 | dBm/15KHz | -104.7dBm | | |
| 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 TS 38.133 [6] A.3.6.  Note 5: Information about types of UE beam is given in TS 38.133 [6] 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 | | | | | |

#### 5.5.1.4 EN-DC FR2 radio link monitoring in-sync test for PSCell configured with SSB-based RLM RS in DRX mode

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.5.1.4.1 Test Purpose

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 with DRX configured. This test will partly verify the FR2 PSCell radio link monitoring requirements in clause 8.1.

5.5.1.4.2 Test Applicability

This test applies to all types of E-UTRA UEs Release 15 and forward supporting EN-DC

5.5.1.4.3 Minimum Conformance Requirements

The minimum requirements are specified in clause 5.5.1.0.2. DRX configuration is used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.2.

5.5.1.4.4 Test Description

5.5.1.4.4 Test Description

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 five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.4.1-1 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.

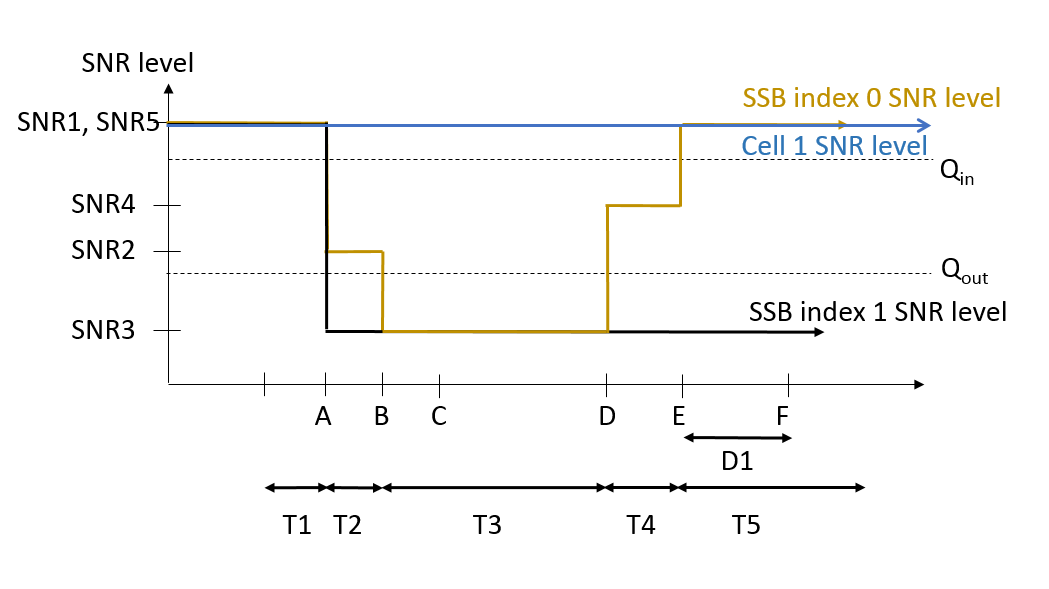


Figure 5.5.1.4.4-1: SNR variation for in-sync testing

5.5.1.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table [5.3.5-1] and Table 5.3.5-1 of 38.521-2 [18].

This test shall be tested using any of the test configurations in Table 5.5.1.4.4.1-1.

Table 5.5.1.4.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.4-1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.1.4-2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to pass in one of the supported test configurations in FR2 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.4.4.1-2.

Table 5.5.1.4.4.1-2: Initial conditions for EN-DC FR2 radio link monitoring in-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.3.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

PDCCH transmission parameters are given in Table 5.5.1.4.4.1-4.

Table 5.5.1.4.4.1-3: Void

1. Message contents are defined in clause 5.5.1.4.4.3.

2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2

3. The general test parameters are given in Table 5.5.1.4.5-4 below.

4. Downlink signals for NR cell are initially set up according to clause C.1.

Table 5.5.1.4.4.1-4: General test parameters for FR2 in-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, 2 |  | TDD |
| BWchannel | | Config 1, 2 |  | 100: NRB,c = 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.3.1 TDD |
| SSB Configuration | | Config 1, 2 |  | SSB.1 FR2 |
| SMTC Configuration | | Config 1, 2 |  | SMTC.3 |
| PDSCH/PDCCH subcarrier spacing | | Config 1, 2 |  | 120 KHz |
| PRACH Configuration | | Config 1, 2 |  | PRACH.1 FR2 |
| SSB index assigned as RLM RS | | Config 1, 2 |  | 0,1 |
| OCNG parameters | | |  | OP.1 |
| CP length | | |  | Normal |
| In sync transmission parameters | DCI format | |  | 1-0 |
| Number of Control OFDM symbols | |  | 2 |
| Aggregation level | | CCE | 4 |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | | dB | 0 |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | | dB | 0 |
| DMRS precoder granularity | |  | REG bundle size |
| REG bundle size | |  | 6 |
| 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.11 |
| Gap pattern ID | | |  | N.A. |
| Layer 3 filtering | | |  | *Enabled* |
| T310 timer | | | ms | 4000 |
| 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 | 0.2 |
| T3 | | | s | 2.8 |
| T4 | | | s | 0.2 |
| T5 | | | s | 3.88 |
| D1 | | | s | 3.84 |
| 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. | | | | |

5.5.1.4.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.5.1.4.4.1-4.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 4.5.

2. Set the parameters according to T1 in Table 5.5.1.4.4-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

3. When T1 expires, the SS shall change the SNR value to T2 as specified in Table 5.5.1.4.5-1. T2 starts.

4. When T2 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.4.5-1. T3 starts.

5. When T3 expires, the SS shall change the SNR value to T4 as specified in Table 5.5.1.4.5-1. T4 starts.

6. When T4 expires, the SS shall change the SNR value to T5 as specified in Table 5.5.1.4.5-1. T5 starts.

7. If the SS detects uplink power in the On-duration part of every DRX cycle in the subframe according the configured CQI reporting mode (PUCCH 2-0) during the period from time point A to time point F ( D1after the start of time duration T5) the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

8. Repeat steps 2-7 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.4.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with condition “Short\_DCI” and with the following exceptions.

Table 5.5.1.4.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.4-1  Table H.3.1-8 with Condition SSB RLM  Table H.3.7-1 with condition DRX.11 |

Table 5.5.1.4.4.3-2: Void

Table 5.5.1.4.4.3-3: *RLF-TimersAndConstant*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| t310 | ms4000 |  |  |
| n310 | n1 |  |  |
| n311 | n1 |  |  |
| t311 | ms1000 |  |  |
| } |  |  |  |

Table 5.5.1.4.4.3-4: Void

Table 5.5.1.4.4.3-5: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.5-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig ::= CHOICE { |  |  |  |
| slots40 | 4 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList SEQUENCE (SIZE (1..maxNrofBWPs)) OF{ |  |  |  |
| PUCCH\_CSI\_Resource[0] SEQUENCE { |  |  |  |
| uplinkBandwidthPartId | BWP-Id |  |  |
| pucch\_Resource | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.1.4.5 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90% with a 95% confidence interval.

Table 5.5.1.4.5-1: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring tests in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.9.1 | | | | |
| Assumption for UE beamsNote 5 | |  | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | 0 | | | | |
| 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 |
| ssb-Index 0 SNR | Config 1, 2 | dB | 3.3  Note 6 | -4.7  Note 6 | -15.4 | -4.9 | 3.3  Note 6 |
| ssb-Index 1 SNR | Config 1, 2 | 3.3  Note 6 | -15.4 | -15.4 | -15.4 | -15.4 |
|  | Config 1, 2 | dBm/15KHz | -104.7dBm | | | | |
| 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.3  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 TS 38.133 [6] A.3.6.  Note 5: Information about types of UE beam is given in 38.133 [6] 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 | | | | | | | |

#### 5.5.1.5 EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with CSI-RS-based RLM RS in non-DRX mode

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- TT analysis is made at Test frequency f ≤ 40.8 GHz

- Connection diagram is TBD

- Test Procedure and message contents will need further editing and review

- Usage of 2 antenna ports in CSI-RS 3.1 TDD implies SS transmitting signal on both polarizations. Potential signal imbalance impact to the test verdict is under investigation

5.5.1.5.1 Test purpose

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 PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in TS 38.133 clause 8.1.

5.5.1.5.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and CSI-RS based RLM.

5.5.1.5.3 Minimum conformance requirements

The minimum requirements are specified in clause 5.5.1.0.3. DRX configuration is not used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.5.

5.5.1.5.4 Test description

There are two cells configured in this test, the E-UTRA PCell and NR PSCell. This test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.5.4-1 shows the three different time durations and the corresponding variation of the downlink SNR in the active cell to emulate out-of-sync states.

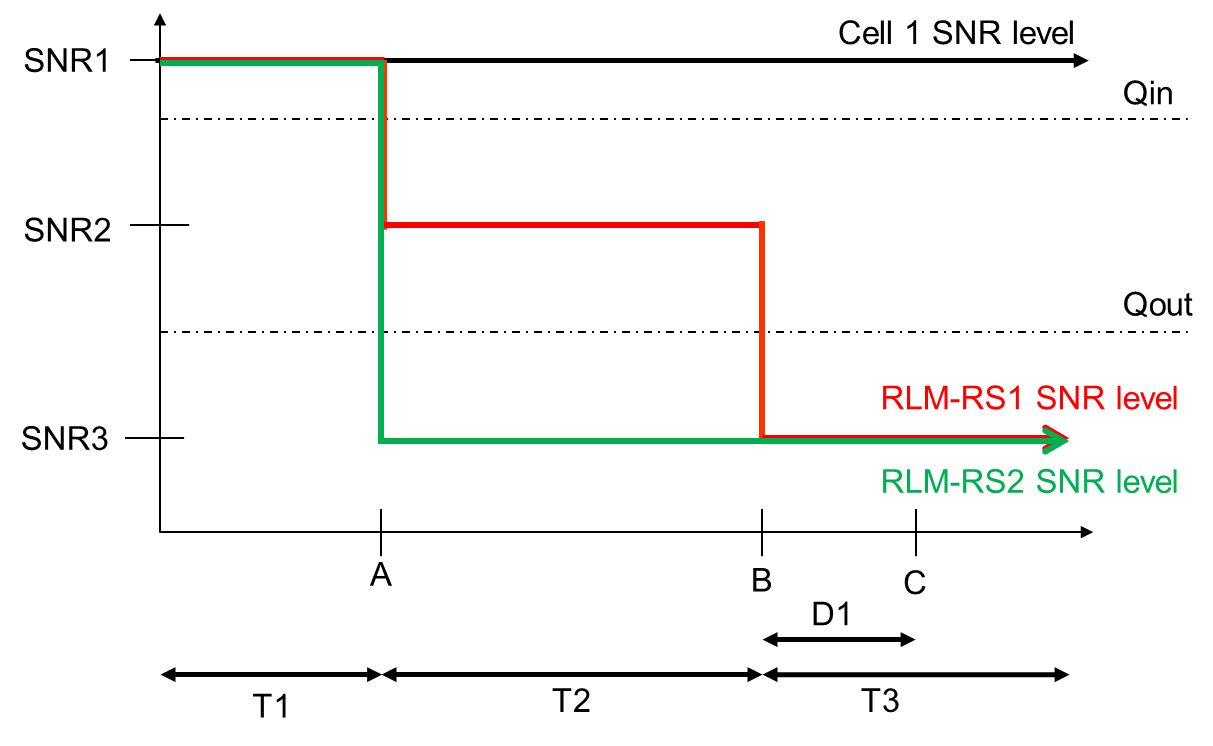


Figure 5.5.1.5.4-1: SNR variation for out-of-sync testing

5.5.1.5.4.1 Initial conditions

Test 5.5.1.5 can be run in one of the configurations defined in Table 5.5.1.5.4.1-1.

Table 5.5.1.5.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.5-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.1.5-2 | LTE TDD, 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.5.4.1-2

Table 5.5.1.5.4.1-2: Initial conditions for CSI-RS In-sync radio link monitoring in non-DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.5.1.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | TBD |
| Exceptions to connection diagram | N/A | |  |

1. The test parameters are given in Table 5.5.1.5.4.1-3 below.

2. Message contents are defined in clause 5.5.1.5.4.3.

3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to TS 38.133 [6] Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.5.4.1-3: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in non-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 | |  | TDD |
| BWchannel | | Config 1, 2 | 100: NRB,c = 66 |
| Data RBs allocated | | Config 1, 2 | 24 |
| BWoccupied | | Config 1, 2 | 24 |
| TDD Configuration | Config 1 |  | TDDConf.3.1 |
|  | Config 2 |  | TDDConf.3.1 |
| DL initial BWP configuration | Config 1, 2 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2 |  | DLBWP.1.4 |
| UL initial BWP configuration | Config 1, 2 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2 |  | ULBWP.1.4 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.3.1 TDD |
| Config 2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.3.4 TDD  CCR.3.6 TDD |
|  | Config 2 |  | CCR.3.4 TDD  CCR.3.6 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR2 |
|  | Config 2 |  | SSB.1 FR2 |
| SMTC Configuration | Config 1 |  | SMTC.1 |
|  | Config 2 |  | SMTC.1 |
| PDSCH/PDCCH | Config 1 |  | 120 KHz |
| subcarrier spacing | Config 2 |  | 120 KHz |
| CSI-RS for RLM | Config 1, 2 |  | Resource #4 in TRS.2.1 TDD  Resource #4 in TRS.2.2 TDD |
| reportConfigType | |  | periodic |
| reportQuantity | |  | cri-RI-PMI-CQI |
| CSI reporting periodicity | | slot | 40 |
| CSI reporting offset | | slot | 4 |
| TRS configuration | |  | TRS.2.1 TDD  TRS.2.2 TDD |
| TCI configuration for PDCCH#1/PDSCH | |  | TCI.State.2 |
| TCI configuration for PDCCH#2 | |  | TCI.State.3 |
| OCNG parameters | |  | OP.5 |
| CP length | |  | Normal |
| 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 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 | |  | *OFF* |
| Gap pattern ID | |  | *gp0* |
| Layer 3 filtering | |  | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310 | |  | 1 |
| N311 | |  | 1 |
| CSI-RS for CSI | Config 1 |  | CSI-RS.3.1 TDD |
| reporting | Config 2 |  | CSI-RS.3.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 0.35 |
| T3 | | s | 0.35 |
| D1 | | s | 0.31 |
| NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.  NOTE 2: E-UTRAN is in non-DRX mode under test. | | | |

Table 5.5.1.5.4.1-4: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode

|  |  |
| --- | --- |
| Field | Test 1 |
| Value |
| gapOffset | 0 |
| NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

5.5.1.5.4.2 Test procedure

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 defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms).

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.5.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.5.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.5.5-1. T3 starts.

5. If the SS:

a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B

and

b) does not detect any uplink power on NR carrier from time point C (D1 after the start of T3) until T3 expires,

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

6. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.5.5-1.

7. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.

8. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

9. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].

10. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.5.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.5.1.5.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED;  Table H.3.1-3 with Condition INTER-FREQ MO, SSB.1 FR2, SMTC.1 and RLM  Table H.3.1-4 with a3-offset = -6dB;  Table H.3.1-8 with Condition CSI RLM  Table H.3.1-9 |

Table 5.5.1.5.4.3-2: MeasConfig for E-UTRAN PCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [25], Table 4.6.6-1 with condition RF | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasConfig-DEFAULT ::= SEQUENCE { |  |  |  |
| reportConfigToAddModList | Not present |  |  |
| measIdToAddModList | Not present |  |  |
| measGapConfig | MeasGapConfig-GP1 | TS 36.508, table 4.6.6-1A |  |
| } |  |  |  |

5.5.1.5.5 Test requirement

Tables 5.5.1.5.4.1-2 and 5.5.1.5.5-1 define the primary level settings including test tolerances for Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode.

Table 5.5.1.5.5-1: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | | |
| T1 | T2 | T3 | T1 | T2 | T3 |
| AoA setup | |  | Setup 3 defined in A.9.3 | | | | | |
| AoA1 | | | AoA2 | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | Rough | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | | Not sent | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | 0 | | |
| 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 on RLM-RS1 | Config 1, 2 | dB | 4.1Note 11 | -3.9Note 11 | -15 |
| SNR on RLM-RS2 | Config 1, 2 | dB | Not sent | | | 4.1Note 11 | -15 | -15 |
|  | Config 1, 2 | dBm/ 15kHz | -94.8 | | | -94.8 | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | 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 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 5.5.1.5.4-1.  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 TS 38.133 [6] A.3.6.  Note 10: Information about types of UE beam is given in TS 38.133 [6] 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 | | | | | | | | |

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 in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according the configured periodic CSI reporting for Cell 2.

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

The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

#### 5.5.1.6 EN-DC FR2 radio link monitoring in-sync test for PSCell configured with CSI-RS-based RLM RS in non-DRX mode

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- TT analysis is made at Test frequency f ≤ 40.8 GHz

- Connection diagram is TBD.

- Usage of 2 antenna ports in CSI-RS 3.1 TDD implies SS transmitting signal on both polarizations. Potential signal imbalance impact to the test verdict is under investigation5.5.1.6.1 Test purpose

The purpose of this test is to verify that the UE properly detects the in-sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS in-sync radio link monitoring requirements in TS 38.133 clause 8.1.

5.5.1.6.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and CSI-RS based RLM.

5.5.1.6.3 Minimum conformance requirements

The minimum requirements are specified in clause 4.5.1.0.4. DRX configuration is not used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.6.

5.5.1.6.4 Test description

There are two cells configured in this test, the E-UTRA PCell and NR PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.1.6.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate in-sync states.

グラフ, 折れ線グラフ, 箱ひげ図

自動的に生成された説明

Figure 5.5.1.6.4-1: SNR variation for in-sync testing

5.5.1.6.4.1 Initial conditions

Test 5.5.1.6 can be run in one of the configurations defined in Table 5.5.1.6.4.1-1.

Table 5.5.1.6.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.6-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.1.6-2 | LTE TDD, 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.6.4.1-2

Table 5.5.1.6.4.1-2: Initial conditions for CSI-RS in-sync radio link monitoring in non-DRX mode

| Parameter | Value | | Comment |
| --- | --- | --- | --- |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.5.1.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | TBD |
| Exceptions to connection diagram | N/A | |  |

1. The test parameters are given in Table 5.5.1.6.4.1-3 below.

2. Message contents are defined in clause 5.5.1.6.4.3.

3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to TS 38.133 [6] Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.6.4.1-3: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-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 | | |  | TDD |
| BWchannel | | Config 1, 2 |  | 100: NRB,c = 66 |
| Data RBs allocated | | Config 1, 2 |  | 24 |
| BWoccupied | | Config 1, 2 |  | 24 |
| TDD | Config 1 | |  | TDDConf.3.1 |
| Configuration | Config 2 | |  | TDDConf.3.1 |
| DL initial BWP configuration | Config 1, 2 | |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2 | |  | DLBWP.1.4 |
| UL initial BWP configuration | Config 1, 2 | |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2 | |  | ULBWP.1.4 |
| RMSI CORESET Reference Channel | Config 1 | |  | CR.3.1 TDD |
| Config 2 | | CR.3.1 TDD |
| Dedicated CORESET Reference | Config 1 | |  | CCR.3.1 TDD  CCR.3.3 TDD |
| Channel | Config 2 | |  | CCR.3.1 TDD  CCR.3.3 TDD |
| SSB | Config 1 | |  | SSB.1 FR2 |
| Configuration | Config 2 | |  | SSB.1 FR2 |
| SMTC | Config 1 | |  | SMTC.1 |
| Configuration | Config 2 | |  | SMTC.1 |
| PDSCH/PDCCH | Config 1 | |  | 120 KHz |
| subcarrier spacing | Config 2 | |  | 120 KHz |
| CSI-RS for RLM | Config 1, 2 | |  | Resource #4 in TRS.2.1 TDD  Resource #4 in TRS.2.2 TDD |
| OCNG parameters | | |  | OP.5 |
| TRS configuration | | |  | TRS.2.1 TDD  TRS.2.2 TDD |
| TCI configuration for PDCCH#1/PDSCH | | |  | TCI.State.2 |
| TCI configuration for PDCCH#2 | | |  | TCI.State.3 |
| CP length | | |  | Normal |
| 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 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 |
| In sync | DCI format | |  | 1-0 |
| transmission parameters | Number of Control OFDM symbols | |  | 2 |
|  | Aggregation level | | CCE | 4 |
|  | 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 |
| DRX | | |  | *OFF* |
| Gap pattern ID | | |  | N.A. |
| Layer 3 filtering | | |  | *Enabled* |
| T310 timer | | | ms | 1000 |
| T311 timer | | | ms | 1000 |
| N310 | | |  | 1 |
| N311 | | |  | 1 |
| CSI-RS for CSI | Config 1 | |  | CSI-RS.3.1 TDD |
| reporting | Config 2 | |  | CSI-RS.3.1 TDD |
| T1 | | | s | 0.2 |
| reportConfigType | | |  | periodic |
| reportQuantity | | |  | cri-RI-PMI-CQI |
| CSI reporting periodicity | | | slot | 40 |
| CSI reporting offset | | | slot | 4 |
| T2 | | | s | 0.2 |
| T3 | | | s | 0.24 |
| T4 | | | s | 0.2 |
| T5 | | | s | 0.88 |
| D1 | | | s | 0.84 |
| NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.  NOTE 2: E-UTRAN is in non-DRX mode under test. | | | | |

5.5.1.6.4.2 Test procedure

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 defined in CSI-RS configuration. In the test, DRX configuration is not enabled.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.6.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.6.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.6.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.1.6.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.1.6.5-1. T5 starts.

7. If the SS detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point F (T6 ms after the start of time duration T5) the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

8. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.

9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5].

11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.6.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.5.1.6.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-2 with Condition INTRA-FREQ, L3 FILTERING NEEDED;  Table H.3.1-3 with Condition INTRA-FREQ MO, SSB.1 FR2, SMTC.1 and RLM  Table H.3.1-8 with Condition CSI RLM  Table H.3.1-9 |

5.5.1.6.5 Test requirement

Tables 5.5.1.6.4.1-2 and 5.5.1.6.5-1 define the primary level settings including test tolerances for Radio Link Monitoring in-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode.

Table 5.5.1.6.5-1: Cell specific test parameters for FR2 for CSI-RS is-sync radio link monitoring in non-DRX mode

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | | | | | | |
| T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 3 defined in A.9.3 | | | | | | | | | |
| AoA1 | | | | | AoA2 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | | | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | | Not sent | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | 0 | | | | |
| 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 on RLM-RS1 | Config 1, 2 | dB | 4.1Note 11 | -3.9Note 11 | -15 | -15 | -15 |
| SNR on RLM-RS2 | Config 1, 2 |  | Not sent | | | | | 4.1Note 11 | -15 | -15 | -4.5 | 4. 1Note 11 |
|  | Config 1, 2 | dBm/ 15KHz | -94.8 | | | | | -94.8 | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | | | | | 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 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, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure 5.5.1.6.4-1.  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 TS 38.133 [6] A.3.6.  Note 10: Information about types of UE beam is given in TS 38.133 [6] 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 | | | | | | | | | | | | |

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 after the start of time duration T5) the UE shall transmit uplink signal at least in all slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

#### 5.5.1.7 EN-DC FR2 radio link monitoring out-of-sync test for PSCell configured with CSI-RS-based RLM RS in DRX mode

Editor's note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.1.7.1 Test purpose

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 PSCell when DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in TS 38.133 clause 8.1.

5.5.1.7.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC, CSI-RS based RLM and long DRX cycle.

5.5.1.7.3 Minimum conformance requirements

The minimum requirements are specified in clause 5.5.1.0.3. DRX configuration is used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.7.

5.5.1.7.4 Test description

There are two cells configured in this test, the E-UTRA PCell and NR PSCell. This test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.7.4-1 shows the three different time durations and the corresponding variation of the downlink SNR in the active cell to emulate out-of-sync states.

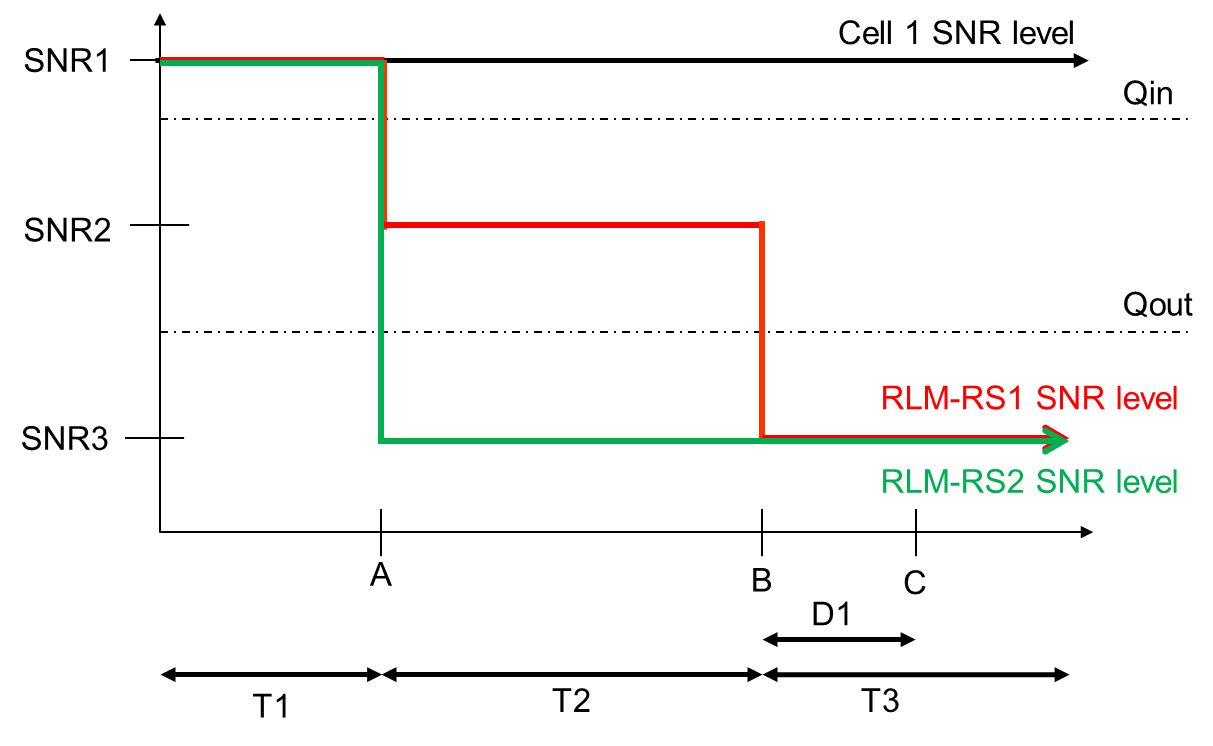


Figure 5.5.1.7.4-1: SNR variation for out-of-sync testing

5.5.1.7.4.1 Initial conditions

Test 5.5.1.7 can be run in one of the configurations defined in Table 5.5.1.7.4.1-1.

Table 5.5.1.7.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.7-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.1.7-2 | LTE TDD, 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.7.4.1-2

Table 5.5.1.7.4.1-2: Initial conditions for CSI-RS out-of-sync radio link monitoring in DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.7.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The test parameters are given in Table 5.5.1.7.4.1-3 below.

2. Message contents are defined in clause 5.5.1.7.4.3.

3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.7.4.1-3: General test parameters for FR2 PSCell for CSI-RS 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 | |  | TDD |
| TDD | Config 1 |  | TDDConf.3.1 |
| Configuration | Config 2 |  | TDDConf.3.1 |
| 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 |
| RMSI CORESET Reference Channel | Config 1 |  | CR. 3.1 TDD |
| Config 2 | CR. 3.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR. 3.4 TDD  CCR.3.6 TDD |
|  | Config 2 |  | CCR. 3.4 TDD  CCR.3.6 TDD |
| SSB | Config 1 |  | SSB.1 FR2 |
| Configuration | Config 2 |  | SSB.1 FR2 |
| SMTC | Config 1 |  | SMTC.1 |
| Configuration | Config 2 | SMTC.1 |
| PDSCH/PDCCH | Config 1 |  | 120 KHz |
| subcarrier spacing | Config 2 |  | 120 KHz |
| CSI-RS for RLM | Config 1, 2 |  | Resource #4 in TRS.2.1 TDD  Resource #4 in TRS.2.2 TDD |
| SSB index for BFD-RS | Config 1, 2 |  | 0, 1 |
| TRS configuration | |  | TRS.2.1 TDD  TRS.2.2 TDD |
| TCI configuration for PDCCH#1/PDSCH | |  | TCI.State.2 |
| TCI configuration for PDCCH#2 | |  | TCI.State.3 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| 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 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.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 |  | CSI-RS.3.1 TDD |
| reporting | Config 2 |  | CSI-RS.3.1 TDD |
| reportConfigType | |  | periodic |
| reportQuantity | |  | cri-RI-PMI-CQI |
| CSI reporting periodicity | | slot | 40 |
| CSI reporting offset | | slot | 4 |
| T1 | | s | 0.2 |
| T2 | | s | 1.28 |
| T3 | | s | 1.28 |
| D1 | | s | 1.24 |
| NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.  NOTE 2: E-UTRAN is in non-DRX mode under test. | | | |

5.5.1.7.4.2 Test procedure

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 defined in CSI-RS configuration. In the test, DRX configuration is enabled in PSCell 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.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.7.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.7.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.7.5-1. T3 starts.

5. If the SS:

a) detects uplink power on NR carrier in the On-duration part of every DRX cycle in the slots configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B

and

b) does not detect any uplink power on NR carrier from time point C (D1 after the start of T3) until T3 expires,

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

6. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.7.5-1.

7. If the UE has not re-established the connection in at least 1s, the UE is switched off and then on. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

8. Repeat steps 2-7 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.7.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 5.5.1.7.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-9  Table H.3.7-1 with condition DRX.3 |

Table 5.5.1.7.4.3-2: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.5-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig ::= CHOICE { |  |  |  |
| slots40 | 4 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList SEQUENCE (SIZE (1..maxNrofBWPs)) OF{ |  |  |  |
| PUCCH\_CSI\_Resource[0] SEQUENCE { |  |  |  |
| uplinkBandwidthPartId | BWP-Id |  |  |
| pucch\_Resource | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.1.7.4.3-3: *RadioLinkMonitoringConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF { | 4 entries |  |  |
| RadioLinkMonitoringRS[1] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 0 |  |  |
| purpose | beamFailure |  |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 | Index of SSB #0 |  |
| } |  |  |  |
| } |  |  |  |
| RadioLinkMonitoringRS[2] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 1 |  |  |
| purpose | beamFailure |  |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 1 | Index of SSB #1 |  |
| } |  |  |  |
| } |  |  |  |
| RadioLinkMonitoringRS[3] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 2 |  |  |
| purpose | rlf |  |  |
| detectionResource CHOICE { |  |  |  |
| csi-RS-Index | NZP-CSI-RS-ResourceId for TRS(4) | TS 38.508-1[14], table 7.3.1-7C |  |
| } |  |  |  |
| } |  |  |  |
| RadioLinkMonitoringRS[4] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 3 |  |  |
| purpose | rlf |  |  |
| detectionResource CHOICE { |  |  |  |
| csi-RS-Index | NZP-CSI-RS-ResourceId for TRS(4) with condition SECOND\_SET | TS 38.508-1[14], table 7.3.1-7C |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.1.7.5 Test requirement

Tables 5.5.1.7.4.1-2 and 5.5.1.7.5-1 define the primary level settings including test tolerances for Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode.

Table 5.5.1.7.5-1: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | | |
| **T1** | **T2** | **T3** |
| AoA setup | |  | Setup 1 defined in A.9.1 | | |
| Assumption for UE beamsNote 10 | |  | Rough | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | 0 | | |
| 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 on RLM-RS1 | Config 1, 2 | dB | 3.3Note | -4.7Note | -15.4 |
| SNR on RLM-RS2 | Config 1, 2 | 3.3Note | -15.4 | -15.4 |
|  | Config 1 | dBm/15KHz | -104.7 | | |
| Config 2 | -104.7 | | |
| 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 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 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.1.7.4-1.  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 TS 38.133 [6] A.3.6.  Note 10: Information about types of UE beam is given in TS 38.133 [6] 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 | | | | | |

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 once every DRX cycle, in the On-duration part of the cycle in the slots configured for CSI transmission according the configured periodic CSI reporting for Cell 2.

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

The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

5.5.1.8 EN-DC FR2 radio link monitoring in-sync test for PSCell configured with CSI-RS-based RLM RS in DRX mode

Editor's note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.1.8.1 Test purpose

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 PSCell CSI-RS in-sync radio link monitoring requirements in TS 38.133 clause 8.1.

5.5.1.8.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC, CSI-RS based RLM and long DRX cycle.

5.5.1.8.3 Minimum conformance requirements

The minimum requirements are specified in clause 5.5.1.0.4. DRX configuration is used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.8.

5.5.1.8.4 Test description

There are two cells configured in this test, the E-UTRA PCell and NR PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.1.8.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate in-sync states.

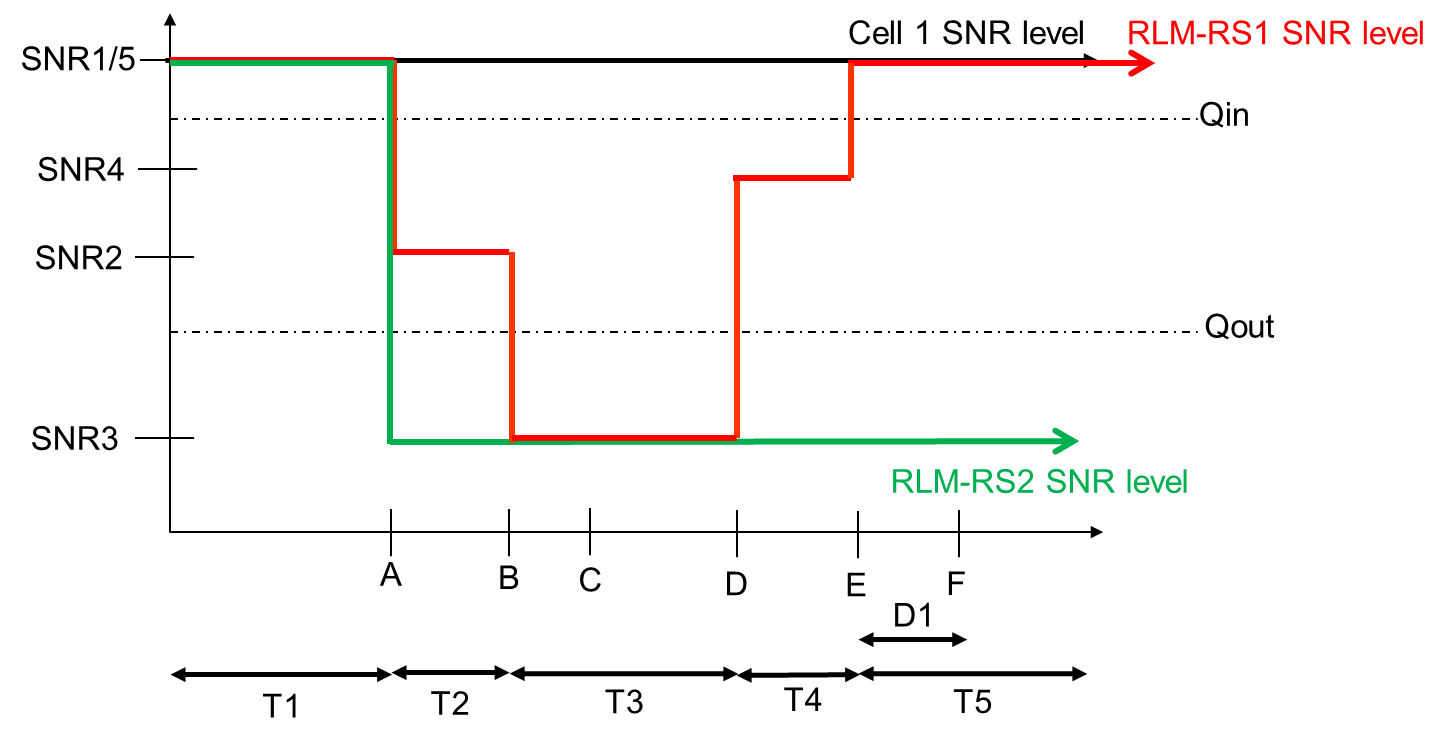


Figure 5.5.1.8.4-1: SNR variation for In-sync testing

5.5.1.8.4.1 Initial conditions

Test 5.5.1.8 can be run in one of the configurations defined in Table 5.5.1.8.4.1-1.

Table 5.5.1.8.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.8-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.1.8-2 | LTE TDD, 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.8.4.1-2

Table 5.5.1.8.4.1-2: Initial conditions for CSI-RS In-sync radio link monitoring in DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.8.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The test parameters are given in Table 5.5.1.8.4.1-2 below.

2. Message contents are defined in clause 5.5.1.8.4.3.

3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.8.4.1-3: General test parameters for FR2 PSCell for CSI-RS In-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 | |  | TDD |
| TDD Configuration | Config 1 |  | TDDConf.3.1 |
|  | Config 2 |  | TDDConf.3.1 |
| 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 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.3.1 TDD |
| Config 2 | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.3.1 TDD  CCR.3.3 TDD |
|  | Config 2 |  | CCR.3.1 TDD  CCR.3.3 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR2 |
|  | Config 2 |  | SSB.1 FR2 |
| SMTC Configuration | Config 1 |  | SMTC.1 |
|  | Config 2 |  | SMTC.1 |
| PDSCH/PDCCH | Config 1 |  | 120 KHz |
| subcarrier spacing | Config 2 |  | 120 KHz |
| CSI-RS for RLM | Config 1, 2 |  | Resource #4 in TRS.2.1 TDD  Resource #4 in TRS.2.2 TDD |
| SSB index for BFD-RS | Config 1, 2 |  | 0, 1 |
| TRS configuration | |  | TRS.2.1 TDD  TRS.2.2 TDD |
| TCI configuration for PDCCH#1/PDSCH | |  | TCI.State.2 |
| TCI configuration for PDCCH#2 | |  | TCI.State.3 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| 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 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 |
| In sync transmission | DCI format |  | 1-0 |
| parameters | Number of Control OFDM symbols |  | 2 |
|  | Aggregation level | CCE | 4 |
|  | 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 |
| DRX | |  | DRX.3 |
| Gap pattern ID | |  | *gp0* |
| Layer 3 filtering | |  | *Enabled* |
| T310 timer | | ms | 2000 |
| T311 timer | | ms | 1000 |
| N310 | |  | 1 |
| N311 | |  | 1 |
| CSI-RS for CSI | Config 1 |  | CSI-RS.3.1 TDD |
| reporting | Config 2 |  | CSI-RS.3.1 TDD |
| reportConfigType | |  | periodic |
| reportQuantity | |  | cri-RI-PMI-CQI |
| CSI reporting periodicity | | slot | 40 |
| CSI reporting offset | | slot | 4 |
| T1 | | s | 0.2 |
| T2 | | s | 0.2 |
| T3 | | s | 1.64 |
| T4 | | s | 0.2 |
| T5 | | s | 1.88 |
| D1 | | s | 1.84 |
| NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.  NOTE 2: E-UTRAN is in non-DRX mode under test. | | | |

Table 5.5.1.8.4.1-4: Measurement gap configuration for FR2 CSI-RS In-sync radio link monitoring in DRX mode

|  |  |
| --- | --- |
| Field | Test 1 |
| Value |
| gapOffset | 0 |
| NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

5.5.1.8.4.2 Test procedure

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 defined in CSI-RS configuration. In the test, DRX configuration is enabled in PSCell 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. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms).

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. The SS shall transmit an *RRCConnectionReconfiguration* message configuring the UE for inter-frequency measurements.

3. The UE shall transmit *RRCReconfigurationComplete* message.

4. Set the parameters of Cell 2 according to T1 in Table 5.5.1.8.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

5. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.8.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.8.5-1. T3 starts.

7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.1.8.5-1. T4 starts.

8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.1.8.5-1. T5 starts.

9. If the SS detects uplink power on NR carrier in the On-duration part of every DRX cycle in the configured slots for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point F (D1 after the start of time duration T5) the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

10. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.

11. The SS then shall transmit *RRCConnectionReconfiguration* message with condition *MCG\_and\_SCG* according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

12. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG and SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].

13. Repeat steps 2-12 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.8.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 5.5.1.8.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED;  Table H.3.1-3 with Condition INTER-FREQ MO, (where ssbFrequency is set to the ARFCN value of carrier center of High range),and RLM  Table H.3.1-4 with a3-offset = 0dB;  Table H.3.7-1 with condition DRX.3 and Gap |

Table 5.5.1.8.4.3-2: MeasConfig for E-UTRAN PCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508, Table 4.6.6-1 with condition RF | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasConfig-DEFAULT ::= SEQUENCE { |  |  |  |
| reportConfigToAddModList | Not present |  |  |
| measIdToAddModList | Not present |  |  |
| measGapConfig | MeasGapConfig-GP1 | TS 36.508, table 4.6.6-1A |  |
| } |  |  |  |

Table 5.5.1.8.4.3-3: RLF-TimersAndConstant

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| t310 | ms2000 |  |  |
| } |  |  |  |

Table 5.5.1.8.4.3-4: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.5-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig ::= CHOICE { |  |  |  |
| slots40 | 4 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList SEQUENCE (SIZE (1..maxNrofBWPs)) OF{ |  |  |  |
| PUCCH\_CSI\_Resource[0] SEQUENCE { |  |  |  |
| uplinkBandwidthPartId | BWP-Id |  |  |
| pucch\_Resource | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.1.8.4.3-5: *RadioLinkMonitoringConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF { | 4 entries |  |  |
| RadioLinkMonitoringRS[1] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 0 |  |  |
| purpose | beamFailure |  |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 | Index of SSB #0 |  |
| } |  |  |  |
| } |  |  |  |
| RadioLinkMonitoringRS[2] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 1 |  |  |
| purpose | beamFailure |  |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 1 | Index of SSB #1 |  |
| } |  |  |  |
| } |  |  |  |
| RadioLinkMonitoringRS[3] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 2 |  |  |
| purpose | rlf |  |  |
| detectionResource CHOICE { |  |  |  |
| csi-RS-Index | NZP-CSI-RS-ResourceId for TRS(4) | TS 38.508-1[14], table 7.3.1-7C |  |
| } |  |  |  |
| } |  |  |  |
| RadioLinkMonitoringRS[4] SEQUENCE { |  |  |  |
| radioLinkMonitoringRS-Id | 3 |  |  |
| purpose | rlf |  |  |
| detectionResource CHOICE { |  |  |  |
| csi-RS-Index | NZP-CSI-RS-ResourceId for TRS(4) with condition SECOND\_SET | TS 38.508-1[14], table 7.3.1-7C |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.1.8.5 Test requirement

Tables 5.5.1.8.4.1-2 and 5.5.1.8.5-1 define the primary level settings including test tolerances for Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode.

Table 5.5.1.8.5-1: Cell specific test parameters for FR2 for CSI-RS In-sync radio link monitoring in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.9.1 | | | | |
| 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 | 0 | | | | |
| 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 on RLM-RS1 | Config 1, 2 | dB | 3.3Note | -4.7Note 11 | -15.4 | -4. 9 | 3.3Note 11 |
| SNR on RLM-RS2 | Config 1, 2 | dB | 3.3Note | -15.4 | -15.4 | -15.4 | -15.4 |
|  | Config 1, 2 | dBm/15KHz | -104.7 | | | | |
| 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 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, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure 5.5.1.8.4-1.  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 TS 38.133 [6] A.3.6.  Note 10: Information about types of UE beam is given in TS 38.133 [6] 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 | | | | | | | |

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 after the start of time duration T5) the UE shall transmit uplink signal at least once every DRX cycle, in the ON-duration part of the cycle in the slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

#### 5.5.1.9 EN-DC FR2 radio link monitoring UE scheduling restrictions

Editor's note: This test case is incomplete. The following aspects are either missing or not yet determined:

- The test tolerances and test system uncertainties applicable to this test are undefined.

- Message content is TBD

5.5.1.9.1 Test purpose

The purpose of this test is to verify that the NR UE correctly follows the RLM scheduling restrictions requirements defined in TS 38.133 [6] clause 8.1.7, and to verify that the UE correctly receive the PDCCH scheduled on the symbols right before the RLM SSB symbols without overlap so that it sends ACK/NACK correctly.

5.5.1.9.2 Test applicability

This test applies to all types of NR UE from Release 15 onwards.

This test is only applicable to UE which supports *pdcch-MonitoringAnyOccasions* or *pdcch-MonitoringAnyOccasionsWithSpanGap*.

5.5.1.9.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 5.5.1.0.5.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.9.

5.5.1.9.4 Test description

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and NR FR2 PSCell (Cell 2). The test parameters for NR PSCell are given in table 5.5.1.9.4.1-1, table 5.5.1.9.4.1-3 and table 5.5.1.9.5-1 below and the parameters and applicability for the E-UTRAN cell are defined in A.6.1.2. The test consists of one time period with time duration of T1. Figure 5.5.1.9.4-1 shows the Time multiplexed downlink transmissions from each Angle of Arrival. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.



Figure 5.5.1.9.4-1: Time multiplexed downlink transmissions

5.5.1.9.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.1.9.4.1-1.

Table 5.5.1.9.4.1-1: Supported test configurations for EN-DC FR2 radio link monitoring UE scheduling restrictions

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.1.9-1 | FDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.1.9-2 | TDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to be tested in one of the supported test configurations. | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.9.4.1-2

Table 5.5.1.9.4.1-2: Initial conditions for EN-DC FR2 radio link monitoring UE scheduling restrictions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.2, Table E.4-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.9.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | TBD |
| Exceptions to connection diagram | N/A | |  |

1. The test parameters for PSCell are given in Table 5.5.1.9.4.1-3
2. Message contents are defined in clause 5.5.1.9.4.3.
3. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2

Table 5.5.1.9.4.1-3: General test parameters for EN-DC FR2 radio link monitoring UE scheduling restrictions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | 1, 2 | 1 and 2 | 1 for NR PSCell and 2 for LTE PCell |
| SSB configuration |  | 1, 2 | SSB.1 FR2 |  |
| SMTC configuration |  | 1, 2 | SMTC pattern 1 |  |
| DRX cycle length | s | 1, 2 | OFF |  |
| T1 | s | 1, 2 | 5 | During T1 the UE is required to correctly transmit ACK/NACK |

5.5.1.9.4.2 Test Procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

1. Set the parameters according to T1 in Table 5.5.1.9.4.4-1. Propagation conditions are set according to clause C.2.2. T1 starts.

2. If the SS receives ACK/NACK from Cell 2 on each UL transmission occasion scheduled by PDCCH which are not overlapped with SSBs configured for radio link monitoring during T1, the number of successful tests is increased by one. otherwise the number of failed tests is increased by one.

3. The UE is switched off and then on. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* according to TS 38.508-1 [10] clause 4.5.

4. Repeat steps 1-3 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.9.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.1.9.4.3-1: Common Exception messages for EN-DC FR2 radio link monitoring UE scheduling restrictions

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions | TBD |
| Default RRC messages and information elements contents exceptions | TBD |

5.5.1.9.5 Test Requirement

Table 5.5.1.9.4.1-3 and 5.5.1.9.5-1 define the primary level settings including test tolerances for EN-DC FR2 radio link monitoring UE scheduling restrictions.

Table 5.5.1.9.5-1: Cell specific test parameters for EN-DC FR2 radio link monitoring UE scheduling restrictions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test configuration** | **Cell 2** | |
| AoA setup |  | 1, 2 | Setup 3 defined in A.9.3 | |
| **AoA1** | **AoA2** |
| Assumption for UE beamsNote 1 |  |  | Rough | Rough |
| TDD configuration |  | 1, 2 | TDDConf.3.1 | |
| BWchannel | MHz | 1, 2 | 100: NRB,c = 66 | |
| Data RBs allocated |  | 1, 2 | 24 | |
| PDSCH Reference measurement channel |  | 1, 2 | SR.3.2 TDD | Not sent |
| RMSI CORESET RMC configuration |  | 1, 2 | CR.3.1 TDD | Not sent |
| Dedicated CORESET RMC configuration |  | 1, 2 | CCR.3.2 TDD | Not sent |
| TRS configuration |  | 1, 2 | TRS.2.1 TDD | TRS.2.2 TDD |
| PDCCH/PDSCH TCI state |  | 1, 2 | TCI.State.2 | Not sent |
| OCNG Pattern |  | 1, 2 | OP.5 | Not sent |
| Initial DL BWP configuration |  | 1, 2 | DLBWP.0.1 | |
| Initial UL BWP configuration |  | 1, 2 | ULBWP.0.1 | |
| RLM-RS |  | 1, 2 | SSB with index 0 | SSB with index 1 |
|  | dBm/15kHz | 1, 2 | -92.1 | -92.1 |
| Note2 | dBm/SCS | 1, 2 | -83.1 | -83.1 |
|  | dB | 1, 2 | 2 | 2 |
| BB Note 4 | dB | 1, 2 | 1 | 1 |
| SSB\_RP Note3 | dBm/SCS | 1, 2 | -81.1 | -81.1 |
| Io | dBm/95.04 MHz | 1, 2 | -54.35 | -54.35 |
| Time multiplexing of the downlink transmissions from each AoA | | 1, 2 | Defined in Figure 5.5.1.9.4-1 | |
| Propagation Condition |  | 1, 2 | AWGN | AWGN |
| Note 1: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 3: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [3] Table 6.2.1.3-4. | | | | |

The UE behaviour during time duration T1 follows the requirements defined in TS 38.133 [6] clause 8.1.7.3:

The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95%.

#### 5.5.1.10 EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.5.1.10.1 Test purpose

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 5.5.1.0.6.1 for UE fulfilling good serving cell quality criterion.

5.5.1.10.2 Test applicability

This test applies to all types of E-UTRA UE release 17 and forward, supporting EN-DC FR2 and RLM relaxation criteria *rlm-Relaxation-r17*.

5.5.1.10.3 Minimum conformance requirement

The requirements for UE supporting relaxed measurement criterion are specified in clause 5.5.1.0.6. The minimum requirements for SSB-based RLM with this criterion are specified in clause 5.5.1.0.6.1. DRX configuration is used for this test.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.10.

5.5.1.10.4 Test description

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 5.5.1.10.4.1-1. The test parameters are given in Tables 5.5.1.10.4.1-3 and 5.5.1.10.5-1.

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.6.1.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.10.4-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states.

Chart

Description automatically generated

Figure 5.5.1.10.4-1: SNR variation for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

5.5.1.10.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.1.10.4.1-1.

Table 5.5.1.10.4.1-1: Supported test configurations for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.5.1.10-1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.1.10-2 | 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.10.4.1-2.

Table 5.5.1.10.4.1-2: Initial conditions for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 and 7.2.3. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.1.10.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.1.10.4.1-3.

2. Message contents are defined in clause 5.5.1.10.4.3.

3. There are two cells (one E-UTRAN carrier and one NR carrier) specified in the test. Cell 1 is the PCell on the E-UTRAN carrier and Cell 2 is the PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.1.10.4.1-3: General test parameters for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS 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.7.2 |
| 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. | | | | |

5.5.1.10.4.2 Test Procedure

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.

Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508‑1 [14] clause 4.5.

2. The SS shall transmit an *RRCReconfiguration* message (embedded in *RRCConnectionReconfiguration* message) configuring the UE with *goodServingCellEvaluationRLM* and measurements as specified in section 5.5.1.10.4.3.

3. The UE shall transmit *RRCReconfigurationComplete* message (embedded in *RRCConnectionReconfiguration* message).

4. Set the parameters according to T1 in Table 5.5.1.10.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

5. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.10.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.10.5-1. T3 starts.

7. If the SS:

a) detects uplink power in the On-Duration part of every DRX cycle in each subframe configured for CSI transmission (according to configured CSI periodicity on PUCCH format 2) during the period from time point A to time point B; and

b) does not detect any uplink power in any of such CSI transmission occasions from time point C (D1 after the start of T3) until T3 expires,

the number of successful tests is increased by one. Otherwise, the number of failed tests is increased by one.

8. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.10.5-1.

9. If the UE has not re-established the connection in at least 1s, go to step 10. Otherwise go to step 11.

10. The SS shall ensure the PSCell is released. Then it shall transmit an *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message. If the reconfiguration fails go to step 11, otherwise go to step 12.

11. Switch off and on the UE and go to step 12.

12. Repeat steps 1-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.10.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6.1 and 7.3.1 with the following exceptions.

Table 5.5.1.10.4.3-1: Common Exception messages for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition L3 FILTERING NEEDED  Table H.3.1-3 with Condition INTRA-FREQ MO  Table H.3.1-4 with A3-offset = 0  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-3  Table H.3.5-4  Table H.3.5-9 with Condition SSB RLM  Table H.3.7-1 with Condition DRX.3 |

Table 5.5.1.10.4.3-2: *RLF-TimersAndConstant* for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| t310 | ms0 |  |  |
| n310 | n1 |  |  |
| n311 | n1 |  |  |
| t311-v1530 | ms1000 |  |  |
| } |  |  |  |

Table 5.5.1.10.4.3-3: *CellGroupConfig* for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| goodServingCellEvaluationRLM-r17 SEQUENCE { |  |  |  |
| offset-r17 | Not present | If this field is absent, the UE applies the (default) value of 0 dB |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.1.10.5 Test Requirement

Table 5.5.1.10.5-1 defines the cell specific primary level settings including test tolerances for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion.

Table 5.5.1.10.5-1: Cell specific test parameters for EN-DC FR2 Radio Link Monitoring Out-of-sync Test for PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
|  | |  | T1 | T2 | T3 |
| AoA setup | |  | Setup 1 defined in A.9 | | |
| 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 | 3.25Note 6 | 3.25 Note 6 | -15.50 |
|  | 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 D.4.  Note 5: Information about types of UE beam is given in 38.133 [6] clause 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 | | | | | |

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).

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95 %.

### 5.5.2 Interruption

#### 5.5.2.0 Minimum conformance requirements

##### 5.5.2.0.1 Minimum conformance requirements for interruptions at transitions between active and non-active during DRX

[TS38.133, clause 8.2.1.2.1]

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions between active and non-active during DRX when PSCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 5.5.2.0.1-1.

Each interruption shall not exceed X slot as defined in table 5.5.2.0.1-1.

Table 5.5.2.0.1-1: Interruption length X at transition between active and non-active during DRX

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X | |
| Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 1 | 2 |
| 2 | 0.25 | 3 | |
| 3 | 0.125 | 5 | |

When both E-UTRA PCell and PSCell are in DRX, no interruption is allowed.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.1.

##### 5.5.2.0.2 Minimum conformance requirements for interruptions during measurements on deactivated NR SCC

[TS38.133, clause 8.2.1.2.5.1]

Interruption on PSCell and other active NR SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with PSCell.

[TS38.133, clause 8.2.2.2.3]

Interruptions on PCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 5.5.2.0.2-1 if the PCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 5.5.2.0.2-2 if the PCell is in the same band as the deactivated SCell.

Interruptions on active SCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 5.5.2.0.2-1 if the active SCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 5.5.2.0.2-2 if the active SCell is in the same band as the deactivated SCell.

[TS38.133, clause 8.2.2.2.2]

Table 5.5.2.0.2-1: Interruption duration for SCell activation/deactivation for inter-band CA

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 2 |
| 3 | 0.125 | 4 |

Table 5.5.2.0.2-2: Interruption duration for SCell activation/deactivation for intra-band CA

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms)** | **Interruption length** |
| 0 | 1 | 1 + TSMTC\_duration |
| 1 | 0.5 | 1 + TSMTC\_duration |
| 2 | 0.25 | 2 + TSMTC\_duration |
| 3 | 0.125 | 4 + TSMTC\_duration |
| NOTE: TSMTC\_duration is  - the longest SMTC duration among all above activated serving cells and the SCell being activated when one SCell is activated;  - the longest SMTC duration among all activated serving cells in the same band when one SCell is deactivated. | | |

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.5.1.

##### 5.5.2.0.3 Minimum conformance requirements for interruptions during measurements on deactivated E-UTRAN SCC

[TS38.133 clause 8.2.1.2.5.2]

When one E-UTRA SCell in MCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [2] for the deactivated E-UTRA SCellsis 640 ms or longer.

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2]for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [2].

Each interruption shall not exceed

- X3 slot, if the PSCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or

- Y3 slot + SMTC duration, if the PSCell or activated SCell is in the same band as the E-UTRA deactivated SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

Table 5.5.2.0.3-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X3 slot | Interruption length Y3 slot |
| 0 | 1 | 1 | 1 |
| 1 | 0.5 | 1 | 1 |
| 2 | 0.25 | 2 | 2 |
| 3 | 0.125 | 4 | 4 |

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.5.1.

##### 5.5.2.0.4 Minimum conformance requirements for interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to an active UL BWP of another activated carrier;

- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].

- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD in SCG.

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [5], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 5.5.2.0.4-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 5.5.2.0.4-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 5.5.2.0.4-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 5.5.2.0.4-2.

Table 5.5.2.0.4-1: Interruption length X1 (slot)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length | SRS carrier | Interruption length X1 (slots) | |
|  | (ms) of victim cell | switching time (us)Note 1 | Sub carrier spacing for agressor cell (kHz) | |
|  |  |  | 15 | 30 |
| 0 | 1 | ≤ 200 | 2 | 2 |
|  |  | 300, 500 | 2 | 2 |
|  |  | 900 | 3 | 3 |
| 1 | 0.5 | ≤ 200 | 3 | 2 |
|  |  | 300, 500 | 3 | 3 |
|  |  | 900 | 4 | 4 |
| 2 | 0.25 | ≤ 200 | 4 | 3 |
|  |  | 300, 500 | 5 | 4 |
|  |  | 900 | 7 | 6 |
| 3 | 0.125 | ≤ 200 | 7 | 5 |
|  |  | 300, 500 | 9 | 7 |
|  |  | 900 | 12 | 10 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | | | | |

Table 5.5.2.0.4-2: Interruption length X2 (slot)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot | SRS carrier | Interruption length X2 (slots) | |
|  | length (ms) of victim cell | switching time (us) Note1 | Sub carrier spacing for agressor cell (kHz) | |
|  |  |  | 60 | 120 |
| 0 | 1 | ≤ 200 | 2 | 2 |
| 1 | 0.5 | ≤ 200 | 2 | 2 |
| 2 | 0.25 | ≤ 200 | 3 | 3 |
| 3 | 0.125 | ≤ 200 | 4 | 4 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | | | | |

For intra-band SRS carrier switching in FR1 or FR2, interruptions in Table 5.5.2.0.4-1 and in Table 5.5.2.0.4-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1, interruptions in Table 5.5.2.0.4-1 and in Table 5.5.2.0.4-2 shall apply.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.12.

##### 5.5.2.0.5 Minimum conformance requirements for interruptions at E-UTRA SRS carrier based switching

A PUSCH-less carrier of E-UTRA SCell is a TDD carrier without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [23] and/or non-contention based PRACH on a PUSCH-less carrier of E-UTRA SCell, the UE can perform carrier based switching to one or more PUSCH-less carrier of E-UTRA SCells from a E-UTRA carrier with PUSCH or from another PUSCH-less E-UTRA carrier of SCell prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured E-UTRA carrier to another activated TDD E-UTRA carrier;

- the PUSCH-less carrier of E-UTRA SCells to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [15] for periodic SRS transmission;

- the E-UTRA serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [15];

- the SRS switching is not colliding with any other transmission with higher priority defined in TS36.213 [26];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in TS36.213 [26];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [25], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other E-UTRA carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between E-UTRA carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching to the PUSCH-less carrier of a serving cell,

- with up to X3 slot as specified in Table 5.5.2.0.5-1.

When SRS carrier based switching is performed between E-UTRA carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching from the PUSCH-less carrier of a serving cell,

- with up to X3 slot as specified in Table 5.5.2.0.5-1

Table 5.5.2.0.5-1: Interruption length X3 (slot)

|  |  |  |
| --- | --- | --- |
|  | NR Slot | Interruption length X3 |
|  | length (ms) | (slots) |
| 0 | 1 | 2 |
| 1 | 0.5 | 3 |
| 2 | 0.25 | 5 |
| 3 | 0.125 | 9 |

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.13.

#### 5.5.2.1 EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.2.1.1 Test purpose

The purpose of this test is:

- To verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits.

- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and long DRX cycle.

5.5.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.1.

5.5.2.1.4 Test description

5.5.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.2.1.4.1-1.

Table 5.5.2.1.4.1-1: Supported test configurations for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.1-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.2.1-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.1.4.1-2.

Table 5.5.2.1.4.1-2: Initial conditions for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.1.4.1-3.

2. Message contents are defined in clause 5.5.2.1.4.3.

3. There are one E-UTRAN carrier and one NR carrier and two cells in the test. Cell 1 is PCell on the E-UTRAN carrier, Cell 2 is PSCell on the NR carrier, Cell 1 is the cell used for connection setup with the power levels set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.2.1.4.1-3: General test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| CP length |  | Normal | Applicable to cell1 and cell 2 |
| DRX |  | DRX.4 | DRX related parameters are defined in TS 38.133 Table A.3.3.4-1 |
| Measurement gap pattern Id |  | OFF |  |
| T1 | s | 6.25 |  |

5.5.2.1.4.2 Test procedure

The test consists of two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1 and Cell2. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.

3. The SS shall transmit an *RRCConnectionReconfiguration* message to configure PCell (Cell1) and PSCell (Cell2) on the MCG and SCG as per TS 36.508 [7] clause 4.6 with the message content exceptions defined in clause 5.5.2.1.4.3.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. The SS would ensure continuous transmission on PSCell, while not scheduling on PCell at least for 200 ms to ensure inactivity timer is expired on the UE for LTE PCell.

6. Set the parameters according to T1 in Table 5.5.2.1.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.

7. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.

8. If more than 99% of uplink transmissions are received by SS then count a success for the event “ACK/NACK”. Otherwise count a fail for the event “ACK/NACK”.

9. If no two consecutive missing PUCCH transmissions are observed by the SS, then count a success for the event “DTX”. Otherwise count a fail for the event “DTX”.

10. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),

or

- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

11. Repeat step 3-10 until a test verdict has been achieved

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict. If all events pass, the test passes. If one event fails, the test fails.

5.5.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.2.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.7-2 with Condition DRX.4 |

5.5.2.1.5 Test requirement

Table 5.5.2.1.4.1-1, 5.5.2.1.5-1 and 5.5.2.1.5-2 define the NR cell specific primary level settings including test tolerances for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC test.

Table 5.5.2.1.5-1: NR cell specific test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | Config 1,2 |  | TDD |
| TDD configuration | Config 1,2 |  | TDDConf.3.1 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 |
| Data RBs allocated | Config 1,2 |  | 66 |
| Initial DL BWP Configuration | Config 1,2 |  | DLBWP.0.1 |
| Downlink dedicated BWP Configuration | Config 1,2 |  | DLBWP.1.1 |
| Uplink initial BWP configuration | Config 1,2 |  | ULBWP.0.1 |
| Uplink dedicated BWP configuration | Config 1,2 |  | ULBWP.1.1 |
| TRS configuration | Config 1,2 |  | TRS.2.1 TDD |
| TCI state | Config 1,2 |  | TCI.State.0 |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 |  | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 |  | CCR.3.1 TDD |
| OCNG Patterns | |  | OP.1 |
| SSB Configuration | |  | SSB.3 FR2 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |
| EPRE ratio of PBCH to PBCH DMRS | |
| EPRE ratio of PDCCH DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH DMRS | |
| EPRE ratio of PDSCH DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |
| Ês/Noc | | dB | 17 |
| Propagation Condition | |  | AWGN |
| Time offset to cell1 Note 2 | | μs | 3 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

Table 5.5.2.1.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell2 |
| Angle of arrival configuration |  | Setup 1 according to clause A.9.1 |
| Assumption for UE beamsNote 6 |  | Fine |
| Note1 | dBm/15kHzNote4 | -112 |
| Note1 | dBm/SCSNote3 | -102.97 |
|  | dB | 17 |
| SSB\_RPNote2 | dBm/SCS Note4 | -85.97 |
|  | dB | 17 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.90 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133[6], and does not limit UE implementation or test system implementation | | |

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in clause TS 38.133 clause 8.2.1.

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

#### 5.5.2.2 EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.2.2.1 Test purpose

The purpose of this test is:

- To verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits.

- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.2.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and long DRX cycle.

5.5.2.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.2.

5.5.2.2.4 Test description

5.5.2.2.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 5.5.2.2.4.1-1.

Table 5.5.2.2.4.1-1: Supported test configurations for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.2-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.2.2-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.2.4.1-2.

Table 5.5.2.2.4.1-2: Initial conditions for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.2.4.1-3.

2. Message contents are defined in clause 5.5.2.2.4.3.

3. There are one E-UTRAN carrier and one NR carrier and two cells in the test. Cell 1 is PCell on the E-UTRAN carrier, Cell 2 is PSCell on the NR carrier, Cell 1 is the cell used for connection setup with the power levels set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.2.2.4.1-3: General test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| CP length |  | Normal | Applicable to cell1 and cell 2 |
| DRX |  | DRX.4 | DRX related parameters are defined in TS 38.133 Table A.3.3.4-1 |
| Measurement gap pattern Id |  | OFF |  |
| T1 | s | 6.25 |  |

5.5.2.2.4.2 Test procedure

The test consists of two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1 and Cell2. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.

3. The SS shall transmit an *RRCConnectionReconfiguration* message to configure PCell (Cell1) and PSCell (Cell2) on the MCG and SCG as per TS 36.508 [7] clause 4.6 with the message content exceptions defined in clause 5.5.2.2.4.3.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. The SS would ensure continuous transmission on PSCell, while not scheduling on PCell at least for 200 ms to ensure inactivity timer is expired on the UE for LTE PCell.

6. Set the parameters according to T1 in Table 5.5.2.2.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.

7. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.

8. If more than 99% of uplink transmissions are received by SS then count a success for the event “ACK/NACK”. Otherwise count a fail for the event “ACK/NACK”.

9. If no two consecutive missing PUCCH transmissions are observed by the SS, then count a success for the event “DTX”. Otherwise count a fail for the event “DTX”.

10. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),

or

- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

11. Repeat step 3-10 until a test verdict has been achieved

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict. If all events pass, the test passes. If one event fails, the test fails.

5.5.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.2.2.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.7-2 with Condition DRX.4 |

5.5.2.2.5 Test requirement

Table 5.5.2.2.4.1-1, 5.5.2.2.5-1 and 5.5.2.2.5-2 define the NR cell specific primary level settings including test tolerances for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC test.

Table 5.5.2.2.5-1: NR cell specific test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | Config 1,2 |  | TDD |
| TDD configuration | Config 1,2 |  | TDDConf.3.1 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 |
| Data RBs allocated | Config 1,2 |  | 66 |
| Initial DL BWP Configuration | Config 1,2 |  | DLBWP.0.1 |
| Dedicated DL BWP Configuration | Config 1,2 |  | DLBWP.1.1 |
| Initial UL BWP configuration | Config 1,2 |  | ULBWP.0.1 |
| Dedicated UL BWP configuration | Config 1,2 |  | ULBWP.1.1 |
| TRS configuration | Config 1,2 |  | TRS.2.1 TDD |
| TCI state | Config 1,2 |  | TCI.State.0 |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 |  | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 |  | CCR.3.1 TDD |
| OCNG Patterns | |  | OP.1 |
| SSB Configuration | |  | SSB.3 FR2 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |
| EPRE ratio of PBCH to PBCH DMRS | |
| EPRE ratio of PDCCH DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH DMRS | |
| EPRE ratio of PDSCH DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |
| Ês/Noc | | dB | 17 |
| Propagation Condition | |  | AWGN |
| Time offset to cell1 Note 2 | | μs | 62.5 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

Table 5.5.2.2.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell2 |
| Angle of arrival configuration |  | Setup 1 according to clause A.9.1 |
| Assumption for UE beamsNote 6 |  | Fine |
| Note1 | dBm/15kHzNote4 | -112 |
| Note1 | dBm/SCSNote3 | -102.97 |
|  | dB | 17 |
| SSB\_RPNote2 | dBm/SCS Note4 | -85.97 |
|  | dB | 17 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.90 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133[6], and does not limit UE implementation or test system implementation | | |

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in TS 38.133 clause 8.2.1.

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

#### 5.5.2.3 EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.2.3.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits.

- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC. and 2 DL CA

5.5.2.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.3.

5.5.2.3.4 Test description

5.5.2.3.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 5.5.2.3.4.1-1.

Table 5.5.2.3.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.3-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.2.3-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.3.4.1-2.

Table 5.5.2.3.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.3.4.1-3.

2. Message contents are defined in clause 5.5.2.3.4.3.

3. There are three cells (one E-UTRAN carrier and two NR carriers) specified in the test. Cell 1 is the PCell on E-UTRAN carrier, Cell 2 is the PSCell on one NR carrier and Cell 3 is the SCell on the other NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.3.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2, 3 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell |  | Cell3 | Deactivated SCell on NR RF channel number 3. |
| CP length |  | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| SCell measurement cycle (measCycleSCell) | ms | 640 |  |
| T1 | s | 10 |  |

5.5.2.3.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 is E-UTRAN PCell, Cell2 is NR PSCell and Cell3 is deactivated NR SCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be connected and fully synchronized to Cell1, Cell2 and Cell3. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell DL and NR PSCell DL.

Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. Message contents are defined in clause 5.5.2.3.4.3.

2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels. Set the parameters according to values in Table 5.5.2.3.4.1-3 as appropriate.

3. The SS shall transmit an *RRCReconfiguration* message including *measCycleSCell* for the deactivated NR SCell.

4. The UE shall transmit *RRCReconfigurationComplete* message.

5. Set the parameters according to T1 in Table 5.5.2.3.5-1 and Table 5.5.2.3.5-2. Propagation conditions are set according to clause C.2.2.

6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. T1 starts. During T1, the SS shall monitor ACK/NACK/DTX on PSCell.

7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event “ACK/NACK”. Otherwise count a fail for the event “ACK/NACK”.

8. If no longer than X consecutive DTXs are observed by the SS, then count a success for the event “DTX”. Otherwise count a fail for the event “DTX”, where,

- X = 6 if the NR PSCell is not in the same band as the deactivated SCell, otherwise X = 16.

9. After T1 expires, the SS shall transmit an RRC connection release. Afterwards, the SS shall:

9a. transmit in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and go back to step 1 to prepare for the next iteration. If the paging fails, proceed as per step 9b

or

9b. switch off and on the UE and go back to step 1 to prepare for the next iteration.

10. Repeat steps 1-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.5.2.3.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Specific message contents exceptions for Test Configuration 5.5.2.3-1 and 5.5.2.3-2 | Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.1 FR2 |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1;  Table H.3.1-2 with Condition Deactivated SCell;  Table H.3.1-3 with Condition Deactivated SCell, SSB.1 FR2 and SMTC.1;  Table H.3.1-4 with A3-offset = -6dB;  Table H.3.1-7 with Condition Deactivated SCell; |

5.5.2.3.5 Test requirement

Table 5.5.2.3.5-1 and Table 5.5.2.3.5-2 define the primary level settings including test tolerances for FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC test configurations.

Table 5.5.2.3.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 | Cell 3 |
| Frequency Range | |  | FR2 | FR2 |
| Duplex mode | Config 1,2 |  | TDD | TDD |
| TDD configuration | Config 1,2 |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 | 100: NRB,c = 66 |
| Data RBs allocated | Config 1,2 |  | 66 | 66 |
| Downlink initial BWP Configuration | Config 1,2 |  | DLBWP.0.1 | DLBWP.0.1 |
| Downlink dedicated BWP Configuration | Config 1,2 |  | DLBWP.1.1 | DLBWP.1.1 |
| Uplink initial BWP configuration | Config 1,2 |  | ULBWP.0.1 | ULBWP.0.1 |
| Uplink dedicated BWP configuration | Config 1,2 |  | ULBWP.1.1 | ULBWP.1.1 |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 |  | CCR 3.1 TDD | CCR 3.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 |
| SSB Configuration | Config 1,2 |  | SSB.1 FR2 | SSB.1 FR2 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 | SMTC.1 |
| TRS configuration | Config 1,2 |  | TRS.2.1 TDD | TRS.2.1 TDD |
| TCI state | Config 1,2 |  | TCI.State.0 | TCI.State.0 |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS | |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |  |
| EPRE ratio of PDSCH to PDSCH | |  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |  |
| Propagation Condition | |  | AWGN | AWGN |
| Time offset to cell1 Note 2 | | μs | 3 | 3+ Time offset to cell2 |
| Time offset to cell2 Note 3 | | μs | - | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells  Note 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells | | | | |

Table 5.5.2.3.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell 2** | **Cell 3** |
| Angle of arrival configuration | |  | Setup 1 defined in clause A.9 | |
| Assumption for UE beamsNote 6 | |  | Fine | Rough |
| Note1 | NR\_TDD\_FR2\_A | dBm/15kHz | -111.7 | -104.7 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| Note1 | NR\_TDD\_FR2\_A | dBm/SCSNote3 | -102.7 | -95.7 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| SSB\_RPNote2 | NR\_TDD\_FR2\_A | dBm/SCS Note4 | -90.7 | -90.7 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
|  | NR\_TDD\_FR2\_A | dB | 12 | 5 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| Ês/Noc | NR\_TDD\_FR2\_A | dB | 12 | 5 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| IoNote2 | NR\_TDD\_FR2\_A | dBm/95.04 MHz Note4 | -61.45 | -60.52 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone  Note 6: Information about types of UE beam is given in 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell.

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.3.5-3.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on NR PSCell no earlier than 4 slots before an SMTC and no later than 4 slots after the SMTC. The interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.3.5-4.

Table 5.5.2.3.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length  (slot) |
| 3 | 0.125 | 4 |

Table 5.5.2.3.5-4: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length  (slot) |
| 3 | 0.125 | 8 + SMTC duration |

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

#### 5.5.2.4 EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.2.4.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits.

- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.4.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and 2 DL CA.

5.5.2.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.4.

5.5.2.4.4 Test description

5.5.2.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.2.4.4.1-1.

Table 5.5.2.4.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.4-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.2.4-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.4.4.1-2.

Table 5.5.2.4.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.4.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.4.4.1-3.

2. Message contents are defined in clause 5.5.2.4.4.3.

3. There are three cells (one E-UTRAN carrier and two NR carriers) specified in the test. Cell 1 is the PCell on E-UTRAN carrier, Cell 2 is the PSCell on one NR carrier and Cell 3 is the SCell on the other NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.4.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2, 3 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell |  | Cell3 | Deactivated SCell on NR RF channel number 3. |
| CP length |  | Normal | Applicable to cell1, cell 2 and cell3 |
| AoA number |  | 1 | Applicable to cell2 and cell3 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| SCell measurement cycle (measCycleSCell) | ms | 640 |  |
| T1 | s | 10 |  |

5.5.2.4.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 is E-UTRAN PCell, Cell2 is NR PSCell and Cell3 is deactivated NR SCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be connected and fully synchronized to Cell1, Cell2 and Cell3. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell DL and NR PSCell DL.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. Message contents are defined in clause 5.5.2.4.4.3.

2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels. Set the parameters according to values in Table 5.5.2.3.4.1-3 as appropriate.

3. The SS shall transmit an *RRCReconfiguration* message including *measCycleSCell* for the deactivated NR SCell.

4. The UE shall transmit *RRCReconfigurationComplete* message.

5. Set the parameters according to T1 in Table 5.5.2.4.5-1 and Table 5.5.2.4.5-2. Propagation conditions are set according to clause C.2.2.

6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. T1 starts. During T1, the SS shall monitor ACK/NACK/DTX on PSCell.

7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event “ACK/NACK”. Otherwise count a fail for the event “ACK/NACK”.

8. If no longer than X consecutive DTX is observed by the SS, then count a success for the event “DTX”. Otherwise count a fail for the event “DTX”, where,

- X = 6 if the NR PSCell is not in the same band as the deactivated SCell, otherwise X = 16.

9. After T1 expires, the SS shall transmit an RRC connection release. Afterwards, the SS shall:

9a. transmit in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and go back to step 1 to prepare for the next iteration. If the paging fails, proceed as per step 9b

or

9b. switch off and on the UE and go back to step 1 to prepare for the next iteration.

10. Repeat steps 1-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.5.2.4.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Specific message contents exceptions for Test Configuration 5.5.2.4-1 and 5.5.2.4-2 | Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.1 FR2 |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1;  Table H.3.1-2 with Condition Deactivated SCell;  Table H.3.1-3 with Condition Deactivated SCell, SSB.1 FR2 and SMTC.1;  Table H.3.1-4 with A3-offset = -6dB;  Table H.3.1-7 with Condition Deactivated SCell; |

5.5.2.4.5 Test requirement

Table 5.5.2.4.5-1 and Table 5.5.2.4.5-2 define the primary level settings including test tolerances for FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC test configurations.

Table 5.5.2.4.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 | Cell 3 |
| Frequency Range | |  | FR2 | FR2 |
| Duplex mode | Config 1,2 |  | TDD | TDD |
| TDD configuration | Config 1,2 |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 | 100: NRB,c = 66 |
| Data RBs allocated | Config 1,2 |  | 66 | 66 |
| Downlink initial BWP Configuration | Config 1,2 |  | DLBWP.0.1 | |
| Downlink dedicated BWP Configuration | Config 1,2 |  | DLBWP.1.1 | |
| Uplink initial BWP configuration | Config 1,2 |  | ULBWP.0.1 | |
| Uplink dedicated BWP configuration | Config 1,2 |  | ULBWP.1.1 | |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 |  | CCR.3.1 TDD | CCR.3.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 |
| SSB Configuration |  |  | SSB.1 FR2 | SSB.1 FR2 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 FR2 | SMTC.1 FR2 |
| TRS configuration | Config 1,2 |  | TRS.2.1 TDD | TRS.2.1 TDD |
| TCI state | Config 1,2 |  | TCI.State.0 | TCI.State.0 |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS | |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |  |
| EPRE ratio of PDSCH to PDSCH | |  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |  |
| Propagation Condition | |  | AWGN | AWGN |
| Time offset to cell1 Note 2 | | μs | 62.5 | 62.5+ Time offset to cell2 |
| Time offset to cell2 Note 3 | | μs | - | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells  Note 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells | | | | |

Table 5.5.2.4.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell 2** | **Cell 3** |
| Angle of arrival configuration | |  | Setup 1 defined in clause A.9 | |
| Assumption for UE beamsNote 6 | |  | Fine | Rough |
| Note1 | NR\_TDD\_FR2\_A | dBm/15kHz | -111.7 | -104.7 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| Note1 | NR\_TDD\_FR2\_A | dBm/SCSNote3 | -102.7 | -95.7 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| SSB\_RPNote2 | NR\_TDD\_FR2\_A | dBm/SCS Note4 | -90.7 | -90.7 |
|  | NR\_TDD\_FR2\_B |  |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
|  | | dB | 12 | 5 |
| Ês/Noc | | dB | 12 | 5 |
| IoNote2 | NR\_TDD\_FR2\_A | dBm/95.04 MHz | -61.45 | -60.52 |
|  | NR\_TDD\_FR2\_B | Note4 |  |  |
|  | NR\_TDD\_FR2\_F |  |  |  |
|  | NR\_TDD\_FR2\_G |  |  |  |
|  | NR\_TDD\_FR2\_T |  |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |  |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone  Note 6: Information about types of UE beam is given in 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell.

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PSCell on NR PSCell immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.4.5-3.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on NR PSCell no earlier than 4 slots before an SMTC and no later than 4 slots after the SMTC. The interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.4.2-4.

Table 5.5.2.4.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length  (slot) |
| 3 | 0.125 | 4 |

Table 5.5.2.4.2-4: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length  (slot) |
| 3 | 0.125 | 8 + SMTC duration |

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

#### 5.5.2.5 EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Editor's note:

- Connection diagram is TBD.

- Test tolerance is missing.

- Test procedure may be further modified.

5.5.2.5.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits.

- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.5.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC.

5.5.2.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.5.

5.5.2.5.4 Test description

5.5.2.5.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 5.5.2.5.4.1-1.

Table 5.5.2.5.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.5-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.2.5-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.5.4.1-2.

Table 5.5.2.5.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.5.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | A.3.TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.TBD |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.5.4.1-3.

2. Message contents are defined in clause 5.5.2.5.4.3.

3. There are two E-UTRAN carriers and one NR carrier and three cells specified in the test. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.5.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell |  | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length |  | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| SCell measurement cycle (measCycleSCell) | ms | 640 |  |
| T1 | s | 10 |  |

5.5.2.5.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1, Cell2 and Cell3. Cell1 shall be configured as E-UTRAN PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as E-UTRAN deactivated SCell. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the E-UTRAN SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell and NR PSCell.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.

3. The SS shall transmit an *RRCConnectionReconfiguration* message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCell to perform measurements on the deactivated SCC.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. Set the parameters according to T1 in Table 5.5.2.5.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.

6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.

7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event “ACK/NACK”. Otherwise count a fail for the event “ACK/NACK”.

8. If no longer than 8 consecutive DTX is observed by the SS, then count a success for the event “DTX”. Otherwise count a fail for the event “DTX”.

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),

or

- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 3-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.5.2.5.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions |  |

Table 5.5.2.5.4.3-2: MeasObjectEUTRA for E-UTRAN deactivated SCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 Table 4.6.6-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectEUTRA ::= SEQUENCE { |  |  |  |
| carrierFreq | Downlink EARFCN for E-UTRAN SCell |  |  |
| measCycleSCell-r10 | sf640 |  |  |
| } |  |  |  |

5.5.2.5.5 Test requirement

Table 5.5.2.5.5-1 and Table 5.5.2.5.5-2 defines the primary level settings including test tolerances for E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC test configurations.

Table 5.5.2.5.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | Config 1,2 |  | TDD |
| TDD configuration | Config 1,2 |  | TBD |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 |
| Initial BWP Configuration | Config 1,2 |  | TBD |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 |  | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 |  | TBD |
| OCNG Patterns | |  | OP.1 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |
| EPRE ratio of PBCH to PBCH DMRS | |
| EPRE ratio of PDCCH DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH DMRS | |
| EPRE ratio of PDSCH DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |
| Ês/Noc | | dB | TBD+TT |
| Propagation Condition | |  | AWGN |
| Time offset to cell1 Note 2 | | μs | 3 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

Table 5.5.2.5.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

| Parameter | | Unit | Cell 2 |
| --- | --- | --- | --- |
| UE orientation around TBD axis and TBD axis | |  | TBD |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | TBD |
| Note1 | NR\_TDD\_FR2\_A | dBm/15kHzNote4 | TBD+TT |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_C |
| NR\_TDD\_FR2\_D |
| NR\_TDD\_FR2\_E |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| Note1 | NR\_TDD\_FR2\_A | dBm/SCSNote3 | TBD+TT |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_C |
| NR\_TDD\_FR2\_D |
| NR\_TDD\_FR2\_E |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| SS-RSRPNote2 | NR\_TDD\_FR2\_A | dBm/SCS Note4 | TBD+TT |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_C |
| NR\_TDD\_FR2\_D |
| NR\_TDD\_FR2\_E |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
|  | | dB | TBD+TT |
| IoNote2 | NR\_TDD\_FR2\_A | dBm/95.04 MHz Note4 | TBD+TT |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | |

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.5.5-3.

Table 5.5.2.5.5-3: Interruption duration if the NR PSCell is not  
in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length  (slot) |
| 3 | 0.125 | 5 |

Table 5.5.2.5.5-4: Void

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

#### 5.5.2.6 EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Editor's note:

- Connection diagram is TBD.

- Test tolerance is missing.

- Test procedure may be further modified.

5.5.2.6.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits.

-To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.6.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward supporting EN-DC.

5.5.2.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.6.

5.5.2.6.4 Test description

5.5.2.6.4.1 Initial conditions

Test 5.5.2.6 can be run in one of the configurations defined in Table 5.5.2.6.4.1-1.

Table 5.5.2.6.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.6-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.2.6-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.6.4.1-2.

Table 5.5.2.6.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | A.3.TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.TBD |
| Exceptions to connection diagram | N/A | |  |

2. The general test parameter settings are set up according to Table 5.5.2.6.4.1-3.

4. Message contents are defined in clause 5.5.2.6.4.3.

5. There are two E-UTRAN carriers and one NR carrier and three cells specified in the test. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.6.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell |  | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length |  | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| SCell measurement cycle (measCycleSCell) | ms | 640 |  |
| T1 | s | 10 |  |

5.5.2.6.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1, Cell2 and Cell3. Cell1 shall be configured as E-UTRAN PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as E-UTRAN deactivated SCell. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the E-UTRAN SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell and NR PSCell.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.

3. The SS shall transmit an *RRCConnectionReconfiguration* message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCell to perform measurements on the deactivated SCC.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. Set the parameters according to T1 in Table 5.5.2.6.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.

6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.

7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event “ACK/NACK”. Otherwise count a fail for the event “ACK/NACK”.

8. If no longer than 8 consecutive DTX is observed by the SS, then count a success for the event “DTX”. Otherwise count a fail for the event “DTX”.

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),

or

- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 3-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.6.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.5.2.6.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions |  |

Table 5.5.2.6.4.3-2: MeasObjectEUTRA for EUTRAN deactivated SCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 Table 4.6.6-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectEUTRA ::= SEQUENCE { |  |  |  |
| carrierFreq | Downlink EARFCN for E-UTRAN SCell |  |  |
| measCycleSCell-r10 | sf640 |  |  |
| } |  |  |  |

5.5.2.6.5 Test requirement

Table 5.5.2.6.5-1 and Table 5.5.2.6.5-2 defines the primary level settings including test tolerances for E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC test configurations.

Table 5.5.2.6.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | Config 1,2 |  | TDD |
| TDD configuration | Config 1,2 |  | TBD |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 |
| Initial BWP Configuration | Config 1,2 |  | TBD |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 |  | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 |  | TBD |
| OCNG Patterns | |  | OP.1 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |
| EPRE ratio of PBCH to PBCH DMRS | |
| EPRE ratio of PDCCH DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH DMRS | |
| EPRE ratio of PDSCH DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |
| Ês/Noc | | dB | TBD |
| Propagation Condition | |  | AWGN |
| Time offset to cell1 Note 2 | | μs | 62.5 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

Table 5.5.2.6.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| UE orientation around TBD axis and TBD axis | |  | TBD |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | TBD |
| Note1 | NR\_TDD\_FR2\_A | dBm/15kHzNote4 | TBD |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_C |
| NR\_TDD\_FR2\_D |
| NR\_TDD\_FR2\_E |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| Note1 | NR\_TDD\_FR2\_A | dBm/SCSNote3 | TBD |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_C |
| NR\_TDD\_FR2\_D |
| NR\_TDD\_FR2\_E |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| SS-RSRPNote2 | NR\_TDD\_FR2\_A | dBm/SCS Note4 | TBD |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_C |
| NR\_TDD\_FR2\_D |
| NR\_TDD\_FR2\_E |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
|  | | dB | TBD |
| IoNote2 | NR\_TDD\_FR2\_A | dBm/95.04 MHz Note4 | TBD |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the center of the quiet zone | | | |

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.6.5-3.

Table 5.5.2.6.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length |
| 3 | 0.125 | 5 |

Table 5.5.2.6.5-4: Void

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

#### 5.5.2.7 EN-DC FR2 interruptions at E-UTRA SRS carrier based switching

Editor's Note: This test case is incomplete in following aspects:

- TT analysis is missing.

- Test applicability needs to be updated

- Antenna connection diagram is FFS

- E-UTRA - FR2 OTA testability is still FFS.

5.5.2.7.1 Test purpose

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during carrier-based switching to one PUSCH-less SCCs from a CC with PUSCH, when a UE needs to transmit aperiodic SRS.

5.5.2.7.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward supporting EN-DC and 2 DL CA in E-UTRA.

5.5.2.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.2.0.5.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.7.

5.5.2.7.4 Test description

5.5.2.7.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.2.7.4.1-1.

Table 5.5.2.7.4.1-1: Supported test configurations for EN-DC FR1 interruptions at E-UTRA SRS carrier based switching

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.7-1 | LTE FDD(cell1), LTE TDD (cell3), NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.2.7-2 | LTE TDD(cell1), LTE TDD (cell3), NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE.1: The UE is only required to be tested in one of the supported test configurations. | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.7.4.1-2.

Table 5.5.2.7.4.1-2: Initial conditions for EN-DC FR1 interruptions at SRS carrier based switching in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.7.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | TBD |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.7.4.1-3.

2. Message contents are defined in clause 5.5.2.7.4.3.

3. There are two E-UTRA carriers and one NR carrier, and three cells specified in the test. Each cell is on a different carrier. Cell1 Is E‑UTRAN PCell, Cell2 is NR FR1 PSCell and Cell 3 is E-UTRA activated Scell. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 shall be configured according to clauses C.1.1 and C.1.2.

Table 5.5.2.7.4.1-3: General test parameters for EN-DC FR2 interruptions at E-UTRA SRS carrier based switching

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2, 3 | One is NR RF channel and the other two are E-UTRAN RF channels |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Active PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| Activated SCell |  | Cell3 | SCell on E-UTRAN RF channel number 3. |
| CP length |  | Normal | Applicable to Cell1, Cell2 and Cell3 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| T1 | s | 0.2 |  |
| T2 | s | 0.2 | UE shall perform SRS switching during T2 |

Table 5.5.2.7.4.1-4: Sounding Reference Symbol Configuration for E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

|  |  |  |
| --- | --- | --- |
| Field | Value | Comment |
| srsBandwidthConfiguration | bw5 |  |
| srsSubframeConfiguration | Sc8 | Once every 5 subframes |
| ackNackSrsSimultaneousTransmission | FALSE |  |
| srsMaxUpPTS | N/A | Not applicable |
| srsBandwidth | 0 | No hopping |
| srsHoppingBandwidth | hbw0 |
| frequencyDomainPosition | 0 |  |
| Duration | TRUE | Indefinite duration |
| Srs-ConfigIndexAp | 17 | SRS periodicity of 10ms. See Table 8.2-5 in TS 36.213 for aperiodic SRS transmission. |
| transmissionComb | 0 |  |
| cyclicShift | cs0 | No cyclic shift |
| SRS-AntennaPort | an1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 36.331. | | |

5.5.2.7.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 is E-UTRAN Pcell, Cell2 is NR FR1 PSCell with PUCCH/PUSCH transmission, Cell3 is E-UTRAN activated SCell which operates in downlink without PUCCH/PUSCH. The test consists of two time periods, with duration of T1 and T2. Prior to the start of the test, the UE is configured with the SRS carrier based switching between PCell and SCell. UE shall also indicate SRS-SwitchingTimeNR in the capabilities.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG\_and\_SCG, Connected without release On and Test Mode On according to TS 38.508-1 [14] clause 4.5.7.

2. Configure MCG according to TS 36.521-3 [26] Annex C.0, C.1 and SCG according to Annex C.1.1 and C.1.2 for all downlink physical channels.

3. The SS shall configure SCell (Cell 3) on the SCC as per TS 36.508 [25] clause 5.2A, with the message content exceptions defined in clause 4.5.2.9.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

4. Set the parameters according to T1 in Table 4.5.2.9.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.

5. The SS activates Scell (Cell3) and starts to schedule DL transmission continuously on PCell and PSCell.

6. Set the parameters according to T2 in Tables 4.5.2.9.5-1. T2 starts.

7. Immediately at the beginning of T2, SRS is requested via DCI format 2\_3 and the UE shall initiate NR SRS switching.

8. If the interruption on NR PSCell during the switching from NR PSCell to E-UTRA SCell exceeds the value as defined in Table 4.5.2.9.5-2, increase the number of failed iterations by one and move to step 12, otherwise increase the number of passed iterations by one and continue with step 9.

9. The SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

10. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5

11. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5

12. Repeat step 2-11 until a test verdict has been achieved.5.5.2.7.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions.

Table 5.5.2.7.4.3-1: *ServingCellConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| carrierSwitching | *SRS-CarrierSwitching* |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.2.7.4.3-2: *SRS-CarrierSwitching*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-181 | | | |
| Information Element | Value/remark | Comment | Condition |
| SRS-CarrierSwitching ::= SEQUENCE { |  |  |  |
| srs-SwitchFromServCellIndex | 0 |  |  |
| srs-SwitchFromCarrier | nUL |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| } |  |  |  |

Table 5.5.2.7.4.3-3: SoundingRS-UL-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 Table 4.6.3-22 | | | |
| Information Element | Value/remark | Comment | Condition |
| SoundingRS-UL-ConfigDedicated-DEFAULT ::= CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| srs-BandwidthConfig | bw5 |  |  |
| srsSubframeConfig | Sc8 |  |  |
| ackNackSrsSimultaneousTransmission | FALSE |  |  |
| srs-HoppingBandwidth | hbw0 |  |  |
| freqDomainPosition | 0 |  |  |
| duration | TRUE |  |  |
| srs-ConfigIndex | 47 | See Table 8.2-1 in TS 36.213 | FDD |
| transmissionComb | 0 |  |  |
| cyclicShift | cs0 |  |  |
| SRS-AntennaPort | an1 |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.2.7.5 Test requirement

Tables 5.5.2.7.5-1 and 5.5.2.7.5-2 define the primary level settings including test tolerances for EN-DC FR2 interruptions at E-UTRA SRS carrier based switching in asynchronous EN-DC.

Table 5.5.2.7.5-1: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | Config 1,2 |  | TDD |
| TDD configuration | Config 1,2 |  | [TDDConf.3.2] |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 |
| Downlink initial BWP Configuration | Config 1,2 |  | DLBWP.0.1 |
| Downlink dedicated BWP Configuration | Config 1,2 |  | DLBWP.1.1 |
| Uplink initial BWP configuration | Config 1,2 |  | ULBWP.0.1 |
| Uplink dedicated BWP configuration | Config 1,2 |  | ULBWP.1.1 |
| TRS configuration | Config 1,2 |  | TRS.2.1 TDD |
| TCI state | Config 1,2 |  | TCI.State.0 |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD |
| RMC CORESET Reference Channel | Config 1,2 |  | CCR.3.1 TDD |
| OCNG Patterns | |  | OP.1 |
| SSB Configuration | |  | SSB.1 FR2 |
| SMTC Configuration | Config 1,2 |  | SMTC.1 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |  |  |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS | |  |  |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |
| EPRE ratio of PDSCH to PDSCH | |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |
| Ês/Noc | | dB | 17 |
| Propagation Condition | |  | AWGN |
| Time offset to cell1 Note 2 | | ms | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

Table 5.5.2.7.5-2: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell2 |
| Angle of arrival configuration |  | Setup 1 according to clause A.9.1 |
| Assumption for UE beamsNote 6 |  | Fine |
| Note1 | dBm/15kHzNote4 | -112 |
| Note1 | dBm/SCSNote3 | -102.97 |
|  | dB | 17 |
| SS-RSRPNote2 | dBm/SCS Note4 | -85.97 |
|  | dB | 17 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.90 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone  Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | |

The UE shall be continuously scheduled in NR FR2 PSCell throughout the test. During T2 two interruption time periods are allowed on Cell2 and Cell1, each interruption due to SRS carrier based switching on Cell2 shall not exceed X defined in Table A.5.5.2.7.2-1.

Table 5.5.2.7.5-3: Interruption length X (slot) E-UTRAN – NR at E-UTRA SRS carrier based switching

|  |  |  |
| --- | --- | --- |
|  | NR Slot | Interruption length X |
|  | length (ms) | (slots) |
| 2 | 0.25 | 5 |
| 3 | 0.125 | 9 |

The rate of correct events observed during repeated tests shall be at least 90% with the confidence level of 95%.

#### 5.5.2.8 EN-DC FR2 interruptions at NR SRS carrier based switching

Editor's Note: This test case is incomplete in following aspects:

- TT analysis is missing.

- Test applicability needs to be updated

- Antenna connection diagram is FFS

5.5.2.8.1 Test purpose

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during carrier-based switching to one carrier not configured for PUCCH/PUSCH transmission from a CC with PUCCH/PUSCH transmission, when a UE needs to transmit aperiodic SRS.

5.5.2.8.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward supporting EN-DC and 2 DL CA in NR.

5.5.2.8.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.2.0.5.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.8.

5.5.2.8.4 Test description

5.5.2.8.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.2.8.4.1-1.

Table 5.5.2.8.4.1-1: Supported test configurations for EN-DC FR2 interruptions at NR SRS carrier based switching

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.2.8-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.2.8-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE.1: The UE is only required to be tested in one of the supported test configurations. | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.8.4.1-2.

Table 5.5.2.8.4.1-2: Initial conditions for EN-DC FR1 interruptions at SRS carrier based switching in asynchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.2.8.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.1. |
| Connection Diagram | TE Part | TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | TBD |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.2.8.4.1-3.

2. Message contents are defined in clause 5.5.2.8.4.3.

3. There are two NR carriers and one E-UTRA carrier, and three cells specified in the test. Each cell is on a different carrier. Cell1 is E‑UTRAN PCell, Cell2 is NR FR2 PSCell and Cell 3 is NR activated Scell. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clauses C.1.1 and C.1.2.

Table 5.5.2.8.4.1-3: General test parameters for EN-DC FR2 interruptions at NR SRS carrier based switching

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2, 3 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell |  | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell |  | Cell2 | PSCell on NR RF channel number 2. |
| Configured SCell |  | Cell3 | SCell on NR RF channel number 3. |
| CP length |  | Normal | Applicable to cell1 and cell 2 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| T1 | s | 5 |  |
| T2 | s | 0.1 |  |

5.5.2.8.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 is E-UTRAN Pcell, Cell2 is NR FR1 PSCell with PUCCH/PUSCH transmission, Cell3 is activated SCell which operates in downlink without PUCCH/PUSCH. The test consists of two time periods, with duration of T1 and T2. Prior to the start of the test, the UE is configured with the SRS carrier based switching between PSCell and SCell. UE shall also indicate SRS-SwitchingTimeNR in the capabilities.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG\_and\_SCG, Connected without release On and Test Mode On according to TS 38.508-1 [14] clause 4.5.7.
2. Configure MCG according to TS 36.521-3 [26] Annex C.0, C.1 and SCG according to Annex C.1.1 and C.1.2 for all downlink physical channels.
3. The SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.\
4. Set the parameters according to T1 in Table 5.5.2.8.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
5. The SS activates Scell (Cell3) and starts to schedule DL transmission continuously on PCell and PSCell.
6. Set the parameters according to T2 in Tables 5.5.2.8.5-1. T2 starts.
7. Immediately at the beginning of T2, SRS is requested via DCI format 2\_3 and the UE shall initiate NR SRS switching.
8. If the interruption on NR PSCell during the switching from NR PSCell to NR SCell exceeds the value as defined in Table 5.5.2.8.5-2 or the interruption on E-UTRAN PCell during the switching from NR PSCell to NR SCell exceeds the value as defined in Table 4.5.2.9.5-3, increase the number of failed iterations by one and move to step 12, otherwise increase the number of passed iterations by one and continue with step 9.
9. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
10. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5
11. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5
12. Repeat step 2-11 until a test verdict has been achieved.

5.5.2.8.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions.

Table 5.5.2.8.4.3-1: *ServingCellConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| carrierSwitching | *SRS-CarrierSwitching* |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.2.8.4.3-2: *SRS-CarrierSwitching*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-181 | | | |
| Information Element | Value/remark | Comment | Condition |
| SRS-CarrierSwitching ::= SEQUENCE { |  |  |  |
| srs-SwitchFromServCellIndex | 1 |  |  |
| srs-SwitchFromCarrier | nUL |  |  |
| } |  |  |  |

Table 5.5.2.8.4.3-3: SRS-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-182 | | | |
| Information Element | Value/remark | Comment | Condition |
| SRS-Config ::= SEQUENCE { |  |  |  |
| srs-ResourceSetToAddModList SEQUENCE (SIZE(0..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet { | 1 entry |  |  |
| SRS-ResourceSet[1] SEQUENCE { |  | entry 1 |  |
| srs-ResourceSetId | 0 |  |  |
| srs-ResourceIdList SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-ResourceId { | 1 entry |  |  |
| SRS-ResourceId[1] | 0 | entry 1 |  |
| } |  |  |  |
| resourceType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| } |  |  |  |
| } |  |  |  |
| usage | antennaSwitching |  |  |
| } |  |  |  |
| } |  |  |  |
| srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-Resource { | 1 entry |  |  |
| SRS-Resource[1] SEQUENCE { |  | entry 1 |  |
| resourceMapping SEQUENCE { |  |  |  |
| startPosition | 1 |  |  |
| nrofSymbols | n1 |  |  |
| repetitionFactor | n1 |  |  |
| } |  |  |  |
| freqDomainPosition | 0 |  |  |
| freqDomainShift | 0 |  |  |
| freqHopping SEQUENCE { |  |  |  |
| c-SRS | 12 |  |  |
| } |  |  |  |
| groupOrSequenceHopping | neither |  |  |
| resourceType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.2.8.5 Test requirement

Tables 5.5.2.8.5-1 and 5.5.2.8.5-2 define the primary level settings including test tolerances for EN-DC FR2 interruptions at E-UTRA SRS carrier based switching in asynchronous EN-DC.

Table 5.5.2.8.5-1: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at NR SRS carrier based switching

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 | Cell 3 |
| Frequency Range | |  | FR2 | |
| Duplex mode | Config 1,2 |  | TDD | |
| TDD configuration | Config 1,2 |  | [TDDConf.3.2] | |
| BWchannel | Config 1,2 | MHz | 100: NRB,c = 66 | |
| Downlink initial BWP Configuration | Config 1,2 |  | DLBWP.0.1 | |
| Downlink dedicated BWP Configuration | Config 1,2 |  | DLBWP.1.1 | |
| Uplink initial BWP configuration | Config 1,2 |  | ULBWP.0.1 | |
| Uplink dedicated BWP configuration | Config 1,2 |  | ULBWP.1.1 | |
| TRS configuration | Config 1,2 |  | TRS.2.1 TDD | |
| SRS configuration | Config 1,2 |  | SRS.6 TDD | |
| TCI state | Config 1,2 |  | TCI.State.0 | |
| PDSCH Reference measurement channel | Config 1,2 |  | SR.3.1 TDD | |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.3.1 TDD | |
| RMC CORESET Reference Channel | Config 1,2 |  | CCR.3.1 TDD | |
| OCNG Patterns | |  | OP.1 | |
| SSB Configuration | |  | SSB.1 FR2 | |
| SMTC Configuration | Config 1,2 |  | SMTC.1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | |
| EPRE ratio of PBCH DMRS to SSS | |  |  | |
| EPRE ratio of PBCH to PBCH DMRS | |  |  | |
| EPRE ratio of PDCCH DMRS to SSS | |  |  | |
| EPRE ratio of PDCCH to PDCCH DMRS | |  |  | |
| EPRE ratio of PDSCH DMRS to SSS | |  |  | |
| EPRE ratio of PDSCH to PDSCH | |  |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  | |
| Ês/Noc | | dB | 17 | |
| Propagation Condition | |  | AWGN | |
| Time offset to cell1 Note 2 | | μs | 33 | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | | |

Table 5.5.2.8.5-2: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at NR SRS carrier based switching

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | |
|  |  | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 according to clause A.9.1 | |
| Assumption for UE beamsNote 6 |  | Fine | |
| Note1 | dBm/15kHzNote4 | -112 | |
| Note1 | dBm/SCSNote3 | -103 | |
|  | dB | 4 | |
| SS-RSRPNote2 | dBm/SCS Note4 | -99 | |
|  | dB | 4 | |
| IoNote2 | dBm/95.04 MHz Note4 | -68.5 | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone  Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | |

In T2 UE shall transmit SRS on Cell3 as requested. During T2 interruption on Cell2 due to SRS carrier based switching from Cell2 to Cell3 shall not exceed the requirements defined in TS38.133 clause 8.2.1.2.12.

The rate of correct events observed during repeated tests shall be at least 90% with the confidence level of 95%.

### 5.5.3 SCell activation and deactivation delay

#### 5.5.3.1 EN-DC FR2 SCell activation and deactivation intra-band in non-DRX

*Editor's* Note: This test case has been completed for the following configurations: (?)

*- Test frequency f ≤ 40.8 GHz*

*- UE PC3*

*- The test is incomplete for UE power classes other than PC3*

*- The test is incomplete for test frequencies > 40.8 GHz*

5.5.3.1.1 Test purpose

This test is to verify that the SCell activation and deactivation times are within the requirements, when the SCell in FR2 intra-band is known by the UE at the time of activation.

5.5.3.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards and supporting 2DL CA.

5.5.3.1.3 Minimum conformance requirements

Same minimum conformance requirements as described in clause 4.5.3.1.3.

The normative reference for this requirement is TS 38.133 [6] clause 8.3 and A.5.5.3.1.

5.5.3.1.4 Test description

5.5.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.3.1.4.1-1.

Table 5.5.3.1.4.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.5.3.1-1 | FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.3.1-2 | TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to pass in one of the supported test configurations. | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.3.1.4.1-2 and Table 5.5.3.1.4.1-3.

Table 5.5.3.1.4.1-2: Initial conditions for known FR2 SCell activation case with FR2 PSCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.1-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.7.1.1.2-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

Table 5.5.3.1.4.1-3: General test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1,2,3 | One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test |
| Active PCell |  | Cell 1 | Primary cell on E-UTRAN RF channel number 1.  As specified in clause A.3.7.2.2 of TS38.133 [6] |
| Active PSCell |  | Cell 2 | Primary secondary cell on NR RF channel number 2. |
| Configured deactivated SCell |  | Cell 3 | Configured deactivated secondary cell on NR RF channel number 3 |
| CP length |  | Normal |  |
| DRX |  | OFF | Continuous monitoring of primary cell |
| Cell-individual offset for cells on E-UTRA RF channel number | dB | 0 | Individual offset for cells on primary component carrier. |
| Cell-individual offset for cells on NR channel number | dB | 0 | Individual offset for cells on secondary component carrier. |
| SCell measurement cycle (measCycleSCell) | ms | 160 |  |
| Cell3 timing offset to cell2 | μs | 0 |  |
| Time alignment error between cell3 and cell2 | μs | ≤ Time alignment error as specified in TS 38.104 [28] clause 6.5.3.1. | The value of time alignment error depends upon the type of carrier aggregation. |
| T1 | s | 7 | During this time the PSCell shall be known and the SCell configured and detected. |
| T2 | s | 1 | During this time the UE shall activate the SCell. |
| T3 | s | 1 | During this time the UE shall deactivate the SCell. |
| THARQ | ms | k1\*NR slot length | k1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by dl-DataToUL-ACK, the value of k should be the minimum value defined in TS 38.213 [8] |
| TCSI\_Reporting | ms | 15 | the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in 38.331 [13]. |
| k | ms |  | As specified in clause 4.3 of TS38.213 [8] |

1. Message contents are defined in clause 5.5.3.1.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in the same frequency. Cell 2 is the PSCell and Cell 3 is the deactivated SCell.

3. Downlink signals for NR cell are initially set up according to clause C.2.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.5.3.1.4.2 Test procedure

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot . The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell or PSCell interruption due to activation of SCell shall occur in the slot to . Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe to subframe , where and are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and is the interruption length given in TS 36.133 [23] section 7.32.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot . The starting point of any PSCell interruption due to the deactivation shall occur in the slot to . The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe to subframe , where and are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters according to T1 in Tables 5.5.3.1.5-1 and A.6.1.2-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. T1 starts. Immediately after, the SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.3.1.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

3a. The UE send a *MeasurementReport* message embedded in *ULInformationTransferMRDC.*

4. The SS shall configure transmission of PDSCH with a maximum number of 1 HARQ transmission.

5. The SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.10) in a slot # denoted m and T2 starts in slot m. If the SS receives ACK for MAC-CE sent by the UE, the test proceeds to step 6, otherwise go to step 9.

6. After at least one CSI-RS transmission occasion for channel measurement, the UE shall start sending CSI reports for SCell and the SS shall monitor CSI reports for SCell sent from the UE and ACK/NACK sent in PSCell according to the following criteria:

- If the first CSI report for SCell is received by the SS no later than slot ,

- or slot if the slot was subject to interruption,

- and CSI report with non-zero CQI index is received by the SS earlier than or equal to slot ,

- or the next available uplink resource if there are no uplink resources for reporting the valid CSI in a slot

- and DTX is not observed by the SS outside the slot to up to the end of T2

- Then the number of successes for the event "Activation" is increased by one. Otherwise, count a fail for the event "Activation" and go to step 9.

7. When T2 expires, the SS deactivate SCC by sending the deactivation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.10) in a slot # denoted n and T3 starts in slot n. If the SS receives ACK for MAC-CE sent by the UE, the test proceeds to step 8, otherwise go to step 9.

8. The UE shall stop sending CSI reports for SCell and the SS shall monitor CSI reports for SCell sent from the UE and ACK/NACK sent in PSCell during SCell deactivation.

- If the last CSI report is received by the SS earlier than or equal to slot

- and DTX is not observed by the SS outside the slot to up to the end of T3,

- Then the number of successes for the event "Deactivation" is increased by one. Otherwise, count a fail for the event "Deactivation".

9. When T3 expires, or Activation in step 5 was not acknowledged, or a fail was counted for the event "Activation" in step 6, or Deactivation in step 7 was not acknowledged, the SS shall transmit an *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508[25] Table 4.6.1-8 to release NR PSCell. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

10. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.

11. The SS shall transmit an *RRCConnectionReconfiguration* message with condition MCG and SCG according to TS 36.508 [25] Table 4.6.1-8 to ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. The UE shall transmit an RRCConnectionReconfigurationComplete message.

12. Repeat steps 2-11 until a test verdict has been achieved.

Each of the events "Activation" and "Deactivation" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.  
If all events pass, the test passes. If one event fails, the test fails.

5.5.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3, with following exception:

Table 5.5.3.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-7 with Condition Deactivated SCell  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.5.3.1.4.3-2: *RRCReconfiguration* in step 3: SCell addition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition EN-DC\_MEAS and EN-DC\_SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig-SCell | Table 5.5.3.1.4.3-5 |  |
| measConfig | MeasConfig | Table 5.5.3.1.4.3-2A |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.1.4.3-2A: MeasConfig (Table 5.5.3.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: Table H.3.1-2 with condition Deactivated SCell | | | |
| Information Element | Value/Remark | Comment | Condition |
| measConfig ::= SEQUENCE { |  |  |  |
| measObjectToAddModList SEQUENCE (SIZE (1..maxNrofMeasId)) OF SEQUENCE { | 2 entries |  |  |
| measObject[2] CHOICE { |  |  |  |
| measObjectNR | MeasObjectNR for SCell | entry 2  Table 5.5.3.1.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |
| reportConfigToAddModList SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod { | 1 entry |  |  |
| ReportConfigToAddMod[1] SEQUENCE { |  | entry 1 |  |
| reportConfigId | ReportConfigId |  |  |
| reportConfig CHOICE { |  |  |  |
| reportConfigNR | ReportConfigNR | Table 5.5.3.1.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.1.4.3-3: MeasObjectNR for SCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 with condition Deactivated SCell and Synchronous cells | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| smtc1 | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| measCycleSCell-v1530 | sf160 |  |  |
| } |  |  |  |

Table 5.5.3.1.4.3-4: ReportConfigNR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| eventTriggered SEQUENCE { |  |  |  |
| eventId CHOICE { |  |  |  |
| eventA3 SEQUENCE { |  |  |  |
| a3-Offset CHOICE { |  |  |  |
| rsrp | -30 | To ensure reporting can always be triggered |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.1.4.3-5: CellGroupConfig-SCell (Table 5.5.3.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-19 with condition MEAS and SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | ServCellIndex of NR SpCell |  |  |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| rlmInSyncOutOfSyncThreshold | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 5.5.3.1.4.3-6 |  |
| } |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig-SCell | Table 5.5.3.1.4.3-7 |  |
| smtc | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.1.4.3-6: ServingCellConfig-SpCell (Table 5.5.3.1.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition MEAS | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| csi-MeasConfig | CSI-MeasConfig for RRM specified in TS 38.508-1 [14] Table 7.3.1-6 |  |  |
| servingCellMO | 1 |  |  |
| } |  |  |  |

Table 5.5.3.1.4.3-7: ServingCellConfig-SCell (Table 5.5.3.1.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition No\_UL | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| csi-MeasConfig | CSI-MeasConfig for RRM specified in TS 38.508-1 [14] Table 7.3.1-6 |  |  |
| servingCellMO | 2 |  |  |
| } |  |  |  |

5.5.3.1.5 Test requirement

Table 5.5.3.1.5-1 will replace the values of corresponding parameters in Table 4.5.3.1.5-1 and Table 5.5.3.1.5-2 defines OTA related test parameters.

Table 5.5.3.1.5-1: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ParameterNote 5 | Unit | Cell 2 | | | Cell 3 | | |
| T1 | T2 | T3 | T1 | T2 | T3 |
| SSB ARFCN |  | freq1 | | | freq2 | | |
| Duplex mode |  | TDD | | | TDD | | |
| TDD configuration |  | TDDConf.3.1 | | | TDDConf.3.1 | | |
| BWchannel | MHz | 100: NRB,c = 66 | | | 100: NRB,c = 66 | | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | | | SR.3.1 TDD | | |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | | | CR.3.1 TDD | | |
| RMC CORESET Reference Channel |  | CCR.3.1 TDD | | | CCR.3.1 TDD | | |
| DL initial BWP configuration |  | DLBWP.0.1 | | | | | |
| DL dedicated BWP configuration |  | DLBWP.1.1 | | | | | |
| UL initial BWP configuration |  | ULBWP.0.1 | | | | | |
| UL dedicated BWP configuration |  | ULBWP.1.1 | | | | | |
| OCNG Patterns |  | OP.1 | | | | | |
| SMTC configuration |  | SMTC.1 | | | | | |
| SSB configuration |  | SSB.1 FR2 | | | | | |
| TCI state |  | TCI.State.0 | | | | | |
| TRS configuration |  | TRS.2.1 TDD | | | | | |
| CSI-RS configuration for CSI reporting |  | CSI-RS.3.1 TDD | | | | | |
| reportConfigType |  | periodic | | | N/A | | |
| reportQuantity |  | cri-RI-PMI-CQI | | | N/A | | |
| CSI reporting periodicity | slot | 40 | | | N/A | | |
| CSI reporting offset | slot | 4 | | | N/A | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | | | | | |
| TRS configuration |  | TRS.2.1 TDD | | | | | |
| EPRE ratio of PSS to SSS | dB | 0 | | | | | |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSS note 1 |
| EPRE ratio of OCNG to OCNG DMRS note 1 |
| Propagation conditions |  | AWGN | | | | | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 5: All parameters apply for configuration 1 and 2. | | | | | | | |

Table 5.5.3.1.5-2: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ParameterNote 6 | Unit | Cell 2 | | | Cell 3 | | |
|  |  | T1 | T2 | T3 | T1 | T2 | T3 |
| Angle of arrival configuration |  | Setup 1 according to A.9.1 | | | | | |
| Assumption for UE beamsNote 7 |  | Rough | | | Rough | | |
| Note1 | dBm/15kHzNote4 | -104.7 | | | -104.7 | | |
| Note1 | dBm/SCSNote3 | -95.7 | | | -95.7 | | |
|  | dB | 7 | | | 7 | | |
| SS-RSRPNote2 | dBm/SCS Note4 | -88.7 | | | -88.7 | | |
|  | dB | 7 | | | 7 | | |
| IoNote2 | dBm/95.04 MHz Note4 | -58.92 | | | -58.92 | | |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: Void  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: Void  NOTE 6: All parameters apply for configuration 1 and 2  NOTE 7: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | | |

The test requirements defined in clause 4.5.3.1.5 shall apply to this test case, with the following exceptions:

- Placement of interruptions is only verified in NR PSCell.

#### 5.5.3.2 to 5.5.3.6

#### 5.5.3.7 EN-DC FR2 direct SCell activation at SCell addition of known SCell

*Editor's* Note: This test case has been completed for the following configurations:

*- Test frequency f ≤ 40.8 GHz*

*- UE PC3*

*- The test is incomplete for UE power classes other than PC3*

*- The test is incomplete for test frequencies > 40.8 GHz*

5.5.3.7.1 Test Purpose

The purpose of this test is to verify that the direct SCell activation time is within the requirements, when the SCell in FR2 is known by the UE at the time of activation.

5.5.3.7.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards and supporting 2DL CA and direct SCell activation.

5.5.3.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 4.5.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause 8.3 and A.5.5.3.7.

5.5.3.7.4 Test description

5.5.3.7.4.1 Initial Conditions

This test shall be tested using any of the test configurations in Table 5.5.3.7.4.1-1.

Table 5.5.3.7.4.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.5.3.7-1 | FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.3.7-2 | TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to pass in one of the supported test configurations. | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.3.7.4.1-2 and Table 5.5.3.7.4.1-3.

Table 5.5.3.7.4.1-2: Initial conditions for known FR2 SCell activation case with FR2 PSCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.1-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.7.1.1.2-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

Table 5.5.3.7.4.1-3: General test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2, 3 | Two radio channels are used for this test. One for E-UTRA cell and two for NR Cell |
| Active PCell |  | Cell1 | PCell on RF channel number 1. As specified in clause TS 38.133[6] A.3.7.2.2 |
| Active PSCell |  | Cell2 | PSCell on RF channel number 2. |
| SCell |  | Cell3 | secondary cell on RF channel number 3 |
| DRX |  | OFF | Continuous monitoring of PCell/PSCell |
| PRACH configuration on cell2 |  | FR2 configuration 2 | Captured in TS 38.133[6] A.3.8.3.2 |
| PSCell CQI/PMI periodicity and offset configuration index |  | slot5 | CQI reporting for PSCell every uplink slot |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on carrier frequency of cell1. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on carrier frequency of cell2. |
| Cell-individual offset for cells on RF channel number 3 | dB | 0 | Individual offset for cells on carrier frequency of cell3. |
| T1 | s | 7 | During this time the PCell/PSCell shall be known and cell3 is detected, and UE shall report a valid CQI for PCell/PSCell. |
| T2 | s | *Ndirect* | During this time the UE shall be configured with directly activated SCell1. |
| T3 | s | 1 | During this time the UE shall report a valid CQI for PCell/PSCell and SCell. |

1. Message contents are defined in clause 5.5.3.7.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in the same frequency. Cell 2 is the PSCell and Cell 3 is the SCell.

5.5.3.7.4.2 Test procedure

Same as in 4.5.3.5.4.2 with the following exception:

2. Set the parameters according to T1 in Tables 5.5.3.7.5-1 and A.6.1.2-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. T1 starts. Immediately after, the SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.3.7.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

5.5.3.7.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the exception as described in section 4.5.3.5.4.3.

5.5.3.7.5 Test requirement

Table 5.5.3.7.5-1 defines the cell specific test parameters will replace corresponding values in Table 4.5.3.5.5-1 and Table 4.5.3.5.5-1A, and Table 5.5.3.7.5-2 defines OTA related test parameters.

Table 5.5.3.7.5-1: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ParameterNote 5 | Unit | Cell 2 | | | Cell 3 | | |
|  |  | T1 | T2 | T3 | T1 | T2 | T3 |
| SSB ARFCN |  | freq1 | | | freq2 | | |
| Duplex mode |  | TDD | | | TDD | | |
| TDD configuration |  | TDDConf.3.1 | | | TDDConf.3.1 | | |
| BWchannel | MHz | 100: NRB,c = 66 | | | 100: NRB,c = 66 | | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | | | SR.3.1 TDD | | |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | | | CR.3.1 TDD | | |
| RMC CORESET Reference Channel |  | CCR.3.1 TDD | | | CCR.3.1 TDD | | |
| DL initial BWP configuration |  | DLBWP.0.1 | | | | | |
| DL dedicated BWP configuration |  | DLBWP.1.1 | | | | | |
| UL initial BWP configuration |  | ULBWP.0.1 | | | | | |
| UL dedicated BWP configuration |  | ULBWP.1.1 | | | | | |
| OCNG Patterns |  | OP.1 | | | | | |
| SMTC configuration |  | SMTC.1 | | | | | |
| SSB configuration |  | SSB.1 FR2 | | | | | |
| TCI state |  | TCI.State.0 | | | | | |
| TRS configuration |  | TRS.2.1 TDD | | | | | |
| EPRE ratio of PSS to SSS | dB | 0 | | | | | |
| CSI-RS configuration for CSI reporting |  | CSI-RS.3.1 TDD | | | | | |
| reportConfigType |  | periodic | | | N/A | | |
| reportQuantity |  | cri-RI-PMI-CQI | | | N/A | | |
| CSI reporting periodicity | slot | 40 | | | N/A | | |
| CSI reporting offset | slot | 4 | | | N/A | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | | | | | |
| EPRE ratio of PBCH\_DMRS to SSS |  |  | | | | | |
| EPRE ratio of PBCH to PBCH\_DMRS |  |  | | | | | |
| EPRE ratio of PDCCH\_DMRS to SSS |  |  | | | | | |
| EPRE ratio of PDCCH to PDCCH\_DMRS |  |  | | | | | |
| EPRE ratio of PDSCH\_DMRS to SSS |  |  | | | | | |
| EPRE ratio of PDSCH to PDSCH\_DMRS |  |  | | | | | |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  | | | | | |
| Propagation conditions |  | AWGN | | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 5: All parameters apply for configuration 1 and 2. | | | | | | | |

Table 5.5.3.7.5-2: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ParameterNote 6 | Unit | Cell 2 | | | Cell 3 | | |
|  |  | T1 | T2 | T3 | T1 | T2 | T3 |
| Angle of arrival configuration |  | Setup 1 according to A.9.1 | | | | | |
| Assumption for UE beamsNote 7 |  | Rough | | | Rough | | |
| Note1 | dBm/15kHzNote4 | -104.7 ~~+TT~~ | | | -104.7~~+TT~~ | | |
| Note1 | dBm/SCSNote3 | -95.7~~+TT~~ | | | -95.7~~+TT~~ | | |
|  | dB | 7~~+TT~~ | | | 7+TT | | |
| SS-RSRPNote2 | dBm/SCS Note4 | -88.7~~+TT~~ | | | -88.7~~+TT~~ | | |
|  | dB | 7~~+TT~~ | | | 7~~+TT~~ | | |
| IoNote2 | dBm/95.04 MHz Note4 | -58.92~~+TT~~ | | | -58.92~~+TT~~ | | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone  Note 6: All parameters apply for configuration 1 and 2  Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | | |

The UE shall accomplish the activation of the SCell no later than subframe m+*Ndirect* as defined in TS 38.133[6], clause 8.3.4. Time period T3 starts at (m+ *Ndirect*), at which point UE shall be reporting a valid CQI for both PSCell and SCell.

During T3 the UE shall send CSI reports for SCell with non-zero CQI index and continue to send CSI reports for SCell 1 with non-zero CQI index until the end of T3. All of the above test requirements shall be fulfilled in order for the observed SCell1 direct activation delay to be counted as correct. The rate of correct observed SCell1 direct activation delay during repeated tests shall be at least 90%.

NOTE: In this test case the placement of interruptions is only verified in NR PSCell.

#### 5.5.3.8 EN-DC FR2 fast SCell Activation of SCell in FR2 intra-band

Editor’s note: This test case is incomplete only in following aspects:

-

- The test is incomplete for test frequencies > 40.8 GHz

5.5.3.8.1 Test purpose

The purpose of this test is to verify that the fast SCell activation times are within the requirements stated in TS 38.133 [6] clause 8.3.16, when the SCell in FR2 is known by the UE at the time of activation.

5.5.3.8.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 17 onwards and supporting 2DL CA in NR and fast SCell activation.

5.5.3.8.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 4.5.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause 8.3.16.

5.5.3.8.4 Test description

5.5.3.8.4.1 Initial conditions

This test shall be tested using any of the test configurations in this clause. The supported test configurations for LTE PCell, NR PSCell and NR SCell are shown in Table 5.5.3.8.4.1-1.

Table 5.5.3.8.4.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

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

Configure the test equipment and the DUT according to the parameters in Table 5.5.3.8.4.1-2 and Table 5.5.3.8.4.1-3.

Table 5.5.3.8.4.1-2: Initial conditions for fast known FR2 SCell activation case

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.1-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from 5.5.3.8.5-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | Connection Diagram |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

Table 5.5.3.8.4.1-3: General test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1,2,3 | One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test |
| Active PCell |  | Cell 1 | Primary cell on E-UTRAN RF channel number 1.  As specified in clause A.3.7.2.2 |
| Active PSCell |  | Cell 2 | Primary secondary cell on NR RF channel number 2. |
| Configured deactivated SCell |  | Cell 3 | Configured deactivated secondary cell on NR RF channel number 3 |
| CP length |  | Normal |  |
| DRX |  | OFF | Continuous monitoring of primary cell |
| Cell-individual offset for cells on E-UTRA RF channel number | dB | 0 | Individual offset for cells on primary component carrier. |
| Cell-individual offset for cells on NR channel number | dB | 0 | Individual offset for cells on secondary component carrier. |
| Cell3 timing offset to cell2 | μs | 0 |  |
| Time alignment error between cell3 and cell2 | μs | ≤ Time alignment error as specified in TS 38.104 [28] clause 6.5.3.1. | The value of time alignment error depends upon the type of carrier aggregation. |
| T1 | s | 7 | During this time the PSCell shall be known and the SCell configured and detected. |
| T2 | s | 1 | During this time the UE shall activate the SCell. |
| A3-offset | dB | -15 |  |
| THARQ | ms | k1NR slot length | k1 is a number of slots indicated by the PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [8] |
| TCSI\_Reporting | ms | 15 | the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] |
| k | slot |  | As specified in clause 4.3 of TS 38.213 [8] |

1. Message contents are defined in clause 5.5.3.8.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in the same frequency. Cell 2 is the PSCell and Cell 3 is the known activated SCell.

5.5.3.8.4.2 Test procedure

The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell and triggering the aperiodic CSI-RS for fast SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m (where m mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot , as defined in TS 38.133 [6] clause 8.3.16. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot to slot , as defined in TS 38.133 [6] clause 8.3, where is the interruption length given in TS 38.133 [6] clause 8.2.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation of SCell. The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters according to T1 in Tables 5.5.3.8.5-1 and A.6.1.2-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. T1 starts. Immediately after, the SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.3.8.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

3a. The UE send a *MeasurementReport* message embedded in *ULInformationTransferMRDC.*

4. The SS shall configure transmission of PDSCH with a maximum number of 1 HARQ transmission.

5. The SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.55) in a slot # denoted m and T2 starts in slot m. If the SS receives ACK for MAC-CE sent by the UE, the test proceeds to step 6, otherwise go to step 7.

6. After at least one CSI-RS transmission occasion for channel measurement, the UE shall start sending CSI reports for SCell and the SS shall monitor CSI reports for SCell sent from the UE and ACK/NACK sent in PSCell according to the following criteria:

- If the first CSI report for SCell is received by the SS no later than slot ,

- or slot if the slot was subject to interruption,

- or the next CSI report occasion if there is no CSI report occasion in slots or ,

- and CSI report with non-zero CQI index is received by the SS earlier than or equal to slot , where Tactivation\_time = TFirstATRS + 5ms, as defined in TS 38.133 [6] clause 8.3.16,

- or slot if slot was subject to interruption,

- or the next available CSI report occasion if there is no CSI report occasion for reporting the valid CSI in slot , or slot if was subject to interruption,

- and DTX is not observed by the SS outside the slot to up to the end of T2

- Then the number of successes for the event "Activation" is increased by one. Otherwise, count a fail for the event "Activation" and go to step 7.

7. When T2 expires, or Activation in step 5 was not acknowledged, or a fail was counted for the event "Activation" in step 6, the SS shall transmit an *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508[25] Table 4.6.1-8 to release NR PSCell. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.

9. The SS shall transmit an *RRCConnectionReconfiguration* message with condition MCG and SCG according to TS 36.508 [25] Table 4.6.1-8 to ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. The UE shall transmit an RRCConnectionReconfigurationComplete message.

10. Repeat steps 2-9 until a test verdict has been achieved.

The event "Activation" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved.

5.5.3.8.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3, with following exception:

Table 5.5.3.8.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-7 with Condition Deactivated SCell |

Table 5.5.3.8.4.3-2: *RRCReconfiguration* in step 3: SCell addition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition EN-DC\_MEAS and EN-DC\_SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig-SCell | Table 5.5.3.8.4.3-5 |  |
| measConfig | MeasConfig | Table 5.5.3.8.4.3-2A |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.8.4.3-2A: MeasConfig (Table 5.5.3.8.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: Table H.3.1-2 with condition Deactivated SCell | | | |
| Information Element | Value/Remark | Comment | Condition |
| measConfig ::= SEQUENCE { |  |  |  |
| measObjectToAddModList SEQUENCE (SIZE (1..maxNrofMeasId)) OF SEQUENCE { | 2 entries |  |  |
| measObject[2] CHOICE { |  |  |  |
| measObjectNR | MeasObjectNR for SCell | entry 2  Table 5.5.3.8.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |
| reportConfigToAddModList SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod { | 1 entry |  |  |
| ReportConfigToAddMod[1] SEQUENCE { |  | entry 1 |  |
| reportConfigId | ReportConfigId |  |  |
| reportConfig CHOICE { |  |  |  |
| reportConfigNR | ReportConfigNR | Table 5.5.3.8.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.8.4.3-3: MeasObjectNR for SCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 with condition Deactivated SCell and Synchronous cells | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| smtc1 | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| measCycleSCell-v1530 | sf160 |  |  |
| } |  |  |  |

Table 5.5.3.8.4.3-4: ReportConfigNR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| eventTriggered SEQUENCE { |  |  |  |
| eventId CHOICE { |  |  |  |
| eventA3 SEQUENCE { |  |  |  |
| a3-Offset CHOICE { |  |  |  |
| rsrp | -30 | To ensure reporting can always be triggered |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.8.4.3-5: CellGroupConfig-SCell (Table 5.5.3.8.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-19 with condition MEAS and SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | ServCellIndex of NR SpCell |  |  |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| rlmInSyncOutOfSyncThreshold | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 5.5.3.8.4.3-6 |  |
| } |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig-SCell | Table 5.5.3.8.4.3-7 |  |
| smtc | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.3.8.4.3-6: ServingCellConfig-SpCell (Table 5.5.3.8.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition MEAS | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| csi-MeasConfig | CSI-MeasConfig for RRM specified in TS 38.508-1 [14] Table 7.3.1-6 |  |  |
| servingCellMO | 1 |  |  |
| } |  |  |  |

Table 5.5.3.8.4.3-7: ServingCellConfig-SCell (Table 5.5.3.8.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition No\_UL | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| csi-MeasConfig | CSI-MeasConfig for RRM specified in TS 38.508-1 [14] Table 7.3.1-6 with condition FastActivation\_SCell |  |  |
| servingCellMO | 2 |  |  |
| } |  |  |  |

5.5.3.8.5 Test requirement

Table 5.5.3.8.5-1 defines the primary level settings including test tolerances for all tests and Table 5.5.3.8.5-2 defines OTA related test parameters.

Table 5.5.3.8.5-1: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ParameterNote 5** | **Unit** | **Cell 2** | | **Cell 3** | |
|  |  | **T1** | **T2** | **T1** | **T2** |
| SSB ARFCN |  | freq1 | | freq2 | |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 66 | | 66 | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | | SR.3.1 TDD | |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | | CR.3.1 TDD | |
| RMC CORESET Reference Channel |  | CCR.3.1 TDD | | CCR.3.1 TDD | |
| DL initial BWP configuration |  | DLBWP.0.1 | | | |
| DL dedicated BWP configuration |  | DLBWP.1.1 | | | |
| UL initial BWP configuration |  | ULBWP.0.1 | | | |
| UL dedicated BWP configuration |  | ULBWP.1.1 | | | |
| OCNG Patterns |  | OP.1 | | | |
| SMTC configuration |  | SMTC.1 | | | |
| SSB configuration |  | SSB.1 FR2 | | | |
| Aperiodic CSI-RS for Scell activation |  | - | | TRS.2.3 | |
| gapBetweenBursts | slots | N/A | | | |
| TCI state |  | TCI.State.0 | | | |
| TRS configuration |  | TRS.2.1 TDD | | | |
| CSI-RS configuration for CSI reporting |  | CSI-RS.3.1 TDD | | | |
| reportConfigType |  | periodic | | N/A | |
| reportQuantity |  | cri-RI-PMI-CQI | | N/A | |
| CSI reporting periodicity | slot | 40 | | N/A | |
| CSI reporting offset | slot | 4 | | N/A | |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | | | |
| EPRE ratio of PSS to SSS | dB | 0 | | | |
| EPRE ratio of PBCH\_DMRS to SSS |  |  | | | |
| EPRE ratio of PBCH to PBCH\_DMRS |  |  | | | |
| EPRE ratio of PDCCH\_DMRS to SSS |  |  | | | |
| EPRE ratio of PDCCH to PDCCH\_DMRS |  |  | | | |
| EPRE ratio of PDSCH\_DMRS to SSS |  |  | | | |
| EPRE ratio of PDSCH to PDSCH\_DMRS |  |  | | | |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  | | | |
| Propagation conditions |  | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Void  Note 3: Void  Note 4: Void  Note 5: All parameters apply for configuration 1 and 2. | | | | | |

Table 5.5.3.8.5-2: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ParameterNote 6 | Unit | Cell 2 | | Cell 3 | |
|  |  | T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 1 according to A.9.1 | | | |
| Assumption for UE beamsNote 7 |  | Rough | | Rough | |
| Note1 | dBm/15kHzNote4 | -104.7 | | -104.7 | |
| Note1 | dBm/SCSNote3 | -95.7 | | -95.7 | |
|  | dB | 7 | | 7 | |
| SS\_RPNote2 | dBm/SCS Note4 | -88.7 | | N/A | |
| CSI-RS\_RPNote2 | dBm/SCS Note4 | N/A | | -88.7 | |
|  | dB | 7 | | 7 | |
| IoNote2 | dBm/95.04 MHz Note4 | -58.92 | | -58.92 | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: Es/Iot, SS\_RP, CSI\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: Void  Note 6: All parameters apply for configuration 1 and 2  Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | |

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot , Tactivation\_time = TFirstATRS+ 5ms, as defined in TS 38.133 [6] clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot to .

The interruption of PSCell shall not be more than the values specified for EN-DC in TS 38.133 [6] Clause 8.2.1.2.4.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot as defined in TS 38.133 [6] clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI. In this test case the placement of interruptions is only verified in NR PSCell.

### 5.5.4 UE UL carrier RRC reconfiguration delay

### 5.5.5 Link recovery procedures

#### 5.5.5.0 Minimum conformance requirements

##### 5.5.5.0.1 Minimum conformance requirements for SSB-based BFD and link recovery procedures

[TS38.133, clause 8.5.2.1]

The requirements in this clause apply for each SSB resource in the set  configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in TS 38.133 [6] clause 8.5.2.2. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band.

Table 5.5.5.0.1-1: PDCCH transmission parameters for beam failure instance

|  |  |
| --- | --- |
| Attribute | Value for BLER |
| 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 | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 0dB |
| Bandwidth (PRBs) | 24 |
| Sub-carrier spacing (kHz) | Same as the SCS of RMSI CORESET |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

[TS38.133, clause 8.5.2.2]

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set  estimated over the last TEvaluate\_BFD\_SSB ms period becomes worse than the threshold Qout\_LR\_SSB within TEvaluate\_BFD\_SSB ms period.

The value of TEvaluate\_BFD\_SSB is defined in Table 5.5.5.0.1-2 for FR2 with scaling factor N=8.

For FR2,

- P=1/(1-TSSB/TSMTCperiod), when BFD-RS is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- P=1/(1-TSSB/MGRP-TSSB/TSMTCperiod), when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- P= Psharing factor /(1-TSSB/MGRP), when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- P=1/(1-TSSB/ TSMTCperiod), when the BFD-RS resource is partially overlapped with measurement gap (TSSB <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- P= Psharing factor /(1-TSSB/MGRP), when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the BFD-RS resource outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

Longer evaluation period would be expected if the combination of BFD resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 5.5.5.0.1-2: Evaluation period TEvaluate\_BFD\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Max([50], Cceil(5\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | Mmax([50], Cceil(7.5\*P\*N)\*Mmax(TDRX,TSSB)) |
| DRX cycle > 320ms | Cceil(5\*P\*N)\*TDRX |
| NOTE: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

[TS38.133, clause 8.5. 2.3]

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

For FR2, when the SSB for BFD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

[TS38.133, clause 8.5.4]

When the radio link quality on all the RS resources in set  is worse than Qout\_LR, Layer 1 of the UE shall send a beam failure instance indication to the higher layers.

The beam failure instance evaluation for the RS resources in set  shall be performed as specified in clause 6 in TS 38.213. Two successive indications from Layer 1 shall be separated by at least TIndication\_interval\_BFD.

When DRX is not used, TIndication\_interval\_BFD is max(2ms, TSSB-RS,M) ) or max(2ms, TCSI-RS,M), where TSSB-RS,M and TCSI-RS,M is the shortest periodicity of all RS resources in set  for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set  or CSI-RS resource in the set .

When DRX is used, for SSB based link quality measurement,

- TIndication\_interval\_BFD = Max(1.5 × DRX\_cycle\_length, 1.5 × TSSB-RS,M), if DRX\_cycle\_length ≤ 320ms,

- TIndication\_interval\_BFD = DRX\_cycle\_length, if DRX\_cycle\_length > 320ms.

[TS38.133, clause 8.5.5.1]

The requirements in this clause apply for each SSB resource in the set  configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in TS 38.133 [6] clause 8.5.5.2. The requirements in this clause could not be applicable if UE is required to perform candidate beam detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

[TS38.133, clause 8.5.5.2]

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set  estimated over the last TEvaluate\_CBD\_SSB ms period becomes better than the threshold Qin\_LR provided SSB\_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 5.5.5.0.1-3 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of TEvaluate\_CBD\_SSB is defined in Table 5.5.5.0.1-3 for FR2 with scaling factor N=8.

Where,

For FR2,

- P=1/(1-TSSB/TSMTCperiod), when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor , when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- P=1/(1-TSSB/MGRP-TSSB/TSMTCperiod), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- P= Psharing factor /(1-TSSB/MGRP), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- P=1/(1-TSSB/ TSMTCperiod), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- P= Psharing factor /(1-TSSB/MGRP), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the candidate beam detection RS outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured - Psharing factor = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of PCBD used in Table 5.5.5.0.1-3 are defined as

For each SSB resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PCBD = 1.

For each SSB resource in the set  configured for PSCell in NR-DC

- PCBD = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each SSB resource in the set  configured for a SCell

- PCBD = Z in EN-DC or NE-DC or SA.

- PCBD = 2\* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell Table 5.5.5.0.1-3: Evaluation period TEvaluate\_CBD\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_CBD\_SSB (ms) |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(3 × P × N × PCBD) × TSSB) |
| DRX cycle > 320ms | Ceil(3 × P × N × PCBD) × TDRX |
| NOTE: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

[TS38.133, clause 8.5.5.3]

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.2.1, 8.5.2.2, 8.5.2.3, 8.5.4, 8.5.5.1, 8.5.5.2 and 8.5.5.3.

##### 5.5.5.0.2 Minimum conformance requirements for CSI-RS-based BFD and link recovery procedures

[TS38.133, clause 8.5.3.1]

The requirements in this clause apply for each CSI-RS resource in the set  of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in TS 38.133 clause 8.5.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured as BFD-RS if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

Table 5.5.5.0.2-1: PDCCH transmission parameters for beam failure instance

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER** |
| 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 | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 0dB |
| Bandwidth (PRBs) | 48 |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

[TS38.133, clause 8.5.3.2]

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set  estimated over the last TEvaluate\_BFD\_CSI-RS ms period becomes worse than the threshold Qout\_LR\_CSI-RS within TEvaluate\_BFD\_CSI-RS ms period.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 5.5.5.0.2-2 for FR2 with N=1. The requirements of TEvaluate\_BFD\_CSI-RS apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR2,

- P=1, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=1/(1 – TCSI-RS/MGRP) , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- P=1/(1 – TCSI-RS /TSMTCperiod), when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P is Psharing factor, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P is 1/(1- TCSI-RS /MGRP - TCSI-RS /TSMTCperiod), when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5\*TSMTCperiod

- P is 1/(1- TCSI-RS /MGRP)\* Psharing factor, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5\*TSMTCperiod

- P is 1/{1- TCSI-RS / TSMTCperiod }, when the BFD-RS resource is partially overlapped with measurement gap (TCSI-RS < MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is 1/(1- TCSI-RS /MGRP)\* Psharing factor, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the BFD-RS resource outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- Psharing factor is 3, otherwise**.**

where,

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of BFD-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of MBFD used in Table 5.5.5.0.2-2 are defined as

- MBFD = 10, if the CSI-RS resource(s) in set  used for BFD is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of PBFD used in Table 5.5.5.0.2-2 are defined as

For each CSI-RS resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PBFD = 1.

For each CSI-RS resource in the set  configured for PSCell in NR-DC

PBFD = 2 if UE is configured for beam failure detection on SCell, 1 otherwise.

For each CSI-RS resource in the set  configured for a SCell

- PBFD = Z in EN-DC or NE-DC or SA.

- PBFD = 2\* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

Table 5.5.5.0.2-2: Evaluation period TEvaluate\_BFD\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_CSI-RS (ms) |
| no DRX | Max(50, Ceil(MBFD × P × N × PBFD) × TCSI-RS) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × MBFD × P × N × PBFD) × Max(TDRX, TCSI-RS)) |
| DRX cycle > 320ms | Ceil(MBFD × P × N × PBFD) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

[TS38.133, clause 8.5.3.3]

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For FR2, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM/BFD/CBD/L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for BFD measurement and the other CSI-RS. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

- The CSI-RS for BFD measurement or the other CSI-RS in a resource set configured with repetition ON, or

- The other CSI-RS is configured in set  and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

[TS38.133, clause 8.5.4]

When the radio link quality on all the RS resources in set  is worse than Qout\_LR, Layer 1 of the UE shall send a beam failure instance indication to the higher layers.

The beam failure instance evaluation for the RS resources in set  shall be performed as specified in clause 6 in TS 38.213. Two successive indications from Layer 1 shall be separated by at least TIndication\_interval\_BFD.

When DRX is not used, TIndication\_interval\_BFD is max(2ms, TSSB-RS,M) ) or max(2ms, TCSI-RS,M), where TSSB-RS,M and TCSI-RS,M is the shortest periodicity of all RS resources in set  for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set  or CSI-RS resource in the set .

When DRX is used, for CSI-RS based link quality measurement,

- TIndication\_interval\_BFD = Max(1.5 × DRX\_cycle\_length, 1.5 × TCSI-RS,M), if DRX\_cycle\_length ≤ 320ms,

- TIndication\_interval\_BFD = DRX\_cycle\_length, if DRX\_cycle\_length > 320ms.

[TS38.133, clause 8.5.6.1]

The requirements in this clause apply for each CSI-RS resource in the set  configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in TS 38.133 clause 8.5.6.2. The requirements in this clause could not be applicable if UE is required to perform candidate beam detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

[TS38.133, clause 8.5.6.2]

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set  estimated over the last TEvaluate\_CBD\_CSI-RS [ms] period becomes better than the threshold Qin\_LR within TEvaluate\_CBD\_CSI-RS [ms] period provided CSI-RS Ês/Iot is according to TS 38.133 Annex Table B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in Table 5.5.5.0.2-3 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 5.5.5.0.2-3 for FR2 with scaling factor N=8.

For FR2,

- P=1, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=1/(1 – TCSI-RS/MGRP) , when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- P=1/(1 – TCSI-RS /TSMTCperiod), when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P =Psharing factor, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P is 1/(1- TCSI-RS /MGRP - TCSI-RS /TSMTCperiod), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5\*TSMTCperiod

- P is 1/(1- TCSI-RS /MGRP)\* Psharing factor, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5\*TSMTCperiod

- P is 1/{1- TCSI-RS / TSMTCperiod }, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- TCSI-RS /MGRP)\* 3, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)- Psharing factor = 1, if the candidate beam detection RS outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signalling of *smtc2* is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in TS 38.133 clause 8.5.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of MCBD used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- MCBD = 3, if the CSI-RS resource configured in the set  is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of PCBD used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

For each CSI-RS resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PCBD = 1.

For each CSI-RS resource in the set  configured for PSCell in NR-DC

- PCBD = 2 if UE configured for candidate beam detection on SCell, 1 otherwise.

For each CSI-RS resource in the set  configured for a SCell

- PCBD = Z in EN-DC or NE-DC or SA.

- PCBD = 2\* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

Table 5.5.5.0.2-3: Evaluation period TEvaluate\_CBD\_CSI-RS for FR2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_CSI-RS (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(MCBD × P × N × PCBD) × TCSI-RS) |
| DRX cycle > 320ms | Ceil(MCBD × P × N × PCBD) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

[TS38.133, clause 8.5.6.3]

For FR2, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM/BFD/CBD/L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and the other CSI-RS. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.3.1, 8.5.3.2, 8.5.3.3, 8.5.4, 8.5.6.1, 8.5.6.2 and 8.5.6.3.

##### 5.5.5.0.3 Scheduling availability of UE during beam failure detection and candidate beam detection

[TS38.133, clause 8.5.7.3]

The following scheduling restriction applies due to beam failure detection.

- For the case where no RSs are provided for BFD, or when CSI-RS is configured for BFD is explicitly configured and is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON

- There are no scheduling restrictions due to beam failure detection performed based on the CSI-RS.

- Otherwise

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

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for BFD measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for BFD measurement.

[TS38.133, clause 8.5.8.3]

The following scheduling restriction applies due to candidate beam detection

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

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for CBD measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for CBD measurement.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.7.4, 8.5.8.3.

##### 5.5.5.0.4 Requirements for Beam Failure Recovery in SCell

[TS 38.133, clause 8.5.9.1]

For the UE provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of SCells, the UE shall transmit SR for UL resource, followed by MAC CE providing one index for at least one corresponding SCell with radio link quality is worse than Qout,LR, and the index for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS38.321 [7], if any, for a corresponding SCell.

For the UE not provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of SCells, the UE shall transmit preamble for UL-SCH resource application, followed by MAC CE providing one index for at least one corresponding SCell with radio link quality is worse than Qout,LR, and the index for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS38.321 [7], if any, for a corresponding SCell.

[TS 38.133, clause 8.5.9.2]

Provided that UE is configured by *schedulingRequestIDForBFR* a configuration for LRR in a PUCCH transmission, after BFR is triggered on any of SCells as described in clause 5.17 of TS38.321 [7], UE shall be capable of transmit PUCCH with a LRR within a period of T, where

- T = T1 x Ceil((T2+D) /T1) in which T1, T2 and D are defined as

- T1 is equal to the periodicity of PUCCH configured with *schedulingRequestIDForBFR*.

- T2 = TEvaluate\_CBD is the evaluation period specified in TS 38.133 clause 8.5.5 or 8.5.6 for SSB or CSI-RS based candidate beam detection, that is TEvaluate\_CBD\_SSB or TEvaluate\_CBD\_CSI-RS, depending on the applicable reference signal configured for candidate beam detection.

- D = 2ms is the UE Processing time.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.9.1, 8.5.9.2.

##### 5.5.5.0.5 Requirements for SSB based beam failure detection for UE fulfilling relaxed measurement criteria

[TS 38.133, clause 8.5.2.4]

This clause contains minimum requirements for SSB based relaxed beam failure detection.

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set  estimated over the last TEvaluate\_BFD\_SSB\_Relax ms period becomes worse than the threshold Qout\_LR\_SSB within TEvaluate\_BFD\_SSB\_Relax ms period.

The value of TEvaluate\_BFD\_SSB\_Relax is defined in Table 5.5.5.0.5-1 for FR2 with scaling factor N=8

The value of P is defined in 5.5.5.0.1.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 5.5.5.0.5-1: Evaluation period TEvaluate\_BFD\_SSB\_Relax for FR2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_SSB\_Relax (ms)** |
| Mas(TDRX, TSSB) ≤ 80 ms | Max(50 × K4, Ceil(7.5 × K2 × P × N) × Max(TDRX,TSSB)) |
| 80ms＜Max(TDRX, TSSB) ≤ 160 ms | Max(50, Ceil(7.5 × P× N) × Max(TDRX,TSSB)) |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length and no longer than 80ms.  Note 2: K2 is the relaxation factor. K2 = 2.  Note 3: K4 is the relaxation factor for the lower bound. K4 = K2, if 1 < K2 ≤ 2; K4 = 1 otherwise. | |

#### 5.5.5.1 EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Editor's Note: This test case is complete for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for Test frequency f > 40.8 GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.1.1 Test purpose

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 he downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in TS 38.133 [6] clause 8.5.

5.5.5.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 onwards.

5.5.5.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.1.

5.5.5.1.4 Test description

There are two cells configured in this test: E-UTRAN PCell and NR PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.1.4-1 shows the five different time durations and the corresponding 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 5.5.5.1.4-2 shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery.

文字と写真のスクリーンショット

自動的に生成された説明

Figure 5.5.5.1.4-1: SNR for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

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自動的に生成された説明

Figure 5.5.5.1.4-2: SSB\_RP level variation for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

5.5.5.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.1.4.1-1.

Table 5.5.5.1.4.1-1: Supported test configurations for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.1-1 | LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.1-2 | LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.1-3 | LTE FDD, NR TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.1-4 | LTE TDD, NR 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.1.4.1-2.

Table 5.5.5.1.4.1-2: Initial conditions for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.1.4.1-3.

2. Message contents are defined in clause 5.5.5.1.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.1.4.1-3: General test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 | Table A.1.5-3 |
| 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 | Table A.8.1-1 |
| DL dedicated BWP configuration | | 1-4 |  | DLBWP.1.1 | Table A.8.1-2 |
| UL initial BWP configuration | | 1-4 |  | ULBWP.0.1 | Table A.8.2-1 |
| UL dedicated BWP configuration | | 1-4 |  | ULBWP.1.1 | Table A.8.2-2 |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD | Table A.1.1.2-3 |
| 3-4 | SR.3.3 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | Table A.1.2.2-3 |
| 3-4 | CR.3.2 TDD |  |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD | Table A.1.3.2-3 |
| 3-4 | CCR.3.7 TDD |  |
| OCNG parameters | | 1-4 |  | OP.1 | Table A.2.1-1 |
| CP length | | 1-4 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-4 |  | TCI.State.0 | Table A.10.2-1 |
| CSI-RS for tracking | | 1-4 |  | TRS.2.1 TDD | Table A.1.4A.2.1-1 |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 | Table A.3.2-1 |
| 3-4 | SSB.2 FR2 |  |
| SMTC Configuration | | 1-4 |  | SMTC.3 | Table A.4-1 |
| PRACH Configuration | | 1-4 |  | PRACH.2 FR2 | Table A.7.2-1 |
| DRX configuration | | 1-4 |  | OFF |  |
| 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 |  | gp0 |  |
| gapOffset | | 1-4 | ms | 0 |  |
| rlmInSyncOutOfSyncThreshold | | 1-4 |  | absent | Value 0 is applied. (38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109Note 3 | Threshold used for Qin\_LR\_SSB |
| 3-4 | -106Note 3 |
| powerControlOffsetSS | | 1-4 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-4 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-4 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-4 |  | CSI-RS.3.1 TDD | Table A.1.4.2-3 |
| 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 |  | 2 |  |
| T1 | | 1-4 | s | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1-4 | s | 2.61 |  |
| T3 | | 1-4 | s | 1.64 |  |
| T4 | | 1-4 | s | 0 |  |
| T5 | | 1-4 | s | 1.01 |  |
| D1 | | 1-4 | 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.  Note 3: Including test tolerance given in Annex F.1.3.2. | | | | | |

5.5.5.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA Cell 1 and NR Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms).

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.1.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.1.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.1.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.1.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.1.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect preamble on a beam associated with candidate beam set q1 before time point B; and

c) detects preamble on a beam associated with candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one.Otherwise the number of failed tests is increased by one.

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.1.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.1.4.3-1: Common Exception messages for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with condition INTER-FREQ  Table H.3.1-3 with condition INTER-FREQ MO (where ssbFrequency is set to the ARFCN value of carrier centre of High range)  Table H.3.1-4 with A3-offset = 0  Table H.3.1-8 with condition SSB BFD  Table H.3.1-10 with condition SSB  Table H.3.1-10A  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition BFD |

Table 5.5.5.1.4.3-2: PDCCH *Search Space* for BFR

| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| --- | --- | --- | --- |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 3 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 and 1 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.5.1.4.3-3: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| n310 | n2 |  |  |
| } |  |  |  |

Table 5.5.5.1.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | entry 1, BFR |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[2] | SearchSpace | entry 2, BFR |  |
| } |  |  |  |
| searchSpacesToReleaseList | Not present |  |  |
| downlinkPreemption | Not present |  |  |
| tpc-PUSCH | Not present |  |  |
| tpc-PUCCH | Not present |  |  |
| tpc-SRS | Not present |  |  |
| } |  |  |  |

Table 5.5.5.1.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 7.3.1-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 2 |  |  |
| 1 |  | Test Configuration 3 & 4 |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n6 |  |  |
| interleaverSize | n2 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| tci-StatesPDCCH-ToAddList | Not present |  |  |
| pdcch-DMRS-ScramblingID | 1008 | DMRS scrambling ID different from Physical Cell ID |  |
| } |  |  |  |

5.5.5.1.5 Test requirement

Tables 5.5.5.1.4.1-3 and 5.5.5.1.5-1 define the primary level settings including test tolerances for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX.

Table 5.5.5.1.5-1: NR Cell specific test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

| Parameter | | Unit | Test 1 | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.9 | | | | |
| 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 | 13.7 Note 11,12 | 5.7 Note 11,12 | -12 | -12 | -12 |
| SNR\_SSB of set q1 | Config 1-4 | dB | 0.2 | 0.2 | 20 Note 12 | 20 Note 12 | 20 Note 12 |
| SSB\_RP of set q1 | Config 1-2 | dBm/  SCS | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
| Config 3-4 | -101.5 | -101.5 | -81.7 | -81.7 | -81.7 |
|  | Config 1-4 | 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: 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, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.1.4-1.  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 D.4.  NOTE 10: Information about types of UE beam is given in TS 38.133 clause 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  Note 12: Including test tolerance given in Annex F.1.3.2 | | | | | | | |

Table 5.5.5.1.5-2: Void

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 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 = 960+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%.

#### 5.5.5.2 EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Editor's Note: This test case is complete for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for Test frequency f > 40.8 GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.2.1 Test purpose

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 TS 38.133 [6] clause 8.5.

5.5.5.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 onwards and supporting long DRX cycle.

5.5.5.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.2.

5.5.5.2.4 Test description

There is one E-UTRAN PCell and one NR PSCell configured in this test. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.2.4-1 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 5.5.5.2.4-2 shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery

文字と写真のスクリーンショット

自動的に生成された説明

Figure 5.5.5.2.4-1: SNR variation for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

グラフ

自動的に生成された説明

Figure 5.5.5.2.4-2: SSB\_RP level variation for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

5.5.5.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.2.4.1-1.

Table 5.5.5.2.4.1-1: Supported test configurations for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.2-1 | LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.2-2 | LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.2-3 | LTE FDD, NR TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.2-4 | LTE TDD, NR 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.2.4.1-2.

Table 5.5.5.2.4.1-2: Initial conditions for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

| Parameter | Value | | Comment |
| --- | --- | --- | --- |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.2.4.1-3. The DRX configuration for is according to Table 5.5.5.2.4.1-3. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

2. Message contents are defined in clause 5.5.5.2.4.3.

3. There is one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.2.4.1-3: General test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 | Table A.1.5-3 |
| 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 | Table A.8.1-1 |
| DL dedicated BWP configuration | | 1-4 |  | DLBWP.1.1 | Table A.8.1-2 |
| UL initial BWP configuration | | 1-4 |  | ULBWP.0.1 | Table A.8.2-1 |
| UL dedicated BWP configuration | | 1-4 |  | ULBWP.1.1 | Table A.8.2-2 |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD | Table A.1.1.2-3 |
| 3-4 | SR.3.3 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | Table A.1.2.2-3 |
| 3-4 | CR.3.2 TDD |  |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD | Table A.1.3.2-3 |
| 3-4 | CCR.3.7 TDD |  |
| OCNG parameters | | 1-4 |  | OP.1 | Table A.2.1-1 |
| CP length | | 1-4 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-4 |  | TCI.State.0 | Table A.10.2-1 |
| CSI-RS for tracking | | 1-4 |  | TRS.2.1 TDD | Table A.1.4A.2.1-1 |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 | Table A.3.2-1 |
| 3-4 | SSB.2 FR2 |  |
| SMTC Configuration | | 1-4 |  | SMTC.3 | Table A.4-1 |
| PRACH Configuration | | 1-4 |  | PRACH.2 FR2 | Table A.7.2-1 |
| DRX configuration | | 1-4 |  | DRX.3 | Table A.5-1 |
| 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. (TS 38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109Note 2 | Threshold used for Qin\_LR\_SSB |
| 3-4 | -106Note 2 |
| powerControlOffsetSS | | 1-4 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-4 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-4 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-4 |  | CSI-RS.3.1 TDD | Table A.1.4.2-3 |
| 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 |  | 2 |  |
| 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 | 2.8 |  |
| 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.  Note 2: Including test tolerance given in Annex F.1.3.2 | | | | | |

5.5.5.2.4.2 Test procedure

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 PSCell 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.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.2.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.2.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.2.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.2.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.2.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect preamble on a beam associated with the candidate beam set q1 before time point B; and

c) detects preamble on a beam associated with the candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one. Otherwise the number of failed tests is increased by one.

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.2.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.2.4.3-1: Common Exception messages for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8 with condition SSB BFD  Table H.3.1-10 with condition SSB  Table H.3.1-10A  Table H.3.7-1 with condition DRX.3 |

Table 5.5.5.2.4.3-2: PDCCH *Search Space* for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 3 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 and 1 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.5.2.4.3-3: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| n310 | n2 |  |  |
| } |  |  |  |

Table 5.5.5.2.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | entry 1, BFR |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[2] | SearchSpace | entry 2, BFR |  |
| } |  |  |  |
| searchSpacesToReleaseList | Not present |  |  |
| downlinkPreemption | Not present |  |  |
| tpc-PUSCH | Not present |  |  |
| tpc-PUCCH | Not present |  |  |
| tpc-SRS | Not present |  |  |
| } |  |  |  |

Table 5.5.5.2.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 7.3.1-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 2 |  |  |
| 1 |  | Test Configuration 3 & 4 |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n6 |  |  |
| interleaverSize | n2 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| tci-StatesPDCCH-ToAddList | Not present |  |  |
| pdcch-DMRS-ScramblingID | 1008 | DMRS scrambling ID different from Physical Cell ID |  |
| } |  |  |  |

5.5.5.2.5 Test requirement

Tables 5.5.5.2.4.1-3 and 5.5.5.2.5-1 define the primary level settings including test tolerances for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX.

Table 5.5.5.2.5-1: NR Cell specific test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

| Parameter | | Unit | Test 1 | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.9 | | | | |
| 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 | 13.7 Note 11,12 | 5.7 Note 11,12 | -12 | -12 | -12 |
| SNR\_SSB of set q1 | Config 1-4 | dB | 0.2 | 0.2 | 20 Note 12 | 20 Note 12 | 20 Note 12 |
| SSB\_RP of set q1 | Config 1-2 | dBm/ | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
|  | Config 3-4 | SCS kHz | -101.5 | -101.5 | -81.7 | -81.7 | -81.7 |
|  | Config 1-4 | 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: 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, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.2.4-1.  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 D.4.  NOTE 10: Information about types of UE beam is given in TS 38.133 clause 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  Note 12: Including test tolerance given in Annex F.1.3.2 | | | | | | | |

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%.

#### 5.5.5.3 EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Editor's Note: This test case is complete for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for Test frequency f > 40.8 GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.3.1 Test purpose

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 candidate 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 serving cell requirements in TS 38.133 [6] clause 8.5.

5.5.5.3.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 and forward supporting CSI-RS-based RLM and link recovery.

5.5.5.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.3.

5.5.5.3.4 Test description

There are two cell configured in this test: E-UTRAN PCell and NR PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.3.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate CSI-RS based beam failure. Figure 5.5.5.3.4-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.

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Figure 5.5.5.3.4-1: SNR variation for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

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Figure 5.5.5.3.4-2: CSI-RS\_RP level variation for EN-DC FR2 CSI-RS based beam failure detection and link recovery in non-DRX

5.5.5.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.3.4.1-1.

Table 5.5.5.3.4.1-1: Supported test configurations for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.3-1 | LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.3-2 | LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.3.4.1-2.

Table 5.5.5.3.4.1-2: Initial conditions for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

| Parameter | Value | | Comment |
| --- | --- | --- | --- |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.3.4.1-3. The NZP-CSI-RS configuration is according to Table 5.5.5.3.4.1-3.

2. Message contents are defined in clause 5.5.5.3.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.3.4.1-3: General test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active E-UTRA PCell | | 1-2 |  | Cell 1 |  |
| E-UTRA RF Channel Number | | 1-2 |  | 1 |  |
| Active PCell | | 1-2 |  | Cell 2 |  |
| RF Channel Number | | 1-2 |  | 2 |  |
| Duplex mode | | 1-2 |  | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 | Table A.1.5-3 |
| BWchannel | | 1-2 | MHz | 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 | Table A.8.1-1 |
| DL dedicated BWP configuration | | 1-2 |  | DLBWP.1.1 | Table A.8.1-2 |
| UL initial BWP configuration | | 1-2 |  | ULBWP.0.1 | Table A.8.2-1 |
| UL dedicated BWP configuration | | 1-2 |  | ULBWP.1.1 | Table A.8.2-2 |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD | Table A.1.1.2-3 |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | Table A.1.2.2-3 |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD | Table A.1.3.2-3 |
| OCNG parameters | | 1-2 |  | OP.1 | Table A.2.1-1 |
| CP length | | 1-2 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-2 |  | TCI.State.0 | Table A.10.2-1 |
| CSI-RS for tracking | | 1-2 |  | TRS.2.1 TDD | Table A.1.4A.2.1-1 |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 | Table A.3.2-1 |
| SMTC Configuration | | 1-2 |  | SMTC.3 | Table A.4-1 |
| PRACH Configuration | | 1-2 |  | PRACH.4 FR2 | Table A.7.2-1 |
| DRX configuration | | 1-2 |  | OFF |  |
| CSI-RS configuration for BFD/CBD/RLM | | 1-2 |  | CSI-RS.3.2 TDD | Table A.1.4.2-3 |
| CSI-RS index assigned as BFD RS (q0) | | 1-2 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) | | 1-2 |  | 1 |  |
| CSI-RS index assigned as RLM RS | | 1-2 |  | 0,1 |  |
| 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. (TS 38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109Note 2 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1-2 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD | Table A.1.4.2-3 |
| 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 | 1.17 |  |
| T3 | | 1-2 | s | 0.9 |  |
| T4 | | 1-2 | s | 0 |  |
| T5 | | 1-2 | s | 0.31 |  |
| D1 | | 1-2 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.  Note 2: Including test tolerance given in Annex F.1.3.2. | | | | | |

5.5.5.3.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to NR 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.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.3.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.3.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.3.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.3.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.3.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B;

and

b) does not detect preamble on a beam associated with the candidate beam set q1 before time point B; and

c) detects preamble on a beam associated with the candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one. Otherwise the number of failed tests is increased by one.

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.3.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.3.4.3-1: Common Exception messages for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8 with condition CSI-RS BFD  Table H.3.1-10 with condition CSI-RS  Table H.3.1-10A |

Table 5.5.5.3.4.3-2: PDCCH *Search Space* for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 3 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 and 1 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.5.3.4.3-3: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| n310 | n2 |  |  |
| } |  |  |  |

Table 5.5.5.3.4.3-4: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-85 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| powerControlOffsetSS | db0 |  |  |
| } |  |  |  |

Table 5.5.5.3.4.3-5: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | entry 1, BFR |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[2] | SearchSpace | entry 2, BFR |  |
| } |  |  |  |
| searchSpacesToReleaseList | Not present |  |  |
| downlinkPreemption | Not present |  |  |
| tpc-PUSCH | Not present |  |  |
| tpc-PUCCH | Not present |  |  |
| tpc-SRS | Not present |  |  |
| } |  |  |  |

Table 5.5.5.3.4.3-6: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 7.3.1-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 2 |  |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n6 |  |  |
| interleaverSize | n2 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| tci-StatesPDCCH-ToAddList | Not present |  |  |
| pdcch-DMRS-ScramblingID | 1008 | DMRS scrambling ID different from Physical Cell ID |  |
| } |  |  |  |

5.5.5.3.5 Test requirement

Tables 5.5.5.3.4.1-3 and 5.5.5.3.5-1 define the primary level settings including test tolerances for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX.

Table 5.5.5.3.5-1: NR Cell specific test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.9 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | | | | |
| 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 | 0 | | | | |
| 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 | dB | 13.7 Note 11,12 | 5.7 Note 11,12 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1-2 | dB | 0.2 | 0.2 | 20 Note 12 | 20 Note 12 | 20 Note 12 |
| CSI-RS\_RP of set q1 | Config 1-2 | dBm/SCS | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
|  | Config 1-2 | dBm/120 KHz | TBD | | | | |
| 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 5.5.5.3.4-1.  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 D.4.  NOTE 10: Information about types of UE beam is given in TS 38.133 clause 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  Note 12: Including test tolerance given in Annex F.1.3.2 | | | | | | | |

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 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 = 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%.

#### 5.5.5.4 EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Editor's Note: This test case is complete for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for Test frequency f > 40.8 GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.4.1 Test purpose

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 candidate 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 TS 38.133 [6] clause 8.5.

5.5.5.4.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 and forward supporting CSI-RS-based RLM and long DRX cycle and link recovery.

5.5.5.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.4.

5.5.5.4.4 Test description

There is one E-UTRAN PCell and one NR PSCell configured in this test. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.4.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate CSI-RS based beam failure. Figure 5.5.5.4.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.

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Figure 5.5.5.4.4-1: SNR variation for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

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Figure 5.5.5.4.4-2: CSI-RS\_RP level variation for EN-DC FR2 CSI-RS based beam failure detection and link recovery in DRX

5.5.5.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.4.4.1-1.

Table 5.5.5.4.4.1-1: Supported test configurations for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.4-1 | LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |
| 5.5.5.4-2 | LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.4.4.1-2.

Table 5.5.5.4.4.1-2: Initial conditions for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.4.4.1-3. The NZP-CSI-RS configuration is according to Table 5.5.5.4.4.1-3. The DRX configuration for is according to Table 5.5.5.4.4.1-3. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

2. Message contents are defined in clause 5.5.5.4.4.3.

3. There is one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.4.4.1-3: General test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active E-UTRA PCell | | 1-2 |  | Cell 1 |  |
| E-UTRA RF Channel Number | | 1-2 |  | 1 |  |
| Active PCell | | 1-2 |  | Cell 2 |  |
| RF Channel Number | | 1-2 |  | 2 |  |
| Duplex mode | | 1-2 |  | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 | Table A.1.5-3 |
| BWchannel | | 1-2 | MHz | 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 | Table A.8.1-1 |
| DL dedicated BWP configuration | | 1-2 |  | DLBWP.1.1 | Table A.8.1-2 |
| UL initial BWP configuration | | 1-2 |  | ULBWP.0.1 | Table A.8.2-1 |
| UL dedicated BWP configuration | | 1-2 |  | ULBWP.1.1 | Table A.8.2-2 |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD | Table A.1.1.2-3 |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | Table A.1.2.2-3 |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD | Table A.1.3.2-3 |
| OCNG parameters | | 1-2 |  | OP.1 | Table A.2.1-1 |
| CP length | | 1-2 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-2 |  | TCI.State.0 | Table A.10.2-1 |
| CSI-RS for tracking | | 1-2 |  | TRS.2.1 TDD | Table A.1.4A.2.1-1 |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 | Table A.3.2-1 |
| SMTC Configuration | | 1-2 |  | SMTC.3 | Table A.4-1 |
| PRACH Configuration | | 1-2 |  | PRACH.4 FR2 | Table A.7.2-1 |
| DRX configuration | | 1-2 |  | DRX.3 | Table A.5-1 |
| CSI-RS configuration for BFD/CBD/RLM | | 1-2 |  | CSI-RS.3.2 TDD | Table A.1.4.2-3 |
| CSI-RS index assigned as BFD RS (q0) | | 1-2 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) | | 1-2 |  | 1 |  |
| CSI-RS index assigned as RLM RS | | 1-2 |  | 0,1 |  |
| 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. (TS 38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109Note 2 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1-2 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD | Table A.1.4.2-3 |
| 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 | 5.43 |  |
| T3 | | 1-2 | s | 5.16 |  |
| T4 | | 1-2 | s | 0 |  |
| T5 | | 1-2 | s | 0.31 |  |
| D1 | | 1-2 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.  Note 2: Including test tolerance given in Annex F.1.3.2. | | | | | |

Table 5.5.5.4.4.1-4: Void

5.5.5.4.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to NR 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.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.4.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.4.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.4.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.4.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.4.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect preamble on a beam associated with the candidate beam set q1 before time point B; and

c) detects preamble on a beam associated with the candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one. Otherwise the number of failed tests is increased by one.

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.4.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.4.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.4.4.3-1: Common Exception messages for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8 with condition CSI-RS BFD  Table H.3.1-10 with condition CSI-RS  Table H.3.1-10A  Table H.3.7-1 with condition DRX.3 |

Table 5.5.5.4.4.3-2: PDCCH *Search Space* for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 3 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 and 1 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.5.4.4.3-3: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| n310 | n2 |  |  |
| } |  |  |  |

Table 5.5.5.4.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | entry 1, BFR |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[2] | SearchSpace | entry 2, BFR |  |
| } |  |  |  |
| searchSpacesToReleaseList | Not present |  |  |
| downlinkPreemption | Not present |  |  |
| tpc-PUSCH | Not present |  |  |
| tpc-PUCCH | Not present |  |  |
| tpc-SRS | Not present |  |  |
| } |  |  |  |

Table 5.5.5.4.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 7.3.1-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 2 |  |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n6 |  |  |
| interleaverSize | n2 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| tci-StatesPDCCH-ToAddList | Not present |  |  |
| pdcch-DMRS-ScramblingID | 1008 | DMRS scrambling ID different from Physical Cell ID |  |
| } |  |  |  |

5.5.5.4.5 Test requirement

Tables 5.5.5.4.4.1-3 and 5.5.5.4.5-1 define the primary level settings including test tolerances for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX.

Table 5.5.5.4.5-1: NR Cell specific test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A.9 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | | | | |
| 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 | 0 | | | | |
| 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 | dB | 13.7 Note 11,12 | 5.7 Note 11,12 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1-2 | dB | 0.2 | 0.2 | 20 Note 12 | 20 Note 12 | 20 Note 12 |
| CSI-RS\_RP of set q1 | Config 1-2 | dBm/SCS | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
|  | 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 5.5.5.4.4-1.  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 D.4.  NOTE 10: Information about types of UE beam is given in TS 38.133 clause 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  Note 12: Including test tolerance given in Annex F.1.3.2. | | | | | | | |

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 = 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%.

#### 5.5.5.5 EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Editor's Note: This test case is complete for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for Test frequency f > 40.8 GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.5.1 Test purpose

The purpose of this test 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, and to verify the scheduling availability restriction requirements for SSB based beam failure detection and link recovery for an FR2 serving cell in TS 38.133 [6] clause 8.5.7 and 8.5.8.

5.5.5.5.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 onwards.

5.5.5.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.5.

5.5.5.5.4 Test description

There are two cell configured in this test. Cell 1 is the E-UTRAN PCell and Cell 2 is the PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.5.4-1 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 5.5.5.5.4-2 shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery.

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Figure 5.5.5.5.4-1: SNR variation for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

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Figure 5.5.5.5.4-2: SSB\_RP level variation for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

5.5.5.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.5.4.1-1.

Table 5.5.5.5.4.1-1: Supported test configurations for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.5-1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.5.5-2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.5.5-3 | LTE FDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.5.5.5-4 | LTE TDD, 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.5.4.1-2.

Table 5.5.5.5.4.1-2: Initial conditions for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.5.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.5.4.1-3.

2. Message contents are defined in clause 5.5.5.5.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.5.4.1-3: General test parameters for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 | Table A.1.5-3 |
| 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 | Table A.8.1-1 |
| DL dedicated BWP configuration | | 1-4 |  | DLBWP.1.1 | Table A.8.1-2 |
| UL initial BWP configuration | | 1-4 |  | ULBWP.0.1 | Table A.8.2-1 |
| UL dedicated BWP configuration | | 1-4 |  | ULBWP.1.1 | Table A.8.2-2 |
| PDSCH Reference Channel | | 1-2 |  | SR.3.2 TDD | Table A.1.1.2-3 |
| 3-4 | SR.3.3 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | Table A.1.2.2-3 |
| 3-4 | CR.3.2 TDD |  |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD | Table A.1.3.2-3 |
| 3-4 | CCR.3.7 TDD |  |
| OCNG parameters | | 1-4 |  | OP.1 | Table A.2.1-1 |
| CP length | | 1-4 |  | Normal |  |
| PDSCH/PDCCH TCI state | | 1-4 |  | TCI.State.0 | Table A.10.2-1 |
| CSI-RS for tracking | | 1-4 |  | TRS.2.1 TDD | Table A.1.4A.2.1-1 |
| SSB Configuration | | 1-2 |  | SSB.1 FR2 | Table A.3.2-1 |
| 3-4 | SSB.2 FR2 |  |
| SMTC Configuration | | 1-4 |  | SMTC.1 | Table A.4-1 |
| PRACH Configuration | | 1-4 |  | PRACH.2 FR2 | Table A.7.2-1 |
| DRX configuration | | 1-4 |  | OFF |  |
| SSB index assigned as BFD RS (q0) | | 1-4 |  | 0 |  |
| SSB index assigned as CBD RS (q1) | | 1-4 |  | 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 | No measurement gap is configured |
| rlmInSyncOutOfSyncThreshold | | 1-4 |  | absent | Value 0 is applied. (TS 38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109 Note 3 | Threshold used for Qin\_LR\_SSB |
| 3-4 | -106 Note 3 |
| powerControlOffsetSS | | 1-4 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-4 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-4 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-4 |  | CSI-RS.3.1 TDD | Table A.1.4.2-3 |
| 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 |  | 2 |  |
| T1 | | 1-4 | s | 1 | The UE shall be fully synchronized to cell 1 during T1 |
| T2 | | 1-4 | s | 2.6 |  |
| T3 | | 1-4 | s | 1.64 |  |
| T4 | | 1-4 | s | 0 |  |
| T5 | | 1-4 | s | 1.01 |  |
| D1 | | 1-4 | 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.  Note 3: Including test tolerance given in Annex F.1.3.2 | | | | | |

5.5.5.5.4.2 Test procedure

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 defined in CSI-RS configuration. This test will focus on the scheduling availability during beam failure detection and candidate beam detection. In the test, DRX configuration is not enabled. During the test the UE is scheduled to transmit continuously in UL.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.5.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.5.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.5.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.5.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.5.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) which are not overlapped with SSBs configured for beam failure detection during the period from time point B to time point D; and

b) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point D until T5 expires,

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.5.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.5.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 5.5.5.5.4.3-1: Common Exception messages for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8 with condition SSB BFD  Table H.3.1-10 with condition SSB  Table H.3.1-10A |

Table 5.5.5.5.4.3-2: PDCCH *Search Space* for BFR

| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| --- | --- | --- | --- |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 3 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 and 1 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.5.5.4.3-3: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| n310 | n2 |  |  |
| } |  |  |  |

Table 5.5.5.5.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | entry 1, BFR |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[2] | SearchSpace | entry 2, BFR |  |
| } |  |  |  |
| searchSpacesToReleaseList | Not present |  |  |
| downlinkPreemption | Not present |  |  |
| tpc-PUSCH | Not present |  |  |
| tpc-PUCCH | Not present |  |  |
| tpc-SRS | Not present |  |  |
| } |  |  |  |

Table 5.5.5.5.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14],Table 7.3.1-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 2 |  |  |
| 1 |  | Test Configuration 3 & 4 |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n6 |  |  |
| interleaverSize | n2 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| tci-StatesPDCCH-ToAddList | Not present |  |  |
| pdcch-DMRS-ScramblingID | 1008 | DMRS scrambling ID different from Physical Cell ID |  |
| } |  |  |  |

Table 5.5.5.5.4.3-6: PDCCH *Search Space* for USS

| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| --- | --- | --- | --- |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 2 |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n1 |  |  |
| aggregationLevel4 | n2 |  | Test  Configuration  1 & 2 |
| n1 |  | Test  Configuration  3 & 4 |
| aggregationLevel8 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.5.5.5 Test requirement

Tables 5.5.5.5.4.1-3 and 5.5.5.5.5-1 define the primary level settings including test tolerances for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX.

Table 5.5.5.5.5-1: NR Cell specific test parameters for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| AoA setup | |  | Setup 1 defined in A. 9.1 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | | | | |
| 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 | 0 | | | | |
| 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 | 13.7 Note 11,12 | 5.7 Note 11,12 | -12 | -12 | -12 |
| SNR\_SSB of set q1 | Config 1-4 | dB | 0.2 | 0.2 | 20 Note 12 | 20 Note 12 | 20 Note 12 |
| SSB\_RP of set q1 | Config 1-2 | dBm/ | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
|  | Config 3-4 | SCS | -101.5 | -101.5 | -81.7 | -81.7 | -81.7 |
|  | Config 1-4 | dBm/120KHz | -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 5.5.5.5.4-1.  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 D.4.  NOTE 10: Information about types of UE beam is given in TS 38.133 clause 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  Note 12: Including test tolerance given in Annex F.1.3.2. | | | | | | | |

The UE behaviour during time duration T3 follows the requirements defined in TS 38.133 [6] 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 TS 38.133 [6] 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.

#### 5.5.5.6 EN-DC FR2 CSI-RS-based BFD and LR for SCell in non-DRX

Editor's Note:

- This test case is incomplete for Test frequency f > 40.8 GHz

- This test case is incomplete for UE power class other than PC3.

5.5.5.6.1 Test purpose

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q0 configured for an active SCell and that the UE performs correct CSI-RS-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 SCell with *schedulingRequestID-BFR-SCell-r16* configuration, 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 SCell requirements in TS 38.133 [6] clause 8.5.

5.5.5.6.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 16 onwards supporting SCell BFR.

5.5.5.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2 and 5.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.6.

5.5.5.6.4 Test description

There are three cells configured in this test. Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell and Cell 3 is the SCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.6.4-1 shows the variation of the downlink SNR of the active SCell and the SNR of the CSI-RS in set q0 in the active SCell to emulate CSI-RS based beam failure. Figure 5.5.5.6.4-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.

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Figure 5.5.5.6.4-1: SNR variation for CSI-RS based beam failure detection and link recovery testing for SCell in non-DRX mode

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Figure 5.5.5.6.4-2: CSI-RS\_RP level variation for CSI-RS based beam failure detection and link recovery testing for SCell in non-DRX mode

5.5.5.6.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.6.4.1-1.

Table 5.5.5.6.4.1-1: Supported test configurations for EN-DC FR2 SCell beam failure detection and link recovery testing in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.6-1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.6-2 | LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| Note: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.6.4.1-2.

Table 5.5.5.6.4.1-2: Initial conditions for EN-DC FR2 SCell beam failure detection and link recovery testing in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.6.4.1-3.

2. Message contents are defined in clause 5.5.5.6.4.3.

3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.5.6.4.1-3: General test parameters for FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active E-UTRA PCell | | 1-2 |  | Cell 1 |  |
| E-UTRA RF Channel Number | | 1-2 |  | 1 |  |
| Active PCell | | 1-2 |  | Cell 2 |  |
| RF Channel Number for PSCell | | 1-2 |  | 2 |  |
| Active SCell | | 1-2 |  | Cell 3 |  |
| RF Channel Number for SCell | | 1-2 |  | 3 |  |
| Duplex mode | | 1-2 |  | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 |  |
| BWchannel | | 1-2 | MHz | 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 | | 1-2 |  | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | A.1.2.2 |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD |  |
| OCNG parameters | | 1-2 |  | OP.1 | A.2.1 |
| 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 | | 1-2 |  | SSB.3 FR2 | A.3 |
| SMTC Configuration | | 1-2 |  | SMTC.3 | A.4 |
| PRACH Configuration | | 1-2 |  | FR2 PRACH configuration 4 | Table A.7.2-1 |
| DRX configuration | | 1-2 |  | OFF |  |
| CSI-RS configuration for BFD/CBD in activated SCell | | 1-2 |  | CSI-RS.3.2 TDD | A.1.4.2 |
| CSI-RS index assigned as BFD RS (q0) in activated SCell | | 1-2 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) in activated SCell | | 1-2 |  | 1 |  |
| CSI-RS configuration for RLM in PSCell | | 1-2 |  | CSI-RS.3.2 TDD | A.1.4.2 |
| 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 |  |
| schedulingRequestID-BFR-SCell-r16 | | 1-2 |  | Configured |  |
| Periodicity of PUCCH for SR configuration for BFR on SCell | | 1-2 | slot | 40 | 5ms |
| Offset of PUCCH for SR configuration for BFR on SCell | | 1-2 | slot | 4 |  |
| PUCCH parameters for SR configuration for BFR on SCell | | 1-2 |  | Table 8.3.3.1.2-1 in [28] |  |
| rlmInSyncOutOfSyncThreshold | | 1-2 |  | absent | Value 0 is applied. (Table 8.1.1-1 in TS 38.133 [6]). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109Note 2 | Threshold used for Qin\_LR\_SSB |
| 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 | A.1.4.2 |
| 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 | 1.17 |  |
| T3 | | 1-2 | s | 0.9 |  |
| T4 | | 1-2 | s | 0 |  |
| T5 | | 1-2 | s | 0.31 |  |
| D1 | | 1-2 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.  Note 2: Including test tolerance given in Annex F.1.3.2 | | | | | |

5.5.5.6.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1, Cell 2 and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. During the test the UE is scheduled to transmit continuously in UL.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

2. The SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.5.6.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

3. The SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.10).

4. Set the parameters of NR Cell 2 and Cell 3 according to T1 in Table 5.5.5.6.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

5. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.6.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.6.5-1. T3 starts.

7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.6.5-1. T4 starts.

8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.6.5-1. T5 starts.

9. If the SS:

a) detects uplink power on NR in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect PUCCH with LRR before time point B, and

c) detects PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

10. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.6.5-1.

11. If the iteration fails, the SS shall first attempt to release and add the FR2 SCell. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration, and ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

12. Repeat steps 2-11 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.6.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.6.4.3-1: Common Exception messages for EN-DC FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8 with Condition CSI-RS BFD  Table H.3.1-12 on Cell 3  Table H.3.1-13 on Cell 3 |

Table 5.5.5.6.4.3-2: MAC-CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| schedulingRequestID-BFR-SCell-r16 | SchedulingRequestId |  |  |
| } |  |  |  |

Table 5.5.5.6.4.3-3: *SchedulingRequestResourceConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl40 | 4 |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.5.6.5 Test requirement

Tables 5.5.5.6.4.1-3 and 5.5.5.6.5-1 define the primary level settings including test tolerances for EN-DC FR2 SCell for beam failure detection and link recovery testing in non-DRX.

Table 5.5.5.6.5-1: NR Cell specific test parameters for EN-DC FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell2** | **Cell3**  **Test 1** | | | | |
|  | |  | **T1 to T5** | **T1** | **T2** | **T3** | **T4** | **T5** |
| AoA setup | |  | Setup 1 defined in A.9.1 | Setup 1 defined in A.9.1 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  |  | | | | |
| 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 | 0 | 0 | | | | |
| 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 | 13.7 | 5.7 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1 | dB | 0.2 | 0.2 | 0.2 | 20 | 20 | 20 |
| CSI-RS\_RP of set q1 | Config 1 | dBm/SCS  kHz | -104.5 | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
| Noc | Config 1 | dBm/120kHz | -104.7 | -104.7 | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | 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 5.5.5.6.4-1.  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 D.4.  Note 10: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | | | | |

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 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates 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 PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q1. The UE shall not transmit PUCCH with an LRR 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%.

#### 5.5.5.7 EN-DC FR2 SCell CSI-RS-based beam failure detection and link recovery in DRX

Editor's Note: This test case is incomplete for Test frequency f > 40.8 GHz

- This test case is incomplete for UE power class other than PC3.

5.5.5.7.1 Test purpose

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q0 configured for an active SCell and that the UE performs correct CSI-RS-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 SCell with *schedulingRequestID-BFR-SCell-r16* configuration, 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 SCell requirements in TS 38.133 [6] clause 8.5.

5.5.5.7.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 16 onwards supporting SCell BFR.

5.5.5.7.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2 and 5.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.7.

5.5.5.7.4 Test description

There are three cells configured in this test. Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell and Cell 3 is the SCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.7.4-1 shows the variation of the downlink SNR of the active SCell and the SNR of the CSI-RS in set q0 in the active SCell to emulate CSI-RS based beam failure. Figure 5.5.5.7.4-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.

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Figure 5.5.5.7.4-1: SNR variation for CSI-RS based beam failure detection and link recovery testing for SCell in DRX mode

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Figure 5.5.5.7.4-2: CSI-RS\_RP level variation for CSI-RS based beam failure detection and link recovery testing for SCell in DRX mode

5.5.5.7.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.7.4.1-1.

Table 5.5.5.7.4.1-1: Supported test configurations for EN-DC FR2 SCell beam failure detection and link recovery testing in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.5.5.7-1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| 5.5.5.7-2 | LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth |
| Note: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.7.4.1-2.

Table 5.5.5.7.4.1-2: Initial conditions for EN-DC FR2 SCell beam failure detection and link recovery testing in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.7.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.7.4.1-3.

2. Message contents are defined in clause 5.5.5.7.4.3.

3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.5.7.4.1-3: General test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Test**  **Config.** | **Unit** | **Value** | **Comment** |
|  | |  |  | **Test 1** |  |
| Active E-UTRA PCell | | 1-2 |  | Cell 1 |  |
| E-UTRA RF Channel Number | | 1-2 |  | 1 |  |
| Active PCell | | 1-2 |  | Cell 2 |  |
| RF Channel Number for PSCell | | 1-2 |  | 2 |  |
| Active SCell | | 1-2 |  | Cell 3 |  |
| RF Channel Number for SCell | | 1-2 |  | 3 |  |
| Duplex mode | | 1-2 |  | TDD |  |
| TDD Configuration | | 1-2 |  | TDDConf.3.1 |  |
| BWchannel | | 1-2 | MHz | 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 | | 1-2 |  | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | A.1.2.2 |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD |  |
| OCNG parameters | | 1-2 |  | OP.1 | A.2.1 |
| 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 | | 1-2 |  | SSB.3 FR2 | A.3 |
| SMTC Configuration | | 1-2 |  | SMTC.3 | A.4 |
| PRACH Configuration | | 1-2 |  | FR2 PRACH configuration 4 | Table A.7.2-1 |
| DRX configuration | | 1-2 |  | DRX.3 | A.5 |
| CSI-RS configuration for BFD/CBD in activated SCell | | 1-2 |  | CSI-RS.3.2 TDD | A.1.4.2 |
| CSI-RS index assigned as BFD RS (q0) in activated SCell | | 1-2 |  | 0 |  |
| CSI-RS index assigned as CBD RS (q1) in activated SCell | | 1-2 |  | 1 |  |
| CSI-RS configuration for RLM in PSCell | | 1-2 |  | CSI-RS.3.2 TDD | A.1.4.2 |
| 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 |  |
| schedulingRequestID-BFR-SCell-r16 | | 1-2 |  | Configured |  |
| Periodicity of PUCCH for SR configuration for BFR on SCell | | 1-2 | slot | 40 | 5ms |
| Offset of PUCCH for SR configuration for BFR on SCell | | 1-2 | slot | 4 |  |
| PUCCH parameters for SR configuration for BFR on SCell | | 1-2 |  | Table 8.3.3.1.2-1 in [28] |  |
| rlmInSyncOutOfSyncThreshold | | 1-2 |  | absent | Value 0 is applied. (Table 8.1.1-1 in TS 38.133 [6]). |
| rsrp-ThresholdSSB | | 1-2 | dBm/SCS | -109Note 2 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | 1-2 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD | A.1.4.2 |
| 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 | 5.43 |  |
| T3 | | 1-2 | s | 5.16 |  |
| T4 | | 1-2 | s | 0 |  |
| T5 | | 1-2 | s | 0.31 |  |
| D1 | | 1-2 | s | 0.27 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.  Note 2: Including test tolerance given in Annex F.1.3.2 | | | | | |

5.5.5.7.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1, Cell 2 and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. 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. During the test the UE is scheduled to transmit continuously in UL.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

2. The SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.5.7.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

3. The SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.10).

4. Set the parameters of NR Cell 2 and Cell 3 according to T1 in Table 5.5.5.7.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

5. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.7.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.7.5-1. T3 starts.

7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.7.5-1. T4 starts.

8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.7.5-1. T5 starts.

9. If the SS:

a) detects uplink power on NR carrier in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect PUCCH with LRR before time point B, and

c) detects PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

10. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.7.5-1.

11. If the iteration fails, the SS shall first attempt to release and add the FR2 SCell. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration, and ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

12. Repeat steps 2-11 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.7.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.7.4.3-1: Common Exception messages for EN-DC FR2 SCell for beam failure detection and link recovery testing in DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8 with Condition CSI-RS BFD  Table H.3.1-12 on Cell 3  Table H.3.1-13 on Cell 3  Table H.3.7-1 with condition DRX.3 |

Table 5.5.5.7.4.3-2: MAC-CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| schedulingRequestID-BFR-SCell-r16 | SchedulingRequestId |  |  |
| } |  |  |  |

Table 5.5.5.7.4.3-3: *SchedulingRequestResourceConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl40 | 4 |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.5.7.5 Test requirement

Tables 5.5.5.7.4.1-3 and 5.5.5.7.5-1 define the primary level settings including test tolerances for EN-DC FR2 SCell for beam failure detection and link recovery testing in DRX.

Table 5.5.5.7.5-1: NR Cell specific test parameters for EN-DC FR2 SCell for beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell2** | **Cell3**  **Test 1** | | | | |
|  | |  | **T1 to T5** | **T1** | **T2** | **T3** | **T4** | **T5** |
| AoA setup | |  | Setup 1 defined in A.9.1 | Setup 1 defined in A.9.1 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  |  | | | | |
| 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 | 0 | 0 | | | | |
| 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 | 13.7 | 5.7 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1 | Config 1 | dB | 0.2 | 0.2 | 0.2 | 20 | 20 | 20 |
| CSI-RS\_RP of set q1 | Config 1 | dBm/SCS  kHz | -104.5 | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
| Noc | Config 1 | dBm/120kHz | -104.7 | -104.7 | | | | |
| Propagation condition | |  | TDL-A 30ns 75Hz | 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 5.5.5.7.4-1.  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 D.4.  Note 10: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | | | | |

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 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates 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 PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q1. The UE shall not transmit PUCCH with an LRR 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%.

#### 5.5.5.8 EN-DC FR2 CSI-RS-based PSCell TRP specific Beam Failure Detection and Link Recovery in DRX mode

Editor's Note: This test case is incomplete in following aspects:

- This test case is incomplete for Test frequency f > 40.8 GHz

- This test case is incomplete for UE power class other than PC3.

- TS 38.522 applicability spec update is pending

5.5.5.8.1 Test purpose

The purpose of this test is to verify that the UE properly detects the TRP specific CSI-RS-based beam failure in the set (q0,0), (q0,1) configured for a serving PSCell and a cell with PCID different from the serving cell, and that the UE performs correct CSI-RS-based link recovery based on beam candidate set (q1,0) and (q1,1). The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell with *schedulingRequestID-BFR-r17* configured, 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 TS 38.133 [6] clause 8.5.

5.5.5.8.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 17 onwards supporting PSCell BFR.

5.5.5.8.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2 and 5.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.8.

5.5.5.8.4 Test description

There are three cells, cell 1 is the E-UTRAN PCell, cell 2 is the PSCell and cell 3 is the cell with different PCID in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.8.4-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q0 in the active PSCell to emulate CSI-RS based beam failure. Figure 5.5.5.8.4-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.

A diagram of a number of lines

Description automatically generated with medium confidence

Figure 5.5.5.8.4-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

5.5.5.8.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.8.4.1-1.

Table 5.5.5.8.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.8.4.1-2.

Table 5.5.5.8.4.1-2: Initial conditions for EN-DC FR2 PSCell beam failure detection and link recovery testing in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.8.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.8.4.1-3.

2. Message contents are defined in clause 5.5.5.8.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.5.8.4.1-3: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Test  Config. | Unit | Value | Comment |
|  | |  |  | Test 1 |  |
| Active E-UTRA PCell | | 1-2 |  | Cell 1 |  |
| E-UTRA RF Channel Number | | 1-2 |  | 1 |  |
| Active PSCell | | 1-2 |  | Cell 2 |  |
| RF Channel Number | | 1-2 |  | 2 |  |
| 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 | | 1-2 |  | SR.3.2 TDD |  |
| RMSI CORESET Reference Channel | | 1-2 |  | CR.3.1 TDD | A.1.2.2 |
| Dedicated CORESET Reference Channel | | 1-2 |  | CCR.3.1 TDD |  |
| OCNG parameters | | 1-2 |  | OP.1 | A.2.1 |
| 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 | | 1-2 |  | SSB.1 FR2 | A.3 |
| SMTC Configuration | | 1-2 |  | SMTC.3 | A.4 |
| PRACH Configuration | | 1-2 |  | FR2 PRACH configuration 4 | Table A.7.2-1 |
| DRX configuration | | 1-2 |  | DRX.3 | A.5 |
| CSI-RS configuration for TRP0 | | 1-2 |  | CSI-RS.3.2 TDD | A.1.4.2 |
| CSI-RS configuration for TRP1 | |  |  | CSI-RS.3.6 TDD | A.1.4.2 |
| CSI-RS index assigned as BFD RS (q0,0) | | 1-2 |  | CSI-RS#0 |  |
| CSI-RS index assigned as CBD RS (q1,0) | | 1-2 |  | CSI-RS#1 |  |
| CSI-RS index assigned as BFD RS (q0,1) | | 1-2 |  | CSI-RS#2 |  |
| CSI-RS index assigned as CBD RS (q1,1) | | 1-2 |  | CSI-RS#3 |  |
| CSI-RS index assigned as RLM RS | | 1-2 |  | 0,1,2,3 | A.1.4.2 |
| 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 |  |
| schedulingRequestID-BFR- r17 | | 1-2 |  | Configured |  |
| Periodicity of PUCCH for SR configuration for BFR on PSCell | | 1-2 | slot | 40 | 5ms |
| rlmInSyncOutOfSyncThreshold | | 1-2 |  | absent | Value 0 is applied. (Table 8.1.1-1 in TS 38.133 [6]). |
| rsrp-ThresholdCSI-RS | | 1-2 | dBm/SCS | -109 Note 2 | Threshold used for Qin\_LR\_CSI-RS |
| powerControlOffsetSS | | 1-2 |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | 1-2 |  | n1 | see TS 38.321 [12], clause 5.17 |
| beamFailureDetectionTimer | | 1-2 |  | pbfd4 | see TS 38.321 [12], clause 5.17 |
| CSI-RS configuration for CSI reporting | | 1-2 |  | CSI-RS.3.1 TDD | A.1.4.2 |
| 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 | 10.81 |  |
| T3 | | 1-2 | s | 10.28 |  |
| T4 | | 1-2 | s | 0 |  |
| T5 | | 1-2 | s | 0.57 |  |
| D1 | | 1-2 | s | 0.53 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

5.5.5.8.4.2 Test procedure

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 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.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

2. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.

3. Set the parameters of NR Cell 2 according to T1 in Table 5.5.5.8.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

4. When T1 expires the SS shall change the SNR1 and SNR2 values to T2 as specified in Table 5.5.5.8.5-1. T2 starts.

5. When T2 expires the SS shall change the SNR1 and SNR2 values to T3 as specified in Table 5.5.5.8.5-1. T3 starts.

6. When T3 expires the SS shall change the SNR1 and SNR2 values to T4 as specified in Table 5.5.5.8.5-1. T4 starts.

7. When T4 expires the SS shall change the SNR1 and SNR2 values to T5 as specified in Table 5.5.5.8.5-1. T5 starts.

8. If the SS:

a) detects uplink power on NR carrier in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect PUCCH with LRR before time point B, and

c) detects PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q10 and q11 before time point F (D1 after the start of T5),

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

9. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.8.5-1.

10. If the iteration fails, the SS shall first attempt to release and add the FR2 PSCell. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration, and ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.8.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.8.4.3-1: Common Exception messages for EN-DC FR2 PSCell for beam failure detection and link recovery testing in DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8A with Condition CSI-RS BFD  Table H.3.1-12A on Cell 2  Table H.3.1-13 on Cell 2 with condition SpCell  Table H.3.7-1 with condition DRX.3 |

Table 5.5.5.8.4.3-2: *MAC-CellGroupConfig for R17 BFR*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1, Table 4.6.3-68 |  |  |  |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| schedulingRequestID-BFR-r17 | Not present |  |  |
| schedulingRequestID-BFR2-r17 | Not present |  |  |
| schedulingRequestConfig-v1700 | SchedulingRequest-Config |  |  |
| } |  |  |  |

Table 5.5.5.8.4.3-3: *SchedulingRequestResourceConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl40 | 4 |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.5.8.5 Test requirement

Tables 5.5.5.8.4.1-3 and 5.5.5.8.5-1 define the primary level settings including test tolerances for EN-DC FR2 PSCell for beam failure detection and link recovery testing in DRX.

Table 5.5.5.8.5-1: Cell specific test parameters for EN-DC FR2 PSCell for 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.9.1 | | | | |
| Assumption for UE beamsNote 10 | |  | Rough | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | | | | |
| 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 | 0 | | | | |
| 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 q0,0 | Config 1-2 | dB | 13.7 | 5.7 | -12 | -12 | -12 |
| SNR\_CSI-RS of set q1,0 | Config 1-2 | dB | 13.7 | 13.7 | 13.7 | 13.7 | 13.7 |
| SNR\_CSI-RS of set q0,1 | Config 1-2 | dB | 0.2 | 0.2 | 20 | 20 | 20 |
| SNR\_CSI-RS of set q1,1 | Config 1-2 | dB | 0.2 | 0.2 | 20 | 20 | 20 |
| CSI-RS\_RP of set q1,0 | Config 1-2 | dBm/SCS | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
| CSI-RS\_RP of set q1,1 | Config 1-2 | dBm/SCS | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
|  | 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 5.5.5.8.4-1.  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 | | | | | | | |

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 = 260+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q1,0. The UE shall not transmit PUCCH with an LRR with the candidate beam set q1,0 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%.

#### 5.5.5.9 EN-DC FR2 SSB-based beam failure detection and link recovery in DRX mode for UE fulfilling relaxed measurement criterion

Editor's Note: This test case is incomplete in following aspects:

- This test case is incomplete for Test frequency f > 40.8 GHz

- This test case is incomplete for UE power class other than PC3.

- RAN4 dependency: Test parameters have brackets.

5.5.5.9.1 Test purpose

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 TS 38.133 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 5.5.5.9.4.1-3.

5.5.5.9.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 17 onwards supporting long DRX cycle and supporting BFD relaxation criteria *bfd-Relaxation-r17*.

5.5.5.9.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.5.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.9.

5.5.5.9.4 Test description

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 5.5.5.9.4-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSBs in set q0 in the active PSCell to emulate SSB based beam failure. Figure 5.5.5.9.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery.

A black background with colorful lines

Description automatically generated

Figure 5.5.5.9.4-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in DRX mode for UE fulfilling relaxed measurement criterion

5.5.5.9.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.9.4.1-1.

Table 5.5.5.9.4.1-1: Supported test configurations for FR2 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode |
| 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 | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.9.4.1-2.

Table 5.5.5.9.4.1-2: Initial conditions for EN-DC FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.5.9.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.5.9.4.1-3.

2. Message contents are defined in clause 5.5.5.9.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to Annex C.1.1 and C.1.2 for this test.

Table A.5.5.5.9.4.1-3: 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.7.2-1 |
| DRX configuration | | 1-4 |  | DRX.3 | A.5-1 |
| SSB index assigned as BFD RS (q0) | | 1-4 |  | 0,1 |  |
| SSB index assigned as CBD RS (q1) | | 1-4 |  | 2 |  |
| SSB index assigned as RLM RS | | 1-4 |  | 0,2 |  |
| Beam failure detection transmission parameters | DCI format | 1-4 | 1-0 | 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. | | | | | |

5.5.5.9.4.2 Test procedure

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 PSCell 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.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 2 according to T1 in Table 5.5.5.9.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.

3. When T1 expires the SS shall change the SNR1 and SNR2 values to T2 as specified in Table 5.5.5.9.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR1 and SNR2 values to T3 as specified in Table 5.5.5.9.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR1 and SNR2 values to T4 as specified in Table 5.5.5.9.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR1 and SNR2 values to T5 as specified in Table 5.5.5.9.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point B; and

b) does not detect preamble on a beam associated with the candidate beam set q1 before time point B; and

c) detects preamble on a beam associated with the candidate beam set q1 before time point F (D1 after the start of T5),

the number of successful tests is increased by one. Otherwise the number of failed tests is increased by one.

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.9.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.9.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.5.9.4.3-1: Common Exception messages for EN-DC FR2 PSCell for beam failure detection and link recovery testing in DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-8A with Condition SSB BFD  Table H.3.1-10 with condition SSB  Table H.3.1-10A  Table H.3.7-1 with condition DRX.3 |

Table 5.5.5.9.4.3-2: PDCCH *Search Space* for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 3 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 and 1 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.5.9.4.3-3: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-150 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLF-TimersAndConstants ::= SEQUENCE { |  |  |  |
| n310 | n1 |  |  |
| } |  |  |  |

Table 5.5.5.9.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | entry 1, BFR |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[2] | SearchSpace | entry 2, BFR |  |
| } |  |  |  |
| searchSpacesToReleaseList | Not present |  |  |
| downlinkPreemption | Not present |  |  |
| tpc-PUSCH | Not present |  |  |
| tpc-PUCCH | Not present |  |  |
| tpc-SRS | Not present |  |  |
| } |  |  |  |

Table 5.5.5.9.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 7.3.1-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 2 |  |  |
| 1 |  | Test Configuration 3 & 4 |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n6 |  |  |
| interleaverSize | n2 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| tci-StatesPDCCH-ToAddList | Not present |  |  |
| } |  |  |  |

5.5.5.9.5 Test requirement

Tables 5.5.5.9.4.1-3 and 5.5.5.9.5-1 define the primary level settings including test tolerances for EN-DC FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode.

Table 5.5.5.9.5-1: NR Cell specific test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_SSB0 of set q0 | Config 1-4 | dB | 14.70Note 11 | 14.70Note 11 | -12 | -12 | -12 |
| SNR\_SSB1 of set q0 | Config 1-4 | dB | -12 | -12 | -12 | -12 | -12 |
| SNR\_SSB of set q1 | Config 1-4 | dB | 0.2 | 0.2 | 20 | 20 | 20 |
| SSB\_RP of set q1 | Config 1-2 | dBm/ | -104.5 | -104.5 | -84.7 | -84.7 | -84.7 |
|  | Config 3-4 | SCS | -101.5 | -101.5 | -81.7 | -81.7 | -81.7 |
|  | 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 for SSB0 in time periods T1, T2, T3, T4 and T5 is denoted as SNR0\_1, SNR0\_2 and SNR0\_3 respectively in figure A.5.5.5.9.1-1. The SNR for SSB1 in time periods T1, T2, T3, T4 and T5 is denoted as SNR1\_1, SNR1\_2 and SNR1\_3 respectively in figure A.5.5.5.9.1-1.  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 | | | | | | | |

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%.

### 5.5.6 Active BWP switch delay

#### 5.5.6.1 DCI-based and time-based active BWP switch

##### 5.5.6.1.0 Minimum conformance requirements

FFS

##### 5.5.6.1.1 EN-DC FR2 DCI-based DL active BWP switch in non-DRX in synchronous EN-DC

*Editor's note: This test case is incomplete. The following aspects are either missing or TBD*

*- Test tolerance analysis is missing*

*- Message contents are TBD*

*- Cell mapping is TBD*

*- Test procedure is TBD*

*- Test applicability needs to be added to TS 38.522*

5.5.6.1.1.1 Test purpose

FFS

5.5.6.1.1.2 Test applicability

FFS

5.5.6.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.1.1.

5.5.6.1.1.4 Test description

5.5.6.1.1.4.1 Initial conditions

FFS

5.5.6.1.1.4.2 Test procedure

FFS

5.5.6.1.1.4.3 Message contents

FFS

5.5.6.1.1.5 Test requirements

FFS

##### 5.5.6.1.2 EN-DC FR2 DCI-based DL active BWP switch with SCell in non-DRX in synchronous EN-DC

*Editor's note: This test case is incomplete. The following aspects are either missing or TBD*

*- Test tolerance analysis is missing*

*- Message contents are TBD*

*- Cell mapping is TBD*

*- Test procedure is TBD*

*- Test applicability needs to be added to TS 38.522*

*- Testability or LTE requirements in uncalibrated link is still FFS.*

5.5.6.1.2.1 Test purpose

FFS

5.5.6.1.2.2 Test applicability

FFS

5.5.6.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.6.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.1.2.

5.5.6.1.2.4 Test description

5.5.6.1.2.4.1 Initial conditions

FFS

5.5.6.1.2.4.2 Test procedure

FFS

5.5.6.1.2.4.3 Message contents

FFS

5.5.6.1.2.5 Test requirements

FFS

#### 5.5.6.2 RRC-based active BWP switch

The requirements in this clause apply for a UE configured with more than one BWP on PSCell or any activated SCell in SCG in EN-DC. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

##### 5.5.6.2.0 Minimum conformance requirements

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured, with

* Active BWP switch or parameter change of its active BWPs for SpCell
* Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* for SCell

For RRC-based BWP switch, after the UE receives BWP switching request, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after the beginning of DL slot , where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

is the length of the RRC procedure delay in millisecond as defined in clause 11.2 in TS 36.331 [29] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [2], and

is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by on the cell where RRC-based BWP switch occurs. When a longer switching delay is allowed. Where is the time between DL data transmission and acknowledgement as specified in TS 38.213 [8].

##### 5.5.6.2.1 EN-DC FR2 RRC-based DL active BWP switch in non-DRX in synchronous EN-DC

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.6.2.1.1 Test purpose

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 5.5.6.2.0.1. Supported test configurations are shown in Table 5.5.6.2.1.4.1-1.

5.5.6.2.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC and BWP adaptation of at least 2 BWPs.

5.5.6.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.6.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.2.1.

5.5.6.2.1.4 Test description

5.5.6.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2 [18].

This test shall be tested using any of the test configurations in Table 5.5.6.2.1.4.1-1.

Table 5.5.6.2.1.4.1-1: DL BWP switch supported test configurations

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

Configure the test equipment and the DUT according to the parameters in Table 5.5.6.2.1.4.1-2

Table 5.5.6.2.1.4.1-2: Initial conditions for EN-DC FR2 RRC-based DL active BWP switch in non-DRX in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E.1.1, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.6.2.1.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.5.6.2.1.4.3.

2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in Annex C.1.1, and the downlink signal levels as per Annex C.1.2.

3. The test parameters are given in Table 5.5.6.2.1.4.1-3 below.

Table 5.5.6.2.1.4.1-3: General test parameters for DL BWP switch in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| PDCCH and PDSCH maximum number of HARQ transmission |  | 1 | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| T1 | s | 0.2 |  |

5.5.6.2.1.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (PCell), and a single NR cell (PSCell). Prior to the start of the test, the UE shall be fully synchronized to PSCell. The UE shall be configured for parameters as mentioned in the Table 5.5.6.2.1.4.1-3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 5.5.

2. PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and PSCell (Cell 2) throughout the test procedure to ensure that the UE will have ACK/NACK sending.

3. The SS shall send an *RRCConnectionReconfiguration* message releasing the dedicated configuration of the *initialDownlinkBWP* and the *initialUplinkBWP*. This message also configures another UE-specific bandwidth part, BWP-1, and indicates BWP-1 as the active DL BWP using *firstActiveDownlinkBWP-Id*, according to the initial condition of Active BWP-1 in Table 5.5.6.2.1.5-1 and Table 5.5.6.2.1.4.3-2.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. Before the test starts UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).

6. Before the test starts UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell).

7. Before the test starts UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWPis BWP-1 in PSCell.

8. Ensure all cells have constant signal levels throughout the test.

9. The test consists of 1 time period, with duration of T1.

10. Time period T1 starts when a *RRCConnectionReconfiguration* with updated bandwidth part configuration for active BWP-1, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part corresponding to the final condition of active BWP-1, according to Table 5.5.6.2.1.5-1 and Table 5.5.6.2.1.4.3-2.

11. If the UE starts to report valid ACK/NACK for PSCell from the first UL slot that occurs after the beginning of DL slot i+208+k1 then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.

12. After the SS receives the ACK/NACK in step 11, or when T1 expires, the SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

13. The SS shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message. If either of the reconfiguration in step 3, step 10, step 12 or step 13 fails, switch off and on the UE and go to step 1.

14. Repeat steps 2-13 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.6.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.6.2.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |

Table 5.5.6.2.1.4.3-2: *RRCReconfiguration* (Step 3 and Step 10)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition EN-DC | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig | Table 5.5.6.2.1.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.6.2.1.4.3-3: *CellGroupConfig* (configured in Table 5.5.6.2.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated | ServingCellConfig | Table 5.5.6.2.1.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.6.2.1.4.3-4: *ServingCellConfig* (configured in Table 5.5.6.2.1.4.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP SEQUENCE { |  |  |  |
| pdcch-Config CHOICE { |  |  |  |
| release | NULL |  |  |
| } |  |  |  |
| pdsch-Config CHOICE { |  |  |  |
| release | NULL |  |  |
| } |  |  |  |
| radioLinkMonitoringConfig CHOICE { |  |  |  |
| release | NULL |  |  |
| } |  |  |  |
|  |  |  |  |
| downlinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Downlink { | 1 entry |  |  |
| BWP-Downlink[1] SEQUENCE { | BWP-Downlink | entry 1  Table 5.5.6.2.1.4.3-5 |  |
| } |  |  |  |
| firstActiveDownlinkBWP-Id | 1 | BWP-1 |  |
| defaultDownlinkBWP-Id | 1 | BWP-1 |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| pucch-Config CHOICE { |  |  |  |
| release | NULL |  |  |
| } |  |  |  |
| pusch-Config CHOICE { |  |  |  |
| release | NULL |  |  |
| } |  |  |  |
| srs-Config CHOICE { |  |  |  |
| release | NULL |  |  |
| } |  |  |  |
|  |  |  |  |
| uplinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Uplink { | 1 entry |  |  |
| BWP-Uplink[1] | BWP-Uplink | entry 1  Table 5.5.6.2.1.4.3-6 |  |
| } |  |  |  |
| firstActiveUplinkBWP-Id | 1 | BWP-1 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.6.2.1.4.3-5: *BWP-Downlink* (configured in Table 5.5.6.2.1.4.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-Downlink ::= SEQUENCE { |  |  |  |
| bwp-Id | 1 |  |  |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters | RIV defined in TS 38.214 [9] that corresponds to DLBWP.1.3 |  | Step 3 |
|  | RIV defined in TS 38.214 [9] that corresponds to DLBWP.1.1 |  | Step 10 |
| } |  |  |  |
| } |  |  |  |

Table 5.5.6.2.1.4.3-6: *BWP-Uplink* (configured in Table 5.5.6.2.1.4.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-Uplink ::= SEQUENCE { |  |  |  |
| bwp-Id | 1 |  |  |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters | RIV defined in TS 38.214 [9] that corresponds to ULBWP.1.3 |  | Step 3 |
|  | RIV defined in TS 38.214 [9] that corresponds to ULBWP.1.1 |  | Step 10 |
| } |  |  |  |
| } |  |  |  |

5.5.6.2.1.5 Test requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell from the first DL slot that occurs right after the beginning of DL slot and starts to report valid ACK/NACK for the PSCell from the first UL slot that occurs after the beginning of DL slot , where,

TRRCprocessingDelay = 20 ms, is the RRC procedure delay in ms as defined in clause 11.2 in TS 36.331 [29];

TBWPSwitchDelayRRC = 6 ms, is the time used by the UE to perform BWP switch;

NR slot length = 0.125 ms for SCS = 120 kHz.

k1 is the timing between DL data receiving and acknowledgement as specified in [12].

Which gives slots.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

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

Table 5.5.6.2.1.5-1: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | |  | TDD |
| TDD configuration | |  | TDDConf.3.1 |
| BWchannel | |  | 100 MHz: NRB,c = 66 |
| Active BWP ID | |  | 1 |
| Initial DL BWP Configuration | |  | DLBWP.0.2 |
| Initial UL BWP Configuration | |  | ULBWP.0.2 |
| Initial Condition | Active DL BWP-1 Configuration |  | DLBWP.1.3 |
|  | Active UL BWP-1 Configuration |  | ULBWP.1.3 |
| Final Condition | Active DL BWP-1 Configuration |  | DLBWP.1.1 |
|  | Active UL BWP-1 Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel | |  | SR.3.1 TDD |
| RMSI CORESET parameters | |  | CR.3.1 TDD |
| Dedicated CORESET parameters | |  | CCR.3.1 TDD |
| OCNG Patterns | |  | OP.1 |
| SSB Configuration | |  | SSB.1 FR2 |
| SMTC Configuration | |  | SMTC.1 |
| TCI State | |  | TCI.State.0 |
| TRS Configuration | |  | TRS.2.1 TDD |
| Antenna Configuration | |  | 1x2 |
| Propagation Condition | |  | AWGN |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |  |  |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS | |  |  |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |
| EPRE ratio of PDSCH to PDSCH | |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [8]. | | | |

Table 5.5.6.2.1.5-2: OTA related test parameters for BWP switching test case

| Parameter | | Unit | Cell 2 |
| --- | --- | --- | --- |
| Angle of arrival configuration | |  | According to table A. 9 |
| Note1 | NR\_TDD\_FR2\_A | dBm/15kHz | -112 |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| NR\_TDD\_FR2\_T |
| NR\_TDD\_FR2\_Y |
| Note1 | NR\_TDD\_FR2\_A | dBm/SCS | -103 |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| NR\_TDD\_FR2\_T |
| NR\_TDD\_FR2\_Y |
| SS-RSRPNote2 | NR\_TDD\_FR2\_A | dBm/SCS Note3 | -85 |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| NR\_TDD\_FR2\_T |
| NR\_TDD\_FR2\_Y |
|  | | dB | 18 |
| IoNote2 | NR\_TDD\_FR2\_A | dBm/95.04 MHz Note4 | -56 |
| NR\_TDD\_FR2\_B |
| NR\_TDD\_FR2\_F |
| NR\_TDD\_FR2\_G |
| NR\_TDD\_FR2\_T |
| NR\_TDD\_FR2\_Y |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone | | | |

#### 5.5.6.3 Simultaneous DCI-based and timer-based active BWP switch on multiple CCs

##### 5.5.6.3.0 Minimum conformance requirements

###### 5.5.6.3.0.1 Minimum conformance requirements for simultaneous DCI-based and timer-based active BWP switch on multiple CCs

###### 5.5.6.3.0.1.1 Minimum conformance requirements for simultaneous DCI-based active BWP switch on multiple CCs

[TS 38.133, Clause 8.6.2A.1]

The delay requirements for simultaneous DCI based BWP switch on multiple CCs in this clause apply only if the timing difference among the first symbol of slot carrying DCI for all CCs is received within the MRTD for inter-band CA as defined in clause 7.6.4 in TS 38.133 [6].

For DCI-based BWP switch on multiple CCs, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n, where slot n is slot which UE receives the earliest BWP switching request among CCs on which UE is performing simultaneous DCI-based BWP switching.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths on any serving cell.

UE shall finish BWP switch within the time duration TMultipleBWPswitchDelay + Y, which is defined as:

TMultipleBWPswitchDelay = TBWPswitchDelay + D\*(N-1)

Where:

- TBWPswitchDelay is the BWP switching delay on single CC defined in Table 4.6.6.0.1.1-1 depending on UE capability *bwp-SwitchingDelay* (TS 38.331 [13]). TBWPswitchDelay shall be based on the smallest SCS among SCS of all involved CCs before and after BWP switch. If the BWP switch on multiple CCs results in the change of the SCS on any CC among involved CCs, TBWPswitchDelay shall be based on the smallest SCS among all SCS values of all involved CCs.

- D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiCCs-r16* (TS 38.306, [11]) for switching between non-dormant BWPs, and *bwp-SwitchingMultiDormancyCCs-r16* for switching between non-dormant and dormant BWPs.

- For UE which is capable of per-FR gap, and no BWP switch involves SCS change, N is the number of CCs in same FR; For UE which is not capable of per-FR gap, or the BWP switches on any CC involves SCS changing, N is the number of CCs undergoing simultaneous BWP switch.

* Y=0, ­if the serving cell where UE receives DCI for BWP switch is same as the serving cell on which BWP switch occurs for each involved serving cell.

Y equals to the length of one slot at smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change,

- if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

Table 4.6.6.0.1.1-1: BWP switch delay

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length | BWP switch delay TBWPswitchDelay (slots) | |
|  | (ms) | Type 1Note 1 | Type 2Note 1 |
| 0 | 1 | 1 | 3 |
| 1 | 0.5 | 2 | 5 |
| 2 | 0.25 | 3 | 9 |
| 3 | 0.125 | 6 | 18 |
| 5 | 0.03125 | 20 | 65 |
| 6 | 0.015625 | 39 | 129 |
| Note 1: Depends on UE capability.  Note 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch. | | | |

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered on multiple CCs simultaneously within or outside DRX active time, and one of the two BWPs on each CC in a BWP switching is a dormant BWP (TS 38.321, [12]), UE shall be able to complete active BWP switching within the time duration of

- TDormantMultipleBWPswitchDelay = TMultipleBWPswitchDelay+X, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or

- TDormantMultipleBWPswitchDelay = TMultipleBWPswitchDelay +X+Z, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- TMultipleBWPswitchDelay is defined above corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, X shall follow the SCS of 120 KHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where DCI for dormancy indication is received.

The number of CCs, N, on which the UE can simultaneously switch BWPs while still meeting the requirements, if any, related to allocations on downlink, uplink, or transmission of HARQ-ACK, depends on the UE reported capabilities related to BWP switching, the network configuration and the BWP switch method.

###### 5.5.6.3.0.1.2 Minimum conformance requirements for simultaneous timer-based active BWP switch on multiple CCs

[TS 38.133, Clause 8.6.2B.1]

The delay requirements for simultaneous timer-based BWP switch on multiple CCs in this clause apply only if the timing difference among the beginning of the slot where timer-based BWP switching starts for all CCs is within the MRTD for inter-band CA as defined in clause 7.6.4 in TS 38.133 [6].

For timer-based BWP switch on multiple CCs, UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (in FR1) or DL half-subframe ((in FR2) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* (TS 38.331 [13]) expiration occurs on multiple serving cells, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n, where TMultipleBWPswitchDelay is defined in 4.6.6.0.1.1.

The UE is not required to transmit UL signals or receive DL signals during time duration TMultipleBWPswitchDelay after *bwp-InactivityTimer* (TS 38.331 [13]) expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

##### 5.5.6.3.1 E-UTRAN – NR PSCell FR2 and NR SCell FR2 DL active BWP switch on multiple CCs in synchronous EN-DC

Editor's Note: This test case is incomplete in following aspects:

- Test procedure is missing

- Message contents are missing

5.5.6.3.1.1 Test purpose

The purpose of this test is to verify the DL BWP switch on multiple CCs delay requirement defined in clause 8.6 in TS 38.133 [6].

5.5.6.3.1.2 Test applicability

This test applies to all types of EN-DC UE Rel-16 and forward supporting EN-DC with PSCell in FR2, and supporting bwp-SwitchingMultiCCs-r16, either type1-r16 or type2-r16, as well as the corresponding r15 BWP switch capabilities from legacy tests (support of at least 2 active BWPs).

5.5.6.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.6.3.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.3.1.

5.5.6.3.1.4 Test description

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) and one NR SCell (Cell 3).

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and Cell 3 and the time duration of T2.

5.5.6.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.6.3.1.4.1-1.

Table 5.5.6.3.1.4.1-1: DL BWP switch supported test configurations

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

Configure the test equipment and the DUT according to the parameters in Table 5.5.6.3.1.4.1-2.

Table 5.5.6.3.1.4.1-2: Initial conditions for EN-DC PSCell FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.6.3.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | Figure A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | Figure A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.6.3.1.4.1-3. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 in TS 38.133 [6], cell-specific parameters of NR PSCell are specified in Table 5.5.6.3.1.5-1.

2. Message contents are defined in clause 5.5.6.3.1.4.3.

3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.6.3.1.4.1-3: General test parameters for UE specific CBW change in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2, 3 | Two NR radio channel is used for this test for PSCell and SCell |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| Active SCell |  | Cell 3 | SCell on RF channel number 3. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell, PSCell and SCell |
| *bwp-InactivityTimer* | ms | 200 |  |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell-individual offset for cells on RF channel number 3 | dB | 0 | Individual offset for cells on SCC. |
| Cell2 timing offset to Cell1 | μs | 3 | Synchronous EN-DC |
| Cell3 timing offset to Cell2 | μs | 0 | Synchronous Cells |
| T1 | s | 0.2 |  |
| T2 | s | 0.2 |  |
| T3 | s | 0.2 |  |

5.5.6.3.1.4.2 Test procedure

TBD

5.5.6.3.1.4.3 Message contents

TBD

5.5.6.3.1.5 Test requirement

Table 5.5.6.3.1.5-1 defines the NR cell specific test parameters. Table 5.5.6.3.1.5-2 defines OTA related test parameters.

5.5.6.3.1.5-1: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | Cell 3 |
| Frequency Range |  | FR2 | FR2 |
| Duplex mode |  | TDD | TDD |
| TDD configuration |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 | 100 MHz: NRB,c = 66 |
| Active BWP ID |  | 1, 2 | 1, 2 |
| Initial DL BWP Configuration |  | DLBWP.0.2 Note 2 | DLBWP.0.2 Note 2 |
| Active DL BWP-1 Configuration |  | DLBWP.1.1 Note 2 | DLBWP.1.1 Note 2 |
| Active DL BWP-2 Configuration |  | DLBWP.1.3 Note 2 | DLBWP.1.3 Note 2 |
| Initial UL BWP Configuration |  | ULBWP.0.2 Note 2 | ULBWP.0.2 Note 2 |
| Active UL BWP-1 Configuration |  | ULBWP.1.1 Note 2 | ULBWP.1.1 Note 2 |
| Active UL BWP-2 Configuration |  | ULBWP.1.3 Note 2 | ULBWP.1.3 Note 2 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 | OP.1 |
| SSB Configuration |  | SSB.1 FR2 | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 | SMTC.1 |
| TCI State |  | TCI.State.0 | TCI.State.0 |
| TRS Configuration |  | TRS.2.1 TDD | TRS.2.1 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |  |
| EPRE ratio of OCNG DMRS to SSS (Note 1) |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  |
| Propagation Condition |  | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [8]. | | | |

Table 5.5.6.3.1.5-2: OTA related test parameters for DL BWP switch in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 according to clause A.3.15.1 in TS 38.133 [6] | Setup 1 according to clause A.3.15.1 in TS 38.133 [6] |
| Assumption for UE beamsNote 6 |  | Fine | Fine |
| NocNote 1 | dBm/15 kHz | -112 | -112 |
| NocNote 1 | dBm/SCS | -103 | -103 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -85 | -85 |
| Ês/Iot | dB | 18 | 18 |
| IoNote2 | dBm/95.04 MHz Note4 | -56 | -56 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation | | | |

During T1, the UE shall start to send the ACK for PSCell and SCell from the first UL slot that occurs after the beginning of DL slot (*i+TMultipleBWPswitchDelay*+*k1*).

During T3, the UE shall start to send the ACK for PSCell and SCell from the first UL slot that occurs after the beginning of DL slot (*j+TMultipleBWPswitchDelay*+*k1*).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [12].

Depending on UE capability *bwp-SwitchingDelay* and *bwp-SwitchingMultiCCs-r16* in TS 38.331 [13], UE shall finish BWP switch within the time duration *TMultipleBWPswitchDelay* defined in TS 38.133 clause 8.6.2A and 8.6.2B.

All of the above test requirements shall be fulfilled in order for the observed PSCell and SCell active BWP switch delay to be counted as correct.

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

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot (*i+Y1*), (*j+Y2*), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

#### 5.5.6.4 SCell dormancy switch

##### 5.5.6.4.0 Minimum conformance requirements

###### 5.5.6.4.0.1 Minimum conformance requirements for interruptions due to SCell dormancy switch

[TS38.133, Clause 8.2.1.2.15.1]

When one SCell in SCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy (TS 38.321 [12]) when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in SCG as defined in clause 8.2.1.2.7 in TS 38 133, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP.

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2 in TS 38 133.

When multiple SCells in SCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

###### 5.5.6.4.0.2 Minimum conformance requirements for interruptions due to CQI measurements during SCell dormancy

[TS38.133, Clause 8.2.1.2.15.2]

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

###### 5.5.6.4.0.3 Minimum conformance requirements for interruptions due to RRM measurements during SCell dormancy

[TS38.133, Clause 8.2.1.2.15.3]

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0%.

###### 5.5.6.4.0.4 Minimum conformance requirements for DCI and timer-based BWP switch delay on a single CC

[TS38.133, Clause 8.6.2]

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with more than one BWP configurations configured.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of TBWPswitchDelay + Y which starts from the beginning of DL slot n, where

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.

- Y equals to the length of 1 slot, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, TBWPswitchDelay + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of TBWPswitchDelay which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after a BWP-inactivity timer *bwp-InactivityTimer* (TS 38.331 [13]) expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of TBWPswitchDelay which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration TBWPswitchDelay after *bwp-InactivityTimer* (TS 38.331 [13]) expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* (TS 38.331 [13]), UE shall finish BWP switch within the time duration TBWPswitchDelay defined in Table 5.5.6.4.0.4-1.

Table 5.5.6.4.0.4-1: BWP switch delay

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length | BWP switch delay TBWPswitchDelay (slots) | |
|  | (ms) | Type 1Note 1 | Type 2Note 1 |
| 0 | 1 | 1 | 3 |
| 1 | 0.5 | 2 | 5 |
| 2 | 0.25 | 3 | 9 |
| 3 | 0.125 | 6 | 18 |
| 5 | 0.03125 | 20 | 65 |
| 6 | 0.015625 | 39 | 129 |
| Note 1: Depends on UE capability.  Note 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch. | | | |

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP (TS 38.321 [12]), UE shall be able to complete active BWP switching within the time duration of

- TdormantBWPswitchDelay =TBWPswitchDelay+ X, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or

- TdormantBWPswitchDelay =TBWPswitchDelay + X + Z, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- TBWPswitchDelay is defined in Table 5.5.6.4.0.4-1 corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, X shall follow the SCS of 120 KHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of TdormantBWPswitchDelay which starts from the beginning of DL slot n.

###### 5.5.6.4.0.5 Minimum conformance requirements for simultaneous DCI based BWP switch delay on multiple CCs

[TS38.133, Clause 8.6.2A.1]

The delay requirements for simultaneous DCI based BWP switch on multiple CCs in this clause apply only if the timing difference among the first symbol of slot carrying DCI for all CCs is received within the MRTD for inter-band CA as defined in clause 7.6.4 in TS 38.133 [6].

For DCI-based BWP switch on multiple CCs, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n, where slot n is slot which UE receives the earliest BWP switching request among CCs on which UE is performing simultaneous DCI-based BWP switching.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths on any serving cell.

UE shall finish BWP switch within the time duration TMultipleBWPswitchDelay + Y, which is defined as:

TMultipleBWPswitchDelay = TBWPswitchDelay + D\*(N-1)

Where:

- TBWPswitchDelay is the BWP switching delay on single CC defined in Table 8.6.2-1 depending on UE capability *bwp-SwitchingDelay* [13]. TBWPswitchDelay shall be based on the smallest SCS among SCS of all involved CCs before and after BWP switch. If the BWP switch on multiple CCs results in the change of the SCS on any CC among involved CCs, TBWPswitchDelay shall be based on the smallest SCS among all SCS values of all involved CCs.

- D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiCCs-r16* (TS 38.306 [11]) for switching between non-dormant BWPs, and *bwp-SwitchingMultiDormancyCCs-r16* for switching between non-dormant and dormant BWPs.

- For UE which is capable of per-FR gap, and no BWP switch involves SCS change, N is the number of CCs in same FR; For UE which is not capable of per-FR gap, or the BWP switches on any CC involves SCS changing, N is the number of CCs undergoing simultaneous BWP switch.

* Y=0, ­if the serving cell where UE receives DCI for BWP switch is same as the serving cell on which BWP switch occurs for each involved serving cell.

Y equals to the length of one slot at smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change,

- ­if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in TS 38.133 [6] in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered on multiple CCs simultaneously within or outside DRX active time, and one of the two BWPs on each CC in a BWP switching is a dormant BWP (TS 38.321 [12]), UE shall be able to complete active BWP switching within the time duration of

- TDormantMultipleBWPswitchDelay = TMultipleBWPswitchDelay+X, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or

- TDormantMultipleBWPswitchDelay = TMultipleBWPswitchDelay +X+Z, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- TMultipleBWPswitchDelay is defined above corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, X shall follow the SCS of 120 KHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where DCI for dormancy indication is received.

The number of CCs, N, on which the UE can simultaneously switch BWPs while still meeting the requirements, if any, related to allocations on downlink, uplink, or transmission of HARQ-ACK, depends on the UE reported capabilities related to BWP switching, the network configuration and the BWP switch method.

###### 5.5.6.4.0.6 Minimum conformance requirements for interruptions due to NR SCell dormancy switch

[TS36.133, Clause 7.32.2.14.1]

When one NR SCell in SGC is switched from dormancy to non-dormancy or from non-dormancy to dormancy (TS 38.321 [12]) when UE is in DRX active time in SCG,

- the UE is allowed an interruption on any active serving cell in MCG as defined in clause 7.32.2.7 in TS 36.133, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP.

- If the UE is not capable of per-FR gap, or if the dormancy switching involves SCS changing, the interruption is allowed to active serving cell in MCG regardless of the frequency range of the NR SCell on which the dormancy switching occurs. If the UE is capable of per-FR gap and the dormancy switching does not involve SCS changing, UE is allowed to cause interruption to active serving cells in MCG provided that the NR SCell on which the dormancy switching occurs belongs to FR1.

- The starting time of interruption is only allowed within the dormancy switching delay as defined in clause 8.6.2 in TS 38.133 [6].

When more than one NR SCells in SGC are switched from dormancy to non-dormancy or from non-dormancy to dormancy [12] simultaneously when UE is in DRX active time in SCG, the interruption requirements described above apply for dormancy switch on each SCell in SCG.

###### 5.5.6.4.0.7 Minimum conformance requirements for interruptions due to CSI and RRM measurements during SCell dormancy

[TS36.133, Clause 7.32.2.14.2]

When one or more NR SCells in SCG are in dormancy, the UE is allowed to cause interruptions on active E-UTRA serving cells due to CSI and RRM measurements on the NR SCell(s) in dormancy.

The rate of ACK/NACK feedback loss on any active E-UTRA serving cell resulting from CSI and RRM measurements on NR SCells in dormancy shall not exceed 0.5% and 1.0%, respectively.

##### 5.5.6.4.1 E-UTRAN – NR FR2 PSCell SCell dormancy switch of single FR2 Scell inside active time

Editor’s Note: This test case is incomplete in following aspects:

- Test procedure is missing

- Message contents are missing

5.5.6.4.1.1 Test purpose

The purpose of this test is to verify

1. the interruption due to RRM and CSI measurement during Scell dormancy on spCell is within the limits specified in clause 8.2.1.2.15.2 and 8.2.1.2.15.3 in TS 38.133 [6] for NR victim cell, and

2. the Scell dormancy switch delay is within the requirement defined in clause 8.6.2 in TS 38.133 [6], and the Scell dormancy switch interruption is within the limits defined in clause 8.2.1.2.15.1 in TS 38.133 [6] for NR victim cell.

5.5.6.4.1.2 Test applicability

This test applies to all types of EN-DC UE Rel-16 and forward supporting EN-DC with PSCell in FR2, and supporting scellDormancyWithinActiveTime-r16, along with supporting at least 2 active BWPs.

5.5.6.4.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.6.4.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.4.1.

5.5.6.4.1.4 Test description

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3)

The tests consist of three consecutive time periods T1, T2, and T3, respectively. All cells have constant signal levels throughout the test. The UE is continuously scheduled in PCell and PSCell throughout the test.

5.5.6.4.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.6.4.1.4.1-1.

Table 5.5.6.4.1.4.1-1: Dormancy switch supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: A UE which fulfils the requirements in test case in clause 5.5.6.4.2 can skip the test cases in current clause 5.5.6.4.1.  Note 3: NR configuration is the same for PSCell and SCells. | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.6.4.1.4.1-2.

Table 5.5.6.4.1.4.1-2: Initial conditions for EN-DC PSCell FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.6.4.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | Figure A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | Figure A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.6.4.1.4.1-3. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 in TS 38.133 [6], cell-specific parameters of NR PSCell are specified in Table 5.5.6.4.1.5-1.

2. Message contents are defined in clause 5.5.6.4.1.4.3.

3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.6.4.1.4.1-3: General test parameters for Dormancy switch in synchronous EN-DC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | Comment |
| Subtest 1 | Subtest 2 |
| E-UTRA RF Channel Number |  | 1 | | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2, 3 | | Two NR radio channel is used for this test |
| Active PCell |  | Cell 1 | | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | | PSCell on RF channel number 2. |
| Active SCell |  | Cell 3 | | SCell on RF channel number 3. |
| CP length |  | Normal | |  |
| DRX |  | OFF | |  |
| Measurement gap pattern Id |  | OFF | |  |
| *bwp-InactivityTimer* | ms | 500 | |  |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | | Individual offset for cells on PSCC. |
| Cell-individual offset for cells on RF channel number 3 | dB | 0 | | Individual offset for cells on SCC. |
| Cell2 timing offset to cell1 | μs | 3 | | Synchronous EN-DC |
| Cell3 timing offset to cell2 | μs | 0 | | Synchronous cells |
| Triggering DCI format |  | DCI 1\_1 | | Triggering DCI format for triggering during active time |
| OFDM symbol range in slot for transmission of DCI with dormancy indication |  | 0 – 2 | 3 – 11 | Test1 is based on that triggering DCI is received within the first three OFDM symbols of a slot. Test2 is based on that the triggering DCI is received later than within the first three OFDM symbols of a slot. |
| T1 | s | 0.2 | |  |
| T2 | s | 5 | |  |
| T3 | s | 0.2 | |  |

5.5.6.4.1.4.2 Test procedure

TBD

5.5.6.4.1.4.3 Message contents

TBD

5.5.6.4.1.5 Test requirement

Table 5.5.6.4.1.5-1 defines the NR cell specific test parameters. Table 5.5.6.4.1.5-2 defines OTA related test parameters.

5.5.6.4.1.5-1: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Subtest 1 | | Subtest 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Frequency Range |  | FR2 | | FR2 | |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel |  | 100 MHz: NRB,c = 66 | | 100 MHz: NRB,c = 66 | |
| Active BWP ID |  | 0 | 0 | 0 | 0 |
| Initial DL BWP Configuration |  | DLBWP.0.2 | DLBWP.0.2 | DLBWP.0.2 | DLBWP.0.2 |
| Active DL BWP-0 Configuration |  | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 | DLBWP.1.1 |
| Active DL BWP-1 Configuration |  | NA | DLBWP.1.2 | NA | DLBWP.1.2 |
| Initial UL BWP Configuration |  | ULBWP.0.2 | ULBWP.0.2 | ULBWP.0.2 | ULBWP.0.2 |
| Active UL BWP-0 Configuration |  | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 | ULBWP.1.1 |
| Active UL BWP-1 Configuration |  | NA | ULBWP.1.2 | NA | ULBWP.1.2 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | | SR.3.1 TDD | |
| RMSI CORESET parameters |  | CR.3.1 TDD | | CR.3.1 TDD | |
| Dedicated CORESET parameters |  | CCR.3.1 TDD | | CCR.3.2 TDD | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 | | OP.1 | |
| SSB Configuration |  | SSB.1 FR2 | | SSB.1 FR2 | |
| SMTC Configuration |  | SMTC.1 | | SMTC.1 | |
| TCI State |  | TCI.State.0 | | TCI.State.0 | |
| TRS Configuration |  | TRS.2.1 TDD | | TRS.2.1 TDD | |
| CSI-RS for CSI reporting |  | CSI-RS.3.1 TDD | | CSI-RS.3.1 TDD | |
| CSI reporting periodicity | slots | 640 | | 640 | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | | 640 | |
| Antenna Configuration |  | 1x2 | | 1x2 | |
| Propagation Condition |  | AWGN | | AWGN | |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3. | | | | | |

Table 5.5.6.4.1.5-2: OTA related test parameters for Dormancy switch in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 according to clause A.3.15 in TS 38.133 [6] | |
| NocNote 1 | dBm/15 kHz | -112 | -112 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -85 | -85 |
| Ês/Iot | dB | 18 | 18 |
| IoNote2 | dBm/95.04 MHz Note4 | -56 | -56 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone. | | | |

During T1, any interruption on PSCell due to dormancy switching of SCell shall be within the requirement specified in in clause 5.5.6.4.0.1for NR victim cell.

During T2, interruptions on PSCell due to CSI and RRM measurements on dormant SCell shall be within the interruption rate requirements specified in 5.5.6.4.0.1for NR victim cell.

During T3, any interruption on PSCell due to dormancy switching of SCell shall be within the requirement specified in in clause 5.5.6.4.0.1for NR victim cell. Monitoring of PDCCH for SCell in PSCell shall be resumed within the dormancy switching time specified in TS 38.133 [6] clause 8.6.2A.

For an event to be considered to be correct, all requirements above have to be fulfilled.

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

### 5.5.7 Void

### 5.5.8 Active TCI state switch delay

#### 5.5.8.0 Minimum conformance requirements

##### 5.5.8.0.1 Minimum conformance requirements for MAC-CE based active TCI state switch

[TS38.133, clause 8.10.2]

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state

- TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

- The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command

- The TCI state remain detectable during the TCI state switching period

- The SSB associated with the TCI state remain detectable during the TCI switching period

- SNR of the TCI state ≥ -3dB

Otherwise, the TCI state is unknown.

[TS38.133, clause 8.10.3]

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot n+ THARQ +(3ms +TOk\*(Tfirst-SSB + TSSB-proc)) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ +(3ms +TOk\*(Tfirst-SSB)) / *NR slot length*.

Where,

THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.321 [7];

Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE;

TSSB-proc = 2ms;

TOk = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot n+ THARQ +(3 ms + TL1-RSRP +TOuk\*(Tfirst-SSB+ TSSB-proc)) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ THARQ +(3 ms+ TL1-RSRP +TOuk\*(Tfirst-SSB)) / *NR slot length*.

Where

T L1-RSRP is the time for L1-RSRP measurement for Rx beam refinement, defined as

- TL1-RSRP\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4.2

- with the assumption of M=1 for periodic CSI-RS

- for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_SSB = 0 for SSBin FR2 and TL1-RSRP\_Measurement\_Period\_CSI-RS = 0 for CSI-RSin FR2, provided that the TCI state switching involves QCL-TypeA, QCL-TypeB or QCL-TypeC only.

TOuk = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD

TOuk = 1 when TCI state switching involves other QCL types

Tfirst-SSB is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;

Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;

The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

During MAC-CE based TCI state switch the UE is allowed an interruption due to one shot timing adjustment on the serving or any activated serving cells as defined in clause 8.2.

##### 5.5.8.0.2 Minimum conformance requirements for RRC based active TCI state switch

[TS38.133, clause 8.10.2]

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state

- TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

- The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command

- The TCI state remain detectable during the TCI state switching period

- The SSB associated with the TCI state remain detectable during the TCI switching period

- SNR of the TCI state ≥ -3dB

Otherwise, the TCI state is unknown.

[TS38.133, clause 8.10.5]

If the target TCI state is known, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot n+ TRRC\_processing +TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE is not required to receive PDCCH/PDSCH or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.

- TRRC\_processing is the RRC processing delay defined in Clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in Clause 12 of TS 38.331 [2].

- Tfirst-SSB is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

- TSSB-proc and TOk are defined in clause 8.10.3.

If the target TCI state is unknown, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot n+ TRRC\_processing  +TL1-RSRP +TOuk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE is not required to receive PDCCH/PDSCH or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.

- TRRC\_processing is the RRC processing delay defined in Clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in Clause 12 of TS 38.331 [2].

- Tfirst-SSB is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;

- Tfirst-SSB is time to first SSB transmission after RRC processing time at the UE for other QCL types;

- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

- TL1-RSRP, TOuk and TSSB-proc are defined in 38.133 clause 8.10.3.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When a longer switching delay is allowed. Where is the time between DL data transmission and acknowledgement as specified in TS 38.213 [8].

#### 5.5.8.1 EN-DC FR2 MAC-CE based active TCI state switch

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- Connection diagram is TBD.

- TT analysis is missing.

- RAN4 dependency: Test parameters have brackets and TBDs.

5.5.8.1.1 Test purpose

The purpose of this test is to verify the active TCI state switch delay requirement defined in TS 38.133 [6] clause 8.10.3.

5.5.8.1.2 Test applicability

This test applies to all types of NR UE release 15 onwards.

5.5.8.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.8.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.8.1.

5.5.8.1.4 Test description

There are two cell configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.8.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.8.1.4.1-1.

Table 5.5.8.1.4.1-1: Supported test configurations for EN-DC FR2 MAC-CE based active TCI state switch

|  |  |
| --- | --- |
| Config | Description |
| 5.5.8.1-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.8.1-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.8.1.4.1-2.

Table 5.5.8.1.4.1-2: Initial conditions for EN-DC FR2 MAC-CE based active TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.8.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.TBD |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.8.1.4.1-3.

2. Message contents are defined in clause 5.5.8.1.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.8.1.4.1-3: General test parameters for EN-DC FR2 MAC-CE based active TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] |  |
| T2 | s | [0.2] |  |

5.5.8.1.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and PSCell. The UE shall be configured with 2 different TCI states for PSCell: PDCCH TCI-state 0 (QCL'd to SSB0) and TCI-state 1 (QCL'd to SSB1), in Cell 2 before starting the test. TCI state-0 is indicated as the active PDCCH TCI-state

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.8.1.5-1. Propagation conditions are set according to clause C.2.3. T1 starts. During T1 only SSB to which PDCCH TCI-state 0 is QCL'd is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.8.1.5-1. T2 starts. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends a MAC-CE to indicate switch to TCI-state 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.

7. If the SS:

a) Receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 0 until slot n+THARQ+24+8×Tfirst-SSB, and

b) Receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 1 after slot n+THARQ+40+8×Tfirst-SSB

the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

8. When T2 expires the SS shall sends a MAC-CE to indicate switch to TCI-state 0.

9. Wait 1s for the UE to switch TCI-state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 0 continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.8.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.8.1.4.3-1: Common Exception messages for EN-DC FR2 MAC-CE based active TCI state switch

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |

5.5.8.1.5 Test requirement

Tables 5.5.8.1.4.1-3, 5.5.8.1.5-1 and 5.5.8.1.5-2 define the primary level settings including test tolerances for EN-DC FR2 MAC-CE based active TCI state switch.

Table 5.5.8.1.5-1: NR Cell specific test parameters for EN-DC FR2 MAC-CE based active TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 2 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| TCI State 0 |  | TC. State.0 |
| TCI State 1 |  | TCI.State.1 |
| TRS Configuration |  | TRS.2.1 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |
| Propagation Condition |  | AWGN |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.8.1.5-2: OTA related test parameter for EN-DC FR2 MAC-CE based active TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB0 | | SSB1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 | | | |
| NocNote 1 | dBm/15 kHz | [-92.1] | | | |
| NocNote 1 | dBm/SCS | [-83.1] | | | |
| Ês/Noc | dB | 1 | 1 | -Infinity | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | -82.1 | -Infinity | -82.1 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -54.94 | -54.94 | -54.94 | -54.94 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the center of the quiet zone. | | | | | |

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall be able to continue to receive on TCI state 0 until n+THARQ+(3ms+Tfirst-SSB) / NR slot length, where

- THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [8];

- Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE;

- NR slot length = 0.125ms for 120kHz SSB SCS;

So UE shall be able to continue to receive PDCCH on TCI state 0 until n+THARQ+24+8×Tfirst-SSB

After receiving MAC-CE command in slot n, UE shall be able to receive PDCCH with TCI state 1 no later than at slot n+THARQ+(3ms+Tfirst-SSB + TSSB-proc)) / NR slot length., where

- THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [8];

- Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE;

- TSSB-proc = 2 ms;

- NR slot length = 0.125ms for 120kHz SSB SCS;

So UE shall be able to continue to receive PDCCH on TCI state 1 no later than n+THARQ+40+8×Tfirst-SSB

#### 5.5.8.2 EN-DC FR2 RRC based active TCI state switch

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- Connection diagram is TBD.

- TT analysis is missing.

- RAN4 dependency: Test parameters have brackets and TBDs.

5.5.8.2.1 Test purpose

The purpose of this test is to verify the active TCI state switch delay requirement defined in TS 38.133 [6] clause 8.10.3.

5.5.8.2.2 Test applicability

This test applies to all types of NR UE release 15 onwards.

5.5.8.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.8.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.8.2.

5.5.8.2.4 Test description

There are two cell configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.8.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.8.2.4.1-1.

Table 5.5.8.2.4.1-1: Supported test configurations for EN-DC FR2 RRC based active TCI state switch

|  |  |
| --- | --- |
| Config | Description |
| 5.5.8.2-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.8.2-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.8.2.4.1-2.

Table 5.5.8.2.4.1-2: Initial conditions for EN-DC FR2 RRC based active TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.8.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.TBD | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.TBD |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.8.2.4.1-3.

2. Message contents are defined in clause 5.5.8.2.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.8.2.4.1-3: General test parameters for EN-DC FR2 RRC based active TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] |  |
| T2 | s | [0.2] |  |

5.5.8.2.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and PSCell. The UE shall be configured with 2 different TCI states for PSCell: PDCCH TCI-state 0 (QCL'd to SSB0) and TCI-state 1 (QCL'd to SSB1), in Cell 2 before starting the test. TCI state-0 is indicated as the active PDCCH TCI-state

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.8.2.5-1. Propagation conditions are set according to clause C.2.3. T1 starts. During T1 only SSB to which PDCCH TCI-state 0 is QCL'd is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.8.2.5-1. T2 starts. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends an *RRCReconfiguration* message to indicate switch to TCI-state 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.

7. The UE transmits an *RRCReconfigurationComplete* message.

8. If the SS receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 1 after slot n+176+8×Tfirst-SSB the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

9. When T2 expires the SS sends an *RRCReconfiguration* message to indicate switch to TCI-state 0.

10. The UE transmits an *RRCReconfigurationComplete* message.

11. Wait 1s for the UE to switch TCI-state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 0 continue to step 13. Otherwise continue to step 12.

12. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

13. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.8.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.8.2.4.3-1: Common Exception messages for EN-DC FR2 RRC based active TCI state switch

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |

5.5.8.2.5 Test requirement

Tables 5.5.8.2.4.1-3, 5.5.8.2.5-1 and 5.5.8.2.5-2 define the primary level settings including test tolerances for EN-DC FR2 RRC based active TCI state switch.

Table 5.5.8.2.5-1: NR Cell specific test parameters for EN-DC FR2 RRC based active TCI state switch

| Parameter | Unit | Cell 2 |
| --- | --- | --- |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| TCI State 0 |  | TCI.State.0 |
| TCI State 1 |  | TCI.State.1 |
| TRS Configuration |  | TRS.2.1 TDD |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |
| Propagation Condition |  | AWGN |
| NOTE: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.8.2.5-2: OTA related test parameter for EN-DC FR2 RRC based active TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB0 | | SSB1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 | | | |
| NocNote 1 | dBm/15 kHz | [-92.1] | | | |
| NocNote 1 | dBm/SCS | [-83.1] | | | |
| Ês/Noc | dB | 1 | 1 | -Infinity | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | -82.1 | -Infinity | -82.1 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -54.94 | -54.94 | -54.94 | -54.94 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone. | | | | | |

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to receive PDCCH with TCI state 1 no later than at slot n+ (TRRC\_processing + Tfirst-SSB + TSSB-proc) / NR slot length, where

- TRRC\_processing =20 ms is the RRC processing delay as specified in TS 38.331 [13];

- Tfirst-SSB is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to TCI state 1;

- TSSB-proc = 2 ms;

- NR slot length = 0.125ms for 120kHz SSB SCS;

So UE shall be able to continue to receive PDCCH on TCI state 1 no later than slot n+176+8×Tfirst-SSB.

### 5.5.9 Uplink spatial relation switch delay

#### 5.5.9.0 Minimum conformance requirements

##### 5.5.9.0.1 Minimum conformance requirements for MAC-CE based uplink spatial relation switch delay

[TS38.133, Clause 8.12.3]

If the target spatial relation associated to DL RS is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation in the slot n+ THARQ + + 1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1 where THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.213.

If the target spatial relation associated to DL RS is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation in the slot n+ THARQ + + TL1-RSRP+1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- THARQ is the timing between DL data transmission and acknowledgement as specified in TS 38.213,

- T L1-RSRP is the time for Rx beam refinement in FR2, defined as

- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4.2

- configured with higher layer parameter *repetition* set to ON

- with the assumption of M=1 for periodic CSI-RS

- for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

- with TReport = 0

The UE shall be able to transmit with the old UL spatial relation until slot n+ THARQ + .

When the UL spatial relation info switch for PUCCH changes both the associated DL RS and *pucch-PathlossReferenceRS* with the same MAC-CE activation, and if both the DL RS and *pucch-PathlossReferenceRS* are known as specified in clause 8.12.2 and 8.14.2 respectively, the UE shall be able to transmit PUCCH with the target UL spatial relation after the delay specified in clause 8.14.3. If either the associated DL RS or *pucch-PathlossReferenceRS* are unknown, a longer switching delay is allowed. The UE is not required to transmit PUCCH with the target UL spatial relation until the DL RS and pathloss reference RS switch are completed.

##### 5.5.9.0.2 Minimum conformance requirements for RRC based uplink spatial relation switch delay

[TS38.133, Clause 8.12.5]

If the target spatial relation associated to DL RS is known, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured in the slot n+ TRRC\_processing /*NR slot length* +1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.

- TRRC\_processing is the RRC processing delay defined in 36.331 is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in TS38.331.

If the target spatial relation associated to DL RS is unknown, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured in the slot n+ TRRC\_processing /*NR slot length* + TL1-RSRP +1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.

- TRRC\_processing is the RRC processing delay defined in 36.331 is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in TS38.331.

- TL1-RSRP is defined in clause 8.12.3.

#### 5.5.9.1 MAC-CE based uplink spatial relation switch

##### 5.5.9.1.1 EN-DC PSCell FR2 uplink spatial relation switch for a known spatial relation

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing.

5.5.9.1.1.1 Test purpose

The purpose of this test is to verify the uplink spatial relation switch delay requirement defined in TS 38.133 [6] clause 8.12.3 by a UE capable of beam correspondence without the need for UL beam sweeping.

5.5.9.1.1.2 Test applicability

This test applies to all types of EN-DC UE Rel-16 and forward supporting EN-DC with PSCell in FR2.

5.5.9.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.9.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.9.1.

5.5.9.1.1.4 Test description

There are two cells configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.9.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.9.1.1.4.1-1.

Table 5.5.9.1.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 5.5.9.1.1-1 | LTE FDD; NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.9.1.1-2 | LTE TDD; NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.9.1.1.4.1-2.

Table 5.5.9.1.1.4.1-2: Initial conditions for EN-DC PSCell FR2 uplink spatial relation switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.9.1.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | Figure A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | Figure A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.9.1.1.4.1-3. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.2-1 in TS 38.133 [6].
2. Message contents are defined in clause 5.5.9.1.1.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.9.1.1.4.1-3: General test parameters for spatial relation switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| L1-RSRP reporting period | slot | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of reported RS |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

5.5.9.1.1.4.2 Test procedure

During the test PDCCH indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have continuous ACK/NACK sending by PUCCH.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and NR PSCell. The UE shall be configured with 2 different spatial relations for PSCell: PUCCH spatial relation 0 (QCL'd to SSB0) and spatial relation 1 (QCL'd to SSB1), in Cell 2 before starting the test. Spatial relation 0 is indicated as the active PUCCH spatial relation.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 2 according to T1 in Table 5.5.9.1.1.5-1. Propagation conditions are set according to clause C.2.2. T1 starts. During T1 only SSB0 to which PUCCH spatial relation 0 is QCL'd is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.9.1.1.5-2. T2 starts. At the beginning of T2, the SSB1 corresponding to spatial relation 1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends a MAC-CE to indicate switch to spatial relation 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.

7. If the SS:

a) Receives ACK/NACK on each UL transmission occasion scheduled on spatial relation 0 until slot *n* + THARQ/NR slot length + , and

b) Receives ACK/NACK on each UL transmission occasion scheduled on spatial relation 1 on and after slot *n* + THARQ/NR slot length + + 1.

the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

8. When T2 expires the SS shall sends a MAC-CE to indicate switch to spatial relation 0.

9. Wait 1s for the UE to switch to spatial relation 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on spatial relation 0, continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.9.1.1.4.3 Message contents

TBD

5.5.9.1.1.5 Test requirement

Table 5.5.9.1.1.5-1 and 5.5.9.1.1.5-2 define the primary level settings including test tolerances for all tests.

Table 5.5.9.1.1.5-1: NR Cell specific test parameters for spatial relation switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 2 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| Spatial Relation 0 |  | PUCCH.  SRI.0 |
| Spatial Relation 1 |  | PUCCH.  SRI.1 |
| TRS Configuration |  | TRS.2.1 TDD |
| reportConfigType |  | ssb-Index-RSRP |
| reportConfigType |  | periodic |
| timeRestrictionForChannelMeasurements |  | configured |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH |
| EPRE ratio of OCNG DMRS to SSS (Note 1) |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.9.1.1.5-2: OTA related test parameters for uplink spatial relation switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB0 | | SSB1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough | | | |
| NocNote 1 | dBm/15 kHz | -92.1 | | | |
| NocNote 1 | dBm/SCS | -83.1 | | | |
| Ês/Noc | dB | 1 | 1 | -Infinity | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | -82.1 | -Infinity | -82.1 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -50.6 | -50.6 | -54.1 | -50.6 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6] and does not limit UE implementation or test system implementation. | | | | | |

During T2, UE shall send L1-RSRP report with results for SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to transmit PUCCH on spatial relation 0 till *n* + THARQ/NR slot length + ;

- be able to start transmitting PUCCH on spatial relation 1 from slot *n* + THARQ/NR slot length + + 1.

#### The rate of correct events observed during repeated tests shall be at least 90% with the confidence level of 95%.5.5.9.2 RRC based uplink spatial relation switch

##### 5.5.9.2.1 EN-DC PSCell FR2 uplink spatial relation switch associated with a known DL-RS

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing.

5.5.9.2.1.1 Test purpose

The purpose of this test is to verify the RRC based uplink spatial relation switch delay requirement defined in TS 38.133 [6] clause 8.12.5 by a UE capable of beam correspondence without the need for UL beam sweeping.

5.5.9.2.1.2 Test applicability

This test applies to all types of EN-DC UE Rel-16 and forward supporting EN-DC with PSCell in FR2.

5.5.9.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.9.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.9.2.

5.5.9.2.1.4 Test description

There are two cells configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.9.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.9.2.1.4.1-1.

Table 5.5.9.2.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 5.5.9.2.1-1 | LTE FDD; NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.9.2.1-2 | LTE TDD; NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.9.2.1.4.1-2.

Table 5.5.9.2.1.4.1-2: Initial conditions for EN-DC PSCell FR2 uplink spatial relation switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.9.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | Figure A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | Figure A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.9.2.1.4.1-3. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.2-1 in TS 38.133 [6].
2. Message contents are defined in clause 5.5.9.2.1.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.9.2.1.4.1-3: General test parameters for spatial relation switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

5.5.9.2.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and NR PSCell. The UE shall be configured with 1 SRS-SpatialRelation0 associated with SSB0. UE is indicated SRS-SpatialRelation0 as the active SRS spatial relation.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 2 according to T1 in Table 5.5.9.2.1.5-1. Propagation conditions are set according to clause C.2.2. T1 starts. During T1 only SSB0 to which SRS-SpatialRelation0 associated is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.9.2.1.5-2. T2 starts. At the beginning of T2, the SSB1 corresponding to SRS-SpatialRelation1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends a RRC to indicate switch to periodic SRS with target SRS-SpatialRelation1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.

7. If the SS:

a) Receives periodic SRS with target spatial relation (SRS-SpatialRelation0) on PSCell until n + TRRC\_processing/NR slot length, and

b) Receives periodic SRS with target spatial relation (SRS-SpatialRelation1) on PSCell on and after n + TRRC\_processing/NR slot length + 1.

the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

8. When T2 expires the SS shall sends a RRC to indicate switch to SRS-SpatialRelation0.

9. Wait 1s for the UE to switch to SRS-SpatialRelation0. If the SS receives SRS with target spatial relation (SRS-SpatialRelation0), continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.9.2.1.4.3 Message contents

TBD

5.5.9.2.1.5 Test requirement

Table 5.5.9.2.1.5-1 and 5.5.9.2.1.5-2 define the primary level settings including test tolerances for all tests.

Table 5.5.9.2.1.5-1: NR Cell specific test parameters for spatial relation switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 2 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| SRS-SpatialRelation0 |  | SRS.SRI0 |
| SRS-SpatialRelation1 |  | SRS.SRI1 |
| TRS Configuration |  | TRS.2.1 TDD |
| reportConfigType |  | ssb-Index-RSRP |
| reportConfigType |  | periodic |
| Number of reported RS |  | 2 |
| L1-RSRP reporting period | slot | 160 |
| timeRestrictionForChannelMeasurements |  | configured |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS (Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.9.2.1.5-2: OTA related test parameters for uplink spatial relation switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
|  |  | SSB0 | | SSB1 | |
|  |  | T1 | T2 | T1 | T2 |
| Angle of arrival |  | Setup 3 according to clause A.3.15.3 | | | |
| configuration |  | **AoA1** | | **AoA2** | |
| Assumption for UE beamsNote 6 |  | Rough | | Rough | |
| NocNote 1 | dBm/15 kHz | -92.1 | | | |
| NocNote 1 | dBm/SCS | -83.1 | | | |
| Ês/Noc | dB | 1 | 1 | -Infinity | 1 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.1 | -82.1 | -Infinity | -82.1 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -50.6 | -50.6 | -54.1 | -50.6 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the center of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | |

During T2, UE shall send L1-RSRP report with SSB1 to which SRS-SpatialRelation1 is associated.

After receiving RRC command in slot n, UE shall be able to transmit target periodic SRS with SRS-SpatialRelation1 on PSCell in the slot n + TRRC\_processing/*NR slot length* + 1.

The rate of correct events observed during repeated tests shall be at least 90% with the confidence level of 95%.

### 5.5.10 UE specific CBW change

#### 5.5.10.0 Minimum conformance requirements

##### 5.5.10.0.1 Minimum conformance requirements for UE specific CBW change

[TS38.133, Clause 8.13]

After the UE receives RRC reconfiguration involving *offsetToCarrier* or *carrierBandwidth* change on the old CBW, UE shall be able to receive PDSCH/PDCCH on the DL BWP with BWP ID firstActiveDownlinkBWP-Id or transmit PUSCH on the UL BWP with BWP ID firstActiveUplinkBWP-Id of the new CBW right after a time duration of slots which begins from the beginning of DL slot n, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

is the length of the RRC procedure delay in millisecond as defined in clause 11.2 in TS 36.331 [29] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC procedure delay in millisecond as defined in clause 12 in TS 38.331 [13], and

is the time used by the UE to perform CBW change.

The UE is not required to transmit UL signals or receive DL signals during the above defined time duration on the cell where UE-specific CBW change occurs. When a longer switching delay is allowed. Where is the time between DL data transmission and acknowledgement as specified in TS 38.213 [8].

#### 5.5.10.1 UE specific CBW change on FR2 NR PSCell

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing

- TT analysis is missing

5.5.10.1.1 Test purpose

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13 in TS 38.133 [6].

5.5.10.1.2 Test applicability

This test applies to all types of EN-DC UE Rel-16 and forward supporting EN-DC with PSCell in FR2. The requirements in this test apply for a UE which receives reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

5.5.10.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.10.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.10.1.

5.5.10.1.4 Test description

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in Table 5.5.10.1.4.1-3. All cells have constant signal levels throughout the test. The test consists of 1 time period, with duration of T1.

PDCCHs indicating new transmissions shall be sent continuously on E-UTRA PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

During T1 the SS sends an *RRCReconfiguration* message containing *SCS-SpecificCarrier* to reconfigure UE-specific CBW. The SS verifies the UE specific CBW switching delay in PSCell by estimating the time from the moment the *RRCReconfiguration* message including updated UE-specific CBW configuration is sent to the moment a valid ACK/NACK is received (RRC Reconfiguration Complete message).

5.5.10.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.10.1.4.1-1.

Table 5.5.10.1.4.1-1: UE specific CBW change supported test configurations

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

Configure the test equipment and the DUT according to the parameters in Table 5.5.10.1.4.1-2.

Table 5.5.10.1.4.1-2: Initial conditions for EN-DC PSCell FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.10.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | Figure A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | Figure A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.10.1.4.1-3. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 in TS 38.133 [6], cell-specific parameters of NR PSCell are specified in Table 5.5.10.1.5-1.

2. Message contents are defined in clause 5.5.10.1.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.10.1.4.1-3: General test parameters for UE specific CBW change in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel Number |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] |  |

5.5.10.1.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4. UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC). UE has been configured via RRC-configuration (*SCS-SpecificCarrier* in TS 38.331 [13]) with UE specific CBW (CBW-1), initial BWP (BWP-1) and *firstActiveDownlinkBWP-Id* indicating BWP-1 is the active BWP in PSCell. Set the parameters according to Tables 4.5.9.1.4.1-3 and 4.5.9.1.5-1. Propagation conditions are set according to Annex C clauses C.2.2.

2. The SS starts sending PDCCHs indicating new transmissions continuously on Cell 2.

3. The SS sends an *RRCReconfiguration* message containing *SCS-SpecificCarrier* with updated UE specific CBW (CBW-2), dedicated BWP (BWP-1) and *firstActiveDownlinkBWP-Id* indicating BWP-1 is the active BWP.

4. T1 starts from the beginning of slot *i*, where slot *i* is the last slot carrying the PDSCH containing the *RRCReconfiguration* message in step 3.

5. The UE shall reconfigure its CBW with the updated CBW of final condition (CBW-2).

6. The SS verifies the UE specific CBW change time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated CBW configuration is sent till the time when RRC Reconfiguration Complete message is received.

7. If the UE starts to report valid ACK/NACK for the PSCell from the first UL slot that occurs after the beginning of DL slot (*i+* ) then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.

8. If it is successful, continue to step 10. Otherwise continue to step 9.

9. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

10. Repeat steps 2-9 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.10.1.4.3 Message contents

TBD

5.5.10.1.5 Test requirement

Table 5.5.10.1.5-1 defines the NR cell specific test parameters. Table 5.5.10.1.5-2 defines OTA related test parameters, not including test tolerances yet [will update after TT analysis].

5.5.10.1.5-1: NR Cell specific test parameters for UE specific CBW change in synchronous EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Frequency Range | |  | FR2 |
| Duplex mode | |  | TDD |
| TDD configuration | |  | TDDConf.3.1 |
| BWchannel | |  | 100 MHz: NRB,c = 66 |
| Active BWP ID | |  | 1 |
| Initial DL BWP Configuration | |  | DLBWP.0.2 |
| Initial UL BWP Configuration | |  | ULBWP.0.2 |
| Active DL BWP Configuration | |  | DLBWP.1.3 |
| Active UL BWP Configuration | |  | DLBWP.1.3 |
| Initial Condition | Active DL  CBW-1  Configuration |  | DLCBW.1.1 |
|  |
|  | Active UL |  | ULCBW.1.1 |
|  | CBW-1 |  |  |
|  | Configuration |  |  |
| Final Condition | Active DL  CBW-2  Configuration |  | DLCBW.1.2 |
|  |
|  | Active UL |  | ULCBW.1.2 |
|  | CBW-2 |  |  |
|  | Configuration |  |  |
| PDSCH Reference measurement channel | |  | SR.3.1 TDD |
| RMSI CORESET parameters | |  | CR.3.1 TDD |
| Dedicated CORESET parameters | |  | CCR.3.1 TDD |
| OCNG Patterns | |  | OP.1 |
| SSB Configuration | |  | SSB.1 FR2 |
| SMTC Configuration | |  | SMTC.1 |
| TCI State | |  | TCI.State.0 |
| TRS Configuration | |  | TRS.2.1 TDD |
| Antenna Configuration | |  | 1x2 |
| Propagation Condition | |  | AWGN |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | |  |  |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS | |  |  |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |
| EPRE ratio of PDSCH to PDSCH | |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [8]. | | | |

Table 5.5.10.1.5-2: OTA related test parameters for UE specific CBW change test case

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 |
| Angle of arrival configuration | |  | Setup 1 according to table A.3.15 in TS 38.133 [6] |
| Assumption for UE beamsNote 5 | |  | Fine |
| Note1 | NR\_TDD\_FR2\_A | dBm/15kHz | -112 + TT |
|  | NR\_TDD\_FR2\_B |  |  |
|  | NR\_TDD\_FR2\_F |  |  |
|  | NR\_TDD\_FR2\_G |  |  |
|  | NR\_TDD\_FR2\_T |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |
| Note1 | NR\_TDD\_FR2\_A | dBm/SCS | -103 + TT |
|  | NR\_TDD\_FR2\_B |  |  |
|  | NR\_TDD\_FR2\_F |  |  |
|  | NR\_TDD\_FR2\_G |  |  |
|  | NR\_TDD\_FR2\_T |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |
| SS-RSRPNote2 | NR\_TDD\_FR2\_A | dBm/SCS Note3 | -85 + TT |
|  | NR\_TDD\_FR2\_B |  |  |
|  | NR\_TDD\_FR2\_F |  |  |
|  | NR\_TDD\_FR2\_G |  |  |
|  | NR\_TDD\_FR2\_T |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |
|  | | dB | 18 + TT |
| IoNote2 | NR\_TDD\_FR2\_A | dBm/95.04 MHz | -56 + TT |
|  | NR\_TDD\_FR2\_B | Note4 |  |
|  | NR\_TDD\_FR2\_F |  |  |
|  | NR\_TDD\_FR2\_G |  |  |
|  | NR\_TDD\_FR2\_T |  |  |
|  | NR\_TDD\_FR2\_Y |  |  |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.  Note 5: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6]., and does not limit UE implementation or test system implementation. | | | |

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot (*i+*).

All of the above test requirements shall be fulfilled in order for the observed PSCell UE specific CBW change switch delay to be counted as correct.

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

### 5.5.11 Unified TCI state switch delay

#### 5.5.11.0 Minimum conformance requirements

##### 5.5.11.0.1 Minimum conformance requirements for MAC-CE based downlink TCI state switch delay for unified TCI

[TS 38.133, clause 8.15.2]

The downlink TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target downlink TCI state to the completion of active downlink TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target downlink TCI state or QCLed to the target downlink TCI state

- Downlink TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

- The UE has sent at least 1 L1-RSRP report for the target downlink TCI state before the downlink TCI state switch command

- The target downlink TCI state remains detectable during the downlink TCI state switching period

- The SSB associated with the downlink TCI state remain detectable during the downlink TCI switching period

- SNR of the downlink TCI state ≥ -3dB

- The SSB can be associated with either the serving cell PCI or a PCI different from serving cell PCI.

Otherwise, the downlink TCI state is unknown.

[TS 38.133, clause 8.15.3]

The requirements in this clause shall apply for DL TCI state switch using separate DL TCI state or joint TCI state of unified TCI state switch framework.

In case that source RS in DL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the cell with different PCI satisfies the known cell condition defined in 8.15.1. If the known cell condition is not met, longer delay may be expected.

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + + TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ THARQ + where THARQ (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

- TSSB-proc = 2 ms;

- TOk = 1 if target TCI state is not in the active TCI state list for PDSCH/PDCCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ THARQ + + (TL1-RSRP +TOuk\*(Tfirst-SSB+ TSSB-proc)) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ THARQ + .

Where

- T L1-RSRP = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,

- T L1-RSRP is the time for Rx beam refinement in FR2, defined as

- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4.2

- CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

- configured with higher layer parameter *repetition* set to ON

- with the assumption of M=1 for periodic CSI-RS

- for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

- with TReport = 0

- TOuk = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD

- TOuk = 1 when TCI state switching involves other QCL types only

- Tfirst-SSB is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;

- Tfirst-SSB is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;

- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

##### 5.5.11.0.2 Minimum conformance requirements for MAC-CE based uplink TCI state switch delay for unified TCI

[TS 38.133, clause 8.16.2]

The uplink TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target uplink TCI state to the completion of active uplink TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target uplink TCI state or QCLed to the target uplink TCI state

- Uplink TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

- The UE has sent at least 1 L1-RSRP report for the target uplink TCI state before the uplink TCI state switch command

- The RS configured in target uplink TCI state remains detectable during the uplink TCI state switching period

- SNR of the RS configured in target uplink TCI state ≥ -3dB

- The target uplink TCI state remains detectable during the uplink TCI state switching period

- The SSB associated with the uplink TCI state remain detectable during the uplink TCI switching period

- SNR of the uplink TCI state ≥ -3dB

- The SSB can be associated with either the serving cell PCI or a PCI different from serving cell PCI.

Otherwise, the uplink TCI state is unknown.

[TS 38.133, clause 8.16.3]

The requirements in this clause shall apply for UL TCI state switch using separate UL TCI state or joint TCI state of unified TCI state switch framework.

In case that source RS in UL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the cell with different PCI satisfies the known cell condition defined in 8.16.1. If the known cell condition is not met, longer delay may be expected.

In case of joint TCI state switch, UE is not expected to transmit on UL before UE completes the DL and UL TCI state switch.

For separate UL TCI state switch or joint TCI state switch for PUCCH or PUSCH, or semi-persistent/aperiodic/periodic SRS, when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1, upon receiving PDSCH carrying MAC-CE activation command in slot n on serving cell,

- The UE shall be able to transmit uplink signal with the target TCI state in the slot n+THARQ + + NM*\** (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*.

- If target TCI state is unknown,

- The UE shall be able to transmit uplink signal with the target TCI state in the slot n+THARQ + *+* (TL1-RSRP+ Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*.

Where,

- THARQ (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

- NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.

[- PL-RS is maintained provided:

- the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions

- There are no more than 4 different RS configured as PL-RS per serving cell among all active UL (or joint) TCI states for PUSCH/PUCCH/SRS transmissions

- Conditions for known path loss reference signal in section 8.14.2 are fulfilled.

Note: The requirements specified in this clause are not applicable if more than 4 different RSs are configured as PL-RS per serving cell among all active UL (or joint) TCI states.]

- Tfirst\_target-PL-RS is time to first pathloss RS transmission after L1-RSRP measurement when target TCI state is unknown.

- Tfirst\_target-PL-RS is time to first pathloss RS transmission after MAC CE command is decoded by the UE for known TCI State.

- Ttarget\_PL-RS is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS when PL-RS is associated with serving cell

- Ttarget\_PL-RS is the periodicity of the target pathloss reference signal which would be SSB when PL-RS is associated with PCI different from serving cell

- T L1-RSRP is the time for Rx beam refinement in FR2, defined as

- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.5.4.1,

- with the assumption of M=1

- with TReport = 0

- TL1-RSRP\_Measurement\_Period\_CSI-RS for CSI-RS as specified in clause 9.5.4.2

- CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

- configured with higher layer parameter *repetition* set to ON

- with the assumption of M=1 for periodic CSI-RS

- for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

- with TReport = 0

Editor note: when PL-RS is SSB in FR2, the delay requirement is FFS.

- The UE shall be able to transmit with the old UL TCI state until slot n+ THARQ + .

#### 5.5.11.1 EN-DC FR2 MAC-CE based active joint TCI state switch

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- It needs further check in TS 38.133 whether ‘AWGN’ is correct propagation model considering no noise applies in this test case.

5.5.11.1.1 Test purpose

The purpose of this test is to verify the MAC-CE based joint TCI state switch delay requirement defined in TS 38.133 [6] clause 8.15.3 and 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping.

5.5.11.1.2 Test applicability

This test applies to all types of UE supporting E-UTRA and EN-DC from release 17 onwards and supporting unified TCI state operation.

5.5.11.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.11.0.1 and 5.5.11.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.11.1.

5.5.11.1.4 Test description

There are two cells configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.11.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.11.1.4.1-1.

Table 5.5.11.1.4.1-1: Supported test configurations for EN-DC FR2 MAC-CE based active joint TCI state switch

|  |  |
| --- | --- |
| Config | Description |
| 5.5.11.1-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.11.1-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.11.1.4.1-2.

Table 5.5.11.1.4.1-2: Initial conditions for EN-DC FR2 MAC-CE based active joint TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 36.508 [25] clause 4.3.1 for E-UTRA and TS 38.508-1 [14] clause 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.11.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.11.1.4.1-3.

2. Message contents are defined in clause 5.5.11.1.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.11.1.4.1-3: General test parameters for EN-DC FR2 MAC-CE based active joint TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel No. |  | Channel 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel No. |  | Channel 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| L1-RSRP reporting period |  | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of RS for L1-RSRP reporting |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

5.5.11.1.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and NR PSCell. The UE shall be configured with 2 different DLorJoint states for PSCell: Joint TCI state 0 (QCL'd to SSB0) and Joint TCI state 1 (QCL'd to SSB1), in Cell 2 before starting the test. Joint TCI state 0 is indicated as the active joint TCI-state

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 2 according to T1 in Table 5.5.11.1.5-1. Propagation conditions are set according to clause C.2.2. T1 starts. During T1 only SSB0 to which Joint TCI state 0 is QCL'd is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.11.1.5-1. T2 starts. At the beginning of T2, the SSB1 corresponding to Joint TCI state 1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends a MAC-CE to indicate switch to Joint TCI-state 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.

7. If the SS:

a) Receives ACK/NACK on each UL transmission occasion scheduled on Joint TCI state 0 until slot n+THARQ+, and

b) Receives ACK/NACK on each UL transmission occasion scheduled on Joint TCI state 1 after slot n+ THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

8. When T2 expires the SS shall sends a MAC-CE to indicate switch to Joint TCI state 0.

9. Wait 1s for the UE to switch Joint TCI state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on Joint TCI state 0 continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.11.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.11.1.4.3-1: Common Exception messages for EN-DC FR2 MAC-CE based active joint TCI state switch

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |

5.5.11.1.5 Test requirement

Tables 5.5.11.1.4.1-3, 5.5.11.1.5-1 and 5.5.11.1.5-2 define the primary level settings including test tolerances for EN-DC FR2 MAC-CE based active TCI state switch.

Table 5.5.11.1.5-1: NR Cell specific test parameters for EN-DC FR2 MAC-CE based active joint TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 24 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.5 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| Joint TCI State 0 |  | DLorJoint TCI.State.2 |
| Joint TCI State 1 |  | DLorJoint TCI.State.3 |
| TRS Configuration |  | TRS.2.1 TDD for DLorJoint TCI.State.2  TRS 2.2 TDD for DLorJoint TCI.State.3 |
| Pathloss RS Configuration |  | Resource #4 in TRS.2.1 TDD for DLorJoint TCI.State.2 and for DLorJoint TCI.State.3 |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.11.1.5-2: OTA related test parameter for EN-DC FR2 MAC-CE based active joint TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB#0 | | SSB#1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough for SSB reception | | | |
| NocNote 1 | dBm/15 kHz | -95.1 | | | |
| NocNote 1 | dBm/SCS | -86.1 | | | |
| Ês/Noc | dB | 3.4 | 3.4 | -Infinity | 3.4 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.7 | -82.7 | -Infinity | -82.7 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -56.47 | -56.47 | -61.5 | -56.47 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in TS 38.133 [6] B.2.1.3 and does not limit UE implementation or test system implementation. | | | | | |

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall

- be able to continue to receive and transmit with Joint TCI state 0 until n+THARQ+,

- be able to start receiving and transmitting with Joint TCI state 1 after slot n+ THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

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

#### 5.5.11.2 EN-DC FR2 MAC-CE based active uplink TCI state switch

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- It needs further check in TS 38.133 whether ‘AWGN’ is correct propagation model considering no noise applies in this test case.

5.5.11.2.1 Test purpose

The purpose of this test is to verify the MAC-CE based uplink TCI state switch delay requirement defined in TS 38.133 [6] clause 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping.

5.5.11.2.2 Test applicability

This test applies to all types of UE supporting E-UTRA and EN-DC from release 17 onwards and supporting unified TCI state operation.

5.5.11.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.11.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.11.2.

5.5.11.2.4 Test description

There are two cells configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.11.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.11.2.4.1-1.

Table 5.5.11.2.4.1-1: Supported test configurations for EN-DC FR2 MAC-CE based active uplink TCI state switch

|  |  |
| --- | --- |
| Config | Description |
| 5.5.11.2-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.11.2-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.11.2.4.1-2.

Table 5.5.11.2.4.1-2: Initial conditions for EN-DC FR2 MAC-CE based active uplink TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 36.508 [25] clause 4.3.1 for E-UTRA and TS 38.508-1 [14] clause 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.11.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.11.2.4.1-3.

2. Message contents are defined in clause 5.5.11.2.4.3.

3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.11.2.4.1-3: General test parameters for EN-DC FR2 MAC-CE based active uplink TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel No. |  | Channel 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel No. |  | Channel 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| L1-RSRP reporting period |  | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of reported RS |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

5.5.11.2.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and NR PSCell. The UE shall be configured with 2 different uplink TCI states for PSCell: PUCCH uplink TCI state 0 (associated to SSB0) and uplink TCI state 1 (associated to SSB1), in Cell 2 before starting the test. Uplink TCI state 0 is indicated as the active PUCCH uplink TCI-state.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 2 according to T1 in Table 5.5.11.2.5-1. Propagation conditions are set according to clause C.2.2. T1 starts. During T1 only SSB0 to which PUCCH Uplink TCI state 0 is associated is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.11.2.5-1. T2 starts. At the beginning of T2, the SSB1 corresponding to uplink TCI state 1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends a MAC-CE to indicate switch to uplink TCI-state 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.

7. If the SS:

a) Receives ACK/NACK on each UL transmission occasion scheduled on Uplink TCI state 0 until slot n+THARQ+, and

b) Receives ACK/NACK on each UL transmission occasion scheduled on Uplink TCI state 1 after slot n+ THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

8. When T2 expires the SS shall sends a MAC-CE to indicate switch to uplink TCI state 0.

9. Wait 1s for the UE to switch to uplink TCI state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on uplink TCI state 0 continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.11.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.11.2.4.3-1: Common Exception messages for EN-DC FR2 MAC-CE based active uplink TCI state switch

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |

5.5.11.2.5 Test requirement

Tables 5.5.11.2.4.1-3, 5.5.11.2.5-1 and 5.5.11.2.5-2 define the primary level settings including test tolerances for EN-DC FR2 MAC-CE based active TCI state switch.

Table 5.5.11.2.5-1: NR Cell specific test parameters for EN-DC FR2 MAC-CE based active uplink TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 24 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.1 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| DL TCI state |  | DLorJoint TCI.State.0 |
| PL-RS Configuration  (CSI-RS#1) |  | Resource #4 in TRS.2.1 TDD for UL TCI.State.2  Resource #4 in TRS.2.2 TDD for UL TCI.State.3 |
| Uplink TCI State 0 |  | UL TCI.State.2 |
| Uplink TCI State 1 |  | UL TCI.State.3 |
| TRS Configuration |  | TRS.2.1 TDD |
| reportQuantity for SSB |  | ssb-Index-RSRP-Index-r17 |
| reportConfigType for SSB |  | periodic |
| reportQuantity for CSI-RS |  | cri-RSRP-Index-r17 |
| reportConfigType for CSI-RS |  | periodic |
| timeRestrictionForChannelMeasurements |  | configured |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.11.2.5-2: OTA related test parameter for EN-DC FR2 MAC-CE based active uplink TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| SSB#0 | | SSB#1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beams Note 6 |  | Rough for SSB reception | | | |
| NocNote 1 | dBm/15 kHz | -95.1 | | | |
| NocNote 1 | dBm/SCS | -86.1 | | | |
| Ês/Noc | dB | 3.4 | 3.4 | -Infinity | 3.4 |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | -82.7 | -82.7 | -Infinity | -82.7 |
| IoNote2,Note6 | dBm/95.04 MHz Note4 | -56.47 | -56.47 | -61.5 | -56.47 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.  Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in TS 38.133 [6] B.2.1.3 and does not limit UE implementation or test system implementation. | | | | | |

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall

- be able to continue to receive and transmit PUCCH on uplink TCI state 0 until n+THARQ+,

- be able to start transmitting PUCCH on uplink TCI state 1 from slot n+ THARQ + + (Tfirst\_target-PL-RS + 4\*Ttarget\_PL-RS + 2ms) / *NR slot length*

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

#### 5.5.11.3 EN-DC FR2 MAC-CE based active downlink TCI state switch

Editor's note: This test case is incomplete. The following aspects are either missing or TBD

- Message contents are not complete.

- It needs further check in TS 38.133 whether ‘AWGN’ is correct propagation model considering no noise applies in this test case.

5.5.11.3.1 Test purpose

The purpose of this test is to verify the MAC-CE based downlink TCI state switch delay requirement defined in TS 38.133 [6] clause 8.15.3.

5.5.11.3.2 Test applicability

This test applies to all types of UE supporting E-UTRA and EN-DC from release 17 onwards and supporting unified TCI state operation.

5.5.11.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.11.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.11.3.

5.5.11.3.4 Test description

There are two cell configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.11.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.11.3.4.1-1.

Table 5.5.11.3.4.1-1: Supported test configurations for EN-DC FR2 MAC-CE based active downlink TCI state switch

|  |  |
| --- | --- |
| Config | Description |
| 5.5.11.3-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.5.11.3-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.5.11.3.4.1-2.

Table 5.5.11.3.4.1-2: Initial conditions for EN-DC FR2 MAC-CE based active downlink TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 36.508 [25] clause 4.3.1 for E-UTRA and TS 38.508-1 [14] clause 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.11.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 5.5.11.3.4.1-3.

2. Message contents are defined in clause 5.5.11.3.4.3.

3. There are one E-UTRAN cell, one NR PSCell and one NR cell with additional PCI different from serving cell (Cell 3) specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.11.3.4.1-3: General test parameters for EN-DC FR2 MAC-CE based active downlink TCI state switch

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| E-UTRA RF Channel No. |  | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel No. |  | 2 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active PSCell |  | Cell 2 | PSCell on RF channel number 2. |
| Cell with additional PCI |  | Cell 3 | Cell on RF channel number 3. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell and PSCell |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| L1-RSRP reporting period |  | 160 | Periodic L1-RSRP reporting configured |
| L1-RSRP measured RS |  | SSB0, SSB1 | L1-RSRP measurements of SSB0 and SSB1. |
| Number of reported RS |  | 2 | L1-RSRP reporting of measurements on SSB0 and SSB1. |
| T1 | s | 0.2 |  |
| T2 | s | 2 |  |

5.5.11.3.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and cell with additional PCI (Cell 3) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell, NR PSCell and cell with additional PCI. The UE is configured with L1-RSRP measurements on cell with additional PCI (Cell 3). The UE shall be configured with 2 different downlink TCI states for PSCell: TCI state 0 (QCL’d to TRS resource set 1, TCI state of which is QCLed to SSB0 of Cell 2) and downlink TCI state 1 (QCL’d to TRS resource set 3, TCI state of which is QCLed to SSB1 of Cell 3), in Cell 2 before starting the test. TCI state 0 is indicated as the active downlink TCI-state.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

2. Set the parameters of NR Cell 2 according to T1 in Table 5.5.11.3.5-1. Propagation conditions are set according to clause C.2.2. T1 starts. During T1 only SSB0 to which PDCCH-TCI state0 is QCL’d is transmitted.

3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.11.3.5-1. T2 starts. At the beginning of T2, the SSB1 corresponding to downlink TCI state 1 starts transmitting.

4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.

5. The UE transmits an *RRCReconfigurationComplete* message.

6. The SS sends a MAC-CE to indicate switch to downlink TCI-state 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 of cell 2 and SSB1 of cell 3.

7. If the SS:

a) Receives ACK/NACK on each UL transmission occasion scheduled on downlink TCI state 0 until slot n+THARQ+3ms, and

b) Receives ACK/NACK on each UL transmission occasion scheduled on downlink TCI state 1 after slot n+ THARQ +3 ms + (Tfirst-SSB + TSSB-proc)

the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.

8. When T2 expires the SS shall sends a MAC-CE to indicate switch to downlink TCI state 0.

9. Wait 1s for the UE to switch to downlink TCI state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on downlink TCI state 0 continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.11.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.11.3.4.3-1: Common Exception messages for EN-DC FR2 MAC-CE based active downlink TCI state switch

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | FFS |

5.5.11.3.5 Test requirement

Tables 5.5.11.3.4.1-3, 5.5.11.3.5-1 and 5.5.11.3.5-2 define the primary level settings including test tolerances for EN-DC FR2 MAC-CE based active TCI state switch.

Table 5.5.11.3.5-1: NR Cell specific test parameters for EN-DC FR2 MAC-CE based active downlink TCI state switch

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Cell 1 |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 24 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3.2 TDD |
| RMSI CORESET parameters |  | CR.3.1 TDD |
| Dedicated CORESET parameters |  | CCR.3.1 TDD |
| OCNG Patterns |  | OP.5 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1 |
| DL TCI State 0 |  | DLorJoint TCI.State.0 |
| DL TCI State 1 |  | DLorJoint TCI.State.1 |
| UL TCI State 0 |  | UL TCI.State.0 |
| UL TCI State 1 |  | UL TCI.State.1 |
| Pathloss RS Configuration |  | Resource #4 in TRS.2.1 TDD |
| TRS Configuration |  | TRS.2.1 TDD for DLorJoint TCI.State.0  TRS.2.2 TDD for DLorJoint TCI.State.1 |
| Correlation Matrix and Antenna Configuration |  | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |
| EPRE ratio of PDSCH to PDSCH |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AWGN |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | |

Table 5.5.11.3.5-2: OTA related test parameter for EN-DC FR2 MAC-CE based active downlink TCI state switch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | Cell 3 | |
|  |  | SSB0 | | SSB1 | |
|  |  | T1 | T2 | T1 | T2 |
| Angle of arrival |  | Setup 3 according to clause A.3.15.3 | | | |
| configuration |  | AoA1 | | AoA2 | |
| Ês | dBm/SCS | -80.6 | -80.6 | -Infinity | -80.6 |
| SS B\_RP Note 2 | dBm/ SCS | -80.6 | -80.6 | - Infinity | -80.6 |
| BB Note 7 | dB | 8.3 | 8.3 | -Infinity | 8.3 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.0 | -56.0 | - Infinity | -50.0 |
| Note 1: Void  Note 2: SS B\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.  Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | |

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall

- be able to continue to receive on DL TCI state 0 till n+ THARQ +3,

- be able to start receiving on DL TCI state 1 after n+ THARQ +(5 ms + Tfirst-SSB) / *NR slot length*

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

### 5.5.12 PSCell activation and deactivation delay

#### 5.5.12.0 Minimum conformance requirements

5.5.12.0.1 Minimum conformance requirements for PSCell activation and deactivation delay

[TS 36.133, clause 7.38]

The requirements in this clause shall apply for the UE configured with one deactivated SCG in EN-DC, and when PScell in one SCG is being activated.

The delay within which the UE shall be able to activate the deactivated SCG depends upon the specified conditions.

Upon receiving SCG activation command in slot *n*, the UE shall be capable to transmit PRACH preamble or PUCCH towards PSCell no later than in slot ,

where:

Tactivation\_time = TRRC\_delay + Tprocessing + Tsearch + T∆ + TIU + 2 ms

TRRC\_delay is the RRC procedure delay as specified in TS 38.331 [13].

Tprocessing is the SW processing time needed by UE, including RF warm up period. When PSCell is activated from deactivated state, if any PSCell parameter is modified, Tprocessing = [20ms]. Otherwise, Tprocessing = [5 or 10ms].

Tsearch is the time for AGC settling and PSS/SSS detection.

For RACH based PSCell activation, if the target cell is a known NR FR1 or FR2 PScell, Tsearch = 0 ms. If the target cell is an unknown FR1 PScell and Es/Iot ≥ -2 dB, Tsearch = 3\* Trs ms. If the target cell is an unknown FR2 PScell and Es/Iot ≥ -2 dB, then Tsearch = 24\* Trs ms.

For RACH-less based PSCell activation, if RLM and BFD are configured and no failure is detected, Tsearch = 0 ms if the target cell is a known FR2 PScell. There are no requirements if PSCell is unknown.

T∆ is time for fine time tracking and acquiring full timing information of the target PSCell. T∆ = 1\*Trs ms.

TIU: When RACH based PSCell activation is configured, it is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. TIU is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in Table 8.1-1 of TS 38.213 [8].

When RACH-less based PSCell activation is configured, it is the uncertainty in acquiring the first PUSCH transmission occasion [or SR on PUCCH].

Trs is the SMTC periodicity of the PScell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5.

In FR1 and FR2, the PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the SCG activation command:

- the UE has sent a valid measurement report for the PSCell being activated and

- One of the SSBs measured from the PSCell being activated remains detectable according to the cell identification conditions specified in clause 9.3.

- One of the SSBs measured from PSCell being activated also remains detectable during the PSCell activation delay Tconfig\_PSCell according to the cell identification conditions specified in clause 9.3.

otherwise, it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [13].

The requirements in this clause shall apply for a UE which is configured with at least PCell and PSCell.

Upon receiving SCG deactivation command in subframe n, the UE shall accomplish the deactivation actions specified in TS 38.331 [13] no later than in slot :

where

TRRC\_delay is the RRC procedure delay as specified in TS 38.331 [13].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [13].

FFS: MAC CE based SCG deactivation delay requirements.

The normative reference for this requirement is TS 36.133 [23] clause 7.38.2 and 7.38.3.

#### 5.5.12.1 EN-DC FR2 PSCell activation and deactivation delay

Editor's Note: This test case is incomplete in following aspects:

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.5.12.1.1 Test purpose

This test is to verify that the NR PSCell activation and deactivation delay under EN-DC are within the requirements, for the case when UE configured with one deactivated SCG and when PScell in one SCG is being activated where the PSCell is known by the UE at the time of activation.

5.5.12.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 17 onwards and supporting activation and deactivation on SCG.

5.5.12.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.12.0.1.

The normative reference for this requirement is TS 36.133 [23] 7.38 and TS 38.133 [6] clause A.5.5.12.1.

5.5.12.1.4 Test description

5.5.12.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.12.1.4.1-1.

Table 5.5.12.1.4.1-1: Supported test configurations for FR2 PSCell

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

Configure the test equipment and the DUT according to the parameters in Table 5.5.12.1.4.1-2 and Table 5.5.12.1.4.1-3.

Table 5.5.12.1.4.1-2: Initial conditions for PSCell activation and deactivation

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.1-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 4.7.1.1.2-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

Table 5.5.12.1.4.1-3: General Test Parameters for PSCell activation and deactivation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| RF Channel Number | |  | 1, 2 | Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell |
| Initial | Active PCell |  | Cell1 | PCell on RF channel number 1. |
| Condition | Deactivated cell |  | Cell2 | SCell on RF channel number 2. |
| Final | Active PCell |  | Cell1 | PCell on RF channel number 1. |
| Condition | Deactivated cell |  | Cell2 | PSCell deactivated on RF channel number 2. |
| DRX | |  | OFF | Continuous monitoring of primary cell |
| Scheduling request resource priodicity | |  | 20ms | At the starting of period T3, UE sends a SR on PUCCH for PSCell |
| T1 | | s | 1 | During this time the PCell shall be known and cell2 shall be unknown. |
| T2 | | s | 1 | During this time the UE adds the PSCell. |
| T3 | | s | 1 | During this time the UE sends CSI reports for PSCell. |
| T4 | | s | 1 | During this time the UE releases the PSCell. |

1. Message contents are defined in clause 5.5.12.1.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is NR FR2 cells. Cell 2 is the deactivated PSCell.

3. Downlink signals for NR cell are initially set up according to clause C.2.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.5.12.1.4.2 Test procedure

Same as in 4.5.10.1.4.2 with the following exception:

2. Set the parameters according to T1 in Tables 5.5.12.1.5-1 and A.6.1.2-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. T1 starts. Immediately after, the SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add and deactivate NR cell (PSCell), with the message content exceptions defined in clause 5.5.12.1.4.3.

5.5.12.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3 with following exceptions:

Table 5.5.12.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table 4.6.3-19 in TS 38.508-1 [14] with condition RLM\_BFD\_PSCell  Table 4.6.3-167 in TS 38.508-1 [14] with condition SCG\_Activate  Table H.3.1-1  Table H.3.1-2  Table H.3.1-3 with condition SSB.2 FR2 and SMTC.2 |

Table 5.5.12.1.4.3-2: *SchedulingRequestResourceConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| schedulingRequestResourceId | SchedulingRequestResourceId |  |  |
| schedulingRequestID | SchedulingRequestId |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl80 | 9 | With SCS = kHz120 results in repetition every 10 ms | SCS120 |
| } |  |  |  |
| } |  |  |  |

5.5.12.1.5 Test requirement

Table 5.5.12.1.5-1 and Table 5.5.12.1.5-2 defines the primary level settings including test tolerances for all tests.

Table 5.5.12.1.5-1: Cell Specific Parameters for PSCell activation and deactivation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Test | | | |
|  |  |  | T1 | T2 | T3 | T4 |
| E-UTRA Channel Number |  | 1,2 | 1 | | | |
| NR Channel Number |  | 1,2 | 2 | | | |
| Duplex Mode |  | 1,2 | TDD | | | |
| TDD configuration |  | 1,2 | TDDConf.3.1 | | | |
| BWchannel | MHz | 1,2 | 100: NRB,c = 66 | | | |
| Data RBs allocated |  | 1,2 | 48 | | | |
| Initial BWP Configuration |  | 1,2 | DLBWP.0.1  ULBWP.0.1 | | | |
| Dedicated BWP Configuration |  | 1,2 | DLBWP.1.1  ULBWP.1.1 | | | |
| TRS Configuration |  | 1 | TRS.2.1 TDD | | | |
| PDSCH/PDCCH TCI state |  | 1 | TCI.State.2 | | | |
| PDSCH Reference measurement channel |  | 1,2 | SR.3.3 TDD | | | |
| RMSI CORESET Reference Channel |  | 1,2 | CR.3.2 TDD | | | |
| Dedicated CORESET Reference Channel |  | 1,2 | CCR.3.7 TDD | | | |
| OCNG Patterns |  | 1,2 | OP.3 | | | |
| SSB configuration |  | 1,2 | SSB.2 FR2 | | | |
| SMTC configuration |  | 1,2 | SMTC.2 | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1,2 | 120 | | | |
| TRS Configuration |  | 1,2 | TRS.2.1 TDD | | | |
| 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 | slot | 1,2 | 40 | | | |
| CSI reporting offset | slot | 1,2 | 4 | | | |
| EPRE ratio of PSS to SSS | dB | 1,2 | 0 | | | |
| EPRE ratio of PBCH DMRS to SSS |  |  |  | | | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | | | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | | | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | | | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | | | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | | | |
| Propagation condition |  | 1,2 | AWGN | | | |

Table 5.5.12.1.5-2: OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Cell 2 | | | |
| T1 | T2 | T3 | T4 |
| Angle of arrival configuration |  | Setup 2a according to clause A.3.15.2.1 | | | |
| Assumption for UE beamsNote 6 |  | Rough | | | |
| Ês Note2 | dBm/SCS | -81 | | | |
| SSB\_RPNote2, Note 4 | dBm/SCS | -81 | | | |
| BB Note 2, Note 7 | dB | 4.88 | | | |
| IoNote 2, Note 4 | dBm/95.04 MHz | -56.41 | | | |
| Note 1: Void  Note 2: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: Void  Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [3] Table 6.2.1.3-4. | | | | | |

The UE performs RACH-less based PSCell activation. UE shall transmit the SR on PUCCH for PSCell at latest 65 msNote1 into T2.

The UE shall send at least one PUSCH on PSCell during T3.

The UE shall stop transmit PUSCH for PSCell in at latest 20 ms into T4.

All the above test requirements shall be fulfilled for the observed PSCell activation delay and PSCell deactivation delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90%.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 7.38 in TS 36.133 [23]:

Tactivation\_time = TRRC\_delay + Tprocessing + Tsearch + T∆ + TIU + 2 ms

Where:

TRRC\_delay = 20ms

Tprocessing = 5ms

Tsearch = 0 ms

T∆ = 20ms

TIU= max 20 ms

### 5.5.13 Conditional PSCell addition and release delay

#### 5.5.13.1 EN-DC FR2 Addition and Release Delay of NR PSCell

Editor's Note: This test case is incomplete in following aspects:

- This test case is incomplete for Test frequency f > 40.8 GHz

- This test case is incomplete for UE power class other than PC3.

5.5.13.1.1 Test purpose

The purpose of this test is to verify that the conditional NR PSCell addition and release delays under EN-DC are within the requirements.

5.5.13.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 17 onwards and supporting Conditional PSCell addition.

5.5.13.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 4.5.11.0.

The normative reference for this requirement is TS 38.133 [6] clause 8.9A.

5.5.13.1.4 Test description

5.5.13.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.13.1.4.1-1.

Table 5.5.13.1.4.1-1: Supported test configurations for FR2 PSCell

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

Configure the test equipment and the DUT according to the parameters in Table 5.5.13.1.4.1-2.

Table 5.5.13.1.4.1-2: Initial conditions for EN-DC FR2 Addition and Release Delay of NR PSCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.5.13.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

Table 5.5.13.1.4.1-3: General Test Parameters for Conditional PSCell Addition and Release

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** | **Comment** |
| RF Channel Number | |  | 1, 2 | Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell |
| Initial | Active PCell |  | Cell1 | PCell on RF channel number 1. |
| Condition | Neighbour cell |  | Cell2 | Neighbour cell on RF channel number 2. |
| Final | Active PCell |  | Cell1 | PCell on RF channel number 1. |
| Condition | Neighbour Cell |  | Cell2 | PSCell released on RF channel number 2. |
| B1 | Hysteresis | dB | 0 | Hysteresis for evaluation of event B1. |
|  | Threshold RSRP | dBm | -118 | Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin. |
|  | Time to Trigger | s | 0 |  |
| DRX | |  | OFF | Continuous monitoring of primary cell |
| Gap pattern ID | |  | gp0 |  |
| PRACH configuration on cell2 | |  | FR2 configuration 2 | Captured in A.3.8.3.2 |
| Cell-individual offset for cells on RF channel number 1 | | dB | 0 | Individual offset for cells on primary component carrier. |
| Cell-individual offset for cells on RF channel number 2 | | dB | 0 | Individual offset for cells on carrier frequency of cell2. |
| T1 | | s | 1 | During this time the PCell shall be known and cell2 shall be unknown. |
| T2 | | s | <7 | During this time the UE adds the PSCell. |
| T3 | | s | 1 | During this time the UE sends CSI reports for PSCell. |
| T4 | | s | 1 | During this time the UE releases the PSCell. |

1. The test parameters are given in Table 5.5.13.1.4.1-3.

2. Message contents are defined in clause 5.5.13.1.4.3.

3. There are two cells in the test, where Cell 1 is the E-UTRA PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.2-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

5.5.13.1.4.2 Test procedure

The test consists of four successive time periods with duration of T1, T2, T3 and T4. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC.

During T1 only Cell 1 is known to the UE. NR shall configure a condition implying PSCell addition (Cell 2) during T1, at a time earlier than TRRC\_delay before the beginning of T2.

Starting T2, Cell 2 becomes detectable. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T3. The test system shall observe the periodic reporting of CSI for PSCell during T3.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T3, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

1. Ensure the UE is in state E-UTRA RRC\_CONNECTED with generic procedure parameters *Connectivity* E-UTRA/EPC with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. The SS shall set the parameters according to Table 5.5.13.1.5-1 as appropriate. T1 starts.

3. The SS shall transmit an *RRCConnectionReconfiguration* message with condition CPA according to TS 36.508 [25] Table 4.6.1-8 including RRCConnectionReconfiguration\* message and associated execution condition. The RRCConnectionReconfiguration\* message contains PSCell configuration in RRCReconfiguration\*\*. And measurement gap pattern #0 is configured for the UE.

4. The UE shall transmit an RRCConnectionReconfigurationComplete message. T1 expiring.

5. T2 starts. The execution conditionof PSCell (Cell2) becomes satisfied, the UE applies *RRCConnectionReconfiguration*\* message and releases measurement gap corresponding to PSCell (Cell2) and sends an *RRCConnectionReconfigurationComplete\** message with condition MCG\_and\_SCG and CPA, including NR *RRCReconfigurationComplete\*\** message for the selected candidate PSCell.

6. The UE shall send PRACH to PSCell no later than Tconfig\_PSCell\_Addition\_Conditionalfrom the start of T2, otherwise increase the number of failed iterations by one, switch off the UE and continue with step 11.

7 During T3 the UE shall send at least one CSI report for PSCell with non-zero CQI index, otherwise increase the number of failed iterations by one, switch off the UE and continue to step 11.

8. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell) after the UE has send at least one CQI report with non-zero CQI index for PSCell (Cell 2).

9. The UE shall transmit an *RRCConnectionReconfigurationComplete* message. T4 starts.

10. The UE shall stop sending CSI reports for PSCell no later than 20ms from the start of T4, if so increase the number of passed iterations by one otherwise increase the number of failed iterations by one and switch off the UE.

11. Set Cell 2 physical cell identity = [((current cell 2 physical cell identity + 1) mod 1008)] for next iteration of the test procedure loop.

12. If the UE is not switched off, the SS shall transmit an RRCConnectionRelease message to release the RRC connection then, the SS transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in State E-UTRA RRC\_CONNECTED with generic parameter Connectivity E-UTRA/EPC. If paging succeeds, go to step 14, otherwise switches off the UE.

13. Switches on the UE and ensures the UE is in state E-UTRA RRC\_CONNECTED with generic procedure parameters *Connectivity* E-UTRA/EPC with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

14. Repeat step 2-13 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.13.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.5.13.1.4.3-1: Common Exception messages for EN-DC FR2 Addition and Release Delay of NR PSCell

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | 3  Table H.3.4-5 with condition Pattern#0 for step 3  Table H.3.4-4 with condition GAPLESS for step 7  Table H.3.4-6 with condition SMTC.2 and SSB.2 FR2 |

Table 5.5.13.1.4.3-2: RRCConnectionReconfiguration (step 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [25], Table 4.6.1-8 with condition MEAS | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE{ |  |  |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE { |  |  |  |
| measConfig | MeasConfig-DEFAULT | Table 5.5.13.1.4.3--3 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.5.13.1.4.3-3: MeasConfig-DEFAULT

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.4-4 with Condition INTER-RAT NR | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasConfig-DEFAULT ::= SEQUENCE { |  |  |  |
| reportConfigToAddModList SEQUENCE (SIZE (1..maxReportConfigId)) OF SEQUENCE { | 1 entry |  |  |
| reportConfigId | 1 |  |  |
| reportConfig CHOICE { |  |  |  |
| reportConfigInterRAT SEQUENCE { |  |  |  |
| condReconfigurationTriggerNR-r17 SEQUENCE { |  |  |  |
| condEventId CHOICE { |  |  |  |
| condEventB1-NR-r17 SEQUENCE { |  |  |  |
| b1-ThresholdNR-r17 CHOICE { |  |  |  |
| nr-RSRP-r15 | 39 |  |  |
| } |  |  |  |
| hysteresis-r17 | 0 |  |  |
| timeToTrigger-r17 | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.5.13.1.5 Test requirement

Table 5.5.13.1.5-1 and Table 5.5.13.1.5-2 define the primary level settings including test tolerances.

Table 5.5.13.1.5-1: Cell Specific Parameters for Conditional PSCell Addition and Release

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Test** | | | |
|  |  |  | **T1** | **T2** | **T3** | **T4** |
| E-UTRA Channel Number |  | 1,2 | 1 | | | |
| NR Channel Number |  | 1,2 | 2 | | | |
| Duplex Mode |  | 1,2 | TDD | | | |
| TDD configuration |  | 1,2 | TDDConf.3.1 | | | |
| BWchannel | MHz | 1,2 | 100: NRB,c = 66 | | | |
| Data RBs allocated |  | 1,2 | 48 | | | |
| Initial BWP Configuration |  | 1,2 | DLBWP.0.1  ULBWP.0.1 | | | |
| Dedicated BWP Configuration |  | 1,2 | DLBWP.1.1  ULBWP.1.1 | | | |
| TRS Configuration |  | 1 | TRS.2.1 TDD | | | |
| PDSCH/PDCCH TCI state |  | 1 | TCI.State.2 | | | |
| PDSCH Reference measurement channel |  | 1,2 | SR.3.3 TDD | | | |
| RMSI CORESET Reference Channel |  | 1,2 | CR.3.2 TDD | | | |
| Dedicated CORESET Reference Channel |  | 1,2 | CCR.3.7 TDD | | | |
| OCNG Patterns |  | 1,2 | OP.3 | | | |
| SSB configuration |  | 1,2 | SSB.2 FR2 | | | |
| SMTC configuration |  | 1,2 | SMTC.2 | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1,2 | 120 | | | |
| TRS Configuration |  | 1,2 | TRS.2.1 TDD | | | |
| 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 | slot | 1,2 | 40 | | | |
| CSI reporting offset | slot | 1,2 | 4 | | | |
| EPRE ratio of PSS to SSS | dB | 1,2 | 0 | | | |
| EPRE ratio of PBCH DMRS to SSS |  |  |  | | | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | | | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | | | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | | | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | | | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | | | |
| EPRE ratio of OCNG DMRS to SSS  (Note 1) |  |  |  | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | | | |
| Propagation condition |  | 1,2 | AWGN | | | |

Table 5.5.13.1.5-2: OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Cell 2** | | | |
| **T1** | **T2** | **T3** | **T4** |
| Angle of arrival configuration |  | Setup 2a according to clause A.3.15.2.1 | | | |
| Assumption for UE beamsNote 6 |  | Rough | | | |
| Ês Note2 | dBm/SCS | -∞ | -81 | | |
| SSB\_RPNote2, Note 4 | dBm/SCS | -∞ | -81 | | |
| BB Note 2, Note 7 | dB | -∞ | 4.88 | | |
| IoNote 2, Note 4 | dBm/95.04 MHz | N/A | -56.41 | | |
| Note 1: Void  Note 2: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Void  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  Note 5: Void  Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | |

TRRC\_delay + TEvent\_DU occurs during T1 as the PSCell addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall transmit the PRACH to PSCell (Cell 2) less than Tconfig\_PSCell\_Addition\_Conditional Note1 into T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T3.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T3

The UE shall stop sending CSI reports for PSCell in at latest 20 ms into T4.

All the above test requirements shall be fulfilled for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90%.

Note1: The PSCell addition delay during T2 can be expressed as follows:

Tconfig\_PSCell\_Addition\_Conditional = Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 ms

Where:

Tmeasure = 6720ms for power class 1 or 4160 for power class 2/3/4

TUE\_preparation = 10ms

Tprocessing = 40ms

T∆ = 20ms

TPSCell\_ DU = 1\*10+10 = 20 ms

## 5.6 Measurement procedures

### 5.6.1 Intra-frequency measurements

#### 5.6.1.0 Minimum conformance requirements

##### 5.6.1.0.1 Minimum conformance requirements for event-triggered measurement without gap

[TS38.133, clause 9.2.2]

The requirements in Section 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,

- SS-RSRQ related side conditions given in Sections 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,

- SS-SINR related side conditions given in Sections 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

[TS38.133, clause 9.2.4.3]

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra with index or T identify intra without index defined in clause 9.2.5.1 or clause 9.2.6.2.When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period T identify\_intra\_without\_index or T identify\_intra\_with\_index defined in clause 9.2.5.1 or clause 9.2.6.2. If a cell which has been detectable at least for the time period T identify intra without index or T identify intra with index defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_intra provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

[TS38.133-f60, clause 9.2.5.1]

The UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

Tidentify\_intra\_without\_index = (TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra) ms

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 5.6.1.0.1-1

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 5.6.1.0.1-2

CSSFintra: it is a carrier specific scaling factor and is determined

-according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra frequency SMTC is fully overlapping with measurement gaps.

-if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

Mpss/sss\_sync\_w/o\_gaps : For a UE supporting FR2 power class 1, Mpss/sss\_sync=40. For a UE supporting power class 2, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_w/o\_gaps =24

Mmeas\_period\_w/o\_gaps : For a UE supporting power class 1, Mmeas\_period\_w/o\_gaps =40. For a UE supporting FR2 power class 2, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =24.

When intra frequency SMTC is fully non overlapping with measurement gaps or intra frequency SMTC is fully overlapping with MGs, Kp=1

When intra frequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP

If the higher layer signalling in TS38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index

For FR2, if *SSB-ToMeasure* is configured*,* when all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap is fully non-overlapping with the SSB symbols indicated by *SSB-ToMeasure* and 1 symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, Klayer1\_measurement= 1, otherwise Klayer1\_measurement=1.5. If *SSB-ToMeasure* is not configured, when any of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap is fully overlapping with intra-frequency SMTC, Klayer1\_measurement= 1.5, otherwise Klayer1\_measurement=1.

If SCG DRX is in use, intra frequency cell identification requirements specified in Table 5.6.1.0.1-1 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.1-1: Time period for PSS/SSS detection, (Frequency range FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

[TS38.133, clause 9.2.5.2]

The measurement period for intra frequency measurements without gaps is as shown in table 5.6.1.0.1-2. If the higher layer signalling in TS38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement and smtc2 is partially overlapping with measurement gaps, requirements are not specified for TSSB\_measurement\_period\_intra

If SCG DRX is in use, intra frequency measurement period requirements specified in Table 5.6.1.0.1-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.1-2: Measurement period for intrafrequency measurements without gaps(Frequency FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps xKp x Klayer1\_measurement ) x DRX cycle x CSSFintra |
| NOTE: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

The normative reference for this requirement is TS 38.133 [6] clause 9.2.2, 9.2.4.3, 9.2.5.1, 9.2.5.2.

##### 5.6.1.0.2 Minimum conformance requirements for event-triggered measurement with gap

[TS38.133, clause 9.2.2]

The requirements in Section 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,

- SS-RSRQ related side conditions given in Sections 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,

- SS-SINR related side conditions given in Sections 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

[TS38.133, clause 9.2.4.3]

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra with index or T identify intra without index defined in clause 9.2.5.1 or clause 9.2.6.2.When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period T identify\_intra\_without\_index or T identify\_intra\_with\_index defined in clause 9.2.5.1 or clause 9.2.6.2. If a cell which has been detectable at least for the time period T identify intra without index or T identify intra with index defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_intra provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

[TS38.133, clause 9.2.6.2]

The UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

Tidentify\_intra\_without\_index = (TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra) ms

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 5.6.1.0.2-1

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 5.6.1.0.2-2

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

Mpss/sss\_sync\_with\_gaps : For a UE supporting FR2 power class 1, Mpss/sss\_sync with\_gaps=40. For a UE supporting FR2 power class 2, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync with\_gaps =24. For a UE supporting power class 4, Mpss/sss\_sync with\_gaps =24

Mmeas\_period\_with\_gaps: For a UE supporting power class 1, Mmeas\_period\_with\_gaps =40. For a UE supporting power class 2, Mmeas\_period\_with\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_with\_gaps =24. For a UE supporting power class 4, Mmeas\_period with\_gaps =24.

If the higher layer signalling in TS 38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index.

If SCG DRX is in use, intrafrequency cell identification requirements specified in Table 5.6.1.0.2-1 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.2-1: Time period for PSS/SSS detection (Frequency range FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, Mpss/sss\_sync\_with\_gaps x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5x Mpss/sss\_sync\_with\_gaps) x max(MGRP, SMTC period, DRX cycle))x CSSFintra |
| DRX cycle>320ms | Mpss/sss\_sync\_with\_gaps x max(MGRP, DRX cycle) x CSSFintra |

[TS38.133, clause 9.2.6.3]

The measurement period for FR2 intra frequency measurements with gaps is as shown in table 5.6.1.0.2-2.

If SCG DRX is in use, intrafrequency measurement period requirements specified in Table 5.6.1.0.2-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.2-2: Measurement period for intrafrequency measurements with gaps(Frequency Range FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, Mmeas\_period with\_gaps x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5 x Mmeas\_period with\_gaps) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| DRX cycle>320ms | Mmeas\_period with\_gaps x max(MGRP, DRX cycle) x CSSFintra |

The normative reference for this requirement is TS 38.133 [6] clause 9.2.2, 9.2.4.3, 9.2.6.2, 9.2.6.3.

#### 5.6.1.1 EN-DC FR2 event-triggered reporting without gap in non-DRX

Editor's Note: This test case has been completed for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for UE power classes other than PC3

This test case is incomplete for test frequencies > 40.8 GHz

5.6.1.1.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search without gap under non-DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 forward, supporting EN-DC.

5.6.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.1.

5.6.1.1.4 Test description

5.6.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.1.4.1-1.

Table 5.6.1.1.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting without gap under non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.6.1.1-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.1-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.1-3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.1-4 | LTE TDD, 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. | |

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.1.4.1-2.

Table 5.6.1.1.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting without gap under non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.1.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2 |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | TBD | |  |

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.1.4.1-3 below.

2. Message contents are defined in clause 5.6.1.1.4.3.

3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.1.4.1-3: General test parameters for EN-DC FR2 intra-frequency event triggered reporting tests without gap under non-DRX

| Parameter | Unit | Config | Value | Comment |
| --- | --- | --- | --- | --- |
| Active cell |  | 1~4 | E-UTRAN PCell (Cell 1)  PSCell (Cell 2) |  |
| Neighbour cell |  | 1~4 | Cell 3 | Cell to be identified. |
| RF Channel Number |  | 1~4 | 1: Cell 1  2: Cell 2 and Cell 3 | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| SMTC configuration |  | 1~4 | SMTC.1 |  |
| A3-Offset | dB | 1~4 | -11 |  |
| CP length |  | 1~4 | Normal |  |
| Hysteresis | dB | 1~4 | 0 |  |
| Time To Trigger | s | 1~4 | 0 |  |
| Filter coefficient |  | 1~4 | 0 | L3 filtering is not used |
| DRX |  | 1~4 | OFF |  |
| Time offset between Cell 1 and Cell 2 |  | 1~4 | 3 μs | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 |  | 1~4 | 3 μs | Synchronous cells |
| T1 | s | 1~4 | 5 |  |
| T2 | s | 1~4 | 5 |  |

5.6.1.1.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.1.1.5-1.

3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.1.5-1. T2 starts.

6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 1442 ms, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 3) mod 1008) for next iteration of the test procedure loop.

9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.1.1.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests without gap under non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2  Table H.3.1-4 with A3-offset = -11dB  Table H.3.1-7 with Condition INTRA-FREQ  Table H.3.1-8 with Condition SSB RLM  Table H.3.4-1  Table H.3.4-2 |

Table 5.6.1.1.4.3-2: MeasObjectNR (Step 3, test procedure)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 with condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| ssbSubcarrierSpacing | SubcarrierSpacing specified in 38.508-1 [14] Table 7.3.1-3a with condition SSB.3 FR2 |  | 5.6.1.1-1,  5.6.1.1-2 |
|  | SubcarrierSpacing specified in 38.508-1 [14] Table 7.3.1-3a with condition SSB.4 FR2 |  | 5.6.1.1-3,  5.6.1.1-4 |
| smtc1 | SSB-MTC specified in 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| referenceSignalConfig SEQUENCE { |  |  |  |
| ssb-ConfigMobility SEQUENCE { |  |  |  |
| ssb-ToMeasure CHOICE { |  |  |  |
| setup CHOICE { |  |  |  |
| longBitmap | 11000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 | SSB#0 and SSB#1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| cellsToAddModList SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CellsToAddMod { | 1 entry |  |  |
| CellsToAddMod[1] SEQUENCE { |  | entry 1 |  |
| physCellId | PhysCellId of Cell 3 |  |  |
| cellIndividualOffset SEQUENCE { |  |  |  |
| rsrpOffsetSSB | dB16 |  |  |
| rsrqOffsetSSB | Not present |  |  |
| sinrOffsetSSB | Not present |  |  |
| rsrpOffsetCSI-RS | Not present |  |  |
| rsrqOffsetCSI-RS | Not present |  |  |
| sinrOffsetCSI-RS | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.6.1.1.5 Test requirement

Tables 5.6.1.1.4.1-3, 5.6.1.1.5-1 and 5.6.1.1.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test without gap under non-DRX.

Table 5.6.1.1.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap under non-DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| TDD configuration |  | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 1~4 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 1,2 | 24 | | 24 | |
| 3,4 | 48 | | 48 | |
| Initial BWP configuration |  | 1~4 | DLBWP.0.1  ULBWP.0.1 | | DLBWP.0.1  ULBWP.0.1 | |
| Active DL BWP configuration |  | 1~4 | DLBWP.1.1 | | DLBWP.1.1 | |
| Active UL BWP configuration |  | 1~4 | ULBWP.1.1 | | ULBWP.1.1 | |
| RLM-RS |  | 1~4 | SSB | | SSB | |
| PDSCH RMC configuration |  | 1,2 | SR.3.2 TDD | | N/A | |
| 3,4 | SR.3.3 TDD | |
| RMSI CORESET RMC configuration |  | 1,2 | CR.3.1 TDD | | CR.3.1 TDD | |
| 3,4 | CR.3.2 TDD | | CR.3.2 TDD | |
| Dedicated CORESET RMC configuration |  | 1,2 | CCR.3.1 TDD | | CCR.3.1 TDD | |
| 3,4 | CCR.3.7 TDD | | CCR.3.7 TDD | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1~4 | 120 | | 120 | |
| OCNG Patterns |  | 1~4 | OP.5 | | N/A | |
| TRS configuration |  | 1~4 | TRS.2.1 TDD | | N/A | |
| PDSCH/PDCCH TCI state |  | 1~4 | TCI.State.2 | | N/A | |
| cellIndividualOffset | dB | 1~4 | N/A | | 16 | |
| SSB configuration |  | 1, 2 | SSB.3 FR2 | | SSB.7 FR2 | |
| 3, 4 | SSB.4 FR2 | | SSB.8 FR2 | |
| Propagation Condition |  | 1~4 | AWGN | | | |

Table 5.6.1.1.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap under non-DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| AoA setup |  | 1~4 | Setup 3 defined in A.9.3 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beamsNote 4 |  | 1~4 | Rough | | Rough | |
| Es | dBm/SCS | 1, 2 | -89 | | -89 | |
| 3, 4 | -86 | | -86 | |
| BB Note 5 | dB | 1~4 | -0.12 | -0.12 | -Infinity | -0.12 |
| SSB\_RP | dBm/SCS | 1, 2 | -89 | -89 | -Infinity | -89 |
| 3, 4 | -86 | -86 | -Infinity | -86 |
|  | dBm/95.04MHz | 1,2 | -64.41 | -64.41 | -Infinity | -64.41 |
| 3,4 | -61.41 | -61.41 | -Infinity | -61.41 |
| Time multiplexing of the downlink transmissions from each AoA | 1~4 | Defined in Figure 5.6.1.1.5-1 | Time multiplexing of the downlink transmissions from each AoA | | 1~4 | |
| NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.  Note 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | |

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1440 ms from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

The overall delays measured shall be less than a total of 1442 ms in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95%.



Figure 5.6.1.1.5-1: Time multiplexed downlink transmissions (Config 1,2 example)

#### 5.6.1.2 EN-DC FR2 event-triggered reporting without gap in DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for test frequencies > 40.8 GHz5.6.1.2.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search without gap in DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.2.2 Test applicability

This test applies to all types of E-UTRA UE release 15 forward, supporting EN-DC and long DRX cycle.

5.6.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.2.

5.6.1.2.4 Test description

5.6.1.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.2.4.1-1.

Table 5.6.1.2.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting without gap in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.6.1.2-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.2-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.2-3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.2-4 | LTE TDD, 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. | |

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.2.4.1-2.

Table 5.6.1.2.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting without gap in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.1.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2 |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.3 |
| Exceptions to connection diagram | TBD | |  |

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.2.4.1-3 below.

2. Message contents are defined in clause 5.6.1.2.4.3.

3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.2.4.1-3: General test parameters for EN-DC FR2 intra-frequency event triggered reporting tests without gap in DRX

| Parameter | Unit | Config | Value | | Comment |
| --- | --- | --- | --- | --- | --- |
| Test 1 | Test 2 |
| Active cell |  | 1~4 | E-UTRAN PCell (Cell 1)  PSCell (Cell 2) | |  |
| Neighbour cell |  | 1~4 | Cell 3 | | Cell to be identified. |
| RF Channel Number |  | 1~4 | 1: Cell 1  2: Cell 2 and Cell 3 | | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| SMTC configuration |  | 1~4 | SMTC.1 | |  |
| A3-Offset | dB | 1~4 | -7 (Note1) | |  |
| CP length |  | 1~4 | Normal | |  |
| Hysteresis | dB | 1~4 | 0 | |  |
| Time To Trigger | s | 1~4 | 0 | |  |
| Filter coefficient |  | 1~4 | 0 | | L3 filtering is not used |
| DRX |  | 1~4 | DRX.1 | DRX. 7 | DRX related parameters are defined in Table 5.6.1.2.5-2 |
| Time offset between Cell 1 and Cell 2 |  | 1~4 | 3 μs | | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 |  | 1~4 | 3 μs | | Synchronous cells |
| T1 | s | 1~4 | 5 | |  |
| T2 | s | 1~4 | 10 | 52 |  |
| NOTE: Test tolerance of -1dB applied | | | | | |

5.6.1.2.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.1.2.5-1.

3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.2.5-1. T2 starts.

6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 4322 ms for Test 1 and 30722 ms for Test 2, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 3) mod 1008) for next iteration of the test procedure loop.

9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

10. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5].

11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

12. Repeat step 1-11 for each sub-test in Table 5.6.1.2.4.1-3 as appropriate.

5.6.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.1.2.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests without gap in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2  Table H.3.1-3 with Condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR  Table H.3.1-4 with A3-offset = -7dB  Table H.3.1-7 with Condition INTRA-FREQ  Table H.3.1-8 with Condition SSB RLM  Table H.3.4-1  Table H.3.4-2  Table H.3.7-1 with Condition DRX.1 for Test 1  Table H.3.7-1 with Condition DRX. 7 for Test 2  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |
| Specific message contents exceptions for Test Configuration 5.6.1.2-1 and 5.6.1.2-2 | Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.3 FR2 |
| Specific message contents exceptions for Test Configuration 5.6.1.2-3 and 5.6.1.2-4 | Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.4 FR2 |

5.6.1.2.5 Test requirement

Tables 5.6.1.2.4.1-3, 5.6.1.2.5-1 and 5.6.1.2.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test without gap in DRX.

Table 5.6.1.2.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap in DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| TDD configuration |  | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 1~4 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 1~4 | 66 | | 66 | |
| Initial BWP configuration |  | 1~4 | DLBWP.0.1  ULBWP.0.1 | | DLBWP.0.1  ULBWP.0.1 | |
| Active DL BWP configuration |  | 1~4 | DLBWP.1.1 | | DLBWP.1.1 | |
| Active UL BWP configuration |  | 1~4 | ULBWP.1.1 | | ULBWP.1.1 | |
| RLM-RS |  | 1~4 | SSB | | SSB | |
| PDSCH RMC configuration |  | 1,2 | SR.3.2 TDD | | N/A | |
| 3,4 | SR.3.3 TDD | |
| RMSI CORESET RMC configuration |  | 1,2 | CR.3.1 TDD | | N/A | |
| 3,4 | CR.3.2 TDD | | N/A | |
| Dedicated CORESET RMC configuration |  | 1,2 | CCR.3.1 TDD | | N/A | |
| 3,4 | CCR.3.7 TDD | | N/A | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1~4 | 120 | | 120 | |
| OCNG Patterns |  | 1~4 | OP.1 | | OP.1 | |
| PDSCH/PDCCH TCI state |  | 1~4 | TCI.State.2 | | N/A | |
| CSI-RS for tracking |  | 1~4 | TRS.2.1 TDD | | N/A | |
| SSB configuration |  | 1, 2 | SSB.3 FR2 | | SSB.3 FR2 | |
| 3, 4 | SSB.4 FR2 | | SSB.4 FR2 | |
| Propagation Condition |  | 1~4 | AWGN | | AWGN | |

Table 5.6.1.2.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap in DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Cell 2** | | **Cell 3** | |
| **T1** | **T2** | **T1** | **T2** |
| AoA setup |  | 1~4 | Setup 1 defined in A.9.1 | | | |
| BB Note 5 | dB | 1~4 | 3.77 | -1.52 | -Infinity | -1.52 |
| Note 2 | dBm/15 KHz | 1~4 | -101.5 | | | |
| Note 2 | dBm/SCS | 1, 2 | -92.5 | | | |
| 3, 4 | -89.5 | | | |
| SSB\_RP | dBm/SCS | 1, 2 | -88.47 | -88.47 | -Infinity | -88.47 |
| 3, 4 | -85.46 | -85.46 | -Infinity | -85.46 |
|  | dB | 1~4 | 4 | 4 | -Infinity | 4 |
|  | dBm/95.04MHz | 1~4 | -58.03 | -55.68 | See Cell 2 columns | |
| NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.  NOTE 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | |

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 4.32s from the beginning of time period T2.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 30.72s from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

The overall delays measured shall be less than a total of 4322 ms for Test 1 and 30722 ms for Test 2 in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95%.

#### 5.6.1.3 EN-DC FR2 event-triggered reporting with gap in non-DRX

Editor's Note: This test case has been completed for the following configurations:

* Test frequency f ≤ 40.8 GHz
* UE PC3

This test case is incomplete for UE power classes other than PC3

This test case is incomplete for test frequencies > 40.8 GHz

5.6.1.3.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search with gap in non-DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 forward, supporting EN-DC. This test applies to UE that support CSI-RS based RLM and BWP operation without bandwidth restriction.

5.6.1.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.3.

5.6.1.3.4 Test description

5.6.1.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.3.4.1-1.

Table 5.6.1.3.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting with gap in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.6.1.3-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.3-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.3-3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.3-4 | LTE TDD, 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. | |

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.3.4.1-2.

Table 5.6.1.3.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting with gap in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.1.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2 |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | TBD | |  |

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.3.4.1-3 below.

2. Message contents are defined in clause 5.6.1.3.4.3.

3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.3.4.1-3: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Value | Comment |
| Active cell |  | 1~4 | E-UTRAN PCell (Cell 1)  PSCell (Cell 2) |  |
| Neighbour cell |  | 1~4 | Cell 3 | Cell to be identified. |
| RF Channel Number |  | 1~4 | 1: Cell 1  2: Cell 2 and Cell 3 | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| Gap type |  | 1~4 | Per-UE gaps |  |
| Measurement gap repetition periodicity | ms | 1~4 | 40 |  |
| Measurement gap length | ms | 1~4 | 6 |  |
| Measurement gap offset | ms | 1~4 | 39 |  |
| SMTC configuration |  | 1~4 | SMTC.1 |  |
| CSI-RS parameters |  | 1~4 | CSI-RS.3.2 TDD **resource #0** |  |
| A3-Offset | dB | 1~4 | -11 |  |
| CP length |  | 1~4 | Normal |  |
| Hysteresis | dB | 1~4 | 0 |  |
| Time To Trigger | s | 1~4 | 0 |  |
| Filter coefficient |  | 1~4 | 0 | L3 filtering is not used |
| DRX |  | 1~4 | OFF |  |
| Time offset between Cell 1 and Cell 2 |  | 1~4 | 3 μs | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 |  | 1~4 | 3 μs | Synchronous cells |
| T1 | s | 1~4 | 5 |  |
| T2 | s | 1~4 | 5 |  |

5.6.1.3.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.1.3.5-1.

3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.3.5-1. T2 starts.

6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 1922 ms, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 3) mod 1008) for next iteration of the test procedure loop.

9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.1.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.1.3.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests with gap in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTRA-FREQ and GAP NEEDED  Table H.3.1-4 with A3-offset =-11dB  Table H.3.1-7 with Condition INTRA-FREQ  Table H.3.1-8 with Condition CSI-RS RLM  Table H.3.4-1  Table H.3.4-2  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition Pattern #0 |

Table 5.6.1.3.4.3-2: MeasObjectNR (Step 3, test procedure)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 with condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| ssbSubcarrierSpacing | SubcarrierSpacing specified in 38.508-1 [14] Table 7.3.1-3a with condition SSB.3 FR2 |  | 5.6.1.3-1,  5.6.1.3-2 |
|  | SubcarrierSpacing specified in 38.508-1 [14] Table 7.3.1-3a with condition SSB.4 FR2 |  | 5.6.1.3-3,  5.6.1.3-4 |
| smtc1 | SSB-MTC specified in 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| referenceSignalConfig SEQUENCE { |  |  |  |
| ssb-ConfigMobility SEQUENCE { |  |  |  |
| ssb-ToMeasure CHOICE { |  |  |  |
| setup CHOICE { |  |  |  |
| longBitmap | 11000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 | SSB#0 and SSB#1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| cellsToAddModList SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CellsToAddMod { | 1 entry |  |  |
| CellsToAddMod[1] SEQUENCE { |  | entry 1 |  |
| physCellId | PhysCellId of Cell 3 |  |  |
| cellIndividualOffset SEQUENCE { |  |  |  |
| rsrpOffsetSSB | dB16 |  |  |
| rsrqOffsetSSB | Not present |  |  |
| sinrOffsetSSB | Not present |  |  |
| rsrpOffsetCSI-RS | Not present |  |  |
| rsrqOffsetCSI-RS | Not present |  |  |
| sinrOffsetCSI-RS | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.6.1.3.5 Test requirement

Tables 5.6.1.3.4.1-3, 5.6.1.3.5-1 and 5.6.1.3.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test with gap under non-DRX.

Table 5.6.1.3.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| TDD configuration |  | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 1~4 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 1,2 | 24 | | 24 | |
| 3,4 | 48 | | 48 | |
| Initial BWP configuration |  | 1~4 | DLBWP.0.1  ULBWP.0.1 | | DLBWP.0.1  ULBWP.0.1 | |
| Active DL BWP configuration |  | 1,2 | DLBWP.1.2 | | DLBWP.1.1 | |
|  |  | 3,4 | DLBWP.1.7 | | DLBWP.1.1 | |
| Active UL BWP configuration |  | 1,2 | ULBWP.1.2 | | ULBWP.1.1 | |
|  |  | 3,4 | ULBWP.1.7 | | ULBWP.1.1 | |
| RLM-RS |  | 1~4 | CSI-RS | | SSB | |
| PDSCH RMC configuration |  | 1,2 | SR.3.2 TDD | | N/A | |
| 3,4 | SR.3.3 TDD | |
| RMSI CORESET RMC configuration |  | 1,2 | CR.3.1 TDD | | N/A | |
| 3,4 | CR.3.2 TDD | | N/A | |
| Dedicated CORESET RMC configuration |  | 1,2 | CCR.3.1 TDD | | N/A | |
| 3,4 | CCR.3.7 TDD | | N/A | |
| TRS configuration |  | 1~4 | TRS.2.1 TDD | | N/A | |
| PDSCH/PDCCH TCI state |  | 1~4 | TCI.State.2 | | N/A | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1~4 | 120 | | 120 | |
| OCNG Patterns |  | 1~4 | OP.5 | | N/A | |
| cellIndividualOffset | dB | 1~4 | N/A | | 16 | |
| SSB |  | 1, 2 | SSB.3 FR2 | | SSB.7 FR2 | |
| 3, 4 | SSB.4 FR2 | | SSB.8 FR2 | |
| Propagation Condition |  | 1~4 | AWGN | | | |

Table 5.6.1.3.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Cell 2** | | **Cell 3** | | |
| **T1** | **T2** | **T1** | | **T2** |
| AoA setup |  | 1~4 | Setup 3 defined in A.9.3 | | | | |
| **AoA1** | | | **AoA2** | |
| Assumption for UE beamsNote 4 |  | 1~4 | Rough | | | Rough | |
| Es | dBm/SCS | 1,2 | -89 | | | -89 | |
| 3,4 | -86 | | | -86 | |
| BB Note 5 | dB | 1~4 | -0.12 | -0.12 | -Infinity | | -0.12 |
| SSB\_RP | dBm/SCS | 1, 2 | -89 | -89 | -Infinity | | -89 |
| 3, 4 | -86 | -86 | -Infinity | | -86 |
|  | dBm/95.04MHz | 1,2 | -64.41 | -64.41 | -Infinity | | -64.41 |
| 3,4 | -61.41 | -61.41 | -Infinity | | -61.41 |
| Time multiplexing of the downlink transmissions from each AoA | 1~4 | Defined in Figure 5.6.1.3.5-1 | Time multiplexing of the downlink transmissions from each AoA | | Time multiplexing of the downlink transmissions from each AoA | | |
| NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.  Note 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | | |

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1.92s from the beginning of time period T2

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

The overall delays measured shall be less than a total of 1922 ms in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95%.



Figure 5.6.1.3.5-1: Time multiplexed downlink transmissions (Config 1,2 example)

#### 5.6.1.4 EN-DC FR2 event-triggered reporting with gap in DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.6.1.4.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search with gap in DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.4.2 Test applicability

This test applies to all types of E-UTRA UE release 15 forward, supporting EN-DC, This test applies to UE that support CSI-RS based RLM, BWP operation without bandwidth restriction and long DRX cycle.

5.6.1.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.4.

5.6.1.4.4 Test description

5.6.1.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.4.4.1-1.

Table 5.6.1.4.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting with gap in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 5.6.1.4-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.4-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.4-3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.1.4-4 | LTE TDD, 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. | |

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.4.4.1-2.

Table 5.6.1.4.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting with gap in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.1.4.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2 |
| Connection Diagram | TE Part | A.3.3.3.1-2 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | TBD | |  |

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.4.4.1-3 below.

2. Message contents are defined in clause 5.6.1.4.4.3.

3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.4.4.1-3: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Value | | Comment |
| Test 1 | Test 2 |
| Active cell |  | 1~4 | E-UTRAN PCell (Cell 1)  PSCell (Cell 2) | |  |
| Neighbour cell |  | 1~4 | Cell 3 | | Cell to be identified. |
| RF Channel Number |  | 1~4 | 1: Cell 1  2: Cell 2 and Cell 3 | | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| Gap type |  | 1~4 | Per-UE gaps | |  |
| Measurement gap repetition periodicity | ms | 1~4 | 40 | |  |
| Measurement gap length | ms | 1~4 | 6 | |  |
| Measurement gap offset | ms | 1~4 | 39 | |  |
| SMTC configuration |  | 1~4 | SMTC.1 | |  |
| CSI-RS parameters |  | 1~4 | CSI-RS.3.2 TDD **resource #0** | |  |
| A3-Offset | dB | 1~4 | -7(Note1) | |  |
| CP length |  | 1~4 | Normal | |  |
| Hysteresis | dB | 1~4 | 0 | |  |
| Time To Trigger | s | 1~4 | 0 | |  |
| Filter coefficient |  | 1~4 | 0 | | L3 filtering is not used |
| DRX |  | 1~4 | DRX.1 | DRX. 7 | DRX related parameters are defined in Table 5.6.1.4.5-2 |
| Time offset between Cell 1 and Cell 2 |  | 1~4 | 3μs | | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 |  | 1~4 | 3μs | | Synchronous cells |
| T1 | s | 1~4 | 5 | |  |
| T2 | s | 1~4 | 10 | 52 |  |
| Note1 : Test tolerance of -1dB applied | | | | | |

5.6.1.4.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.1.4.5-1.

3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.

4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.4.5-1. T2 starts.

6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 4322 ms for Test 1 and 30722 ms for Test 2, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 3) mod 1008) for next iteration of the test procedure loop.

9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

10. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5].

11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

12. Repeat step 1-11 for each sub-test in Table 5.6.1.2.4.1-3 as appropriate.

5.6.1.4.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.1.4.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests with gap in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTRA-FREQ and GAP NEEDED  Table H.3.1-3 with Condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR  Table H.3.1-4 with A3-offset = -7dB  Table H.3.1-7 with Condition INTRA-FREQ  Table H.3.1-8 with Condition CSI-RS RLM  Table H.3.4-1  Table H.3.4-2  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition Pattern #0  Table H.3.7-1 with Condition DRX.1 and Gap for test 1  Table H.3.7-1 with Condition DRX. 7 and Gap for test 2  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |
| Specific message contents exceptions for Test Configuration 5.6.1.4-1 and 5.6.1.4-2 | Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.3 FR2 |
| Specific message contents exceptions for Test Configuration 5.6.1.4-3 and 5.6.1.4-4 | Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.4 FR2 |

5.6.1.4.5 Test requirement

Tables 5.6.1.4.4.1-3, 5.6.1.4.5-1 and 5.6.1.4.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test with gap in DRX.

Table 5.6.1.4.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| TDD configuration |  | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 1~4 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 1~4 | 66 | | 66 | |
| Initial BWP configuration |  | 1~4 | DLBWP.0.1  ULBWP.0.1 | | DLBWP.0.1  ULBWP.0.1 | |
| Active DL BWP configuration |  | 1,2 | DLBWP.1.2 | | DLBWP.1.1 | |
|  |  | 3,4 | DLBWP.1.7 | | DLBWP.1.1 | |
| Active UL BWP configuration |  | 1,2 | ULBWP.1.2 | | ULBWP.1.1 | |
|  |  | 3,4 | ULBWP.1.7 | | ULBWP.1.1 | |
| RLM-RS |  | 1~4 | CSI-RS | | SSB | |
| PDSCH RMC configuration |  | 1,2 | SR.3.2 TDD | | N/A | |
|  |  | 3,4 | SR.3.3 TDD | |  | |
| RMSI CORESET RMC configuration |  | 1,2 | CR.3.1 TDD | | N/A | |
|  |  | 3,4 | CR.3.2 TDD | | N/A | |
| Dedicated CORESET RMC configuration |  | 1,2 | CCR.3.1 TDD | | N/A | |
|  |  | 3,4 | CCR.3.7 TDD | | N/A | |
| TRS configuration |  | 1~4 | TRS.2.1 TDD | | N/A | |
| PDSCH/PDCCH TCI state |  | 1~4 | TCI.State.2 | | N/A | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1~4 | 120 | | 120 | |
| OCNG Patterns |  | 1~4 | OP.1 | | OP.1 | |
| SSB |  | 1, 2 | SSB.3 FR2 | | SSB.3 FR2 | |
| 3, 4 | SSB.4 FR2 | | SSB.4 FR2 | |
| Propagation Condition |  | 1~4 | AWGN | | AWGN | |

Table 5.6.1.4.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| AoA setup |  | 1~4 | Setup 1 defined in A.3.9.1 | | | |
| BB Note 5 | dB | 1~4 | 3.77 | -1.52 | -Infinity | -1.52 |
| Note 2 | dBm/15 KHz | 1~4 | -101.5 | | | |
| Note 2 | dBm/SCS | 1, 2 | -92.5 | | | |
| 3, 4 | -89.5 | | | |
| SSB\_RP | dBm/SCS | 1, 2 | -88.47 | -88.47 | -Infinity | -88.47 |
| 3, 4 | -85.46 | -85.46 | -Infinity | -85.46 |
|  | dB | 1~4 | 4 | 4 | -Infinity | 4 |
|  | dBm/95.04MHz | 1, 2 | -58.03 | -55.68 | See Cell 2 columns | |
| NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.  NOTE 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [3] Table 6.2.1.3-4. | | | | | | |

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 4.32s from the beginning of time period T2

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 30.72s from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

The overall delays measured shall be less than a total of 4322 ms for Test 1 and 30722 ms for Test 2 in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

For the test to pass, the total number of successful tests shall be more than 90% of the cases with a confidence level of 95%.

### 5.6.2 Inter-frequency measurements

#### 5.6.2.0 Minimum conformance requirements for Inter-frequency measurements

The requirements in Section 9.3 apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding Band,

- SS-RSRQ related side conditions given in Sections 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding Band,

- SS-SINR related side conditions given in Sections 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding Band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter frequency cell within Tidentify\_inter\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within Tidentify\_inter\_without\_index.

Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3.4-1 and table 9.3.4-2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3 and table 9.3.4-4.

T SSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3.5-1 and table 9.3.5-2.

Mpss/sss\_sync\_inter: For a UE supporting FR2 power class 1, Mpss/sss\_sync\_inter = 64 samples. For a UE supporting FR2 power class 2, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_inter = 40 samples.

MSSB\_index\_inter: For a UE supporting power FR2 class 1, MSSB\_index\_inter = 40 samples. For a vehicle mounted UE supporting power class 2, MSSB\_index\_inter = 24 samples. For a UE supporting power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting power class 4, Mmeas\_period\_inter = 24 samples.

Mmeas\_period\_inter: For a UE supporting FR2 power class 1, Mmeas\_period\_inter =64 samples. For a UE supporting FR2 power class 2, Mmeas\_period\_inter=40 samples. For a UE supporting FR2 power class 3, Mmeas\_period\_inter =40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_inter = 40 samples.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

Table 9.3.4-2: Time period for PSS/SSS detection, (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_inter |
| No DRX | Max(600ms, Mpss/sss\_sync\_inter × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Mpss/sss\_sync\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

Table 9.3.4-4: Time period for time index detection (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_inter |
| No DRX | Max(200ms, MSSB\_index\_inter × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | MSSB\_index\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2:

Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (Frequency FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | T SSB\_measurement\_period\_inter |
| No DRX | Max(400ms, Mmeas\_period\_inter × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Mmeas\_period\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 × TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within Tidentify\_inter\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter frequency cell within Tidentify\_inter\_with\_index. Both Tidentify\_inter\_without\_index and Tidentify\_inter\_with\_index are defined in clause 9.3.4.When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_without\_index or Tidentify\_inter\_with\_index defined in clause 9.3.4 and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than T SSB\_measurement\_period\_inter defined in clause 9.3.5 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used an additional delay can be expected.

The normative reference for this requirement is TS 38.133 [6] clause 9.3.2, 9.3.4, 9.3.5, 9.3.6.3.

#### 5.6.2.1 EN-DC FR2-FR2 event-triggered reporting in non-DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.1.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Test 1 is applicable.

5.6.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.1.

5.6.2.1.4 Test description

5.6.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.1.4.1-1.

Table 5.6.2.1.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in non-DRX supported test configurations

|  |  |
| --- | --- |
| **Test Case ID** | **Description** |
| 5.6.2.1-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.1-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

Table 5.6.2.1.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | | Comment |
| Test 1 | Test 2 |
| E-UTRA RF Channel Number |  | Config 1,2 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2 | 1, 2 | | Two FR2 NR carrier frequencies is used. |
| Active cell |  | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2 | 0 | 13 | As specified in TS 38.133 [6] clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2 | 39 | 39 |  |
| SMTC-SSB parameters |  | Config 1,2 | SSB.3 FR2 | | As specified in clause A.3.2 |
| offsetMO | dB | Config 1,2 | 16 | | Applied to NR Cell 3 measurement object |
| A3-Offset | dB | Config 1,2 | -11 | |  |
| Hysteresis | dB | Config 1,2 | 0 | |  |
| CP length |  | Config 1,2 | Normal | |  |
| TimeToTrigger | s | Config 1,2 | 0 | |  |
| Filter coefficient |  | Config 1,2 | 0 | | L3 filtering is not used |
| DRX |  | Config 1,2 | OFF | | DRX is not used |
| Time offset between PCell and PSCell |  | Config 1,2 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,2 | 3μs | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | |  |
| T2 | s | Config 1,2 | 5.2 for PC1; 3.5 for other PC | 5.2 for PC1; 3.5 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.1.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Value** | | **Comment** |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.1.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 are set according to clause C.1.2 and clause C.1.3. Cell 3 is switched off during the initial connection setup.

3. The AoA setup for this test is Setup 3 as defined in clause A.9. The UE RX spherical coverage direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.2.1.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.1.4.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.1.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.1.4.1-2. The TE shall ensure that the NR FR2 cells are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [3] and relative angular offset between active probes are according to Table A.9.3-1. T1 starts.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.1.4.1-2. T2 starts.

6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 5122 ms for UE supporting power class 1, or 3202 ms for UE supporting other power class for Test 1 and Test 2 then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = [(current cell 3 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. TE shall change the active probes in such way that relative angular offset between active probes differs in the following iteration.

10. The SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 10 fails, SS switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

12. Repeat step 1-11 for each sub-test in Table 5.6.2.1.4.1-2 as appropriate.

5.6.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 with the following exceptions:

Table 5.6.2.1.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests in non-DRX test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ for Test 1. For Test 2, additionally with condition GAP NEEDED  Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells  Table H.3.1-4 with A3-offset = -11dB  Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 2  Table H.3.4-4 with Condition gapUE Test 1  Table H.3.4-5 with Condition Pattern #0 for Test 1  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

Table 5.6.2.1.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR2-FR2 measurement object configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| offsetMO SEQUENCE { |  |  |  |
| rsrpOffsetSSB | dB16 |  |  |
| } |  |  |  |

5.6.2.1.5 Test requirement

Table 5.6.2.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.1.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
| T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2 | Setup 3 as specified in clause A.9 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beamsNote 7 |  | Config 1,2 | Rough | | Rough | |
| NR RF Channel Number |  | Config 1,2 | 1 | | 2 | |
| Duplex mode |  | Config 1,2 | TDD | | TDD | |
| BWchannel | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | Config 1,2 | 66 | | 66 | |
| BWP BW | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2 | ULBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns |  | Config 1,2 | OP.1 | | OP.1 | |
| TRS configuration |  | Config 1,2 | TRS.2.1 TDD | | NA | |
| PDSCH/PDCCH TCI state |  | Config 1,2 | TCI.State.2 | | NA | |
| PDSCH Reference measurement channel |  | Config 1,2 | SR.3.1 TDD | | - | |
| RMSI CORESET Reference Channel |  | Config 1,2 | CR.3.1 TDD | | - | |
| Dedicated CORESET Reference Channel |  | Config 1,2 | CCR.3.1 TDD | | - | |
| SMTC configuration |  | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  |
| EPRE ratio of PBCH to PBCH DMRS |  |
| EPRE ratio of PDCCH DMRS to SSS |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |
| EPRE ratio of PDSCH DMRS to SSS |  |
| EPRE ratio of PDSCH to PDSCH |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |
| Ês | dBm/SCS | Config 1,2 | -87 | -87 | -Infinity | -87 |
| SSB-RP Note 3 | dBm/SCS Note5 | Config 1,2 | -87 | -87 | -Infinity | -87 |
| BB Note 8 | dB | Config 1,2 | 1.89 | 1.89 | -Infinity | 1.89 |
| IoNote3 | dBm/95.04 MHz Note5 | Config 1,2 | -58.01 | -58.01 | -Infinity | -58.01 |
| Propagation Condition |  | Config 1,2 | AWGN | | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: SSB-RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Void  NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in TS 38.133 [6] Annex B.2.1.3, and does not limit UE implementation or test system implementation.  NOTE 8: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [3] Table 6.2.1.3-4. | | | | | | |

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 5122 ms in this test for power class UE and 3202 ms for other power classes.

#### 5.6.2.2 EN-DC FR2-FR2 event-triggered reporting in DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.2.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.2.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Tests 3 and 4 are applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Tests 1 and 2 are applicable.

5.6.2.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.2.

5.6.2.2.4 Test description

5.6.2.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.2.4.1-1.

Table 5.6.2.2.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in DRX supported test configurations

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.6.2.2-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.2-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

Table 5.6.2.2.4-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | | | | Comment |
| Test 1 | Test 2 | Test 3 | Test 4 |
| E-UTRA RF Channel Number |  | Config 1,2 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell |  | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2 | 0 | | 13 | | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2 | 39 | | 39 | |  |
| SMTC-SSB parameters |  | Config 1,2 | SSB.3 FR2 | | | | As specified in clause A.3 |
| A3-Offset | dB | Config 1,2 | -12 | | | | Value modified by TT |
| Hysteresis | dB | Config 1,2 | 0 | | | |  |
| CP length |  | Config 1,2 | Normal | | | |  |
| TimeToTrigger | s | Config 1,2 | 0 | | | |  |
| Filter coefficient |  | Config 1,2 | 0 | | | | L3 filtering is not used |
| DRX |  | Config 1,2 | DRX.1 | DRX.7 | DRX.1 | DRX.7 | As specified in clause A.5 |
| Time offset between PCell and PSCell |  | Config 1,2 | 3 μs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,2 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | | | |  |
| T2 | s | Config 1,2 | 8 for PC1;  5 for other PC | 82 for PC1; 52 for other PC | 8 for PC1;  5 for other PC | 82 for PC1; 52 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.2.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.2.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.2.

3. The UE Rx beam peak direction for Cell 2 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.2.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.2.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.2.4.1-2. The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.2.4.1-2.

6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 7682 ms for UE supporting power class 1, or 4802 ms for UE supporting other power class for Test 1 and Test 3 and 81922 ms for UE supporting power class 1, or 51202 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

11. Repeat step 1-10 for each sub-test in Table 5.6.2.2.4.1-2 as appropriate.

5.6.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.2.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests without SSB time index detection in DRX test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ. For Test 3 and Test 4, with condition GAP NEEDED additionally.  Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells  Table H.3.1-4 with A3-offset = -12dB  Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 3 and Test 4  Table H.3.4-4 with Condition gapUE Test 1 and Test 2  Table H.3.4-5 with Condition Pattern #0 for Test 1 and Test 2  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.7-1 with Condition DRX.1 for Test 1 and Test 3  Table H.3.7-1 with Condition DRX.7 for Test 2 and Test 4  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

5.6.2.2.5 Test requirement

Table 5.6.2.2.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.2.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
| T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2 | Setup 1 as specified in clause A.9 | | | |
| Assumption for UE beamsNote 7 |  | Config 1,2 | Rough | | | |
| NR RF Channel Number |  | Config 1,2 | 1 | | 2 | |
| Duplex mode |  | Config 1,2 | TDD | | TDD | |
| BWchannel | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | Config 1,2 | 66 | | 66 | |
| BWP BW | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2 | ULBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns |  | Config 1,2 | OP.1 | | OP.1 | |
| TRS configuration |  | Config 1,2 | TRS.2.1 TDD | | NA | |
| TRS configuration |  | Config 1,2 | TRS.2.1 TDD | | NA | |
| PDSCH Reference measurement channel |  | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel |  | Config 1,2 | CR.3.1 TDD | | - | |
| SMTC configuration |  | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PSS to SSS |  |
| EPRE ratio of PBCH DMRS to SSS |  |
| EPRE ratio of PBCH to PBCH DMRS |  |
| EPRE ratio of PDCCH DMRS to SSS |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |
| EPRE ratio of PDSCH DMRS to SSS |  |
| EPRE ratio of PDSCH to PDSCH |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  | -104.7 | | -104.7 | |
| Note2 | dBm/15kHz Note5 |  | -104.7 | | -104.7 | |
| Note2 | dBm/SCS Note4 | Config 1,2 | -95.7 | -95.7 | -Infinity | -86.7 |
| SSB\_RP Note 3 | dBm/SCS Note5 | Config 1,2 | -89.7 | -89.7 | -Infinity | 9 |
|  | dB | Config 1,2 | 6 | 6 | -Infinity | 9 |
|  | dB | Config 1,2 | 6 | 6 | -66.7 | -57.2 |
| IoNote3 | dBm/95.04 MHz Note5 | Config 1,2 | -59.7 | | | |
| Propagation Condition | | | | | | |

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1, 2, 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 7682 ms for power class 1 UE and 4802 ms for other power classes in test 1 and 81922 for power class 1 UE and 51202 ms for other power classes in test 2.

#### 5.6.2.3 EN-DC FR2-FR2 event-triggered reporting in non-DRX with SSB time index detection

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.3.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Test 1 is applicable.

5.6.2.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.3.

5.6.2.3.4 Test description

5.6.2.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.3.4.1-1.

Table 5.6.2.3.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in non-DRX with SSB time index detection supported test configurations

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.6.2.3-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.3-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

Table 5.6.2.3.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | | Comment |
| Test 1 | Test 2 |
| E-UTRA RF Channel Number |  | Config 1,2 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2 | 1, 2 | | Two FR2 NR carrier frequencies is used. |
| Active cell |  | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2 | 0 | 13 | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2 | 39 | 39 |  |
| SMTC-SSB parameters |  | Config 1,2 | SSB. 3 FR2 | | As specified in clause A.3 |
| offsetMO | dB | Config 1,2 | 16 | | Applied to NR Cell 3 measurement object |
| A3-Offset | dB | Config 1,2 | -11 | |  |
| Hysteresis | dB | Config 1,2 | 0 | |  |
| CP length |  | Config 1,2 | Normal | |  |
| TimeToTrigger | s | Config 1,2 | 0 | |  |
| Filter coefficient |  | Config 1,2 | 0 | | L3 filtering is not used |
| DRX |  | Config 1,2 | OFF | | DRX is not used |
| Time offset between PCell and PSCell |  | Config 1,2 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,2 | 3μs | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | |  |
| T2 | s | Config 1,2 | 7 for PC1; 4.5 for other PC | 7 for PC1; 4.5 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.3.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.3.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and are set according to clause C.1.2 and clause C.1.3. Cell 3 is switched off during the initial connection setup.

3. The AoA setup for this test is Setup 3 as defined in clause A.9. The UE RX spherical coverage direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.2.3.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.3.4.1-1 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.3.4.1-1 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.3.4.1-2. The TE shall ensure that the NR FR2 cells are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [3] and relative angular offset between active probes are according to Table A.9.3-1. T1 starts.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.3.4.1-2. T2 starts.

6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 6722 ms for UE supporting power class 1, or 4162 ms for UE supporting other power class for Test 1 and Test 2, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = [(current cell 3 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. TE shall change the active probes in such way that relative angular offset between active probes differs in the following iteration.

10. The SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 10 fails, SS switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

12. Repeat step 1-11 for each sub-test in Table 5.6.2.3.4.1-2 as appropriate.

5.6.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.3.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests without SSB time index detection in non-DRX test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with condition INTER-FREQ. For Test 2, additionally with condition GAP NEEDED.  Table H.3.1-3 with conditions INTER-FREQ MO and and Synchronous cells  Table H.3.1-4 with condition SSB Index and A3-offset = -11dB  Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 2  Table H.3.4-4 with condition gapUE for Test 1  Table H.3.4-5 with condition Pattern #0 for Test 1  Table H.3.1-7 with condition SSB Index and INTER-FREQ  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

Table 5.6.2.3.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR2-FR2 measurement object configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| offsetMO SEQUENCE { |  |  |  |
| rsrpOffsetSSB | dB16 |  |  |
| } |  |  |  |

5.6.2.3.5 Test requirement

Table 5.6.2.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.3.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
| T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2 | Setup 3 as specified in clause A.3.9 | | | |
| AoA1 | | AoA2 | |
| Assumption for UE beamsNote 7 |  | Config 1,2 | Rough | | Rough | |
| NR RF Channel Number |  | Config 1,2 | 1 | | 2 | |
| Duplex mode |  | Config 1,2 | TDD | | TDD | |
| BWchannel | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | Config 1,2 | 66 | | 66 | |
| BWP BW | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2 | DLBWP.1.1 | | NA | |
| Initial UL BWP |  | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns |  | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel |  | Config 1,2 | SR.3.1 TDD | | - | |
| RMSI CORESET Reference Channel |  | Config 1,2 | CR.3.1 TDD | | - | |
| Dedicated CORESET Reference Channel |  | Config 1,2 | CCR.3.1 TDD | | - | |
| TRS configuration |  | Config 1,2 | TRS.2.1 TDD | | NA | |
| PDSCH/PDCCH TCI state |  | Config 1,2 | TCI.State.2 | | NA | |
| SMTC configuration |  | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  |
| EPRE ratio of PBCH to PBCH DMRS |  |
| EPRE ratio of PDCCH DMRS to SSS |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |
| EPRE ratio of PDSCH DMRS to SSS |  |
| EPRE ratio of PDSCH to PDSCH |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |
| Ês | dBm/SCS | Config 1 | -87 | -87 | -Infinity | -87 |
| SSB-RP Note 3 | dBm/SCS Note5 | Config 1,2 | -87 | -87 | -Infinity | -87 |
| BBNote8 | dB | Config 1,2 | 1.89 | 1.89 | -Infinity | 1.89 |
| IoNote3 | dBm/95.04 MHz Note5 | Config 1,2 | -58.01 | -58.01 | -Infinity | -58.01 |
| Propagation Condition |  | Config 1,2 | AWGN | | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: SSB-RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Void  NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in TS 38.133 [6] Annex B.2.1.3, and does not limit UE implementation or test system implementation  NOTE 8: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [3] Table 6.2.1.3-4. | | | | | | |

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 6722 ms in this test for power class UE and 4162 ms for other power classes.

#### 5.6.2.4 EN-DC FR2-FR2 event-triggered reporting in DRX with SSB time index detection

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.4.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.4.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Test 3 and Test 4 applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Tests 1 and 2 are applicable.

5.6.2.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.4.

5.6.2.4.4 Test description

5.6.2.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.4.4.1-1.

Table 5.6.2.4.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in DRX with SSB time index detection supported test configurations

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.6.2.4-1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.4-2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

Table 5.6.2.4.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

| Parameter | Unit | Test configuration | Value | | | | Comment |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test 1 | Test 2 | Test 3 | Test 4 |  |
| E-UTRA RF Channel Number |  | Config 1,2 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell |  | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2 | 0 | | 13 | | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2 | 39 | | 39 | |  |
| SMTC-SSB parameters |  | Config 1,2 | SSB.3 FR2 | | | | As specified in clause A.3 |
| A3-Offset | dB | Config 1,2 | -12 | | | | Value modified by TT |
| Hysteresis | dB | Config 1,2 | 0 | | | |  |
| CP length |  | Config 1,2 | Normal | | | |  |
| TimeToTrigger | s | Config 1,2 | 0 | | | |  |
| Filter coefficient |  | Config 1,2 | 0 | | | | L3 filtering is not used |
| DRX |  | Config 1,2 | DRX.1 | DRX.7 | DRX.1 | DRX.7 | As specified in clause A.5 |
| Time offset between PCell and PSCell |  | Config 1,2 | 3 μs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,2 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | | | |  |
| T2 | s | Config 1,2 | 11 for PC1; 6.5 for other PC | 108 for PC1; 67 for other PC | 11 for PC1; 6.5 for other PC | 108 for PC1; 67 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.4.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.4.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.4.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and are set according to clause C.1.2 and clause C.1.3. Cell 3 is switched off during the initial connection setup.

3. The UE Rx beam peak direction for Cell 2 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.4.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.4.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.4.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.4.4.1-2.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.4.4.1-2.

6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 10082 ms for UE supporting power class 1, or 6242 ms for UE supporting other power class for Test 1 and Test 3 and 107522 ms for UE supporting power class 1, or 66562 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.

8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

11. Repeat step 1-10 for each sub-test in Table 5.6.2.4.4.1-2 as appropriate.

5.6.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.4.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests with SSB time index detection in DRX test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with condition INTER-FREQ. For Test 3 and Test 4, additionally with condition GAP NEEDED  Table H.3.1-3 with conditions INTER-FREQ MO and and Synchronous cells  Table H.3.1-4 with condition SSB Index and A3-offset = -12dB  Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 3 and Test 4  Table H.3.4-4 with condition gapUE for Test 1 and Test 2  Table H.3.4-5 with condition Pattern #0 for Test 1 and Test 2  Table H.3.1-7 with condition SSB Index and INTER-FREQ  Table H.3.7-1 with condition DRX.1 for Test 1 and Test 3  Table H.3.7-1 with condition DRX.7 for Test 2 and Test 4  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

5.6.2.4.5 Test requirement

Table 5.6.2.4.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.4.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
| T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2 | Setup 1 as specified in clause A.3.9 | | | |
| Assumption for UE beamsNote 7 |  | Config 1,2 | Rough | | | |
| NR RF Channel Number |  | Config 1,2 | 1 | | 2 | |
| Duplex mode |  | Config 1,2 | TDD | | TDD | |
| BWchannel | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | Config 1,2 | 66 | | 66 | |
| BWP BW | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2 | DLBWP.1.1 | | NA | |
| Initial UL BWP |  | Config 1,2 | ULBWP.0.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns |  | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel |  | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel |  | Config 1,2 | CR.3.1 TDD | | - | |
| TRS configuration |  | Config 1,2 | TRS.2.1 TDD | | NA | |
| PDSCH/PDCCH TCI state |  | Config 1,2 | TCI.State.2 | | NA | |
| SMTC configuration |  | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  |
| EPRE ratio of PBCH to PBCH DMRS |  |
| EPRE ratio of PDCCH DMRS to SSS |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |
| EPRE ratio of PDSCH DMRS to SSS |  |
| EPRE ratio of PDSCH to PDSCH |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |
| Note2 | dBm/15kHz Note5 |  | -104.7 | | -104.7 | |
| Note2 | dBm/SCS Note4 | Config 1,2 | -95.7 | | -95.7 | |
| SSB\_RP Note 3 | dBm/SCS Note5 | Config 1,2 | -89.7 | -89.7 | -89.7 | -89.7 |
|  | dB | Config 1,2 | 6 | 6 | 6 | 6 |
|  | dB | Config 1,2 | 6 | 6 | 6 | 6 |
| IoNote3 | dBm/95.04 MHz Note5 | Config 1,2 | -59.7 | -59.7 | -59.7 | -59.7 |
| Propagation Condition |  | Config 1,2 | AWGN | | | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Void  NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in TS 38.133 Annex B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1, 2, 3 and 4 UE is required to report SSB time index.

NOTE 1: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

NOTE 2: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 10082 ms for power class 1 UE and 6242 ms for other power classes in test 1 and 107522 for power class 1 UE and 66562 ms for other power classes in test 2.

#### 5.6.2.5 EN-DC FR1-FR2 event-triggered reporting in non-DRX

Editor’s note: This test case is incomplete. The following aspects are either missing or TBD

- NR FR1 - FR2 OTA testability is still FFS.

5.6.2.5.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.5.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Test 1 is applicable.

5.6.2.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.5.

5.6.2.5.4 Test description

5.6.2.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.5.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.5.4.1-2. Test environment parameters are given in Table 5.6.2.5.4.1-3.

Table 5.6.2.5.4.1-1 EN-DC FR1-FR2 event triggered reporting tests in non-DRX supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Description of serving cell | Description of target cell |
| 5.6.2.5-1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.5-2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.5-3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 5.6.2.5-4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5.6.2.5-5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.5-6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | | |

Table 5.6.2.5.4-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | | Comment |
| Test 1 | Test 2 |
| E-UTRA RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1, 2 | | One FR1 and one FR2 NR carrier frequency is used. |
| Active cell |  | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2,3,4,5,6 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2,3,4,5,6 | 0 | 13 | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2,3,4,5,6 | 39 | 39 |  |
| SMTC-SSB parameters on NR RF Channel 1 |  | Config 1,4 | SSB.1 FR1 | | As specified in clause A.3 |
|  | Config 2,5 | SSB.1 FR1 | | As specified in clause A.3 |
|  | Config 3,6 | SSB.2 FR1 | | As specified in clause A.3 |
| SMTC-SSB parameters on NR RF Channel 2 |  | Config 1,2,3,4,5,6 | SSB.3 FR2 | | As specified in clause A.3 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | |  |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | |  |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | -105 | |  |
| CP length |  | Config 1,2,3,4,5,6 | Normal | |  |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | |  |
| Filter coefficient |  | Config 1,2,3,4,5,6 | 0 | | L3 filtering is not used |
| DRX |  | Config 1,2,3,4,5,6 | OFF | | DRX is not used |
| Time offset between PCell and PSCell |  | Config 1,2,3,4,5,6 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,4 | 3ms | | Asynchronous cells.  The timing of Cell 3 is 3ms later than the timing of Cell 2. |
|  | Config 2,3,5,6 | 3μs | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | |  |
| T2 | s | Config 1,2,3,4,5,6 | 5.2 for PC1; 3.5 for other PC | 5.2 for PC1; 3.5 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.5.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.5.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.5.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD

3. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.5.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.5.4.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.5.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.5.4.1-2. The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.5.4.1-2.

6. UE shall transmit a MeasurementReport message triggered by Event A4 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 5122 ms for UE supporting power class 1, or 3202 ms for UE supporting other power class for Test 1 and Test 2 then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement, then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),  
or:  
- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

11. Repeat step 1-10 for each sub-test in Table 4.6.2.1.4.1-2 as appropriate.

5.6.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.5.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests without SSB time index detection in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ. For Test 2, additionally with condition GAP NEEDED  Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells  Table H.3.1-4AA with A4-threshold = -105  Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 2  Table H.3.4-4 with Condition gapUE Test 1  Table H.3.4-5 with Condition Pattern #0 for Test 1  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

Table 5.6.2.5.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| offsetMO SEQUENCE { |  |  |  |
| rsrpOffsetSSB | 6 dB |  |  |
| } |  |  |  |

5.6.2.5.5 Test requirement

Table 5.6.2.5.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.5.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

| Parameter | Unit | Test | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | configuration | T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2,3,4,5,6 | NA | | Setup 1 | |
| Assumption for UE beamsNote 7 |  | Config 1,2,3,4,5,6 | N/A | | Rough | |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode |  | Config 1,4 | FDD | | TDD | |
|  |  | Config 2,3,5,6 | TDD | | TDD | |
| BWchannel | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| BWP BW | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
|  |  | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns |  | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference |  | Config 1,4 | SR.1.1 FDD | | - | |
| measurement channel |  | Config 2,5 | SR.1.1 TDD | |
|  |  | Config 3,6 | SR.2.1 TDD | |
| RMSI CORESET Reference |  | Config 1,4 | CR.1.1 FDD | | - | |
| Channel |  | Config 2,5 | CR.1.1 TDD | |
|  |  | Config 3,6 | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration |  | Config 1,4 | CCR.1.1 FDD | | CCR.3.1 TDD | |
|  | Config 2,5 | CCR.1.1 TDD | | CCR.3.1 TDD | |
|  | Config 3,6 | CCR.2.1 TDD | | CCR.3.1 TDD | |
| SMTC configuration |  | Config 1,4 | SMTC.2 | | SMTC.2 | |
|  |  | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
|  |  | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  | 1,2,3,4,5,6 |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | |  | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | |  | |
| Ês | dBm/SCS | Config 1,2,3,4,5,6 |  | | -Infinity | -87 |
| SSB\_RP Note 3 | dBm/SCS  Note5 | Config 1,2,3,4,5,6 |  | | -Infinity | -87 |
| BB Note 8 | dB | Config 1,2,3,4,5,6 | Link only, see clause A.6A | | -Infinity | 14.69 |
| IoNote3 | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 |  | | -Infinity | -58.01 |
| Propagation Condition |  | Config 1,2,3,4,5,6 |  | | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: SSB\_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Void.  NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation  NOTE 8: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | |

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 5122 ms in this test for power class UE and 3202 ms for other power classes.

#### 5.6.2.6 EN-DC FR1-FR2 event-triggered reporting in DRX

Editor’s note: This test case is incomplete. The following aspects are either missing or TBD

- NR FR1 - FR2 OTA testability is still FFS.

5.6.2.6.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event in DRX within inter-frequency cell search requirements.

5.6.2.6.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Tests 3 and 4 are applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Tests 1 and 2 are applicable.

5.6.2.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.6.

5.6.2.6.4 Test description

5.6.2.6.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.6.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.6.4.1-2. Test environment parameters are given in Table 5.6.2.6.4.1-3.

Table 5.6.2.6.4.1-1: EN-DC FR1-FR2 event triggered reporting tests in DRX supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Description of serving cell | Description of target cell |
| 5.6.2.6-1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.6-2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.6-3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 5.6.2.6-4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5.6.2.6-5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.6-6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | | |

Table 5.6.2.6.4-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

| Parameter | Unit | Test configuration | Value | | | | Comment |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test 1 | Test 2 | Test 3 | Test 4 |  |
| E-UTRA RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1, 2 | | | | One FR1 and one FR2 NR carrier frequency is used. |
| Active cell |  | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2,3,4,5,6 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2,3,4,5,6 | 0 | | 13 | | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2,3,4,5,6 | 39 | | 39 | |  |
| SMTC-SSB parameters on NR RF Channel 1 |  | Config 1,4 | SSB.1 FR1 | | | | As specified in clause A.3 |
|  | Config 2,5 | SSB.1 FR1 | | | | As specified in clause A.3 |
|  | Config 3,6 | SSB.2 FR1 | | | | As specified in clause A.3 |
| SMTC-SSB parameters on NR RF Channel 2 |  | Config 1,2,3,4,5,6 | SSB.3 FR2 | | | | As specified in clause A.3 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | | | |  |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | | |  |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | -105 | | | |  |
| CP length |  | Config 1,2,3,4,5,6 | Normal | | | |  |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | | |  |
| Filter coefficient |  | Config 1,2,3,4,5,6 | 0 | | | | L3 filtering is not used |
| DRX |  | Config 1,2,3,4,5,6 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | As specified in clause A.5 |
| Time offset between PCell and PSCell |  | Config 1,2,3,4,5,6 | 3 μs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,4 | 3ms | | | | Asynchronous cells.  The timing of Cell 3 is 3ms later than the timing of Cell 2. |
|  | Config 2,3,5,6 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | | |  |
| T2 | s | Config 1,2,3,4,5,6 | 8 for PC1;  5 for other PC | 82 for PC1; 52 for other PC | 8 for PC1;  5 for other PC | 82 for PC1; 52 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.6.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2 | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 4.6.2.3.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD

3. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.6.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.6.4-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.6.4-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.6.4-2. The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.6.4-2.

6. UE shall transmit a MeasurementReport message triggered by Event A4 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 7682 ms for UE supporting power class 1, or 4802 ms for UE supporting other power class for Test 1 and Test 3 and 81922 ms for UE supporting power class 1, or 51202 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement, then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),  
or:  
- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

11. Repeat step 1-10 for each sub-test in Table 5.6.2.6.4-2 as appropriate.

5.6.2.6.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.6.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests without SSB time index detection in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ. For Test 3 and 4, additionally with condition GAP NEEDED  Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells  Table H.3.1-4AA with A4-threshold = -105  Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 3 and Test 4  Table H.3.4-4 with Condition gapUE Test 1 and Test 2  Table H.3.4-5 with Condition Pattern #0 for Test 1 and Test 2  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.7-1 with Condition DRX.1 for Test 1 and Test 3  Table H.3.7-1 with Condition DRX.2 for Test 2 and Test 4  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

Table 5.6.2.6.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| offsetMO SEQUENCE { |  |  |  |
| rsrpOffsetSSB | 6 dB |  |  |
| } |  |  |  |

5.6.2.6.5 Test requirement

Table 5.6.2.6.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.6.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

| Parameter | Unit | Test | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | configuration | T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2,3,4,5,6 | NA | | Setup 1 as specified in clause A.9 | |
| Assumption for UE beamsNote 7 |  | Config 1,2,3,4,5,6 | N/A | | Rough | |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode |  | Config 1,4 | FDD | | TDD | |
|  |  | Config 2,3,5,6 | TDD | | TDD | |
| BWchannel | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| BWP BW | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
|  |  | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns |  | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference |  | Config 1,4 | SR.1.1 FDD | | - | |
| measurement channel |  | Config 2,5 | SR.1.1 TDD | |  | |
|  |  | Config 3,6 | SR2.1 TDD | |  | |
| RMSI CORESET Reference |  | Config 1,4 | CR.1.1 FDD | | - | |
| Channel |  | Config 2,5 | CR.1.1 TDD | |  | |
|  |  | Config 3,6 | CR2.1 TDD | |  | |
| Dedicated CORESET RMC configuration |  | Config 1,4 | CCR.1.1 FDD | | CCR.3.1 TDD | |
|  | Config 2,5 | CCR.1.1 TDD | | CCR.3.1 TDD | |
|  | Config 3,6 | CCR.2.1 TDD | | CCR.3.1 TDD | |
| SMTC configuration |  | Config 1,4 | SMTC.2 | | SMTC.2 | |
|  |  | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
|  |  | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  | 1,2,3,4,5,6 |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | |  | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | |  | |
| Note2 | dBm/15kHz Note5 |  |  | | -104.7 | |
| Note2 | dBm/SCS | Config 1,2,4,5 |  | | -95.7 | |
|  | Note4 | Config 3,6 |  | | -95.7 | |
| SSB\_RP Note 3 | dBm/SCS | Config 1,2,4,5 |  | | -Infinity | -86.7 |
|  | Note5 | Config 3,6 | NA | | -Infinity | -86.7 |
|  | dB | Config 1,2,3,4,5,6 | Link only, see clause A.6A | | -Infinity | 9 |
|  | dB | Config 1,2,3,4,5,6 |  | | -Infinity | 9 |
| IoNote3 | dBm/9.36MHz | Config 1,2,4,5 |  | | - | - |
|  | dBm/38.16MHz | Config 3,6 |  | | - | - |
|  | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 |  | | -66.7 | -57.2 |
| Propagation Condition |  | Config 1,2,3,4,5,6 |  | | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: SSB\_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with the confidence level of 95%.

In test 1, 2, 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 7682 ms for power class 1 UE and 4802 ms for other power classes in test 1 and test 3 and 81922 for power class 1 UE and 51202 ms for other power classes in test 2 and test 4.

#### 5.6.2.7 EN-DC FR1-FR2 event-triggered reporting in non-DRX with SSB time index detection

Editor’s note: This test case is incomplete. The following aspects are either missing or TBD

- NR FR1 - FR2 OTA testability is still FFS.

5.6.2.7.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements with SSB time index detection.

5.6.2.7.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Test 1 is applicable.

5.6.2.7.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.7.

5.6.2.7.4 Test description

5.6.2.7.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.7.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.7.4.1-2. Test environment parameters are given in Table 5.6.2.7.4.1-3.

Table 5.6.2.7.4.1-1: EN-DC FR1-FR2 event triggered reporting tests in non-DRX with SSB time index detection supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Description of serving cell | Description of target cell |
| 5.6.2.7-1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.7-2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.7-3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 5.6.2.7-4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5.6.2.7-5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.7-6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | | |

Table 5.6.2.7.4-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

| Parameter | Unit | Test configuration | Value | | Comment |
| --- | --- | --- | --- | --- | --- |
| Test 1 | Test 2 |
| E-UTRA RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1, 2 | | One FR1 and one FR2 NR carrier frequency is used. |
| Active cell |  | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2,3,4,5,6 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2,3,4,5,6 | 0 | 13 | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2,3,4,5,6 | 39 | 39 |  |
| SMTC-SSB parameters on NR RF Channel 1 |  | Config 1,4 | SSB.1 FR1 | | As specified in clause A.3 |
|  | Config 2,5 | SSB.1 FR1 | | As specified in clause A.3 |
|  | Config 3,6 | SSB.2 FR1 | | As specified in clause A.3 |
| SMTC-SSB parameters on NR RF Channel 2 |  | Config 1,2,3,4,5,6 | SSB.3 FR2 | | As specified in clause A.3 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | |  |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | |  |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | -105 | |  |
| CP length |  | Config 1,2,3,4,5,6 | Normal | |  |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | |  |
| Filter coefficient |  | Config 1,2,3,4,5,6 | 0 | | L3 filtering is not used |
| DRX |  | Config 1,2,3,4,5,6 | OFF | | DRX is not used |
| Time offset between PCell and PSCell |  | Config 1,2,3,4,5,6 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,4 | 3ms | | Asynchronous cells.  The timing of Cell 3 is 3ms later than the timing of Cell 2. |
|  | Config 2,3,5,6 | 3μs | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | |  |
| T2 | s | Config 1,2,3,4,5,6 | 7 for PC1; 4.5 for other PC | 7 for PC1; 4.5 for other PC | PC1 – power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.7.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2 | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.7.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.7.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD

3. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.7.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as Pcell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.7.4.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.7.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.7.4-2 The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.7.4.1-2.

6. UE shall transmit a MeasurementReport message triggered by Event A4 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 6722 ms for UE supporting power class 1, or 4162 ms for UE supporting other power class for Test 1 and Test 2 then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement, then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),  
or:  
- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

11. Repeat step 1-10 for each sub-test in Table 5.6.2.7.41.-2 as appropriate.

5.6.2.7.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.7.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests with SSB time index detection in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with conditions and INTER-FREQ. For Test 2, additionally with condition GAP NEEDED  Table H.3.1-3 with conditions INTER-FREQ MO and Synchronous cells  Table H.3.1-4AA with condition SSB Index and A4-threshold = -105  Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 2  Table H.3.4-4 with condition gapUE for Test 1  Table H.3.4-5 with condition Pattern #0 for Test 1  Table H.3.1-7 with condition SSB Index and INTER-FREQ  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3  Table H.3.1-4 A4 threshold = -105 |

Table 5.6.2.7.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| offsetMO SEQUENCE { |  |  |  |
| rsrpOffsetSSB | 6 dB |  |  |
| } |  |  |  |

5.6.2.7.5 Test requirement

Table 5.6.2.7.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.7.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

| Parameter | Unit | Test | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | configuration | T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2,3,4,5,6 | NA | | Setup 1 | |
| Assumption for UE beamsNote 7 |  | Config 1,2,3,4,5,6 | N/A | | Rough | |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode |  | Config 1,4 | FDD | | TDD | |
|  |  | Config 2,3,5,6 | TDD | | TDD | |
| BWchannel | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| BWP BW | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| OCNG Patterns |  | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference |  | Config 1,4 | SR.1.1 FDD | | - | |
| measurement channel |  | Config 2,5 | SR.1.1 TDD | |  | |
|  |  | Config 3,6 | SR.2.1 TDD | |  | |
| RMSI CORESET Reference |  | Config 1,4 | CR.1.1 FDD | | - | |
| Channel |  | Config 2,5 | CR.1.1 TDD | |  | |
|  |  | Config 3,6 | CR.2.1 TDD | |  | |
| Dedicated CORESET RMC configuration |  | Config 1,4 | CCR.1.1 FDD | | CCR.3.1 TDD | |
|  | Config 2,5 | CCR.1.1 TDD | | CCR.3.1 TDD | |
|  | Config 3,6 | CCR.2.1 TDD | | CCR.3.1 TDD | |
| TDD configuration |  | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
|  |  | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| SMTC configuration |  | Config 1,4 | SMTC.2 | | SMTC.2 | |
|  |  | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
|  |  | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  | 1,2,3,4,5,6 |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | |  | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | |  | |
| Ês | dBm/SCS | Config 1,2,3,4,5,6 |  | | -Infinity | -87 |
| SSB\_RP Note 3 | dBm/SCS  Note5 | Config 1,2,3,4,5,6 |  | | -Infinity | -87 |
| BB Note 8 | dB | Config 1,2,3,4,5,6 | Link only, see clause A.6A | | -Infinity | 14.69 |
| IoNote3 | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 |  | | -Infinity | -58.01 |
| Propagation Condition |  | Config 1,2,3,4,5,6 |  | | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: SS-RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Void  NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation  NOTE 8: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [19] Table 6.2.1.3-4. | | | | | | |

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 6722 ms in this test for power class UE and 4162 ms for other power classes.

#### 5.6.2.8 EN-DC FR1-FR2 event-triggered reporting in DRX with SSB time index detection

Editor’s note: This test case is incomplete. The following aspects are either missing or TBD:

- NR FR1 - FR2 OTA testability is still FFS.

5.6.2.8.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event in DRX within inter-frequency cell search requirements with SSB time index detection.

5.6.2.8.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Tests 3 and 4 are applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13, otherwise Tests 1 and 2 are applicable.

5.6.2.8.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.

5.6.2.8.5.6.2.8.4 Test description

5.6.2.8.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.8.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.8.4.1-2. Test environment parameters are given in Table 5.6.2.8.4.1-3.

Table 5.6.2.8.4.1-1: EN-DC FR1-FR2 event triggered reporting tests in DRX with SSB time index detection supported test configurations

|  |  |  |
| --- | --- | --- |
| Test Case ID | Description of serving cell | Description of target cell |
| 5.6.2.8-1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 5.6.2.8-2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.8-3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 5.6.2.8-4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5.6.2.8-5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 5.6.2.8-6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| NOTE 1: The UE is only required to be tested in one of the supported test configurations  NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | | |

Table A.5.6.2.8.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

| Parameter | Unit | Test configuration | Value | | | | Comment |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test 1 | Test 2 | Test 3 | Test 4 |  |
| E-UTRA RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1, 2 | | | | One FR1 and one FR2 NR carrier frequency is used. |
| Active cell |  | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2,3,4,5,6 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2,3,4,5,6 | 0 | | 13 | | As specified in TS 38.133 clause 9.1.2-1. |
| Measurement gap offset |  | Config 1,2,3,4,5,6 | 39 | | 39 | |  |
| SMTC-SSB parameters on NR RF Channel 1 |  | Config 1,4 | SSB.1 FR1 | | | | As specified in clause A.3 |
|  | Config 2,5 | SSB.1 FR1 | | | | As specified in clause A.3 |
|  | Config 3,6 | SSB.2 FR1 | | | | As specified in clause A.3 |
| SMTC-SSB parameters on NR RF Channel 2 |  | Config 1,2,3,4,5,6 | SSB.3 FR2 | | | | As specified in clause A.3 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | | | |  |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | | |  |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | -105 | | | |  |
| CP length |  | Config 1,2,3,4,5,6 | Normal | | | |  |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | | |  |
| Filter coefficient |  | Config 1,2,3,4,5,6 | 0 | | | | L3 filtering is not used |
| DRX |  | Config 1,2,3,4,5,6 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | As specified in clause A.5 |
| Time offset between PCell and PSCell |  | Config 1,2,3,4,5,6 | 3 μs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,4 | 3ms | | | | Asynchronous cells.  The timing of Cell 3 is 3ms later than the timing of Cell 2. |
|  | Config 2,3,5,6 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | | |  |
| T2 | s | Config 1,2,3,4,5,6 | 11 for PC1; 6.5 for other PC | 108 for PC1; 67 for other PC | 11 for PC1; 6.5 for other PC | 108 for PC1; 67 for other PC | PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0 |

Table 5.6.2.8.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2 | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.2.8.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.2.8.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD.

3. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.8.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.8.4.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.8.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to T1 in Table 5.6.2.8.4-2 The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts,

3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.

5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.8.4.1-2.

6. UE shall transmit a MeasurementReport message triggered by Event A4 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 10082 ms for UE supporting power class 1, or 6242 ms for UE supporting other power class for Test 1 and Test 3 and 107522 ms for UE supporting power class 1, or 66562 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement, then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),  
or:  
- switches off and on the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

11. Repeat step 1-10 for each sub-test in Table 5.6.2.8.4.1-2 as appropriate.

5.6.2.8.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.2.8.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests with SSB time index detection in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with condition INTER-FREQ. For Test 3 and 4, additionally with condition GAP NEEDED  Table H.3.1-3 with conditions INTER-FREQ MO and Synchronous cells  Table H.3.1-4AA with condition SSB Index and A4-threshold = -105  Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 3 and Test 4  Table H.3.4-4 with condition gapUE for Test 1 and Test 2  Table H.3.4-5 with condition Pattern #0 for Test 1 and Test 2  Table H.3.1-7 with condition SSB Index and INTER-FREQ  Table H.3.7-1 with condition DRX.1 for Test 1 and Test 3  Table H.3.7-1 with condition DRX.2 for Test 2 and Test 4  Table H.3.4-1  Table H.3.4-2  Table H.3.4-3 |

Table 5.6.2.5.8.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table H.3.1-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| MeasObjectNR::= SEQUENCE { |  |  |  |
| offsetMO SEQUENCE { |  |  |  |
| rsrpOffsetSSB | 6 dB |  |  |
| } |  |  |  |

5.6.2.8.5 Test requirement

Table 5.6.2.8.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.8.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | T1 | T2 | T1 | T2 |
| AoA setup |  | Config 1,2,3,4,5,6 | NA | | Setup 1 as specified in clause A.9 | |
| Assumption for UE beamsNote 7 |  | Config 1,2,3,4,5,6 | N/A | | Rough | |
| NR RF Channel Number |  | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode |  | Config 1,4 | FDD | | TDD | |
|  |  | Config 2,3,5,6 | TDD | | TDD | |
| BWchannel | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| BWP BW | MHz | Config 1,4 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 2,5 | 10: NRB,c = 52 | | 100: NRB,c = 66 | |
|  |  | Config 3,6 | 40: NRB,c = 106 | | 100: NRB,c = 66 | |
| OCNG Patterns |  | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel |  | Config 1,4 | SR.1.1 FDD | | - | |
|  |  | Config 2,5 | SR.1.1 TDD | |
|  |  | Config 3,6 | SR2.1 TDD | |
| RMSI CORESET Reference Channel |  | Config 1,4 | CR.1.1 FDD | | - | |
|  |  | Config 2,5 | CR.1.1 TDD | |
|  |  | Config 3,6 | CR2.1 TDD | |
| Dedicated CORESET RMC configuration |  | Config 1,4 | CCR.1.1 FDD | | CCR.3.1 TDD | |
|  | Config 2,5 | CCR.1.1 TDD | | CCR.3.1 TDD | |
|  | Config 3,6 | CCR.2.1 TDD | | CCR.3.1 TDD | |
| TDD configuration |  | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
|  |  | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.0.1 | | NA | |
| Dedicated DL BWP |  | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| SMTC configuration |  | Config 1,4 | SMTC.2 | | SMTC.2 | |
|  |  | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
|  |  | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | |  | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | |  | |
| Note2 | dBm/15kHz Note5 |  | NA  Link only, see clause A.6A | | -104.7 | |
| Note2 | dBm/SCS Note4 | Config 1,2,4,5 |  | | -95.7 | |
|  |  | Config 3,6 |  | | -95.7 | |
| SSB\_RP Note 3 | dBm/SCS Note5 | Config 1,2,4,5 |  | | -Infinity | -86.7 |
|  |  | Config 3,6 |  | | -Infinity | -86.7 |
|  | dB | Config 1,2,3,4,5,6 |  | | -Infinity | 9 |
|  | dB | Config 1,2,3,4,5,6 |  | | -Infinity | 9 |
| IoNote3 | dBm/9.36MHz | Config 1,2,4,5 |  | | - | - |
|  | dBm/38.16MHz | Config 3,6 |  | | - | - |
|  | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 |  | | -66.7 | -57.2 |
| Propagation Condition |  | Config 1,2,3,4,5,6 |  | | AWGN | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: SSB\_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 7: Information about types of UE beam is given in 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

In test 1, 2, 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 10082 ms for power class 1 UE and 6242 ms for other power classes in test 1 and test 3 and 107522 for power class 1 UE and 66562 ms for other power classes in test 2 and test 4.

### 5.6.3 L1-RSRP measurement for beam reporting

#### 5.6.3.0 Minimum conformance requirements

##### 5.6.3.0.1 Minimum conformance requirements for SSB-based L1-RSRP measurement for beam reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB.

The value of TL1-RSRP\_Measurement\_Period\_SSB is defined in Table 9.5.4.1-2 for FR2, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- N= 8.

For FR2,

- P=, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- P=, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- P is , when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- P=, when SSB is partially overlapped with measurement gap (TSSB <MGRP) and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is , when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- Psharing factor = 3, otherwise.

Where:

- TSSB = ssb-periodicityServingCell

- TSMTCperiod = the configured SMTC period

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 9.5.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5 K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| NOTE 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: K = 1 when TSSB ≤ 40 ms and RRM enhancements for high speed are configured; otherwise K = 1.5. | |

Table 9.5.4.1-2: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| NOTE: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. | |

The normative reference for this requirement is TS 38.133 [6] clause 9.5.3.1, 9.5.4.1 and 9.5.5.1.

##### 5.6.3.0.2 Minimum conformance requirements for CSI-RS-based L1-RSRP measurement for beam reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_CSI-RS.

The value of TL1-RSRP\_Measurement\_Period\_CSI-RS is defined in Table 9.5.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- For aperiodic CSI-RS resources M=1

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For FR2,

- P=1, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- P=, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P=Psharing factor, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with measurement gap (TCSI-RS < MGRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the CSI-RS configured for L1-RSRP measurement outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured

- Psharing factor = 3, otherwise.

Where:

TSMTCperiod = the configured SMTC period.

TCSI-RS = the periodicity of CSI-RS configured for L1-RSRP measurement

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 9.5.4.2-2: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. | |

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.2.1.2 in TS 38.214 [26].

For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM/BFD/CBD/L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM/BFD/L1-RSRP measurement, or in the same symbol as SSB for CBD when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM/BFD/CBD/L1-RSRP measurement,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

- The CSI-RS for L1-RSRP measurement or the other CSI-RS in a resource set configured with repetition ON, or

- The other CSI-RS is configured in q1 and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clauses 9.5.3.1, 9.5.4.2 and 9.5.5.2.

#### 5.6.3.1 EN-DC FR2 SSB-based L1-RSRP measurement in non-DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.3.1.1 Test purpose

To verify that the UE makes correct reporting of L1-RSRP measurement in non-DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.1.

5.6.3.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC.

5.6.3.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.1.

5.6.3.1.4 Test description

5.6.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.1.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.1.4.1-2. Test environment parameters are given in Table 5.6.3.1.4.1-3.

Table 5.6.3.1.4.1-1: EN-DC SSB based L1-RSRP measurement supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Table 5.6.3.1.4.1-2: General test parameters for EN-DC SSB based L1-RSRP measurement

| Parameter | Config | Unit | Value |
| --- | --- | --- | --- |
| SSB GSCN | 1~4 |  | freq1 |
| 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 Reference measurement 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 |
| SSB configuration | 1,2 |  | SSB.1 FR2 |
| 3,4 | SSB.2 FR2 |
| OCNG Patterns | 1~4 |  | OP.1 |
| Initial BWP Configuration | 1~4 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~4 |  | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~4 |  | SMTC.1 |
| TRS Configuration | 1~4 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~4 |  | TCI.State.2 |
| DRX configuration | 1~4 |  | Off |
| reportConfigType | 1~4 |  | periodic |
| reportQuantity | 1~4 |  | ssb-Index-RSRP |
| Number of reported RS | 1~4 |  | 2 |
| L1-RSRP reporting period | 1~4 | slot | 320 |
| T1 | 1~4 | s | 5 |
| T2 | 1~4 | s | 2 |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition | 1~4 |  | AWGN |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.3.1.4.1-3: Test Environment parameters for EN-DC SSB based L1-RSRP measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.3.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.6.3.1.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.6.3.1.4.1-2. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.6.3.1.4.1-2. SSB#1 shall be muted during this step.

2. Set the parameters according to T1 in Table 5.6.3.1.5-1.

3. T1 starts. The UE shall be transmitting CSI on PUCCH with a periodicity of 320 slots.

4. When T1 expires, the SS shall set the parameters according to T2 in 5.6.3.1.5-1. T2 starts.

5. The UE shall start sending valid L1-RSRP reports. The SS shall check the following requirements:

- R1: the UE shall start to transmit valid L1-RSRP reports no later than 1760ms for UE supporting power class 1 in configuration 1 and 2, no later than 1720 ms for UE supporting power class 1 in configuration 3 and 4 , no later than 1280 ms for UE supporting power class other than 1 in configuration 1 and 2, no later than 1240 ms for UE supporting power class other than 1 in configuration 3 and 4 from the beginning of time period T2. A valid report shall meet the absolute L1-RSRP requirement for SSB#1 Table 5.6.3.1.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.1.5-3 for test configurations 3 and 4. If the first valid report is received before the specified time, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the UE shall transmit L1-RSRP reports every 320 slots. If the reports are received accordingly, the number of passed iterations for R2 is increased by one. Otherwise, the number of failed iterations for R2 is increased by one.

-R3: The L1-RSRP value of SSB#1 reported by the UE is compared to the expected L1-RSRP value for SSB#1. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding absolute accuracy requirements in Table 5.6.3.1.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.1.5-3 for test configurations 3 and 4 the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

-R4: The DIFF-RSRP value of SSB#0 reported by the UE is compared to the expected DIFF-RSRP value. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding relative accuracy requirements in Table 5.6.3.1.5-4 for all test configurations, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

6. The SS waits until T2 expires.

7. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

8. Set the parameters according to T1 in Table 5.6.3.1.5-1. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

9. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat steps 3-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.3.1.4.3-1: Common Exception messages EN-DC SSB based L1-RSRP measurement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6-2 with conditions PERIODIC and SS-RSRP  Table H.3.6-3 with condition SSB  Table H.3.6-10  Table H.3.4-1 |

Table 5.6.3.1.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.6.3.1.5 Test requirement

Table 5.6.3.1.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.1.5-1: SSB specific test parameters for EN-DC SSB based L1-RSRP measurement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | SSB#0 | | SSB#1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9 | | | |
| Assumption for UE beamsNote 4 | 1~4 |  | Rough | | | |
| Note2 | 1~4 | dBm/15kHz | -105 | | | |
| Note2 | 1,2 | dBm/SSB SCS | -96 | | | |
| 3,4 | -93 | | | |
|  | 1~4 | dB | 0 | 0 | -Infinity | 9 |
| SSB\_RP Note3 | 1,2 | dBm/SSB SCS | -96 | -96 | -Infinity | -87 |
| 3,4 | -93 | -93 | -Infinity | -84 |
| Io Note3 | 1,2 | dBm/95.04MHz | -63.97 | -63.97 | -66.98 | -57.47 |
| 3,4 | -63.97 | -63.97 | -66.98 | -57.47 |
|  | 1~4 | dB | 0 | 0 | -Infinity | 9 |
| NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: Information about types of UE beam is given in TS 38.133 Annex B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 1680 for UE supporting power class 1

- 1200 for UE supporting power class 2, 3 or 4.

Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.1.5-2 for for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.1.5-3 for test configurations 3 and 4 and the corresponding relative accuracy requirements in Table 5.6.3.1.5-4 for all test configurations.

Table 5.6.3.1.5-2: L1-RSRP absolute accuracy requirements for the reported values for test configurations 1 and 2 (R1 and R3)

|  |  |  |
| --- | --- | --- |
| Normal Conditions | T1 | T2 |
| Lowest reported value (SSB#1) | - | 40 |
| Highest reported value (SSB#1) | - | 99 |

Table 5.6.3.1.5-3: L1-RSRP absolute accuracy requirements for the reported values for test configurations 3 and 4 (R1 and R3)

|  |  |  |
| --- | --- | --- |
| Normal Conditions | T1 | T2 |
| Lowest reported value (SSB#1) | - | 43 |
| Highest reported value (SSB#1) | - | 102 |

Table 5.6.3.1.5-4: L1-RSRP relative accuracy requirements for the reported values for all test configurations (R4)

|  |  |  |
| --- | --- | --- |
|  | T1 | T2 |
| Lowest DIFF RSRP reported (SSB#0) | - | 1 |
| Highest DIFF RSRP reported (SSB#0) | - | 7 |

For the test to pass, the ratio of successful reported valued for each requirement (R1 to R4) shall be at least 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.6.3.2 EN-DC FR2 SSB-based L1-RSRP measurement in DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.3.2.1 Test purpose

To verify that the UE makes correct reporting of L1-RSRP measurement in DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.1.

5.6.3.2.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle.

5.6.3.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.2.

5.6.3.2.4 Test description

5.6.3.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.2.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.2.4.1-2. Test environment parameters are given in Table 5.6.3.2.4.1-3.

Table 5.6.3.2.4.1-1: EN-DC SSB based L1-RSRP measurement in DRX supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Table 5.6.3.2.4.1-2: General test parameters for EN-DC SSB based L1-RSRP measurement in DRX

| Parameter | Config | Unit | Value |
| --- | --- | --- | --- |
| SSB GSCN | 1~4 |  | freq1 |
| 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 Reference measurement 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 |
| SSB configuration | 1,2 |  | SSB.1 FR2 |
| 3,4 | SSB.2 FR2 |
| OCNG Patterns | 1~4 |  | OP.1 |
| Initial BWP Configuration | 1~4 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~4 |  | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~4 |  | SMTC.1 |
| TRS Configuration | 1~4 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~4 |  | TCI.State.2 |
| DRX configuration | 1~4 |  | DRX.3 |
| reportConfigType | 1~4 |  | periodic |
| reportQuantity | 1~4 |  | ssb-Index-RSRP |
| Number of reported RS | 1~4 |  | 2 |
| L1-RSRP reporting period | 1~4 | slot | 320 |
| T1 | 1~4 | s | 5 |
| T2 | 1~4 | s | 3 |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition | 1~4 |  | AWGN |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.3.2.4.1-3: Test Environment parameters for EN-DC SSB based L1-RSRP measurement in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.3.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.6.3.2.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.2.4.2 Test procedure

Same as in 5.6.3.1.4.2 with the following exception:

5. The UE shall start sending valid L1-RSRP reports. The SS shall check the following requirements:

- R1: the UE shall start to transmit valid L1-RSRP reports no later than 2960ms for UE supporting power class 1 in configuration 1 and 2, no later than 2920ms for UE supporting power class 1 in configuration 3 and 4 , no later than 2000ms for UE supporting power class other than 1 in configuration 1 and 2, no later than 1960 ms for UE supporting power class other than 1 in configuration 3 and 4 from the beginning of time period T2. A valid report shall meet the absolute L1-RSRP requirement for SSB#1 Table 5.6.3.2.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.2.5-3 for test configurations 3 and 4. If the first valid report is received before the specified time, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the UE shall transmit L1-RSRP reports every 320 slots. If the reports are received accordingly, the number of passed iterations for R2 is increased by one. Otherwise, the number of failed iterations for R2 is increased by one.

-R3: The L1-RSRP value of SSB#1 reported by the UE is compared to the expected L1-RSRP value for SSB#1. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding absolute accuracy requirements in Table 5.6.3.2.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.2.5-3 for test configurations 3 and 4 the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

-R4: The DIFF-RSRP value of SSB#0 reported by the UE is compared to the expected DIFF-RSRP value. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding relative accuracy requirements in Table 5.6.3.2.5-4 for all test configurations, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

5.6.3.2.4.3 Message contents

Same message content as in subclause 5.6.3.1.4.3 with the following exception:

Table 5.6.3.2.4.3-1: Common Exception messages EN-DC SSB based L1-RSRP measurement in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.7-1 with condition DRX.3 |

5.6.3.2.5 Test requirement

Table 5.6.3.2.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.2.5-1: SSB specific test parameters for EN-DC SSB based L1-RSRP measurement in DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | SSB#0 | | SSB#1 | |
| T1 | T2 | T1 | T2 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9 | | | |
| Assumption for UE beamsNote 4 | 1~4 |  | Rough | | | |
| Note2 | 1~4 | dBm/15kHz | -105 | | | |
| Note2 | 1,2 | dBm/SSB SCS | -96 | | | |
| 3,4 | -93 | | | |
|  | 1~4 | dB | 0 | 0 | -Infinity | 9 |
| SSB\_RP Note3 | 1,2 | dBm/SSB SCS | -96 | -96 | -Infinity | -87 |
| 3,4 | -93 | -93 | -Infinity | -84 |
| Io Note3 | 1,2 | dBm/95.04MHz | -63.97 | -63.97 | -66.98 | -57.47 |
| 3,4 | -63.97 | -63.97 | -66.98 | -57.47 |
|  | 1~4 | dB | 0 | 0 | -Infinity | 9 |
| NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 3: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1

- 1920 for UE supporting power class 2,3 or 4.

Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.2.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.2.5-3 for test configurations 3 and 4 and the corresponding relative accuracy requirements in Table 5.6.3.2.5-4 for all test configurations.

Table 5.6.3.2.5-2: L1-RSRP absolute accuracy requirements for the reported values for test configurations 1 and 2 (R1 and R3)

|  |  |  |
| --- | --- | --- |
| Normal Conditions | T1 | T2 |
| Lowest reported value (SSB#1) | - | 40 |
| Highest reported value (SSB#1) | - | 99 |

Table 5.6.3.2.5-3: L1-RSRP absolute accuracy requirements for the reported values for test configurations 3 and 4 (R1 and R3)

|  |  |  |
| --- | --- | --- |
| Normal Conditions | T1 | T2 |
| Lowest reported value (SSB#1) | - | 43 |
| Highest reported value (SSB#1) | - | 102 |

Table 5.6.3.2.5-4: L1-RSRP relative accuracy requirements for the reported values for all test configurations (R4)

|  |  |  |
| --- | --- | --- |
|  | T1 | T2 |
| Lowest DIFF RSRP reported (SSB#0) | - | 1 |
| Highest DIFF RSRP reported (SSB#0) | - | 7 |

For the test to pass, the ratio of successful reported valued for each requirement (R1 to R4) shall be at least 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.6.3.3 EN-DC FR2 CSI-RS-based L1-RSRP measurement in non-DRX

Editor’s Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.3.3.1 Test purpose

To verify that the UE makes correct reporting of CSI-RS-based L1-RSRP measurement in non-DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.2.

5.6.3.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC.

5.6.3.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 4.6.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.3.

5.6.3.3.4 Test description

5.6.3.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.3.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.3.4.1-2. Test environment parameters are given in Table 5.6.3.3.4.1-3.

Table 5.6.3.3.4.1-1: EN-DC FR2 CSI-RS based L1-RSRP measurement supported test configurations

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

Table 5.6.3.3.4.1-2: General test parameters for EN-D FR2 C CSI-RS based L1-RSRP measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Value |
| SSB GSCN | 1~2 |  | freq1 |
| Duplex mode | 1~2 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 |
| Data RBs allocated | 1~2 |  | 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.3 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.2 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.7 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 |
| CSI-RS configuration | 1~2 |  | CSI-RS.3.3 TDD |
| OCNG Patterns | 1~2 |  | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.1  ULBWP.1.1 |
| SMTC configuration | 1~2 |  | SMTC.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 |
| DRX configuration | 1~2 |  | Off |
| reportConfigType | 1~2 |  | aperiodic |
| reportQuantity | 1~2 |  | cri-RSRP |
| Number of reported RS | 1~2 |  | 2 |
| qcl-Info | 1~2 |  | SSB#0 for resource#0 |
| SSB#1 for resource#1 |
| reportSlotOffsetList | 1~2 |  | 8 |
| Propagation condition | 1~2 |  | AWGN |
| T1 | 1~2 | s | 5 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.3.3.4.1-3: Test Environment parameters for EN-DC FR2 CSI-RS L1-RSRP measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.3.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.3.3.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.3.4.2 Test procedure

The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. UE is also configured to measure L1-RSRP based on SSB. Upon receiving the DCI trigger, UE provides the report back based on the reporting configuration as defined in table 5.6.3.3.4.1-2.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.3.3.5-1. T1 starts.
3. After 480ms from the start of the test the SS transmits the DCI trigger in slot 1.
4. The SS shall check following requirements:

- R1: the UE shall send L1-RSRP report at slot 9 from the reception of DCI trigger. If the report is received at slot 9 from the reception of DCI trigger, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the L1-RSRP value of CSI-RS#1 reported by the UE is compared to the expected L1-RSRP value for CSI-RS #1. If the resulting value is outside the limits in Table 5.6.3.3.5-2 or the UE fails to report the measurement value for CSI-RS #1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

-R3: The DIFF RSRP value of CSI-RS #0 reported by the UE is compared to the expected DIFF RSRP value. If the resulting value is outside the limits in Table 5.6.3.3.5-33 or the UE fails to report the measurement value for CSI-RS #0, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

1. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

8. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

9. Repeat steps 2-8 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.3.3.4.3-1: Common Exception messages EN-DC CSI-RS based L1-RSRP measurement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6-2 with conditions APERIODIC and CSI-RSRP  Table H.3.6-3 with conditions CSI-RS and APERIODIC  Table H.3.4-1 |

Table 5.6.3.3.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| } |  |  |  |
| } |  |  |  |

Table 5.6.3.3.4.3-3: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 7.2.2.1-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | For 120KHz SCS:  K1 = N/A if mod(i,5) = 2   * PDSCH not scheduled (K1=2 and K1=12 are the possible settings to fall into a different UL slot than CSI Report. But K1=12 is not defined in RRC and K1=12 > PdschNumHarq Process=8. For K1=2, according to TS38.214 Table 5.3-1, considering PDSCH processing time and PUCCH resource index (symbol#0,1), it is better to use different UL slot)   K1 = N/A if mod(i,5) = 0   * PDSCH not scheduled (K1=9 is the only possible setting to fall into a different UL slot than CSI Report but K1=9 > PdschNumHarq Process=8)   K1 = 8 if mod(i,5) = 1  where i is slot index per frame; i = {2,5,6} | - | FR2 |

5.6.3.3.5 Test requirement

Table 5.6.3.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.3.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-RS L1-RSRP measurement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | CSI-RS#0 | CSI-RS#1 |
| Angle of arrival configuration | 1~2 |  | Setup 1 according to A.9 | |
| Assumption for UE beamsNote 3 | 1~2 |  | Rough | |
| Note1 | 1~2 | dBm/15kHz | -105 | |
| Note1 | 1~2 | dBm/SSB SCS | -95.97 | |
|  | 1~2 | dB | 0 | 9 |
| CSI-RS RSRP Note2 | 1~2 | dBm/SSB SCS | -95.97 | -86.97 |
| Io Note2 | 1~2 | dBm/95.04MHz | -63.97 | -57.47 |
|  | 1~2 | dB | 0 | 9 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

After 480ms from the beginning of the test, the UE shall send L1-RSRP report at slot 9 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1. Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.3.5-2 the corresponding relative accuracy requirements in Table 5.6.3.3.5-3.

Table 5.6.3.3.5-2: L1-RSRP absolute accuracy requirements for the reported values R2

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#1) | 40 |
| Highest reported value (CSI-RS#1) | 99 |

Table 5.6.3.3.5-3: L1-RSRP relative accuracy requirements for the reported values R3

|  |  |
| --- | --- |
|  | T1 |
| Lowest DIFF RSRP reported (CSI-RS#0) | 1 |
| Highest DIFF RSRP reported (CSI-RS#0) | 7 |

The rate of correct events observed during repeated tests (R1 to R3) shall be at least 90% with a confidence level of 95%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### 5.6.3.4 EN-DC FR2 CSI-RS-based L1-RSRP measurement in DRX

Editor’s Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.3.4.1 Test purpose

To verify that the UE makes correct reporting of CSI-RS-based L1-RSRP measurement in non-DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.2.

5.6.3.4.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle.

5.6.3.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 4.6.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.4

5.6.3.4.4 Test description

5.6.3.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.3.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.3.4.1-2. Test environment parameters are given in Table 5.6.3.3.4.1-3.

Table 5.6.3.4.4.1-1: EN-DC FR2 CSI-RS based L1-RSRP measurement in DRX supported test configurations

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

Table 5.6.3.4.4.1-2: General test parameters for EN-D FR2 C CSI-RS based L1-RSRP measurement in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Value |
| SSB GSCN | 1~2 |  | freq1 |
| Duplex mode | 1~2 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 |
| Data RBs allocated | 1~2 |  | 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.3 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.2 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.7 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 |
| CSI-RS configuration | 1~2 |  | CSI-RS.3.3 TDD |
| OCNG Patterns | 1~2 |  | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.1  ULBWP.1.1 |
| SMTC configuration | 1~2 |  | SMTC.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 |
| DRX configuration | 1~2 |  | DRX.3 |
| reportConfigType | 1~2 |  | aperiodic |
| reportQuantity | 1~2 |  | cri-RSRP |
| Number of reported RS | 1~2 |  | 2 |
| qcl-Info | 1~2 |  | SSB#0 for resource#0 |
| SSB#1 for resource#1 |
| reportSlotOffsetList | 1~2 |  | 8 |
| Propagation condition | 1~2 |  | AWGN |
| T1 | 1~2 | s | 5 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.3.4.4.1-3: Test Environment parameters for EN-DC FR2 CSI-RS L1-RSRP measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.3.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram |  | |  |

1. Message contents are defined in clause 5.6.3.3.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.4.4.2 Test procedure

Same test procedure as in subclause 5.6.3.3.4.2 with tables 5.6.3.3.4.1-2 and 5.6.3.3.5-1 replaced by tables 5.6.3.4.4.1-2 and 5.6.3.4.5-1 and following change in step 3.

1. After 1440ms from the start of the test the SS transmits the DCI trigger in slot 1.

5.6.3.4.4.3 Message contents

Same message content as in subclause 5.6.3.3.4.3 with the following exception:

Table 5.6.3.4.4.3-1: Common Exception messages EN-DC CSI-RS based L1-RSRP measurement in DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.7-1 with condition DRX.3 and Offset |

5.6.3.4.5 Test requirement

Table 5.6.3.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.4.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-RS L1-RSRP measurement in DRX

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | CSI-RS#0 | CSI-RS#1 |
| Angle of arrival configuration | 1~2 |  | Setup 1 according to A.9 | |
| Assumption for UE beamsNote 3 | 1~2 |  | Rough | |
| Note1 | 1~2 | dBm/15kHz | -105 | |
| Note1 | 1~2 | dBm/SSB SCS | -95.97 | |
|  | 1~2 | dB | 0 | 9 |
| CSI-RS RSRP Note2 | 1~2 | dBm/SSB SCS | -95.97 | -86.97 |
| Io Note2 | 1~2 | dBm/95.04MHz | -63.97 | -57.47 |
|  | 1~2 | dB | 0 | 9 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | |

After 1440ms from the beginning of the test, the UE shall send L1-RSRP report at slot 9 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1. Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.4.5-2 the corresponding relative accuracy requirements in Table 5.6.3.4.5-3.

Table 5.6.3.4.5-2: L1-RSRP absolute accuracy requirements for the reported values

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#1) | 40 |
| Highest reported value (CSI-RS#1) | 99 |

Table 5.6.3.4.5-3: L1-RSRP relative accuracy requirements for the reported values

|  |  |
| --- | --- |
|  | T1 |
| Lowest DIFF RSRP reported (CSI-RS#0) | 1 |
| Highest DIFF RSRP reported (CSI-RS#0) | 7 |

The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### 5.6.4 CLI measurements

#### 5.6.4.0 Minimum conformance requirements

##### 5.6.4.0.1 Minimum conformance requirements for SRS-RSRP measurement period

The UE shall be capable of performing SRS-RSRP measurement based on the configured SRS resource, and the UE shall be capable of reporting SRS-RSRP measured over measurement period of TSRS\_RSRP\_measurement\_period for FR1 and FR2.

Table 5.6.4.0.1‑1 Measurement period TSRS\_RSRP\_measurement\_period

|  |  |
| --- | --- |
| Configuration | TSRS\_measurement\_period (ms) |
| No DRX | Max(60, 3 X TSRS) |
| DRX cycle ≤ 320ms | Max(60, Ceil(1.5 X 3) X max(TSRS, TDRX)) |
| DRX cycle > 320ms | 3 X TDRX |
| Note: TSRS is SRS measurement periodicity configured *SRS-PeriodicityAndOffset*, and TDRX is the DRX cycle length. | |

If the SRS resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for TSRS\_RSRP\_measurement\_period.

When configured by the network, the UE shall be able to perform SRS-RSRP measurements of configured *srs-ResourceConfigCLI*. The requirements apply when the subcarrier spacing for SRS-RSRP measurement resource configuration is the same as the subcarrier spacing of the active DL BWP of serving cell. The UE is not required to measure SRS using different SCS compared to the downlink active BWP SCS of the same carrier.

The requirements as provided:

- SRS resources configured for SRS-RSRP measurements are measurable.

An SRS resource configured for SRS-RSRP shall be considered measurable when for each relevant SRS the following conditions are met:

- SRS-RSRP related side conditions given in clauses 10.1.22.1 for FR1 and FR2 for a corresponding band,

- SRS\_RP and SRS Ês/Iot according to Annex B.2.7 for a corresponding band.

The UE shall send SRS-RSRP reports only for report configurations according to *reportType* which is *cliPeriodical* or *cliEventTriggered* when SRS-RSRP report is configured.

The UE shall report the SRS-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clause 10.1.22.1 for FR1 and FR2.

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.22.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.7.2.3.3.

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report on.

The normative reference for this requirement is TS 38.133 [6] clause 9.7.2.5 and 9.7.2.1, 9.7.2.2 and 9.7.2.3

#### 5.6.4.1 EN-DC FR2 SRS-RSRP measurement in non-DRX

Editor's Note: This test case is incomplete. Following aspects are either missing or TBD

- The test applicability is FFS

- The test procedure is incomplete

- The message content is FFS

- MU/TT analysis for UE PC3 and test frequency f ≤ 40.8 GHz is complete.

- MU/TT analysis for UE power class other than PC3 is incomplete.

- MU//TT analysis for test frequency f > 40.8 GHz is incomplete.

5.6.4.1.1 Test purpose

The purpose of this test case is to verify that the UE makes correct reporting of SRS-RSRP measurement in non-DRX within SRS-RSRP measurement requirements in TS 38.133 [6] clause 9.7.2.5

5.6.4.1.2 Test applicability

FFS

5.6.4.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.4.0.1

The normative reference for this requirement is TS 38.133 [6] clause 9.7.2.5 and A.5.6.4.1.

5.6.4.1.4 Test description

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2).

5.6.4.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.4.1.4.1-1.

Table 5.6.4.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.6.4.1 - 1 | NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.6.4.1 - 2 | NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
|  | Note: UE is only required to be tested in one of the supported test configurations |

Configure the test equipment and the DUT according to the parameters in Table 5.6.4.1.4.1-2.

Table 5.6.4.1.4.1-2: Initial conditions EN-DC FR2 SRS-RSRP measurement in non-DRX

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Comment** |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The test parameters are given in Table 5.6.4.1.4.1-3 below.

2. Message contents are defined in clause 5.6.4.1.4.3.

3. Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters for PSCell is given in Table A.5.6.4.1.4.1-3

. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

Table 5.6.4.1.4.1-3: General test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test configuration** | **Value** | **Comment** |
| Active cell |  | 1 | E-UTRAN Cell 1 and NR Cell 2 |  |
| RF Channel Number |  | 1 | 1: Cell 1  2: Cell 2 |  |
| SSB configuration |  | 1 | SSB.1 FR2 |  |
| SMTC configuration |  | 1 | SMTC.1 |  |
| SRS configuration |  | 1 | SRSConf.1 | Table A.5.6.4.1.2-4 |
| CP length |  | 1 | Normal |  |
| i1-Threshold | dBm | 1 | -112 |  |
| Hysteresis | dB | 1 | 0 |  |
| Time To Trigger | s | 1 | 0 |  |
| Filter coefficient |  | 1 | 0 | L3 filtering is not used |
| DRX | ms | 1 | DRX.11 |  |
| Time offset between DL from serving cell and SRS from test system | μs | 1,2 | 10.67 |  |
| T1 | s | 1 | 5 |  |
| T2 | s | 1 | 1 |  |

5.6.4.1.4.2 Test procedure

There are two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2)

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table 5.6.4.1.5-3 and the test parameters for the (virtual) neighbour cell UE in Table 5.6.4.1.5-23. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.6.4.1.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1 with event I1 configured.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

Editor's note: the rest of the steps are FFS.

5.6.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

FFS

5.6.4.1.5 Test requirement

Table 5.7.1.1.5-1 defines the cell specific settings for all tests. Table 5.7.1.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Table 5.6.4.1.5-1: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test configuration** | **Cell 2** | |
|  |  |  | **T1** | **T2** |
| TDD configuration |  | 1 | TDDConf.3.1 | |
| PDSCH RMC configuration |  | 1 | SR.3.1 TDD | |
| RMSI CORESET RMC configuration |  | 1 | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration |  | 1 | CCR.3.1 TDD | |
| OCNG Patterns |  | 1 | OP.1 | |
| TRS configuration |  |  | TRS.2.1. TDD | |
| PDSCH/PDCCH TCI state |  | 1 | TCI.State.2 | |
| Initial BWP configuration |  | 1 | DLBWP.0.1 ULBWP.0.1 | |
| Active DL BWP configuration |  | 1 | DLBWP.1.1 | |
| Active UL BWP configuration |  | 1 | ULBWP.1.1 | |
| Propagation Condition |  | 1 | AWGN | |

Table 5.6.4.1.5-2: NR OTA Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell and Neighbour cell UE in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test configuration** | **Cell 2** | | **Neighbour cell UE** | |
|  |  |  | **T1** | **T2** | **T1** | **T2** |
| AoA setup |  | 1 | Setup 1 defined A.9.1 | | | |
| Beam assumption Note 4 |  | 1 | Fine | | | |
| Note 2 | dBm/15 kHz | 1 | -100.5 | | -100.5 | |
| Note 2 | dBm/SCS | 1 | -91.5 | | -91.5 | |
|  | dB | 1 | - | - | -infinity | 7 |
|  | dB | 1 | - | - | -infinity | 7 |
| SRS-RSRP Note 3 | dBm/SCS kHz | 1 | - | - | -infinity | -84.5 |
| Io | dBm/95.04 MHz | 1 | -63.86 | -56.07 | -63.86 | -56.07 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation  Note 5: Cell 2 doesn’t transmit during the SRS and the 2 previous symbols. Es/NoC is not applied to those symbols. | | | | | | |

Table 5.6.4.1.5-3: SRS configuration for measurement reporting

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Field** | **SRSConf.1** | **Comments** |
| SRS-ResourceSet | srs-ResourceSetId | 0 |  |
|  | srs-ResourceIdList | 0 |  |
|  | resourceType | Periodic |  |
|  | Usage | Codebook |  |
| SRS-Resource | SRS-ResourceId | 0 |  |
|  | nrofSRS-Ports | Port1 |  |
|  | transmissionComb | n2 |  |
|  | combOffset-n2 | 0 |  |
|  | cyclicShift-n2 | 0 |  |
|  | resourceMapping  startPosition | 0 |  |
|  | resourceMapping  nrofSymbols | n1 |  |
|  | resourceMapping  repetitionFactor | n1 |  |
|  | freqDomainPosition | 0 |  |
|  | freqDomainShift | 0 |  |
|  | freqHopping  c-SRS | 12 |  |
|  | freqHopping  b-SRS | 0 |  |
|  | freqHopping  b-hop | 0 |  |
|  | groupOrSequenceHopping | Neither |  |
|  | resourceType | Periodic |  |
|  | periodicityAndOffset | sl160, 25 |  |
|  | sequenceId | 0 | Any 10 bit number |

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### 5.6.4.2 EN-DC FR2 CLI-RSSI measurement in non-DRX

Editor's Note: This test case is incomplete. Following aspects are either missing or TBD

- The test applicability is FFS

- The test procedure is incomplete

- The message content is FFS

- TT analysis is missing.

5.6.4.2.1 Test purpose

The purpose of this test case is to verify that the UE makes correct reporting of CLI-RSSI measurement in non-DRX within CLICLI-RSSI measurement requirements in TS 38.133 [6] clause 9.7.3.5

5.6.4.2.2 Test applicability

FFS

5.6.4.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.4.0.1

The normative reference for this requirement is TS 38.133 [6] clause 9.7.2.5 and A.5.6.4.2.

5.6.4.2.4 Test description

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2).

5.6.4.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.4.2.4.1-1.

Table 5.6.4.2.1-1: Applicable NR configurations for FR2 CLI-RSSI test

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

Configure the test equipment and the DUT according to the parameters in Table 5.6.4.2.4.1-2.

Table 5.6.4.2.4.1-2: Initial conditions EN-DC FR2 CLI-RSSI measurement in non-DRX

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Comment** |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The test parameters are given in Table 5.6.4.2.4.1-3 below.

2. Message contents are defined in clause 5.6.4.2.4.3.

3. Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters for PSCell is given in Table 5.6.4.2.4.1-3

The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

Table 5.6.4.2.4.1-3: General test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| Active cell |  | 1 | E-UTRAN Cell 1 and NR Cell 2 |  |
| RF Channel Number |  | 1 | 1: Cell 1  2: Cell 2 |  |
| SSB configuration |  | 1 | SSB.1 FR2 |  |
| SMTC configuration |  | 1 | SMTC.1 |  |
| CLI-RSSI configuration |  | 1 | CLI-RSSIConf.1 | Table 5.6.4.2.5-3 |
| CP length |  | 1 | Normal |  |
| i1-Threshold | dBm | 1 | -94.5 |  |
| Hysteresis | dB | 1 | 0 |  |
| Time To Trigger | s | 1 | 0 |  |
| Filter coefficient |  | 1 | 0 | L3 filtering is not used |
| DRX |  | 1 | DRX.11 |  |
| Time offset between DL from serving cell and OCNG from test system | μs | 1 | 10.67 |  |
| T1 | s | 1 | 5 |  |
| T2 | s | 1 | 1 |  |

5.6.4.2.4.2 Test procedure

There are two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2)

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table 5.6.4.2.5-3 and the test parameters for the (virtual) neighbour cell UE in Table 5.6.4.2.5-23. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.6.4.2.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1 with event I1 configured.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

Editor's note: the rest of the steps are FFS.

5.6.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

FFS

5.6.4.2.5 Test requirement

Table 5.7.1.1.5-1 defines the cell specific settings for all tests. Table 5.7.1.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Table 5.6.4.2.5-1: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 2 | |
|  |  |  | T1 | T2 |
| TDD configuration |  | 1 | TDDConf.3.1 | |
| PDSCH RMC configuration |  | 1 | SR.3.1 TDD | |
| PUSCH parameters |  | 1 | N/A | |
| RMSI CORESET RMC configuration |  | 1 | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration |  | 1 | CCR.3.1 TDD | |
| OCNG Patterns Note 1 |  | 1 | OP.1 | |
| TRS configuration |  |  | TRS.2.1. TDD | |
| PDSCH/PDCCH TCI state |  | 1 | TCI.State.2 | |
| Initial BWP configuration |  | 1 | DLBWP.0.1 ULBWP.0.1 | |
| Active DL BWP configuration |  | 1 | DLBWP.1.1 | |
| Active UL BWP configuration |  | 1 | ULBWP.1.1 | |
| Propagation Condition |  | 1 | AWGN | |
| Note 1: OCNG is not transmitted in the CLI-RSSI measurement resources. | | | | |

Table 5.6.4.2.5-2: NR OTA Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 2 | |
|  |  |  | T1 | T2 |
| AoA setup |  | 1 | Setup 1 defined in A.9.1 | |
| Beam assumption Note 3 |  | 1 | Fine | |
| on CLI-RSSI measurement resource Note 2 | dBm/15 kHz | 1 | -119+TT | -108+TT |
| on CLI-RSSI measurement resource Note 2 | dBm/SCS | 1 | -110 | -99 |
| Io on CLI-RSSI measurement resource | dBm/95.04 MHz | 1 | -81.01 | -70.01 |
| Io on CLI-RSSI measurement resource | dBm/1.08 MHz | 1 | -100.46 | -89.46 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation. | | | | |

Table 5.6.4.2.5-3: CLI-RSSI measurement resource configuration for measurement reporting

|  |  |  |
| --- | --- | --- |
|  | Field | CLI-RSSIConf.1 |
| RSSI-Resource | rssi-ResourceId | 0 |
|  | rssi-SCS | 120 |
|  | startPRB | 0 |
|  | nrofPRBs | 66 |
|  | startPosition | 3 |
|  | nrofSymbols | 11 |
|  | rssi-PeriodicityAndOffset | sl160, 25 |

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 20 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### 5.6.5 Measurements with autonomous gaps

#### 5.6.5.0 Minimum conformance requirements

##### 5.6.5.0.1 Minimum conformance requirements for EN-DC inter-frequency CGI identification of NR neighbour cell in FR2

[TS38.133, Clause 9.11]

### 5.6.5.0.1.1 Introduction

The requirements in this clause are applicable for CGI identification of an intra frequency and inter frequency NR target cell.

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC\_CONNECTED state, and

- configured with SA or NR-DC or NE-DC operation mode, or with EN-DC operation mode for CGI identification requested by NR PSCell.

The overall CGI reporting delay is defined in clause 5.6.5.0.1.3.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

### 5.6.5.0.1.2 CGI identification of an NR cell with autonomous gaps

The UE shall identify and report the CGI of a known NR target cell when requested by the network for the purpose of reportCGI. Only one cell is provided to the UE with *cellForWhichToReportCGI* for identifying the CGI. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3 in TS 38.331 [13]. Note that a UE is not required to use autonomous gap if *useAutonomousGaps* is set to false. If autonomous gaps are used for measurement with the purpose of reportCGI, regardless of whether DRX is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of NR cell within:

Tidentify\_CGI = (TMIB + T SIB1) ms

Where:

TMIB is the time period used to acquire MIB message. TMIB = 6 \* TSMTC ms for target cell carrier frequency on FR1 and TMIB = 25 \* TSMTC ms for target cell carrier frequency on FR2.

TSIB1 is the time period used to acquire SIB1 message. TSIB1 = 6 \* TRMSI-scheduling ms.

Where TSMTC is the SMTC periodicity configured for the target cell measurement, and TRMSI-scheduling is

- the maximum between the periodicity with which the SIB1 is actually transmitted by the NR target cell and 20ms when SSB and RMSI CORESET multiplexing pattern is 1

- the maximum between the periodicity with which the SIB1 is actually transmitted by the NR target cell and TSMTC when SSB and RMSI CORESET multiplexing pattern is 2 or 3.

The requirement for identifying the CGI of an NR cell within Tidentify\_CGI is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [13] is used.

Within the time Tidentify\_CGI, over which the UE identifies the CGI of an NR cell, the UE shall fulfil interruption requirements specified in,

- Clause 8.2.1.2.16 in TS 38.133 [6] for NR serving cells and Clause 7.32.2.15 in TS36.133 [29] for E-UTRA serving cells if the UE is configured with EN-DC operation mode,

- Clause 8.2.2.2.14 in TS 38.133 [6] if the UE is configured with SA operation mode,

- Clause 8.2.3.2.14 in TS 38.133 [6] for NR serving cells and Clause 7.36.2.14 in TS36.133 [29] for E-UTRA serving cells if the UE is configured with NE-DC operation mode,

- Clause 8.2.4.2.11 in TS 38.133 [6] if the UE is configured with NR-DC operation mode.

In the requirement a cell is known if,

- During the last 5 seconds for FR1 or 3 seconds for FR2 before the reception of the report CGI command:

- The UE has sent a valid L3-RSRP measurement report with SSB index for the target cell and

- During MIB decoding at least reported SSBs remains detectable according to the cell identification conditions specified in clauses 9.2 or 9.3 in TS 38.133 [6], and

- During SIB1 decoding the SSB used for MIB decoding remains detectable according to the cell identification conditions specified in clauses 9.2 or 9.3 in TS 38.133 [6], and

- During MIB decoding, the SSB for MIB decoding remains detectable with SNR ≥-3dB

- During SIB1 decoding, the PDSCH for SIB1 decoding remains detectable with SNR ≥-3dB

### 5.6.5.0.1.3 CGI reporting delay

The CGI reporting delay is defined as the time between a command that will trigger a CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTIDCCH resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than Tidentify\_CGI defined in clause 5.6.5.0.1.2 plus RRC procedure delay defined in clause 12 in TS 38.331 [13], and additional 20ms margin if target cell is on FR2.

##### 5.6.5.1 EN-DC inter-frequency CGI identification of NR neighbour cell in FR2

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing

- TT analysis is missing

5.6.5.1.1 Test purpose

The purpose of this test is to verify the requirements for inter-frequency identification of a new CGI of NR FR2 cell with autonomous gaps in clause 9.11 in 38.133 [6] for EN-DC.

5.6.5.1.2 Test applicability

This test applies to all types of EN-DC UE Rel-16 and forward supporting EN-DC with PSCell in FR2 and supporting acquisition of CGI from neighbour NR cell using autonomous gap, which is controlled by PICS pc\_nr\_CGI\_Reporting.

5.6.5.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.6.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.5.1.

5.6.5.1.4 Test description

The test scenario comprises of one E-UTRA carrier and one NR FR2 carrier. Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1) on E-UTRA RF channel 1, NR FR2 PSCell (Cell 2) on NR RF channel 1 and NR FR2 neighbour cell (Cell 3) on NR RF channel 2.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 3. Starting T2, Cell 3 becomes detectable and the UE is expected to detect and send a measurement report with SSB index. In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. Gap pattern configuration with id #0 is configured before T2 begins to enable inter-frequency monitoring.

5.6.5.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.5.1.4.1-1.

Table 5.6.5.1.4.1-1: Supported test configurations for EN-DC inter-frequency CGI identification of NR neighbour cell in FR2

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

Configure the test equipment and the DUT according to the parameters in Table 5.6.5.1.4.1-2.

Table 5.6.5.1.4.1-2: Initial conditions for EN-DC PSCell FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.5.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | Figure A.3.3.3.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | Figure A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. The test parameters for NR Cells are given in Table 5.6.5.1.4.1-3 below. The test parameters and applicability for the E-UTRAN PCell are defined in Table A.3.7.2.1-1 in TS 38.133 [6]. Cell-specific parameters of NR PSCell are specified in Table 5.6.5.1.5-1 and 5.6.5.1.5-2.

2. Message contents are defined in clause 5.6.5.1.4.3.

3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.6.5.1.4.1-3: General test parameters for EN-DC inter-frequency CGI identification of NR neighbour cell in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test | Value | Comment |
|  |  | configuration |  |
| E-UTRA RF Channel Number |  | Config 1,2 | 1 | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number |  | Config 1,2 | 1, 2 | Two FR1 NR carrier frequencies is used. |
| Active cell |  | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | LTE Cell 1 is on E-UTRA RF channel number 1.  NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell |  | Config 1,2 | NR cell 3 | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id |  | Config 1,2 | 0 | As specified in clause 9.1.2-1 in TS 38.133 [6]. |
| Measurement gap offset |  | Config 1,2 | 39 |  |
| SMTC-SSB parameters |  | Config 1,2 | SSB.3 FR2 | As specified in clause A.3.10.2 in TS 38.133 [6] |
| A3-Offset | dB | Config 1,2 | [-30] |  |
| Hysteresis | dB | Config 1,2 | 0 |  |
| CP length |  | Config 1,2 | Normal |  |
| TimeToTrigger | s | Config 1,2 | 0 |  |
| Filter coefficient |  | Config 1,2 | 0 | L3 filtering is not used |
| DRX |  | Config 1,2 | OFF | DRX is not used |
| Time offset between PCell and PSCell |  | Config 1,2 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells |  | Config 1,2 | 3μs | Synchronous cells. |
| T1 | s | Config 1,2 | 5 |  |
| T2 | s | Config 1,2 | 7 for PC1; 4.5 for other PC |  |
| T3 | s | Config 1,2 | 5 |  |

5.6.5.1.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG*\_*and*\_*SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4. UE is connected to Cell 1 (PCell) on E-UTRAN RF channel 1 (PCC) and to Cell 2 (PSCell) on NR RF channel 1 (PSCC). NR Cell 3 is on NR RF channel 2. Set the parameters according to Tables 5.6.5.1.4.1-3 and 5.6.5.1.5-1. Propagation conditions are set according to Annex C clauses C.2.2.

2. The SS starts sending PDCCHs indicating new transmissions continuously on Cell 2.

3. T1 starts. At this moment, the UE does not have any timing information of Cell 3.

4. After 5 seconds, T2 starts. A RRC message implying SI reading with autonomous gap shall be sent to the UE during period T2, within 3s after the UE has reported Event A3. The RRC message shall create a measurement report configuration with *reportCGI* and *useAutonomousGaps-r16* setup.

5. After 4.5 seconds, T3 starts. The start of T3 is the instant when the last TTI containing the RRC message implying SI reading is sent to the UE. Measurement gaps shall be deconfigured before the start of T3.

6. If the UE transmits a measurement report containing the cell global identifier of Cell 3 within 775 ms from the start of T3, then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.

7. If it is successful, continue to step 9. Otherwise continue to step 8.

8. Switch the UE OFF and then ON. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.

9. Repeat steps 2-8 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.5.1.4.3 Message contents

TBD

5.6.5.1.5 Test requirement

Table 5.6.5.1.5-1 defines the cell specific test parameters, not including test tolerances yet [will update after TT analysis].

Table 5.6.5.1.5-1: Cell specific test parameters for EN-DC inter-frequency CGI identification of NR neighbour cell in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test | Cell 2 | | Cell 3 | |
|  |  | configuration | T1 | T2, T3 | T1 | T2, T3 |
| NR RF Channel Number |  | Config 1,2 | 1 | | 2 | |
| Duplex mode |  | Config 1,2 | TDD | | TDD | |
| BWchannel | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| BWP BW | MHz | Config 1,2 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| TDD configuration |  | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP |  | Config 1,2 | DLBWP.0.1 | | NA | |
| Initial UL BWP |  | Config 1,2 | DLBWP.0.1 | |  | |
| Dedicated DL BWP |  | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP |  | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) |  | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel |  | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel |  | Config 1,2 | CR.3.1 TDD | | - | |
| RMSI scheduling periodicity | ms | Config 1,2 | NA | | 40 | |
| TRS configuration |  | Config 1,2 | TRS.2.1 TDD | | NA | |
| TCI configuration |  | Config 1,2 | CSI-RS.Config.0 | | NA | |
| SMTC configuration defined in A.3.11 |  | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS |  | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  | |  | |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS (Note 1) |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  | |  | |
| Propagation Condition |  | Config 1,2 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | | | | |

Table 5.6.5.1.5-2: OTA cell specific test parameters for EN-DC inter-frequency CGI identification of NR neighbour cell in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|  |  |  | T1 | T2, T3 | T1 | T2, T3 |
| AoA setup |  | Config 1,2 | Setup 1 defined in A.3.15.1 | | | |
| Assumption for UE beamsNote 4 |  | Config 1,2 | Rough | | Rough | |
|  | dB | Config 1,2 | 4 + TT | 4 + TT | -Infinity | -3 + TT |
| Note 2 | dBm/15 KHz | Config 1,2 | -102 + TT | | | |
| Note 2 | dBm/SCS | 1, 2 | -93 + TT | | | |
|  |  |
| SS-RSRP | dBm/SCS | 1, 2 | -89 + TT | -89 + TT | -Infinity | -96 + TT |
|  |  |
|  | dB | 1~4 | 4 + TT | 4 + TT | -Infinity | -3 + TT |
|  | dBm/95.04MHz | 1~4 | -58.56 + TT | | -62.25 + TT | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

The UE shall transmit a measurement report containing the cell global identifier of cell 3 within 775 milliseconds from the start of T3.

Test requirement = RRC Procedure delay + Tidentify\_CGI + processing time for FR2 + reporting delay

= 10 + (25\*20 + 6\*40) + 20 + 2ms from the start of T3

= 772 ms, allow 775 ms.

The UE shall be scheduled continuously throughout the test, and from the start of T3 until 775 ms the number of interrupted slots shall not exceed the allowed number as defined in clause 8.2.1.2.16 in TS 38.133 [6].

The maximum number of interrupted slots allowed is 6\*48 + 12\*49 = 876.

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

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### 5.6.6 L1-SINR measurement for beam reporting

#### 5.6.6.0 Minimum conformance requirements

##### 5.6.6.0.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and no dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only.

The value of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only is defined in Table 9.8.4.1-2 for FR2, where

For the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;

- For aperiodic CSI-RS resources as CMR, M=1.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured for all resources in the resource set.

For the value of P in FR2,

- P=1, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < MGRP)

- P=, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P=3, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with measurement gap (TCSI-RS < MGRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- P=, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

Where:

TSMTCperiod = the configured SMTC1 period or SMTC2 period if configured.

TCSI-RS = the periodicity of CSI-RS configured for L1-SINR measurement

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 9.8.4.1-2: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. | |

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

The UE is required to be capable of measuring L1-SINR without measurement gaps. The UE is required to perform the SSB and CSI-RS/CSI-IM measurements with measurement restrictions as described in the following clauses.

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

- The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or

- The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or

- The other CSI-RS is configured in q1 and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clause 9.8.3, 9.8.4.1 and 9.8.5.

##### 5.6.6.0.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the SSB configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to SSB configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as SSB configured as CMR.

The value of TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR is defined in Table 9.8.4.2-2 for FR2, where

For the value of M

- For periodic or semi-persistent NZP CSI-RS or CSI-IM resource as dedicated IMR, M=1 if the higher layer parameters *timeRestrictionForChannelMeasurements* and/or *timeRestrictionForInterferenceMeasurements* are configured, and M=3 otherwise;

For the value of N in FR2

- N = 8.

P is defined as the maximum value between PCMR and PIMR, i.e., P = max(PCMR, PIMR), where

- the value of PCMR shall be derived in the same way as the value of P used for SSB based L1-RSRP measurement in clause 9.5.4.1, in which the occasions and period of the SSB for CMR shall be used instead.

- the value of PIMR shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For L1-SINR measurement with SSB as CMR and CSI-RS or CSI-IM as IMR, the requirement shall apply if the CSI-RS is configured as IMR with repetition field as “repetition = OFF” or CSI-IM is configured as IMR.

For L1-SINR measurement with SSB as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if SSB occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.2-2: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity. | |

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

The UE shall transmit the periodic L1-SINR reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

Reported L1-SINR measurements contained in periodic L1-SINR measurement reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

For FR2, when the SSB configured as CMR for L1-SINR measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB configured as CMR for L1-SINR measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

- The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or

- The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or

- The other CSI-RS is configured in q1 and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and SSB. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as the CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and CSI-RS. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

- The CSI-RS in a resource set configured with repetition ON, or

- The CSI-IM or the CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or

- The CSI-RS is configured in q1 and beam failure is detected, or

- The CMR for L1-SINR measurement and the CSI-RS are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clause 9.8.3, 9.8.4.2 and 9.8.5.

##### 5.6.6.0.3 L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to CSI-RS resource configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as CSI-RS resource configured as CMR.

The value of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR is defined in Table 9.8.4.3-2 for FR2, where

For the value of M,

- M=1 shall be applied if

- aperiodic NZP-CSI-RS as CMR or dedicated IMR, or

- aperiodic CSI-IMR as dedicated IMR, or

- periodic and semi-persistent NZP-CSI-RS as CMR or dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured, or

- periodic and semi-persistent CSI-IM as dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured;

- M=3 otherwise.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured for all resources in the resource set.

P is defined as the maximum value between PCMR and PIMR, i.e., P = max(PCMR, PIMR), where

- The value of PCMR and PIMR shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the CSI-RS for CMR and NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead respectively.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS as IMR, the requirement shall apply only if CSI-RS resources as CMR and IMR are configured with the same repetition field and the number of CSI-RS resources in the resource sets for CMR and IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-IM as IMR, the requirement shall apply only if the number of CSI-RS resources in the resource set for CMR and the number of CSI-IM resources in the resource set for IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if CSI-RS occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.3-2: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.  Note 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity. | |

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

- The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or

- The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or

- The other CSI-RS is configured in q1 and beam failure is detected, or

- The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and SSB. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as the CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and CSI-RS. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

- The CSI-RS in a resource set configured with repetition ON, or

- The CSI-IM or the CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or

- The CSI-RS is configured in q1 and beam failure is detected, or

- The CMR for L1-SINR measurement and the CSI-RS are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clause 9.8.3, 9.8.4.3 and 9.8.5.

#### 5.6.6.1 EN-DC FR2 CSI-RS based CMR and no dedicated IMR L1-SINR measurement in DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.6.1.1 Test purpose

To verify that the UE makes correct reporting of L1-SINR measurement within L1-SINR measurement requirements in TS 38.133 [6] clause 9.8.4.1.

5.6.6.1.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC FR2 and long DRX cycle and L1-SINR measurement.

5.6.6.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.6.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.6.1.

5.6.6.1.4 Test description

5.6.6.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.6.1.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.6.1.4.1-2. Test environment parameters are given in Table 5.6.6.1.4.1-3.

Table 5.6.6.1.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-SINR test

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

Table 5.6.6.1.4.1-2: General test parameters for FR2 CSI-RS based L1-SINR test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Value |
| SSB GSCN | 1~2 |  | freq1 |
| Duplex mode | 1~2 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 |
| CSI-RS configuration | 1~2 |  | CSI-RS.3.3 TDD |
| OCNG Patterns | 1~2 |  | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~2 |  | SMTC.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 |
| DRX configuration | 1~2 |  | DRX.3 |
| reportConfigType | 1~2 |  | aperiodic |
| reportQuantity-r16 | 1~2 |  | cri-SINR-r16 |
| Number of reported RS | 1~2 |  | 2 |
| qcl-Info | 1~2 |  | SSB#0 for resource#0 |
| SSB#1 for resource#1 |
| reportSlotOffsetList | 1~2 |  | 26 |
| Propagation condition | 1~2 |  | AWGN |
| T1 | 1~2 | s | 5 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.6.1.4.1-3: Test Environment parameters for FR2 CSI-RS based L1-SINR test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.6.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.6.6.1.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.6.1.4.2 Test procedure

The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. UE is also configured to measure L1-SINR based on SSB. Upon receiving the DCI trigger, UE provides the report back based on the reporting configuration as defined in Table 5.6.6.1.4.1-2.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.6.1.5-1. T1 starts.
3. After 480ms from the start of the test the SS transmits the DCI trigger in slot 8.
4. The SS shall check following requirements:

- R1: the UE shall send L1-SINR report at slot 26 from the reception of DCI trigger. If the report is received at slot 26 from the reception of DCI trigger, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the L1-SINR value of CSI-RS#1 reported by the UE is compared to the expected L1-SINR value for CSI-RS#1. If the resulting value is outside the limits in Table 5.6.6.1.5-2 or the UE fails to report the measurement value for CSI-RS #1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

-R3: The DIFF SINR value of CSI-RS#0 reported by the UE is compared to the expected DIFF SINR value. If the resulting value is outside the limits in Table 5.6.6.1.5-3 or the UE fails to report the measurement value for CSI-RS 0, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

1. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

6. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

7 If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

8. Repeat steps 2-7 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.6.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.6.1.4.3-1: Common Exception messages for EN-DC FR2 CSI-based CMR and no dedicated IMR L1-SINR measurement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6A-1 with conditions APERIODIC and CSI-SINR  Table H.3.6A-2 with conditions CSI-RS and APERIODIC  Table H.3.4-1  Table H.3.7-1 with condition DRX.3 |

Table 5.6.6.1.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| } |  |  |  |
| } |  |  |  |

5.6.6.1.5 Test requirement

Table 5.6.6.1.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.6.1.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-based CMR and no dedicated IMR L1-SINR measurement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **CSI-RS#0** | **CSI-RS#1** |
| Angle of arrival configuration | 1~2 |  | Setup 1 according to A.9.1 | |
| Beam assumptionNote 3 | 1~2 |  | Rough | |
| Note1 | 1~2 | dBm/15kHz | -105 | |
| Note1 | 1~2 | dBm/SSB SCS | -95.97 | |
|  | 1~2 | dB | 0 | 9 |
| CSI-RS RSRP Note2 | 1~2 | dBm/SSB SCS | -95.97 | -86.97 |
| Io Note2 | 1~2 | dBm/95.04MHz | -63.97 | -57.47 |
|  | 1~2 | dB | 0 | 9 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

After 480ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 and CSI-RS#1. Each L1-SINR measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.6.1.5-2 and the corresponding relative accuracy requirements in Table 5.6.6.1.5-3.

Table 5.6.6.1.5-2: L1-SINR absolute accuracy requirements for the reported values R2

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#1) | 51 |
| Highest reported value (CSI-RS #1) | 74 |

Table 5.6.6.1.5-3: L1-SINR relative accuracy requirements for the reported values R3

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest DIFF SINR reported (CSI-RS #0) | 4 |
| Highest DIFF SINR reported (CSI-RS #0) | 13 |

The rate of correct events observed during repeated tests (R1 to R3) shall be at least 90% with a confidence level of 95%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### 5.6.6.2 EN-DC FR2 SSB based CMR and dedicated IMR L1-SINR measurement in non-DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.6.2.1 Test purpose

To verify that the UE makes correct reporting of L1-SINR measurement in non-DRX within L1-SINR measurement requirements in TS 38.133 [6] clause 9.8.4.2.

5.6.6.2.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC FR2 and L1-SINR measurement reporting.

5.6.6.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.6.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.6.2.

5.6.6.2.4 Test description

5.6.6.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.6.2.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.6.2.4.1-2. Test environment parameters are given in Table 5.6.6.2.4.1-3.

Table 5.6.6.2.4.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

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

Table 5.6.6.2.4.1-2: General test parameters for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Value |
| SSB GSCN | 1~4 |  | freq1 |
| Duplex mode | 1~4 |  | TDD |
| TDD Configuration | 1~4 |  | TDDConf.3.1 |
| BWchannel | 1~4 | MHz | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~4 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~4 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~4 |  | CCR.3.1 TDD |
| SSB configuration | 1,2 |  | SSB.1 FR2 |
| 3,4 | SSB.2 FR2 |
| CSI-RS configuration | 1~4 |  | CSI-RS.3.1A TDD |
| OCNG Patterns | 1~4 |  | OP.1 |
| Initial BWP Configuration | 1~4 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~4 |  | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~4 |  | SMTC.1 |
| TRS Configuration | 1~4 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~4 |  | TCI.State.2 |
| DRX configuration | 1~4 |  | off |
| reportConfigType | 1~4 |  | periodic |
| reportQuantity-r16 | 1~4 |  | ssb-Index-SINR-r16 |
| Number of reported RS | 1~4 |  | 2 |
| L1-SINR reporting period | 1~4 | slot | 640 |
| T1 | 1~4 | s | 5 |
| T2 | 1~4 | s | 3 |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition | 1~4 |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.6.2.4.1-3: Test Environment parameters for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.6.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.6.6.2.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.6.2.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above Table 5.6.6.2.4.1-2. Before the test, UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.6.6.2.4.1-2.

2. Set the parameters according to T1 in Table 5.6.6.2.5-1. T1 starts.

3. The UE shall be transmitting CSI on PUCCH with a periodicity of 640 slots.

4. When T1 expires, the SS shall set the parameters according to T2 in 5.6.6.2.5-1. T2 starts.

5. The UE shall start sending valid L1-SINR reports. The SS shall check the following requirements:

- R1: the UE shall start to transmit valid L1-SINR reports no later than 2960ms for UE supporting power class 1 in configuration 1 and 2, no later than 2920 ms for UE supporting power class 1 in configuration 3 and 4, no later than 2000 ms for UE supporting power class other than 1 in configuration 1 and 2, no later than 1960 ms for UE supporting power class other than 1 in configuration 3 and 4 from the beginning of time period T2. A valid report shall meet the absolute L1-SINR requirement for SSB#1 in Table 5.6.6.2.5-3 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.6.2.5-4 for test configurations 3 and 4. If the first valid report is received before the specified time, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the UE shall transmit L1-SINR reports every 640 slots. If the reports are received accordingly, the number of passed iterations for R2 is increased by one. Otherwise, the number of failed iterations for R2 is increased by one.

- R3: The L1-SINR value of SSB#1 reported by the UE is compared to the expected L1-SINR value for SSB#1. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding absolute accuracy requirements in Table 5.6.6.2.5-3 for all test configurations, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

- R4: The DIFF-SINR value of SSB#0 reported by the UE is compared to the expected DIFF-SINR value. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding relative accuracy requirements in Table 5.6.6.2.5-4 for all test configurations, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

6. The SS waits until T2 expires.

7. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

8. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

9. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat steps 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.6.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.6.2.4.3-1: Common Exception messages for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6A-1 with conditions PERIODIC and SS-SINR and CSI-RS\_IMR  Table H.3.6A-2 with conditions SSB and PERIODIC  Table H.3.6A-3 with conditions PERIODIC  Table H.3.4-1 |

Table 5.6.6.2.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.6.6.2.5 Test requirement

Table 5.6.6.2.5-1 and Table 5.6.6.2.5-1 define the primary level settings including test tolerances for all tests.

Table 5.6.6.2.5-1: SSB specific test parameters for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **SSB#0** | | **SSB#1** | |
| **T1** | **T2** | **T1** | **T2** |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | | | |
| Beam assumptionNote 4 |  |  | Rough | | | |
| Note2 | 1~4 | dBm/15kHz | -105 | | | |
| Note2 | 1,2 | dBm/SSB SCS | -96 | | | |
| 3,4 | -93 | | | |
|  | 1~4 | dB | 0 | 0 | -Infinity | 9 |
| SSB RSRP Note3 | 1,2 | dBm/SSB SCS | -94.5 | -94.5 | -Infinity | -87 |
| 3,4 | -91.5 | -91.5 | -Infinity | -84 |
| Io Note3 | 1,2 | dBm/95.04MHz | -63.2 | -63.2 | -67 | -57.5 |
| 3,4 | -63.2 | -63.2 | -67 | -57.5 |
|  | 1~4 | dB | 1.5 | 1.5 | -Infinity | 9 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SSB RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

Table 5.6.6.2.5-2: CSI-RS specific test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Config** | **Unit** | **CSI-RS#0** | | **CSI-RS#1** | |
| **T1** | **T2** | **T1** | **T2** |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | | | |
| Beam assumptionNote 4 |  |  | Rough | | | |
| Note2 | 1~4 | dBm/15kHz | -105 | | | |
| Note2 | 1~4 | dBm/CSI-RS SCS | -96 | | | |
|  | 1~4 | dB | 1.5 | 1.5 | -Infinity | 9 |
|  | 1~4 | dB | 1.5 | 1.5 | -Infinity | 9 |
| CSI-RS RSRP Note3 | 1~4 | dBm/ CSI-RS SCS | -94.5 | -94.5 | -Infinity | -87 |
| Io Note3 | 1~4 | dBm/95.04MHz | -63.2 | -63.2 | -67 | -57.5 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

The UE shall send L1-SINR report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-SINR report including the results for both SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.28.2, where X is

- 2880 for UE supporting power class 1

- 1920 for UE supporting power class 2, 3 or 4.

Each L1-SINR measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.6.2.5-3 for all test configurations and the corresponding relative accuracy requirements in Table 5.6.6.2.5-4 for all test configurations.

Table 5.6.6.2.5-3: L1-SINR absolute accuracy requirements for the reported values for all test configurations R1 and R3

|  |  |  |
| --- | --- | --- |
| Normal Conditions | T1 | T2 |
| Lowest reported value (SSB#1) | - | 54 |
| Highest reported value (SSB#1) | - | 71 |

Table 5.6.6.2.5-4: L1-SINR relative accuracy requirements for the reported values for test configurations R1 and R4

|  |  |  |
| --- | --- | --- |
|  | T1 | T2 |
| Lowest DIFF SINR reported (SSB#0) | - | 4 |
| Highest DIFF SINR reported (SSB#0) | - | 10 |

For the test to pass, the ratio of successful reported valued for each requirement (R1 to R4) shall be at least 90% with a confidence level of 95%. Each requirement is evaluated independently the others.NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### 5.6.6.3 EN-DC FR2 CSI-RS based CMR and dedicated IMR L1-SINR measurement in non-DRX

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test case is incomplete for extreme conditions

5.6.6.3.1 Test purpose

To verify that the UE makes correct reporting of L1-SINR measurement within L1-SINR measurement requirements in TS 38.133 [6] clause 9.8.4.3.

5.6.6.3.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC FR2 and L1-SINR measurement.

5.6.6.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.6.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.6.3.

5.6.6.3.4 Test description

5.6.6.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.6.3.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.6.3.4.1-2. Test environment parameters are given in Table 5.6.6.3.4.1-3.

Table 5.6.6.3.4.1-1: Applicable NR configurations for EN-DC FR2 CSI-RS based CMR and CSI-IM based IMR L1-SINR measurement

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

Table 5.6.6.3.4.1-2: General test parameters for FR2 L1-SINR test with CMR and dedicated IMR

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Value |
| SSB GSCN | 1~2 |  | freq1 |
| Duplex mode | 1~2 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 |
| CSI-RS configuration | 1~2 |  | CSI-RS.3.3 TDD |
| CSI-IM configuration | 1~2 |  | CSI-IM.3.2 TDD |
| OCNG Patterns | 1~2 |  | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~2 |  | SMTC.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 |
| DRX configuration | 1~2 |  | Off |
| reportConfigType | 1~2 |  | aperiodic |
| reportQuantity-r16 | 1~2 |  | cri-SINR-r16 |
| Number of reported RS | 1~2 |  | 2 |
| qcl-Info | 1~2 |  | SSB#0 for resource#0 |
| SSB#1 for resource#1 |
| reportSlotOffsetList | 1~2 |  | 26 |
| T1 | 1~2 | s | 5 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition | 1~2 |  | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

Table 5.6.6.3.4.1-3: Test Environment parameters for FR2 L1-SINR test with CMR and dedicated IMR

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.6.6.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.6.6.3.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.6.3.4.2 Test procedure

The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. UE is also configured to measure L1-SINR based on SSB. Upon receiving the DCI trigger, UE provides the report back based on the reporting configuration as defined in Table 5.6.6.3.4.1-2.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.6.3.5-1. T1 starts.
3. After 480ms from the start of the test the SS transmits the DCI trigger in slot 8.
4. The SS shall check following requirements:

- R1: the UE shall send L1-SINR report at slot 26 from the reception of DCI trigger. If the report is received at slot 26 from the reception of DCI trigger, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the L1-SINR value of CSI-RS#1 reported by the UE is compared to the expected L1-SINR value for CSI-RS#1. If the resulting value is outside the limits in Table 5.6.6.3.5-2 or the UE fails to report the measurement value for CSI-RS #1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

-R3: The DIFF SINR value of CSI-RS#0 reported by the UE is compared to the expected DIFF SINR value. If the resulting value is outside the limits in Table 5.6.6.3.5-3 or the UE fails to report the measurement value for CSI-RS 0, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

1. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC\_PSCell\_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

6. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG\_and\_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.

7 If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

8. Repeat steps 2-7 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.6.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.6.6.3.4.3-1: Common Exception messages for EN-DC FR2 CSI-RS based CMR and CSI-IM based IMR L1-SINR measurement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6A-1 with conditions APERIODIC and CSI-SINR and CSI-IM\_IMR  Table H.3.6A-2 with conditions CSI-RS and APERIODIC  Table H.3.6A-4 with conditions APERIODIC  Table H.3.4-1 |

Table 5.6.6.3.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| } |  |  |  |
| } |  |  |  |

5.6.6.3.5 Test requirement

Table 5.6.6.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.6.3.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-RS based CMR and CSI-IM based IMR L1-SINR measurement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | CSI-RS#0 | CSI-RS#1 |
| Angle of arrival configuration | 1~2 |  | Setup 1 according to A.9 | |
| Assumption for UE beamsNote 3 | 1~2 |  | Rough | |
| Note1 | 1~2 | dBm/15kHz | -105 | |
| Note1 | 1~2 | dBm/SSB SCS | -95.97 | |
|  | 1~2 | dB | 0 | 9 |
| CSI-RS RSRP Note2 | 1~2 | dBm/SSB SCS | -95.97 | -86.97 |
| Io Note2 | 1~2 | dBm/95.04MHz | -63.97 | -57.47 |
|  | 1~2 | dB | 0 | 9 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

After 480ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 as CMR + CSI-IM#0 as IMR and CSI-RS#1 as CMR + CSI-IM#1 as IMR. Each L1-SINR measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.6.3.5-2 and the corresponding relative accuracy requirements in Table 5.6.6.3.5-3. The reported L1-SINR value shall consider the Rx antenna gain in the range of [-10 ~ +20] dB when calculated.

Table 5.6.6.3.5-2: L1-SINR absolute accuracy requirements for the reported values R2

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#1) | 53 |
| Highest reported value (CSI-RS #1) | 72 |

Table 5.6.6.3.5-3: L1-SINR relative accuracy requirements for the reported values R3

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest DIFF SINR reported (CSI-RS #0) | 5 |
| Highest DIFF SINR reported (CSI-RS #0) | 12 |

The rate of correct events observed during repeated tests (R1 to R3) shall be at least 90% with a confidence level of 95%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## 5.7 Measurement performance requirements

### 5.7.1 SS-RSRP

#### 5.7.1.0 Minimum conformance requirements

##### 5.7.1.0.1 Intra-frequency SS-RSRP measurement accuracy requirements

5.7.1.0.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.1.0.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.1.0.1.1-1: SS-RSRP Intra frequency absolute accuracy in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | | |
| **Minimum Io** | | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±6 | ±9 | ≥-6 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±8 | ±11 | N/A | | -70 | -50 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

5.7.1.0.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR2.

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.1.0.1.2-1: SS-RSRP Intra frequency relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±6 | ±9 | ≥-6 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  NOTE 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. | | | | | |

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.3.1 and 10.1.6.

##### 5.7.1.0.2 Inter-frequency SS-RSRP measurement accuracy requirements

5.7.1.0.2.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in Table 5.7.1.0.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [2].

Table 5.7.1.0.2.1-1: SS-RSRP Inter frequency absolute accuracy in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | | |
| **Minimum Io** | | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±6 | ±9 | ≥-4 | Same value as SSB\_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±8 | ±11 | N/A | | -70 | -50 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.5.1 and 10.1.6.

5.7.1.0.2.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell on a frequency in FR2 compared to the SS-RSRP measured from another cell on another frequency in FR2.

The accuracy requirements in Table 5.7.1.0.2.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [3] Clause 7.3 for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

- |SSB\_RP1dBm - SSB\_RP2dBm| ≤ 27dB

- | Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.1.0.2.2-1: SS-RSRP Inter frequency relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±6 | ±9 | ≥-4 | Same value as SSB\_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival | | -50 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  NOTE 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. | | | | | |

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.5.1 and 10.1.6.

#### 5.7.1.1 EN-DC FR2 SS-RSRP measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.1.1.1 Test purpose

The purpose of this test is to verify that the intra-frequency SS-RSRP measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.1.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.1.1.

5.7.1.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.1.1.4.1-1.

Table 5.7.1.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.7.1.1-1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.1.1-2 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.1.1.4.1-2.

Table 5.7.1.1.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.1.1.4.3.

2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the SS-RSRP measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.1.1.4.2 Test procedure

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.7.1.1.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-RSRP reported values in the periodic MeasurementReport for the following requirements:

- R1: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.1.1.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.1.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

- R3: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.1.1.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G for each of the requirements is achieved. The evaluation of a specific requirement is concluded when the confidence level for that requirement is reached, even if more measurement reports are required for the remaining requirements.

7a The SS shall check all the SS-RSRP reported values during Test 1 for the following requirements:

- R9: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 2 reported by the UE. If the difference exceeds the limits in Table 5.7.1.1.5-3a count a fail for R9. Otherwise, R9 is passed.

- R10: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 3 reported by the UE. If the difference exceeds the limits in Table 5.7.1.1.5-3a count a fail for R10. Otherwise, R10 is passed.

8. Set the parameters according to Test 2 in Table 5.7.1.1.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:

- R4: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.1.1.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

- R5: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.1.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.

- R6: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.1.1.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.

- R7: The SS-RSRP value of Cell 2 reported by the UE during Test 2 is compared to the reported SS-RSRP of Cell 2 during Test 1 for the same iteration. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R7 is increased by one. Otherwise, the number of passed iterations for R7 is increased by one

- R8: The SS-RSRP value of Cell 3 reported by the UE during Test 2 is compared to the reported SS-RSRP of Cell 3 during Test 1 for the same iteration. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R8 is increased by one. Otherwise, the number of passed iterations for R8 is increased by one

8a The SS shall check all the SS-RSRP reported values during Test 2 for the following requirements:

- R11: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 2 reported by the UE. If the difference exceeds the limits in Table 5.7.1.1.5-3a count a fail for R11. Otherwise, R11 is passed.

- R12: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 3 reported by the UE. If the difference exceeds the limits in Table 5.7.1.1.5-3a count a fail for R12. Otherwise, R12 is passed.

9. If more measurement reports with Test 1 configuration are needed in order to complete the evaluation R7 or R8, the SS shall set the parameters according to Table 5.7.1.1.5-2 as appropriate and repeat steps 5 to 8, evaluating R7 and / or R8 as appropriate.

5.7.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.1.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2  Table H.3.1-3 with Condition Synchronous cells  Table H.3.1-5  Table H.3.1-7  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.1.1.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrq | false |  |  |
| sinr | false |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.1.1.5 Test requirement

Table 5.7.1.1.5-1 defines the cell specific settings for all tests. Table 5.7.1.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.1.0.1.1 and relative accuracy requirements in clause 5.7.1.0.1.2. The following eight requirements are to be verified:

During T1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.1.5-3.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.1.5-3.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-4.

R9: ∆(Max-Min) accuracy of Cell 2. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.1.5-3a.

R10: ∆(Max-Min) accuracy of Cell 3. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.1.5-3a.

During T2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-4.

R11: ∆(Max-Min) accuracy of Cell 2. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.1.5-3a.

R12: ∆(Max-Min) accuracy of Cell 3. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.1.5-3a.

During T1 and T2:

R7: Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-5.

R8: Relative accuracy of Cell 3 during T2 compared with Cell 3 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-5.

Table 5.7.1.1.5-1: SS-RSRP Intra frequency general test parameters

| ParameterNote 5 | Unit | T1 | | T2 | |
| --- | --- | --- | --- | --- | --- |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Physical cell ID |  | 489 | 0 | 489 | 0 |
| SSB ARFCN |  | freq1 | | freq1 | |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 24 | | 24 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | - | DLBWP.0.1 | - |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | - | DLBWP.1.1 | - |
| Uplink initial BWP configuration |  | ULBWP.0.1 | - | ULBWP.0.1 | - |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | - | ULBWP.1.1 | - |
| DRX cycle configuration |  | Not applicable | - | Not applicable | - |
| TRS configuration |  | TRS.2.1 TDD | - | TRS.2.1 TDD | - |
| TCI state |  | TCI.State.0 | - | TCI.State.0 | - |
| PDSCH Reference measurement channel |  | SR.3.2 TDD | - | SR.3.2 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated CORESET Reference Channel |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns |  | OP.3 | OP.3 | OP.3 | OP.3 |
| SSB configuration |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| SMTC configuration |  | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| Time offset with Cell 2 | μs | - | 3 | - | 3 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation conditions |  | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration |  | 1x2 | 1x2 | 1x2 | 1x2 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: Void  NOTE 4: Void  NOTE 5: All parameters apply for configuration 1 and 2  NOTE 6: Void | | | | | |

Table 5.7.1.1.5-2: SS-RSRP Intra frequency OTA related test parameters

| Parameter | Unit | T1 | | T2 | |
| --- | --- | --- | --- | --- | --- |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 | | | |
| Assumption for UE beamsNote 8 |  | Rough | | | |
| Note1 | dBm/15kHzNote4 | -97.4 | | N/A | |
| Note1 | dBm/SCSNote4 | -88.37 | | N/A | |
|  | dB | 6.0 | 1.4 | N/A | N/A |
| Es | dBm/SCSNote4 |  |  | (Table B.2.2-2 Rx Beam Peak +9.8dB) | (Table B.2.2-2 Rx Beam Peak +9.8dB) |
| SSB\_RPNote2 | dBm/SCS | -82.37 | -86.97 | (Table B.2.2-2 Rx Beam Peak +9.8dB) | (Table B.2.2-2 Rx Beam Peak +9.8dB) |
| BB Note6 | dB | 2.20 | -5.59 | -1.77 | -1.77 |
| IoNote2 | dBm/95.04 MHz Note4 | -55.74 | | (Table B.2.2-2 Rx Beam Peak +37.40dB) | |
| NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SSB\_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: Void  NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  NOTE 5: Void  NOTE 6: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [3] Table 6.2.1.3-4.  NOTE 7: All parameters apply for configurations 1 and 2  NOTE 8: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | |

Table 5.7.1.1.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5

| UE power class 3 | | | |
| --- | --- | --- | --- |
| Normal Conditions | Test 1  All bands | Test 2 | |
| Lowest reported value (Cell 2) | 50 | n257, n258, n261 | 31 |
| n260 | 33 |
| n259 | FFS |
| Highest reported value (Cell 2) | 108 | n257, n258, n261 | 88 |
| n260 | 90 |
| n259 | FFS |
| Lowest reported value (Cell 3) | 46 | n257, n258, n261 | 31 |
| n260 | 33 |
| n259 | FFS |
| Highest reported value (Cell 3) | 103 | n257, n258, n261 | 88 |
| n260 | 90 |
| n259 | FFS |
| Extreme Conditions | Test 1  All bands | Test 2 | |
| Lowest reported value (Cell 2) | 47+ FFS | n257, n258, n261 | 28 + FFS |
| n260 | 30 + FFS |
| n259 | FFS |
| Highest reported value (Cell 2) | 111+ FFS | n257, n258, n261 | 91 + FFS |
| n260 | 93 + FFS |
| n259 | FFS |
| Lowest reported value (Cell 3) | 46+ FFS | n257, n258, n261 | 28+ FFS |
| n260 | 30+ FFS |
| n259 | FFS |
| Highest reported value (Cell 3) | 106+ FFS | n257, n258, n261 | 91+ FFS |
| n260 | 93+ FFS |
| n259 | FFS |

Table 5.7.1.1.5-3a: evaluation limits for the ∆(Max-Min) reported values for each cell during each time period

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value Cell 2 | 16 | 16 |
| ∆(Max-Min) reported value Cell 3 | 16 | 16 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value Cell 2 | 16 + FFS | 16+ FFS |
| ∆(Max-Min) reported value Cell 3 | 16 + FFS | 16 + FFS |

Table 5.7.1.1.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| Lowest reported value (Cell 3) | RSRP\_x - 12 | RSRP\_x - 6 |
| Highest reported value (Cell 3) | RSRP\_x + 2 | RSRP\_x + 6 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| Lowest reported value (Cell 3) | RSRP\_x - 15+ FFS | RSRP\_x - 9+ FFS |
| Highest reported value (Cell 3) | RSRP\_x + 5+ FFS | RSRP\_x + 9+ FFS |
| RSRP\_x is the reported value of Cell 2 | | |

Table 5.7.1.1.5-5: evaluation limits for the reported values for T2 with respect to T1 relative accuracy rules R7, R8

|  |  |  |  |
| --- | --- | --- | --- |
| UE power class 3 | | | |
| Test 2 | Bands | Normal Conditions | Extreme Conditions |
| Lowest reported value (Cell 2) | n257, n258, n261 | RSRP\_x - 28 | RSRP\_x - 31+ FFS |
| n260 | RSRP\_x - 26 | RSRP\_x - 29+ FFS |
| n259 | FFS | FFS |
| Highest reported value (Cell 2) | n257, n258, n261 | RSRP\_x - 12 | RSRP\_x - 9+ FFS |
| n260 | RSRP\_x - 10 | RSRP\_x - 7+ FFS |
| n259 | FFS | FFS |
| Lowest reported value (Cell 3) | n257, n258, n261 | RSRP\_y - 24 | RSRP\_y - 27+ FFS |
| n260 | RSRP\_y - 21 | RSRP\_y - 24+ FFS |
| n259 | FFS | FFS |
| Highest reported value (Cell 3) | n257, n258, n261 | RSRP\_y - 8 | RSRP\_y - 5+ FFS |
| n260 | RSRP\_y - 5 | RSRP\_y - 2+ FFS |
| n259 | FFS | FFS |
| RSRP\_x is the reported value of Cell 2 during T1  RSRP\_y is the reported value of Cell 3 during T1 | | | |

For the test to pass, the ratio of successful reported values for each requirement (R1 to R8) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.7.1.2 EN-DC FR2-FR2 SS-RSRP measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.1.2.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-RSRP measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.1.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.1.2.

5.7.1.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.1.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.1.2.4.1-1.

Table 5.7.1.2.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.7.1.2-1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.1.2-2 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| 5.7.1.2-3 | NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.1.2-4 | NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.1.2.4.1-2.

Table 5.7.1.2.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The general test parameter settings are set up according to Table 5.7.1.2.4.1-3.

2. Message contents are defined in clause 5.7.1.2.4.3.

3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-RSRP measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

4. The rx beam peak and directions in which the UE meets the EIS spherical coverage criteria have been found with one of the procedures from Annex I.

5.7.1.2.4.2 Test procedure

1. Configure the positioning system for a valid test point as defined in A.9.4. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Table 5.7.1.2.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-RSRP reported values in the periodic MeasurementReport for the following requirements:

- R1: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.1.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed samples for R1 is increased by one. Otherwise, the number of passed samples for R1 is increased by one.

- R2: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed samples for R2 is increased by one. Otherwise, the number of passed samples for R2 is increased by one.

- R3: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.1.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed samples for R3 is increased by one. Otherwise, the number of passed samples for R3 is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G for each of the requirements is achieved. The evaluation of a specific requirement is concluded when the confidence level for that requirement is reached, even if more measurement reports are required for the remaining requirements.

7a. The SS shall check all the SS-RSRP reported values during Test 1 for the following requirements:

- R7: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 2 reported by the UE. If the difference exceeds the limits in Table 5.7.1.2.5-3a count a fail for R7. Otherwise, R7 is passed.

- R8: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 3 reported by the UE. If the difference exceeds the limits in Table 5.7.1.2.5-3a count a fail for R8. Otherwise, R8 is passed.

8. The SS shall select a new test point as defined in A.9.4 and rotate the positioning system for the selected test point.

9. Set the parameters according to Test 2 in Table 5.7.2.1.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:

- R4: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.2.1.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed samples for R4 is increased by one. Otherwise, the number of passed samples for R4 is increased by one.

- R5: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.2.1.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed samples for R5 is increased by one. Otherwise, the number of passed samples for R5 is increased by one.

- R6: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.2.1.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed samples for R6 is increased by one. Otherwise, the number of passed samples for R6 is increased by one.

10. The SS shall check all the SS-RSRP reported values during Test 1 for the following requirements:

- R9: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 2 reported by the UE. If the difference exceeds the limits in Table 5.7.1.2.5-3a count a fail for R9. Otherwise, R9 is passed.

- R10: The maximum SS-RSRP value is compared to the minimum SS-RSRP of Cell 3 reported by the UE. If the difference exceeds the limits in Table 5.7.1.2.5-3a count a fail for R10. Otherwise, R10 is passed.

5.7.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.1.2.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ  Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells  Table H.3.1-5  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition Pattern #0  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.1.2.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrq | false |  |  |
| sinr | false |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.1.2.5 Test requirement

Table 5.7.1.2.5-1 defines the cell specific settings for all tests. Table 5.7.1.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.1.0.2.1 and relative accuracy requirements in clause 5.7.1.0.2.2. The following eight requirements are to be verified:

During T1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2 and Table 5.7.1.2.5-3a for both configurations.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.2.5-5.

R7: ∆(Max-Min) accuracy of Cell 2. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.2.5-3a.

R8: ∆(Max-Min) accuracy of Cell 3. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.2.5-3a.During T2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2 and Table 5.7.1.2.5-3a for both configurations.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.2.5-5.

R9: ∆(Max-Min) accuracy of Cell 2. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.2.5-3a.

R10: ∆(Max-Min) accuracy of Cell 3. The UE is deemed to meet the requirement if the difference between the maximum and the minimum SS-RSRP report does not exceed the limit in Table 5.7.1.2.5-3a.

Table 5.7.1.2.5-1: SS-RSRP Inter frequency general test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | Test 2 | |
|  |  |  | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | 1~4 |  | freq1 | freq2 | freq1 | freq2 |
| BWchannel | 1~4 |  | 100:  NRB,c = 66 | | 100:  NRB,c = 66 | |
| Data RBs allocated | 1,2 |  | 24 | | 24 | |
| 3,4 | 48 | | 48 | |
| Duplex mode | 1~4 |  | TDD | | TDD | |
| TDD configuration | 1~4 |  | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH Reference measurement channel | 1,2 |  | SR.3. 2 TDD | - | SR.3. 2 TDD | - |
| 3,4 | SR.3.3 TDD | SR.3.3 TDD |
| RMSI CORESET Reference Channel | 1,2 |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| 3,4 | CR.3.2 TDD | CR.3.2 TDD |
| Dedicated CORESET Reference Channel | 1,2 |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| 3,4 | CCR.3.7 TDD | CCR.3.7 TDD |
| SSB configuration | 1,2 |  | SSB.3 FR2 | | SSB.3 FR2 | |
|  | 3,4 |  | SSB.4 FR2 | | SSB.4 FR2 | |
| PDSCH/PDCCH subcarrier spacing | 1~4 | kHz | 120 | | 120 | |
| OCNG Patterns | 1~4 |  | OP.3 | | OP.3 | |
| Initial BWP Configuration | 1~4 |  | DLBWP.0.1  ULBWP.0.1 | | DLBWP.0.1  ULBWP.0.1 | |
| Dedicated BWP configuration | 1~4 |  | DLBWP.1.3  ULBWP.1.3 | | DLBWP.1.3  ULBWP.1.3 | |
| TRS Configuration | 1~4 |  | TRS.2.1 TDD | | TRS.2.1 TDD | |
| PDCCH/PDSCH TCI Configuration | 1~4 |  | TCI.State.2 | | TCI.State.2 | |
| SMTC configuration | 1~4 |  | SMTC.1 | | SMTC.1 | |
| Time offset between Cell 2 and Cell 3 | 1~4 | μs | 3 | | 3 | |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |  |  |  |
| EPRE ratio of PDSCH to PDSCH DMRS |  |  |  |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |  |  |  |
| Propagation condition | 1~4 | - | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration | 1~4 | - | 1x2 | 1x2 | 1x2 | 1x2 |
| NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void | | | | | | |

Table 5.7.1.2.5-2: SS-RSRP Inter frequency OTA related test parameters

| Parameter | Config | Unit | Test 1 | | Test 2 | |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration | 1~4 |  | Setup 4b according to clause A.9.4 | | Setup 4b according to clause A.9.4 | |
|  |  |  | AoA1  Spherical coverage | AoA2  Rx Beam Peak | AoA1  Spherical coverage | AoA2  Rx Beam Peak |
| Assumption for UE beamsNote 7 | 1~4 |  | Rough | | Rough | |
| Note1 | 1, 2 | dBm/15kHzNote4 | -96.3 | -96.3 | (Table B.2.3-2 Rx Beam PeakNote 8 -4.63dB) | (Table B.2.3-2 Rx Beam PeakNote 8 -3.03dB) |
|  | 3, 4 |  | -99.3 | -99.3 |
| Note1 | 1, 2 | dBm/SCSNote4 | -87.3 | -87.3 | (Table B.2.3-2 Rx Beam PeakNote 8 +4.4dB) | (Table B.2.3-2 Rx Beam PeakNote 8 +6.0dB) |
|  | 3, 4 |  | -87.3 | -87.3 | (Table B.2.3-2 Rx Beam PeakNote 8 +7.4dB) | (Table B.2.3-2 Rx Beam PeakNote 8 +9.0dB) |
|  | 1~4 | dB | 6.0 | 6.0 | 17.0 | 1.0 |
| SSB\_RPNote2 | 1, 2 | dBm/SCS | -81.3 | -81.3 | (Table B.2.3-2 Rx Beam PeakNote 8 +21.4dB) | (Table B.2.3-2 Rx Beam PeakNote 8 +7.0dB) |
|  | 3, 4 |  | -81.3 | -81.3 | (Table B.2.3-2 Rx Beam PeakNote 8 +24.4dB) | (Table B.2. 3-2 Rx Beam PeakNote 8 +10.0dB) |
| (SSB\_RPCell 2 – SSB\_RPCell 3) | 1~4 | dB | 0 | | 14.40 | |
| BBNote6 | 1, 2 | dB | 5.23 | 5.93 | 5.38 | -1.46 |
| 3, 4 | 4. 58 | 5.87 |
| IoNote2 | 1, 2 | dBm/95.04 MHz Note4 | -55.70 | -55.70 | (Table B.2.3-2 Rx Beam PeakNote 8 +46.08dB) | (Table B.2.3-2 Rx Beam PeakNote 8 +35.13dB) |
|  | 3, 4 |  | -55.7 | -55.7 | (Table B.2.3-2 Rx Beam PeakNote 8 +49.09dB) | (Table B.2.3-2 Rx Beam PeakNote 8 +38.14dB) |
| (Iofreq 1 – Io freq 2) | 1~4 | dB | 0 | | 11.95 | |
| NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SSB\_RP, Es/Iot, Io, (SSB\_RPCell 3 – SSB\_RPCell 2) and (Iofreq 2 – Io freq 1) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: Void  NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  NOTE 5: Void  NOTE 6: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP or ΔMBS from TS 38.101-2 [3] Table 6.2.1.3-4.  NOTE 7: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation  NOTE 8: The value in Table B.2.3-2 of TS 38.133 [6] is the Minimum SSB\_RP for SCSSSB = 120 kHz, selected according to the operating band of Cell 3 and UE power class, without ∆MBP,n adjustment. | | | | | | |

Table 5.7.1.2.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5 for test configuration 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE power class 3 | | | | |
| Normal Conditions | Test 1 | | Test 2 | |
| Lowest reported value (Cell 2) | n257, n258, n261 | 41 | n257, n258, n261 | 33 |
| n260 | 39 | n260 | 34 |
| n259 | FFS | n259 | FFS |
| Highest reported value (Cell 2) | All bands: 109 | | n257, n258, n261 | 101 |
| n260 | 104 |
| n259 | FFS |
| Lowest reported value (Cell 3) | All bands: 52 | | n257, n258, n261 | 32 |
| n260 | 34 |
| n259 | FFS |
| Highest reported value (Cell 3) | All bands: 109 | | n257, n258, n261 | 87 |
| n260 | 90 |
| n259 | FFS |
| Extreme Conditions | Test 1 | | Test 2 | |
| Lowest reported value (Cell 2) | n257, n258, n261 | 41 + FFS | n257, n258, n261 | 33 + FFS |
| n260 | 39 + FFS | n260 | 34 + FFS |
| n259 | FFS | n259 | FFS |
| Highest reported value (Cell 2) | All bands: 109 + FFS | | n257, n258, n261 | 101 + FFS |
| n260 | 104 + FFS |
| n259 | FFS |
| Lowest reported value (Cell 3) | All bands: 52 + FFS | | n257, n258, n261 | 32+ FFS |
| n260 | 34+ FFS |
| n259 | FFS |
| Highest reported value (Cell 3) | All bands: 109 + FFS | | n257, n258, n261 | 87+ FFS |
| n260 | 91+ FFS |
| n259 | FFS |

Table 5.7.1.2.5-3a: evaluation limits for the ∆(Max-Min) reportedabsolute values for cell 3 during each time period

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value Cell 3 | 16 | 16 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value Cell 3 | 16 + FFS | 16 + FFS |

Table 5.7.1.2.5-4: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5 for test configuration 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE power class 3 | | | | |
| Normal Conditions | Test 1 | | Test 2 | |
| Lowest reported value (Cell 2) | n257, n258, n261 | 41 | n257, n258, n261 | 36 |
| n260 | 39 | n260 | 37 |
| n259 | FFS | n259 | FFS |
| Highest reported value (Cell 2) | All bands: 109 | | n257, n258, n261 | 104 |
| n260 | 107 |
| n259 | FFS |
| Lowest reported value (Cell 3) | All bands: 52 | | n257, n258, n261 | 35 |
| n260 | 37 |
| n259 | FFS |
| Highest reported value (Cell 3) | All bands: 109 | | n257, n258, n261 | 90 |
| n260 | 93 |
| n259 | FFS |
| Extreme Conditions | Test 1 | | Test 2 | |
| Lowest reported value (Cell 2) | n257, n258, n261 | 41 + FFS | n257, n258, n261 | 28 + FFS |
| n260 | 39 + FFS | n260 | 30 + FFS |
| n259 | FFS | n259 | FFS |
| Highest reported value (Cell 2) | All bands: 109 + FFS | | n257, n258, n261 | 91 + FFS |
| n260 | 93 + FFS |
| n259 | FFS |
| Lowest reported value (Cell 3) | All bands: 52 + FFS | | n257, n258, n261 | 28+ FFS |
| n260 | 30+ FFS |
| n259 | FFS |
| Highest reported value (Cell 3) | All bands: 109 + FFS | | n257, n258, n261 | 91+ FFS |
| n260 | 93+ FFS |
| n259 | FFS |

Table 5.7.1.2.5-5: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE power class 3 | | | | |
| Normal Conditions | Test 1 | | Test 2  All bands | |
| Lowest value (RSRP report Cell 3 – RSRP report Cell 2) | All bands: -23 | | -37 | |
| Highest value (RSRP report Cell 3 – RSRP report Cell 2) | n257, n258, n261 | +26 | n257, n258, n261 | +17 |
| n260 | +27 | n260 | +19 |
| n259 | FFS | n259 | FFS |
| Extreme Conditions | Test 1 | | Test 2  All bands | |
| Lowest value (RSRP report Cell 3 – RSRP report Cell 2) | -23 + FFS | | -37+ FFS | |
| Highest value (RSRP report Cell 3 – RSRP report Cell 2) | n257, n258, n261 | +26 + FFS | n257, n258, n261 | +17 + FFS |
| n260 | +27+ FFS | n260 | +19 + FFS |
| n259 | FFS | n259 | FFS |

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.7.1.3 EN-DC FR1-FR2 SS-RSRP measurement accuracy

Editor’s note: This test case is incomplete. The following aspects are either missing or TBD

- E-UTRA - FR2 OTA testability is still FFS.

5.7.1.3.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-RSRP measurement accuracy for NR FR2 is within the specified limits for all bands, when the PSCell is on an NR FR1 carrier.

5.7.1.3.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.1.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.1.3.

5.7.1.3.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR1 PSCell and Cell 3 is the NR FR2 neighbour cell on a NR FR2 carrier.

5.7.1.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.1.3.4.1-1.

Table 5.7.1.3.4.1-1: Supported test configurations

|  |  |  |
| --- | --- | --- |
| **Config** | **Description of serving cell** | **Description of target cell** |
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100 MHz bandwidth, TDD 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 be tested in one of the supported test configurations | | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.1.3.4.1-2.

Table 5.7.1.3.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.7.1.3.4.1-1. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The general test parameter settings are set up according to Table 5.7.1.3.4.1-3.

2. Message contents are defined in clause 5.7.1.3.4.3.

3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR1 carrier and Cell 3 is the neighbour cell on the NR FR2 carrier. Cell 3 is the target for the SS-RSRP measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

4. The directions in which the UE meets the EIS spherical coverage criteria have been found with one of the procedures from Annex I.

5.7.1.3.4.2 Test procedure

1. Configure the positioning system for a valid test point as defined in A.9.2. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Table 5.7.1.3.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-RSRP reported values in the periodic MeasurementReport for the following requirements:

- R1: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.3.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G for each of the requirements is achieved. The evaluation of a specific requirement is concluded when the confidence level for that requirement is reached, even if more measurement reports are required for the remaining requirements.

8. The SS shall select a new test point as defined in A.9.2 and rotate the positioning system for the selected test point.

9. Set the parameters according to Test 2 in Table 5.7.1.3.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:

- R2: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.3.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5.7.1.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.1.3.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ  Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells  Table H.3.1-5  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition Pattern #0  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.1.3.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrq | false |  |  |
| sinr | false |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.1.3.5 Test requirement

Table 5.7.1.3.5-1 defines the cell specific settings for all tests. Table 5.7.1.3.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.1.0.2. The following requirements are to be verified:

During Test 1:

R1: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.3.5-3.

During Test 2:

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.3.5-3.

Table 5.7.1.3.5-1: SS-RSRP inter-frequency test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | 1~6 |  | freq1 | freq2 | freq1 | freq2 |
| BWchannel | 1,4 | MHz | 10:  NRB,c = 52 | 100:  NRB,c = 66 | 10:  NRB,c = 52 | 100:  NRB,c = 66 |
| 2,5 | 10:  NRB,c = 52 | 10:  NRB,c = 52 |
| 3,6 | 40:  NRB,c = 106 | 40:  NRB,c = 106 |
| Data RBs allocated | 1,2,4,5 |  | 52 | 24 | 52 | 66 |
| 3,6 | 106 | 106 |
| Gap pattern ID |  |  | 0 | | 0 | |
| Duplex mode | 1,4 |  | FDD | TDD | FDD | TDD |
| 2,5 | TDD | TDD |
| 3,6 | TDD | TDD |
| TDD configuration | 1,4 |  | N/A | TDDConf.3.1 | N/A | TDDConf.3.1 |
| 2,5 | TDDConf.1.1 | TDDConf.1.1 |
| 3,6 | TDDConf.2.1 | TDDConf.2.1 |
| PDSCH Reference measurement channel | 1,4 |  | SR.1.1 FDD | - | SR.1.1 FDD | - |
| 2,5 | SR.1.1 TDD | SR.1.1 TDD |
| 3,6 | SR.2.1 FDD | SR.2.1 FDD |
| RMSI CORESET Reference Channel | 1,4 |  | CR.1.1 FDD | - | CR.1.1 FDD | - |
| 2,5 | CR.1.1 TDD | - | CR.1.1 TDD | - |
| 3,6 | CR.2.1 FDD | - | CR.2.1 FDD | - |
| Dedicated CORESET Reference Channel | 1,4 |  | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| 2,5 |  | CCR.1.1 TDD | - | CCR.1.1 TDD | - |
| 3,6 |  | CCR.2.1 TDD | - | CCR.2.1 TDD | - |
| SSB configuration | 1,4 |  | SSB.1 FR1 | SSB.3 FR2 | SSB.1 FR1 | SSB.3 FR2 |
| 2,5 | SSB.1 FR1 | SSB.1 FR1 |
| 3,6 | SSB.2 FR1 | SSB.2 FR1 |
| OCNG Patterns | 1~6 |  | OP.1 | OP.3 | OP.1 | OP.1 |
| Initial BWP Configuration | 1~6 |  | DLBWP.0.1  ULBWP.0.1 | | DLBWP.0.1  ULBWP.0.1 | |
| Dedicated BWP configuration | 1~6 |  | DLBWP.1.3  ULBWP.1.3 | | DLBWP.1.3  ULBWP.1.3 | |
| TRS Configuration | 1~6 |  | TRS.2.1 TDD | | TRS.2.1 TDD | |
| PDCCH/PDSCH TCI Configuration | 1~6 |  | TCI.State.2 | | TCI.State.2 | |
| SMTC configuration | 1~6 |  | SMTC.1 | | SMTC.1 | |
| Time offset between Cell 2 and Cell 3 | 1~6 | μs | 3 | | 3 | |
| EPRE ratio of PSS to SSS | 1~6 | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition | 1~6 | - | NA  Link only, see clause A.3.7A of TS 38.133 [6] | AWGN | NA  Link only, see clause A.3.7A of TS 38.133 [6] | AWGN |
| Antenna configuration | 1~6 | - | 1x2 | 1x2 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Void | | | | | | |

Table 5.7.1.3.5-2: SS-RSRP inter-frequency OTA related test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | Test 2 NOTE 3 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration according to clause A.9 |  |  | NA | Setup 2b | NA | Setup 2b |
| Assumption for UE beamsNote 4 |  |  | N/A | Rough | N/A | Rough |
|  | 1~6 | dBm/15kHz | NA  Link only, see clause A.3.7A of TS 38.133 [6] | -95.5 | NA  Link only, see clause A.3.7A of TS 38.133 [6] | NA |
|  | 1~6 | dBm/SSB SCS | -86.47 | NA |
|  |  |  |
|  | 1~6 | dB | 5 | NA |
| Es | 1~6 | dBm/SCS | NA | (Table B.2.3-2 Spherical coverage +6.5dB) |
| SSB\_RPNote1 | 1~6 | dBm/SCS | -81.47 | (Table B.2.3-2 Spherical coverage +6.5dB) |
|  |  |  |
| BBNote6 | 1~6 | dB | 4.35 | 1.69 |
| IoNote1 | 1~6 | dBm/  95.04MHz | -55.68 | SSB\_RP+34.48 |
| Note 1: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: Void  Note 3: No additional noise is added by the test system in Test 2.  Note 4: Information about types of UE beam is given in B.2.1.3, of TS 38.133 [6] and does not limit UE implementation or test system implementation.  Note 5: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 6: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [2], and an allowance of 1dB for UE multi-band relaxation factor ΔMBS from TS 38.101-2 [2] Table 6.2.1.3-4. | | | | | | |

Table 5.7.1.3.5-3: evaluation limits for the reported values for Test 1 and Test 2 absolute accuracy rules R1, R2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE power class 3 | | | | |
| Normal Conditions | Test 1 | | Test 2 | |
| Lowest reported value (Cell 3) | n257, n258, n261 | 46 | n257, n258, n261 | 46 |
| n260 | 45 | n260 | 47 |
| n259 | FFS | n259 | FFS |
| Highest reported value (Cell 3) | n257, n258, n261 | 103 | n257, n258, n261 | 101 |
| n260 | 102 | n260 | 104 |
| n259 | FFS | n259 | FFS |
| Extreme Conditions | Test 1 | | Test 2 | |
| Lowest reported value (Cell 3) | n257, n258, n261 | FFS | n257, n258, n261 | FFS |
| n260 | FFS | n260 | FFS |
| n259 | FFS | n259 | FFS |
| Highest reported value (Cell 3) | n257, n258, n261 | FFS | n257, n258, n261 | FFS |
| n260 | FFS | n260 | FFS |
| n259 | FFS | n259 | FFS |

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

### 5.7.2 SS-RSRQ

#### 5.7.2.0 Minimum conformance requirements

##### 5.7.2.0.1 Intra-frequency SS-RSRQ measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.2.0.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.2.0.1-1: SS-RSRQ Intra frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±2.5 | ±4 | ≥-3 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-6 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.2.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.8.1 and 10.1.11.

##### 5.7.2.0.2 Inter-frequency SS-RSRQ measurement accuracy requirements

5.7.2.0.2.1 Absolute SS-RSRQ Accuracy

The requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 5.7.2.0.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.2.0.2.1-1: SS-RSRQ Inter frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±2.5 | ±4 | ≥-3 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-4 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.2.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.10.1 and 10.1.11.

5.7.2.0.2.2 Relative SS-RSRQ Accuracy

The relative accuracy of SS-RSRQ in inter frequency case is defined as the RSRQ measured from one cell on a frequency in FR2 compared to the RSRP measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 5.7.2.0.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

- |SSB\_RP1dBm - SSB\_RP2dBm| ≤ 27 dB

- | Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.2.0.2.2-1: SS-RSRQ Inter frequency relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±3 | ±4 | ≥-3 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| ±4 | ±4 | ≥-4 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.  NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.2.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.10.1 and 10.1.11.

#### 5.7.2.1 EN-DC FR2 SS-RSRQ measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.2.1.1 Test purpose

The purpose of this test is to verify that the intra-frequency SS-RSRQ measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.2.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.2.1.

5.7.2.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.2.1.4.1-1.

Table 5.7.2.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.7.2.1-1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.2.1-2 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.2.1.4.1-2.

Table 5.7.2.1.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.2.1.4.3.

2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the SS-RSRQ measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.2.1.4.2 Test procedure

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.7.2.1.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-RSRQ reported values in the periodic MeasurementReport. The SS-RSRQ value of Cell 3 reported by the UE is compared to the expected SS-RSRQ. If the value is outside the limits in Table 5.7.2.1.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.2.1.5-2 as appropriate and repeat steps 5-7.

5.7.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.2.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2  Table H.3.1-3 with Condition Synchronous cells  Table H.3.1-5  Table H.3.1-7  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.2.1.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrp | false |  |  |
| sinr | false |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.2.1.5 Test requirement

Table 5.7.2.1.5-1 defines the cell specific settings for all tests. Table 5.7.2.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each SS-RSRQ measurement report for each of the tests in Table 5.7.2.1.5-2 shall meet the corresponding absolute accuracy requirements in Table 5.7.2.1.5-3.

Table 5.7.2.1.5-1: SS-RSRQ Intra frequency test parameters

| Parameter | | Unit | Test 1 | | Test 2 | |
| --- | --- | --- | --- | --- | --- | --- |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | |  | Freq1 | | Freq1 | |
| Duplex mode | |  | TDD | | TDD | |
| TDD configuration | |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| BWP configuration | Initial DL BWP |  | DLBWP.0.1 | | | |
| Dedicated DL BWP | DLBWP.1.1 | | | |
| Initial UL BWP | ULBWP.0.1 | | | |
| Dedicated UL BWP | ULBWP.1.1 | | | |
| TRS configuration | |  | TRS.2.1 TDD |  | TRS.2.1 TDD |  |
| TCI state | |  | TCI.State.0 |  | TCI.State.0 |  |
| PDSCH Reference measurement channel | |  | SR.3.1 TDD |  | SR.3.1 TDD |  |
| RMSI CORESET Reference Channel | |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Control channel RMC | |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns | |  | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | |  | SMTC.1 | | | |
| SSB configuration | |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| PDSCH/PDCCH subcarrier spacing | | kHz | 120 | 120 | 120 | 120 |
| SS-RSSI-Measurement | |  | Not Applicable | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS | |
| EPRE ratio of PBCH to PBCH\_DMRS | |
| EPRE ratio of PDCCH\_DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH\_DMRS | |
| EPRE ratio of PDSCH\_DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH\_DMRS | |
| EPRE ratio of OCNG DMRS to SSSNote 1 | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | |
| Propagation condition | |  | AWGN | | AWGN | |
| Antenna Configuration | |  | 1x2 | | 1x2 | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void.  NOTE 3: Void.  NOTE 4: Void.  NOTE 5: Void | | | | | | |

Table 5.7.2.1.5-2: SS-RSRQ Intra frequency OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 | | Setup 1 | |
| Assumption for UE beamsNote 9 |  | Rough | | | |
| Note1 | dBm/15kHzNote4 | -100.7 | | -96.7 | |
| Note1 | dBm/SCSNote3 | -91.67 | | -87.67 | |
| SSB\_RPNote2 | dBm/SCS Note4 | -88.67 | -88.67 | -90.67 | -90.67 |
| SS-RSRQ Note2 | dB | -14.81 | -14.81 | -16.84 | -16.84 |
|  | dB | -1.76 | -1.76 | -4.76 | -4.76 |
|  | dB | 3 | 3 | -3 | -3 |
| IoNote2 | dBm/95.04 MHz Note4 | -55.7 | | -55.67 | -55.67 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-RSRQ, SSB\_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRQ and SSB\_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Void.  NOTE 7: Void  NOTE 8: Void  NOTE 9: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | |

Table 5.7.2.1.5-3: SS-RSRQ Intra frequency absolute accuracy requirements for the reported values

|  |  |  |  |
| --- | --- | --- | --- |
| UE Power Class 3 | Test 1 (All bands) | Test 2 | |
| Normal Conditions | | | |
| Lowest reported value (Cell 3) | SS-RSRQ\_41 | n257, n258, n261 | SS-RSRQ\_35 |
| n260 | SS-RSRQ\_34 |
| n259 | FFS |
| Highest reported value (Cell 3) | SS-RSRQ\_73 | All bands | SS-RSRQ\_71 |
| Extreme Conditions | | | |
| Lowest reported value (Cell 3) | SS-RSRQ\_38+ FFS | n257, n258, n261 | SS-RSRQ\_34+ FFS |
| n260 | SS-RSRQ\_33+ FFS |
| n259 | FFS |
| Highest reported value (Cell 3) | SS-RSRQ\_76+ FFS | All bands | SS-RSRQ\_72+ FFS |

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

#### 5.7.2.2 EN-DC FR2-FR2 SS-RSRQ measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.2.2.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-RSRQ measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.2.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.2.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.2.2.

5.7.2.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.2.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.2.2.4.1-1.

Table 5.7.2.2.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.7.2.2-1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.2.2-2 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.2.2.4.1-2.

Table 5.7.2.2.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The general test parameter settings are set up according to Table 5.7.2.2.4.1-3.

2. Message contents are defined in clause 5.7.2.2.4.3.

3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-RSRQ measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.2.2.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5..

2. Set the parameters according to Table 5.7.2.2.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-RSRQ reported values in the periodic MeasurementReport for the following requirements:

- R1: The SS-RSRQ value of Cell 2 reported by the UE is compared to the expected SS-RSRQ for Cell 2. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The SS-RSRQ value of Cell 3 reported by the UE is compared to the expected SS-RSRQ for Cell 3. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

- R3: The SS-RSRQ value of Cell 3 reported by the UE is compared to the reported SS-RSRQ of Cell 2. If the resulting value is outside the limits in Table 5.7.2.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.2.2.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:

- R4: The SS-RSRQ value of Cell 2 reported by the UE is compared to the expected SS-RSRQ for Cell 2. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

- R5: The SS-RSRQ value of Cell 3 reported by the UE is compared to the expected SS-RSRQ for Cell 3. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.

- R6: The SS-RSRQ value of Cell 3 reported by the UE is compared to the reported SS-RSRQ of Cell 2. If the resulting value is outside the limits in Table 5.7.2.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.

5.7.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.2.2.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ  Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells  Table H.3.1-5  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition Pattern #0  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.2.2.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrp | false |  |  |
| sinr | false |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.2.2.5 Test requirement

Table 5.7.2.2.5-1 defines the cell specific settings for all tests. Table 5.7.2.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRQ measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.2.0.2.1 and relative accuracy requirements in clause 5.7.2.0.2.2. The following eight requirements are to be verified:

During T1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in Table 5.7.2.2.5-3.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in Table 5.7.2.2.5-3.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRQ meets the requirements in Table 5.7.2.2.5-4.

During T2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in table 5.7.2.2.5-3.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in table 5.7.2.2.5-3.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRQ meets the requirements in Table 5.7.2.2.5-4.

Table 5.7.2.2.5-1: SS-RSRQ Inter frequency general test parameters

| Parameter | Unit | Test 1 | | Test 2 | |
| --- | --- | --- | --- | --- | --- |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN |  | Freq1 | freq2 | freq1 | Freq2 |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 66 | | 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | - | DLBWP.0.1 | - |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | - | DLBWP.1.1 | - |
| Uplink initial BWP configuration |  | ULBWP.0.1 | - | ULBWP.0.1 | - |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | - | ULBWP.1.1 | - |
| DRX cycle configuration |  | Not applicable | - | Not applicable | - |
| TRS configuration |  | TRS.2.1 TDD | - | TRS.2.1 TDD | - |
| TCI state |  | TCI.State.0 | - | TCI.State.0 | - |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| OCNG Patterns |  | OP.1 | OP.1 | OP.1 | OP.1 |
| SSB configuration |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| SMTC configuration |  | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation conditions |  | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration |  | 1x2 | 1x2 | 1x2 | 1x2 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: Void  NOTE 4: Void | | | | | |

Table 5.7.2.2.5-2: SS-RSRQ Inter frequency OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| AoA setup |  | Setup 1 | | Setup 1 | |
| Assumption for UE beamsNote 8 |  | Rough | | Rough | |
| Note1 | dBm/15kHzNote4 | -95.93 | -95.93 | -95.44 | -95.44 |
| Note1 | dBm/SCSNote3 | -86.9 | -86.9 | -86.41 | -86.41 |
|  | dB | -1.75 | -1.75 | -3 | -3 |
| SSB\_RPNote2 | dBm/SCS Note4 | -88.65 | -88.65 | -89.41 | -89.41 |
| SS-RSRQNote2 | dB | -14.75 | -14.75 | -15.56 | -15.56 |
|  | dB | -1.75 | -1.75 | -3 | -3 |
| IoNote2 | dBm/95.04 MHz Note4 | -55.7 | -55.7 | -55.7 | -55.7 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-RSRQ, SSB\_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Void  NOTE 7: Void  NOTE 8: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | |

Table 5.7.2.2.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| Lowest reported value (Cell 2) | RSRQ\_41 | RSRQ\_37 |
| Highest reported value (Cell 2) | RSRQ\_73 | RSRQ\_74 |
| Lowest reported value (Cell 3) | RSRQ\_41 | RSRQ\_37 |
| Highest reported value (Cell 3) | RSRQ\_73 | RSRQ\_74 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| Lowest reported value (Cell 2) | RSRQ\_41 + FFS | RSRQ\_37 + FFS |
| Highest reported value (Cell 2) | RSRQ\_73 + FFS | RSRQ\_74 + FFS |
| Lowest reported value (Cell 3) | RSRQ\_41 + FFS | RSRQ\_37 + FFS |
| Highest reported value (Cell 3) | RSRQ\_73 + FFS | RSRQ\_74 + FFS |

Table 5.7.2.2.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| Lowest value (RSRQ report Cell 3 – RSRQ report Cell 2) | - 7 | - 9 |
| Highest value (RSRQ report Cell 3 – RSRQ report Cell 2) | + 7 | + 9 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| Lowest value (RSRQ report Cell 3 – RSRQ report Cell 2) | – 7 + FFS | – 9 + FFS |
| Highest value (RSRQ report Cell 3 – RSRQ report Cell 2) | + 7 + FFS | + 9 + FFS |

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

### 5.7.3 SS-SINR

#### 5.7.3.0 Minimum conformance requirements

##### 5.7.3.0.1 Intra-frequency SS-SINR measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of SS-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.3.0.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.3.0.1-1: SS-SINR Intra frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±3 | ±4 | ≥-3 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-6 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB. | | | | | |

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.3.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.13.1 and 10.1.16.

##### 5.7.3.0.2 Inter-frequency SS-SINR measurement accuracy requirements

5.7.3.0.2.1 Absolute SS-SINR Accuracy

The requirements for absolute accuracy of SS-SINR in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 5.7.3.0.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.3.0.2.1-1: SS-SINR Inter frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±3 | ±4 | ≥-3 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-4 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB. | | | | | |

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.3.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.15.1 and 10.1.16.

5.7.3.0.2.2 Relative SS-SINR Accuracy

The relative accuracy of SS-SINR in inter frequency case is defined as the SS-SINR measured from one cell on a frequency in FR2 compared to the SS-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 5.7.3.0.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.

- |SSB\_RP1dBm - SSB\_RP2dBm| ≤ 27 dB

- | Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.3.0.2.2-1: SS-SINR Inter frequency relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **SSB Ês/Iot** | **Io Note 2 range** | | |
| **Minimum Io** | | **Maximum Io** |
| **dB** | **dB** | **dB** | **dBm / SCSSSB Note 1** | | **dBm/BWChannel** |
| **SCSSSB = 120kHz** | **SCSSSB = 240kHz** |
| ±3.5 | ±4 | ≥-3 | Same value as SSB\_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| ±4 | ±4 | ≥-6 |
| NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.  NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  NOTE 5: The requirements apply for SSB Ês/Iot ≤ 25 dB. | | | | | |

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.3.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.15.1 and 10.1.16.

#### 5.7.3.1 EN-DC FR2 SS-SINR measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.3.1.1 Test purpose

The purpose of this test is to verify that the intra-frequency SS-SINR measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.3.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards, which support ss-SINR-Meas.

5.7.3.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.3.1.

5.7.3.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.3.1.4.1-1.

Table 5.7.3.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.7.3.1-1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.3.1-2 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.3.1.4.1-2.

Table 5.7.3.1.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.3.1.4.3.

2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the SS-SINR measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.3.1.4.2 Test procedure

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.7.3.1.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-SINR reported values in the periodic MeasurementReport. The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR. If the value is outside the limits in Table 5.7.3.1.5-2 or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.3.1.5-1 as appropriate and repeat steps 5-7.

5.7.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.3.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2  Table H.3.1-3 with Condition Synchronous cells, SS-SINR  Table H.3.1-5  Table H.3.1-7  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.3.1.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrp | false |  |  |
| rsrq | false |  |  |
| sinr | true |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.3.1.5 Test requirement

Table 5.7.3.1.5-1 defines the cell specific settings for all tests. Table 5.7.3.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each SS-SINR measurement report for each of the tests in Table 5.7.3.1.5-2 shall meet the corresponding absolute accuracy requirements in Table 5.7.3.1.5-3.

Table 5.7.3.1.5-1: SS-SINR Intra frequency test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN |  | Freq2 | | Freq2 | |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | | | |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | | | |
| Uplink initial BWP configuration |  | ULBWP.0.1 | | | |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | | | |
| DRX cycle configuration | ms | Not applicable | | | |
| TRS configuration |  | TRS.2.1 TDD | | | |
| TCI state |  | TCI.State.0 | | | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |  | SR.3.1 TDD |  |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated RMSI CORESET Reference Channel |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns |  | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration |  | SMTC.1 | | | |
| SSB configuration |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 |
| SS-RSSI-Measurement |  | Not Applicable | | | |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition |  | AWGN | | AWGN | |
| Antenna Configuration |  | 1x2 | | 1x2 | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: Void  NOTE 4: Void | | | | | |

Table 5.7.3.1.5-2: SS-SINR Intra frequency OTA related test parameters

| Parameter | | Unit | Test 1 | | Test 2 | |
| --- | --- | --- | --- | --- | --- | --- |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration | |  | Setup 1 | | Setup 1 | |
| Assumption for UE beamsNote 9 | |  | Rough | | Rough | |
| Note1 | | dBm/15kHz Note4 | -105 | | -105 | |
| Note1 | | dBm/SCS Note3 | -96 | | -96 | |
| SSB\_RPNote2 | | dBm/SCS Note4 | -91.46 | -93.34 | -98.8 | -98.8 |
| SS-SINR Note2 | n257, 258, n261 | dB | -0.18 | -3.32 | -4.95 | -4.95 |
| n260 | -0.31 | -3.42 | -5.20 | -5.20 |
| n259 | -0.39 | -3.48 | -5.48 | -5.48 |
|  | n257, 258, n261 | dB | -0.18 | -3.32 | -4.95 | -4.95 |
| n260 | -0.31 | -3.42 | -5.20 | -5.20 |
| n259 | -0.39 | -3.48 | -5.48 | -5.48 |
|  | | dB | 4.54 | 2.66 | -3 | -3 |
| IoNote2 | | dBm/95.04 MHz Note4 | -59.43 | | -63.87 | |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-SINR, SSB\_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-SINR and SSB\_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Void  NOTE 7: Void  NOTE 8: Void  NOTE 9: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | | |

Table 5.7.3.1.5-3: SS-SINR Intra frequency absolute accuracy requirements for the reported values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE Power Class 3 | Test 1 | | Test 2 | |
| Normal Conditions | | | | |
| Lowest reported value (Cell 3) | n257, n258, n261 | SS-SINR\_22 | All bands | SS-SINR\_18 |
| n260 | SS-SINR\_21 |
| n259 | FFS |
| Highest reported value (Cell 3) | All bands | SS-SINR\_58 | n257, n258, n261 | SS-SINR\_55 |
| n260 | SS-SINR\_54 |
| n259 | FFS |
| Extreme Conditions | | | | |
| Lowest reported value (Cell 3) | n257, n258, n261 | SS-SINR\_21+ FFS | All bands | SS-SINR\_17+ FFS |
| n260 | SS-SINR\_20+ FFS |
| n259 | FFS |
| Highest reported value (Cell 3) | All bands | SS-SINR\_59+ FFS | n257, n258, n261 | SS-SINR\_56+ FFS |
| n260 | SS-SINR\_55+ FFS |
| n259 | FFS |

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

#### 5.7.3.2 EN-DC FR2-FR2 SS-SINR measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.3.2.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-SINR measurement accuracy for NR FR2 is within the specified limits for all bands

5.7.3.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards, which support ss-SINR-Meas.

5.7.3.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.3.2.

5.7.3.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.3.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.3.2.4.1-1.Table 5.7.3.2.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 5.7.3.2-1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD |
| 5.7.3.2-2 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD |
| NOTE: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.3.2.4.1-2.

Table 5.7.3.2.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The general test parameter settings are set up according to Table 5.7.3.2.4.1-3.

2. Message contents are defined in clause 5.7.3.2.4.3.

3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-SINR measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.3.2.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5

2. Set the parameters according to Table 5.7.3.2.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-SINR reported values in the periodic MeasurementReport for the following requirements:

- R1: The SS-SINR value of Cell 2 reported by the UE is compared to the expected SS-SINR for Cell 2. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR for Cell 3. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

- R3: The SS-SINR value of Cell 3 reported by the UE is compared to the reported SS-SINR of Cell 2. If the resulting value is outside the limits in Table 5.7.3.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.3.2.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements for Test 2:

- R4: The SS-SINR value of Cell 2 reported by the UE is compared to the expected SS-SINR for Cell 2. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

- R5: The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR for Cell 3. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.

- R6: The SS-SINR value of Cell 3 reported by the UE is compared to the reported SS-SINR of Cell 2. If the resulting value is outside the limits in Table 5.7.3.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.

And the following requirements for Test 3:

- R7: The SS-SINR value of Cell 2 reported by the UE is compared to the expected SS-SINR for Cell 2. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R7 is increased by one. Otherwise, the number of passed iterations for R7 is increased by one.

- R8: The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR for Cell 3. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R8 is increased by one. Otherwise, the number of passed iterations for R8 is increased by one.

- R9: The SS-SINR value of Cell 3 reported by the UE is compared to the reported SS-SINR of Cell 2. If the resulting value is outside the limits in Table 5.7.3.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R9 is increased by one. Otherwise, the number of passed iterations for R9 is increased by one.

5.7.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.3.2.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ  Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells, SS-SINR  Table H.3.1-5  Table H.3.1-7 with Condition INTER-FREQ  Table H.3.4-1  Table H.3.4-1a  Table H.3.4-2  Table H.3.4-4 with Condition gapUE  Table H.3.4-5 with Condition Pattern #0  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.3. 2.4.3-2: ReportConfigNR-DEFAULT(Periodical)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL | | | |
| Information Element | Value/remark | Comment | Condition |
| ReportConfigNR::= SEQUENCE { |  |  |  |
| reportType CHOICE { |  |  |  |
| periodical SEQUENCE { |  |  | PERIODICAL |
| reportQuantityCell SEQUENCE { |  |  |  |
| rsrp | false |  |  |
| rsrq | false |  |  |
| sinr | true |  |  |
| } |  |  |  |
| maxReportCells | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.3.2.5 Test requirement

Table 5.7.3.2.5-1 defines the cell specific settings for all tests. Table 5.7.3.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-SINR measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.3.0.2.1 and relative accuracy requirements in clause 5.7.3.0.2.2. The following eight requirements are to be verified:

During Test 1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in Table 5.7.3.2.5-3.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in Table 5.7.3.2.5-3.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-SINR meets the requirements in Table 5.7.3.2.5-4.

During Test 2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-SINR meets the requirements in Table 5.7.3.2.5-4.

During Test 3:

R7: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R8: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R9: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-SINR meets the requirements in Table 5.7.3.2.5-4.

Table 5.7.3.2.5-1: SS-SINR Inter frequency general test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN |  | Freq1 | freq2 | freq1 | Freq2 | freq1 | Freq2 |
| Duplex mode |  | TDD | | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Data RBs allocated |  | 66 | | 66 | | 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | | | | | |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | | | | | |
| Uplink initial BWP configuration |  | ULBWP.0.1 | | | | | |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | | | | | |
| DRX cycle configuration | ms | Not applicable | | | | | |
| TRS configuration |  | TRS.2.1 TDD | | | | | |
| TCI state |  | TCI.State.0 | | | | | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| OCNG Patterns |  | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration |  | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 |
| SSB configuration |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation conditions |  | AWGN | AWGN | AWGN | AWGN | AWGN | AWGN |
| Antenna Configuration |  | 1x2 | 1x2 | 1x2 | 1x2 | 1x2 | 1x2 |
| NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  NOTE 2: Void  NOTE 3: Void  NOTE 4: Void | | | | | | | |

Table 5.7.3.2.5-2: SS-SINR Inter frequency OTA related test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration | degrees | Setup 1 | | Setup 1 | | Setup 1 | |
| Assumption for UE beamsNote 10 |  | Rough | | Rough | | Rough | |
| Note1 | dBm/15kHz Note4 | -105 | -105 | -105.1 | -105.1 | -105 | -105 |
| Note1 | dBm/SCS Note3 | -96 | -96 | -96.1 | -96.1 | -96 | -96 |
|  | dB | -0.5 | -0.5 | 11 | 11 | -2.1 | -2.1 |
| SS-RSRPNote2 | dBm/SCS Note4 | -96.5 | -96.5 | -85.1 | -85.1 | -98.1 | -98.1 |
| SS-SINRNote2 | dB | -0.5 | -0.5 | 11 | 11 | -2.1 | -2.1 |
|  | dB | -0.5 | -0.5 | 11 | 11 | -2.1 | -2.1 |
| IoNote2 | dBm/95.04 MHz Note4 | -69.3 | -69.3 | -55.75 | -55.75 | -64.9 | -64.9 |
| NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  NOTE 2: SS-SINR, SSB\_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone  NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone  NOTE 6: Void  NOTE 7: Void  NOTE 8: Void  NOTE 9: Void  NOTE 10: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation | | | | | | | |

Table 5.7.3.2.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| UE power class 3 | | | | | | |
| Normal Conditions | Test 1  All bands | | Test 2  All bands | | Test 3  All bands | |
| Lowest reported value (Cell 2) | SINR\_27 | | SINR\_48 | | n257, n258, n261 | SINR\_23 |
| n260 | SINR\_22 |
| n259 | FFS |
| Highest reported value (Cell 2) | n257, n258, n261 | SINR\_62 | n257, n258, n261 | SINR\_87 | n257, n258, n261 | SINR\_60 |
| n260 | SINR\_61 | n260 | SINR\_86 | n260 | SINR\_59 |
| n259 | FFS | n259 | FFS | n259 | FFS |
| Lowest reported value (Cell 3) | SINR\_27 | | SINR\_48 | | n257, n258, n261 | SINR\_23 |
| n260 | SINR\_22 |
| n259 | FFS |
| Highest reported value (Cell 3) | n257, n258, n261 | SINR\_62 | n257, n258, n261 | SINR\_87 | n257, n258, n261 | SINR\_60 |
| n260 | SINR\_61 | n260 | SINR\_86 | n260 | SINR\_59 |
| n259 | FFS | n259 | FFS | n259 | FFS |
| Extreme Conditions | Test 1  All bands | | Test 2  All bands | | Test 3  All bands | |
| Lowest reported value (Cell 2) | SINR\_27 + FFS | | SINR\_48 + FFS | | n257, n258, n261 | SINR\_23 + FFS |
| n260 | SINR\_22 + FfS |
| n259 | FFS |
| Highest reported value (Cell 2) | n257, n258, n261 | SINR\_62 + FFS | n257, n258, n261 | SINR\_87 + FFS | n257, n258, n261 | SINR\_60 + FFS |
| n260 | SINR\_61 + FFS | n260 | SINR\_86 + FFS | n260 | SINR\_59 + FFS |
| n259 | FFS | n259 | FFS | n259 | FFS |
| Lowest reported value (Cell 3) | SINR\_27 + FFS | | SINR\_48 + FFS | | n257, n258, n261 | SINR\_23 + FFS |
| n260 | SINR\_22 + FfS |
| n259 | FFS |
| Highest reported value (Cell 3) | n257, n258, n261 | SINR\_62 + FFS | n257, n258, n261 | SINR\_87 + FFS | n257, n258, n261 | SINR\_60 + FFS |
| n260 | SINR\_61 + FFS | n260 | SINR\_86 + FFS | n260 | SINR\_59 + FFS |
| n259 | FFS | n259 | FFS | n259 | FFS |

Table 5.7.3.2.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

|  |  |  |  |
| --- | --- | --- | --- |
| UE power class 3 | | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands | Test 3  All bands |
| Lowest value (SINR report Cell 3 – SINR report Cell 2) | - 8 | - 17 | - 9 |
| Highest value (SINR report Cell 3 – SINR report Cell 2) | + 8 | + 17 | + 9 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands | Test 3  All bands |
| Lowest value (SINR report Cell 3 – SINR report Cell 2) | – 8 + FFS | – 17 + FFS | – 9 + FFS |
| Highest value (SINR report Cell 3 – SINR report Cell 2) | + 8 + FFS | + 17 + FFS | + 9 + FFS |

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

### 5.7.4 L1-RSRP

#### 5.7.4.0 Minimum conformance requirements

##### 5.7.4.0.1 SSB-based L1-RSRP absolute measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 5.7.4.0.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.4.0.1-1: SSB based L1-RSRP absolute accuracy in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | |
|  |  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSSSB Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSSSB = 120kHz | SCSSSB = 240kHz |  |  |
| ±6.5 | ±9.5 | ≥-3 | Same value as SSB\_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±8.5 | ±11.5 | ≥-3 | N/A | | -70 | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.1.1 and 10.1.6.

##### 5.7.4.0.2 SSB-based L1-RSRP relative measurement accuracy requirements

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in Table 5.7.4.0.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 of TS 38.133 [6] for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.4.0.2-1: SSB based L1-RSRP relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSSSB Note 3 | | dBm/BWChannel |
|  |  |  | SCSSSB = 120kHz | SCSSSB = 240kHz |  |
| ±6.5 | ±9.5 | ≥-3 | Same value as SSB\_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival | | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.1.2 and 10.1.6.

##### 5.7.4.0.3 CSI-RS-based L1-RSRP absolute measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 5.7.4.0.3-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 of TS 38.133 [6] for a corresponding Band for each relevant CSI-RS.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.4.0.3-1.

Table 5.7.4.0.3-1: CSI-RS based L1-RSRP absolute accuracy in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 1 range | | | |
|  |  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±6.5 | ±9.5 | ≥-3 | Same value as CSI-RS\_RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±8.5 | ±11.5 | ≥-3 | N/A | | -70 | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.2.1 and 10.1.6.

##### 5.7.4.0.4 CSI-RS-based L1-RSRP relative measurement accuracy requirements

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 5.7.4.0.4-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 of TS 38.133 for a corresponding Band for each relevant CSI-RS.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.4.0.4-1.

Table 5.7.4.0.4-1: CSI-RS based L1-RSRP relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 1 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±6.5 | ±9.5 | ≥-3 | Same value as CSI-RS RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival | | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.2.2 and 10.1.6.

#### 5.7.4.1 EN-DC FR2 SSB based L1-RSRP measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.4.1.1 Test purpose

The purpose of this test is to verify that the SSB based L1-RSRP absolute measurement accuracy is within the specified limits for all bands.

5.7.4.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.4.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.4.0.1 and 5.7.4.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.4.1.

5.7.4.1.4 Test description

5.7.4.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.4.1.4.1-1.

Table 5.7.4.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.7.4.1-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.7.4.1-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.7.4.1-3 | LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.7.4.1-4 | LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.4.1.4.1-2.

Table 5.7.4.1.4.1-2: Initial conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC, TL/VL, TL/VH, TH/VL, TH/VH | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.7.4.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.3.3.1-1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.7.4.1.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for SSB-based L1-RSRP measurements. The UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.4.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.7.4.1.4.1-2.

The test sequence shall be carried out in RRC\_CONNECTED for every test case. Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.4.1.4.1-2.

2. Set the parameters according to T1 in Table 5.7.4.1.5-1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Rx beam selection to complete. Afterwards, T1 starts.

3. After 320 ms from the beginning of T1, the UE shall start sending L1-RSRP report including results of both SSB#0 and SSB#1 every 320 slots.

4. The UE shall start sending valid L1-RSRP reports, a valid report shall meet the absolute L1-RSRP requirement for SSB#0 and the relative L1-RSRP requirement for SSB#1. The SS shall checkfollowing requirements:

- R1: The L1-RSRP value of SSB#0 reported by the UE is compared to the expected L1-RSRP value for SSB#0. If the value is outside the limits in Table 5.7.4.1.5-3, Table 5.7.4.1.5-3a or Table 5.7.4.1.5-4 (depending on the test configuration) or the UE fails to report the measurement value for SSB#0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The DIFF-RSRP value of SSB#1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for SSB#1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-RSRP report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

6. Set the parameters according T2 in Table 5.7.4.1.5-1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Rx beam selection to complete. Afterwards, T2 starts.

7. Repeat steps 3-5. In Step 4, The SS shall check the L1-RSRP reported values of SSB#0 and SSB#1 in the periodic L1-RSRP reports for the following requirements.

- R3: The L1-RSRP value of SSB#0 or SSB#1 reported by the UE is compared to the expected L1-RSRP value. If the value is outside the limits in Table 5.7.4.1.5-3, Table 5.7.4.1.5-3b or Table 5.7.4.1.5-4 (depending on the test configuration) or the UE fails to report the measurement value for SSB#0 or SSB#1, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

- R4: The DIFF-RSRP value of SSB#0 or SSB#1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for SSB#0 or SSB#1, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

NOTE: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.1.1 in TS 38.521-2 [18].

5.7.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.4.1.4.3-1: Common Exception messages EN-DC SSB based L1-RSRP measurement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6-2 with conditions PERIODIC and SS-RSRP  Table H.3.6-3 with conditions SSB and PERIODIC  Table H.3.6-10  Table H.3.4-1  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.4.1.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.4.1.5 Test requirement

Table 5.7.4.1.5-1 defines the primary level settings including test tolerances for all tests.

Each L1-RSRP measurement report for each of the tests in Table 5.7.4.1.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.4.1.5-2 for test configurations 1, 2, 4 and 5, and the corresponding absolute accuracy requirements in Table 5.7.4.1.5-3 for test configurations 3 and 6 and Table 5.7.4.1.5-3a for all configurations.

Table 5.7.4.1.5-1: L1-RSRP test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | Test 2 |
| SSB GSCN | 1~4 |  | freq1 | freq1 |
| Duplex mode | 1~4 |  | TDD | TDD |
| TDD Configuration | 1~4 |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | 1~4 | MHz | 100: NRB,c = 66 | 100: NRB,c = 66 |
| Data RBs allocated | 1~4 |  | 66 | 66 |
| PDSCH Reference measurement channel | 1,2 |  | SR.3.2 TDD | SR.3.2 TDD |
|  | 3,4 |  | SR.3.3 TDD | SR.3.3 TDD |
| RMSI CORESET Reference Channel | 1,2 |  | CR.3.1 TDD | CR.3.1 TDD |
|  | 3,4 |  | CR.3.2 TDD | CR.3.2 TDD |
| Dedicated CORESET Reference Channel | 1,2 |  | CCR.3.1 TDD | CCR.3.1 TDD |
|  | 3,4 |  | CCR.3.7 TDD | CCR.3.7 TDD |
| SSB configuration | 1,2 |  | SSB.1 FR2 | SSB.1 FR2 |
| 3,4 | SSB.2 FR2 | SSB.2 FR2 |
| OCNG Patterns | 1~4 |  | OP.1 | OP.1 |
| Initial BWP Configuration | 1~4 |  | DLBWP.0.1  ULBWP.0.1 | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~4 |  | DLBWP.1.3  ULBWP.1.3 | DLBWP.1.3  ULBWP.1.3 |
| TRS Configuration | 1~4 |  | TRS.2.1 TDD | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~4 |  | TCI.State.2 | TCI.State.2 |
| SMTC configuration | 1~4 |  | SMTC.1 | SMTC.1 |
| reportConfigType | 1~4 |  | periodic | periodic |
| reportQuantity | 1~4 |  | ssb-Index-RSRP | ssb-Index-RSRP |
| Number of reported RS | 1~4 |  | 2 | 2 |
| L1-RSRP reporting period | 1~4 |  | slot320 | slot320 |
| Propagation condition | 1~4 |  | AWGN | AWGN |
| Antenna configuration |  |  | 1x2 | 1x2 |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | |

Table 5.7.4.1.5-2: L1-RSRP OTA related test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | Test 2 NOTE 3 | |
| SSB0 | SSB1 | SSB0 | SSB1 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | | Setup 1 according to A.9.1 | |
| Assumption for UE beamsNote 4 |  |  | Rough | | Rough | |
|  | 1~4 | dBm/15kHz | -104.1 | | n.a. | |
|  | 1,2 | dBm/SSB SCS | -95.1 | | n.a. | |
| 3,4 | -92.1 | | n.a. | |
|  | 1~4 | dB | 10 | -1.6 | n.a. | |
| SSB\_RPNote1 | 1,2 | dBm/SCS | -85.1 | -96.9 | As in Table B.2.4-2 + 5.7 | |
| 3,4 | -78 | -90 | As in Table B.2.4-2 + 5.7 | |
| IoNote1 | 1~4 | dBm/  95.04MHz | -55.67 | | SSB\_RP+34.68 | |
|  | 1~4 | dB | 10 | -1.6 | n.a. | |
| Note 1: SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: Void  Note 3: No additional noise is added by the test system in Test 2.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

Table 5.7.4.1.5-3: L1-RSRP absolute accuracy requirements for the reported values for test configurations 1 and 2 for the absolute accuracy rules R1, R3

|  |  |  |  |
| --- | --- | --- | --- |
| UE power class 3 | | | |
| Normal Conditions | Test 1 (SSB#0)  All bands | Test 2 (SSB#0 or SSB#1) | |
| Lowest reported value | 42 | n257, n258, n261 | 27 |
| n260 | 30 |
| n259 | FFS |
| Highest reported value | 101 | n257, n258, n261 | 83 |
| n260 | 86 |
| n259 | FFS |
| Extreme Conditions | Test 1 (SSB#0)  All bands | Test 2 (SSB#0 or SSB#1) | |
| Lowest reported value | 39+ FFS | n257, n258, n261 | 24 + FFS |
| n260 | 27 + FFS |
| n259 | FFS |
| Highest reported value | 104+ FFS | n257, n258, n261 | 86 + FFS |
| n260 | 89 + FFS |
| n259 | FFS |

Table 5.7.4.1.5-3a: evaluation limits for the ∆(Max-Min) reported values for SSB#0 for rules R1

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value SSB#0 | 18 | 18 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value SSB#0 | 18 + FFS | 18+ FFS |

Table 5.7.4.1.5-3b: evaluation limits for the ∆(Max-Min) reported values for SSB#0 or SSB#1 for rules R3

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value SSB#0 or SSB#1 | 18 | 18 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value SSB#0 or SSB#1 | 18 + FFS | 18+ FFS |

Table 5.7.4.1.5-4: L1-RSRP absolute accuracy requirements for the reported values for test configurations 3 and 4 for the absolute accuracy rules R1, R3

|  |  |  |  |
| --- | --- | --- | --- |
| UE power class 3 | | | |
| Normal Conditions | Test 1 (SSB#0)  All bands | Test 2 (SSB#0 or SSB#1) | |
| Lowest reported value | 45 | n257, n258, n261 | 30 |
| n260 | 33 |
| n259 | FFS |
| Highest reported value | 104 | n257, n258, n261 | 86 |
| n260 | 90 |
| n259 | FFS |
| Extreme Conditions | Test 1 (SSB#0)  All bands | Test 2 (SSB#0 or SSB#1) | |
| Lowest reported value | 42+ FFS | n257, n258, n261 | 27 + FFS |
| n260 | 30 + FFS |
| n259 | FFS |
| Highest reported value | 107+ FFS | n257, n258, n261 | 89 + FFS |
| n260 | 92 + FFS |
| n259 | FFS |

Table 5.7.4.1.5-5: evaluation limits for the reported values for T1 and T2 relative accuracy rules R2, R4

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| Lowest DIFF RSRP reported value | 2 | 0 |
| Highest DIFF RSRP reported value | 9 | +4 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| Lowest DIFF RSRP reported value | 1+ FFS | 0+ FFS |
| Highest DIFF RSRP reported value | 12+ FFS | + 7+ FFS |

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.7.4.2 EN-DC FR2 CSI-RS based L1-RSRP measurement accuracy

Editor's Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.4.2.1 Test purpose

The purpose of this test is to verify that the CSI-RS based L1-RSRP absolute measurement accuracy is within the specified limits for all bands.

5.7.4.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.4.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.4.0. 3 and 5.7.4.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.4.1.

5.7.4.2.4 Test description

5.7.4.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.4.2.4.1-1.

Table 5.7.4.2.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Test Case ID | Description |
| 5.7.4.2-1 | LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.7.4.2-2 | LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.4.2.4.1-2.

Table 5.7.4.2.4.1-2: Initial conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | | Comment |
| Test environment | NC, TL/VL, TL/VH, TH/VL, TH/VH | | As specified in TS 38.508-1 [14] clause 4.1. |
| Test frequencies | As specified in Annex E, Table E.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 5.7.4.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.3.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.4.1.1 |
| Exceptions to connection diagram | N/A | |  |

1. Message contents are defined in clause 5.7.4.2.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for CSI-RS-based L1-RSRP measurements. The UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.4.2.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.7.4.2.4.1-2.

The test sequence shall be carried out in RRC\_CONNECTED for every test case. Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.4.2.4.1-2.

2. Set the parameters according to T1 in Table 5.7.4.2.5-1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Rx beam selection to complete. Afterwards, T1 starts.

3. After 320 ms from the beginning of T1, the UE shall start sending L1-RSRP report including results of both CSI-RS0 and CSI-RS1.

4. The UE shall start sending valid L1-RSRP reports, a valid report shall meet the absolute L1-RSRP requirement for CSI-RS0 and the relative L1-RSRP requirement for CSI-RS1. The SS shall check for the following requirements:

- R1: The L1-RSRP value of CSI-RS0 reported by the UE is compared to the expected L1-RSRP value for CSI-RS0. If the value is outside the limits in Table 5.7.4.2.5-3, Table 5.7.4.2.5-3a or Table 5.7.4.2.5-4 (depending on the test configuration) or the UE fails to report the measurement value for CSI-RS0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The DIFF-RSRP value of CSI-RS1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for CSI-RS1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-RSRP report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

6. Set the parameters according T2 in Table 5.7.4.2.5-1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Rx beam selection to complete. Afterwards, T2 starts.

7. Repeat steps 3-5. In Step 4, The SS shall check the L1-RSRP reported values of CSI-RS0 and CSI-RS1 in the periodic L1-RSRP reports for the following requirements.

- R3: The L1-RSRP value of CSI-RS0 or CSI-RS1 reported by the UE is compared to the expected L1-RSRP value. If the value is outside the limits in Table 5.7.4.2.5-3, Table 5.7.4.2.5-3b or Table 5.7.4.2.5-4 (depending on the test configuration) or the UE fails to report the measurement value for CSI-RS0 or CSI-RS1, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.

- R4: The DIFF-RSRP value of CSI-RS0 or CSI-RS1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for CSI-RS0 or CSI-RS1, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

NOTE: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.1.1 in TS 38.521-2 [18].

5.7.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.4.2.4.3-1: Common Exception messages EN-DC CSI-RS based L1-RSRP measurement

|  |  |
| --- | --- |
| **Default Message Contents** | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6-2 with conditions PERIODIC and CSI-RSRP  Table H.3.6-3 with conditions CSI-RS and PERIODIC  Table H.3.4-1  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.4.2.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.4.2.5 Test requirement

Table 5.7.4.2.5-1 defines the primary level settings including test tolerances for all tests.

Each L1-RSRP measurement report for each of the tests in Table 5.7.4.2.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.4.2.5-2 for test configurations 1, 2, 4 and 5, and the corresponding absolute accuracy requirements in Table 5.7.4.2.5-3 for test configurations 3 and 6 and Table 5.7.4.2.5-3a for all configurations.

Table 5.7.4.2.5-1: L1-RSRP test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | Test 2 |
| SSB GSCN | 1~2 |  | freq1 | freq1 |
| Duplex mode | 1~2 |  | TDD | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 | SSB.1 FR2 |
| OCNG Patterns | 1~2 |  | OP.1 | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.1  ULBWP.1.1 | DLBWP.1.1  ULBWP.1.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 | TCI.State.2 |
| SMTC configuration | 1~2 |  | SMTC.1 | SMTC.1 |
| CSI-RS | 1~2 |  | CSI-RS.3.2 TDD | CSI-RS.3.2 TDD |
| reportConfigType | 1~2 |  | periodic | periodic |
| reportQuantity | 1~2 |  | cri-RSRP | cri-RSRP |
| Number of reported RS | 1~2 |  | 2 | 2 |
| L1-RSRP reporting period | 1~2 |  | slot320 | slot320 |
| Propagation condition | 1~2 |  | AWGN | AWGN |
| Antenna configuration | 1~2 |  | 1x2 | 1x2 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | |

Table 5.7.4.2.5-2: L1-RSRP OTA related test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | Test 2 NOTE 3 | |
| CSI-RS0 | CSI-RS1 | CSI-RS0 | CSI-RS1 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | | Setup 1 according to A.9.1 | |
| Assumption for UE beamsNote 4 |  |  | Rough | | Rough | |
|  | 1~2 | dBm/15kHz | -104.10 | | n.a. | |
|  | 1~2 | dBm/SSB SCS | -95.11 | | n.a.  n.a. | |
|  | 1~2 | dB | 10 | -1.8 | n.a. | |
| CSI-RS\_RPNote1 | 1~2 | dBm/SCS | -85.11 | -96.93 | As in Table B.2.4.2-2 + 5.7 | |
| IoNote1 | 1~2 | dBm/  95.04MHz | -55.67 | | CSI-RS\_RP+34.68 | |
|  | 1~2 | dB | 10 | -1.82 | n.a. | |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 3: No additional noise is added by the test system in Test 2.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | |

Table 5.7.4.2.5-3: L1-RSRP absolute accuracy requirements for the reported values for the absolute accuracy rules R1, R3

|  |  |  |  |
| --- | --- | --- | --- |
| UE power class 3 | | | |
| Normal Conditions | Test 1 (CSI-RS0)  All bands | Test 2 (CSI-RS0 or CSI-RS1) | |
| Lowest reported value | 42 | n257, n258, n261 | 27 |
| n260 | 30 |
| n259 | FFS |
| Highest reported value | 101 | n257, n258, n261 | 83 |
| n260 | 86 |
| n259 | FFS |
| Extreme Conditions | Test 1 (CSI-RS0)  All bands | Test 2 (CSI-RS0 or CSI-RS1) | |
| Lowest reported value | 39+ FFS | n257, n258, n261 | 25 + FFS |
| n260 | 27 + FFS |
| n259 | FFS |
| Highest reported value | 104+ FFS | n257, n258, n261 | 86 + FFS |
| n260 | 89 + FFS |
| n259 | FFS |

Table 5.7.4.2.5-3a: evaluation limits for the ∆(Max-Min) reported values for CSI-RS#0 for rules R1

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value CSI-RS#0 | 18 | 18 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value CSI-RS#0 | 18 + FFS | 18+ FFS |

Table 5.7.4.2.5-3b: evaluation limits for the ∆(Max-Min) reported values for CSI-RS#0 or CSI-RS#1 for rules R3

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value CSI-RS#0 or CSI-RS#1 | 18 | 18 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| ∆(Max-Min) reported value CSI-RS#0 or CSI-RS#1 | 18 + FFS | 18+ FFS |

Table 5.7.4.2.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R2, R4

|  |  |  |
| --- | --- | --- |
| UE power class 3 | | |
| Normal Conditions | Test 1  All bands | Test 2  All bands |
| Lowest DIFF RSRP reported value | 2 | 0 |
| Highest DIFF RSRP reported value | 9 | + 4 |
| Extreme Conditions | Test 1  All bands | Test 2  All bands |
| Lowest DIFF RSRP reported value | 1+ FFS | 0+ FFS |
| Highest DIFF RSRP reported value | 12+ FFS | + 7+ FFS |

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

### 5.7.5 SRS-RSRP

#### 5.7.5.0 Minimum conformance requirements

##### 5.7.5.0.1 Minimum conformance requirements for SRS-RSRP measurement accuracy

The SRS-RSRP measurement reported by the UE shall fulfil the accuracy requirements defined in Table 5.7.5.0.1-1 for FR1 and Table 5.7.7.0.1-2 for FR2, provided that the following conditions are met. The accuracy requirements in this clause are derived based on AWGN radio propagation conditions.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for SRS-RSRP measurements are fulfilled according to Annex B.2.z for a corresponding Band for each relevant SRS resource configured for measurement.

- The time difference between UE’s DL reference timing in the serving cell and SRS arrival time is no larger than Terror\_SRS\_RSRP, where

- Terror\_SRS\_RSRP = TC × NTA\_offset + 4.67us for FR1

- Terror\_SRS\_RSRP = TC × NTA\_offset + 3.67us for FR2

- NTA\_offset is defined in Table 7.1.2-2

- TC is 0.509ns

- The number of SRS ports in the SRS resource configured for measurement is 1,

- The number of symbols in the SRS resource configured for measurement is 1,

- The number of repetitions in the SRS resource configured for measurement is 1,

- Frequency hopping, sequence group hopping or sequence hopping is disabled in the SRS resource configured for measurement,

- The bandwidth of the SRS resource is 48 PRBs.

- One of the following conditions is met

- There is no other SRS resource with the same root sequence and on the same symbol and with same comb as the relevant SRS resource.

- If multiple SRS resources are on the same symbol and with same comb, the distance between cyclic shifts of any two resources is no less than 6 if transmissionComb = n4, and no less than 4 if transmissionComb = n2.

Table 5.7.5.0.1-1: SRS-RSRP absolute accuracy in FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | | | | | Conditions | | | | | | |
| Normal condition | | | Extreme condition | | | SRS Ês/Iot | Io Note 1 range | | | | | |
|  | | |  | | |  | NR operating band groups Note 2 | Minimum Io | | | | Maximum Io |
| dB | | | | | | dB |  | dBm / SCSSRS | | | dBm/BW Channel | dBm/BW Channel |
| SCSSRS (kHz) | | | SCSSRS (kHz) | | |  |  |  | | |  |  |
| 15 | 30 | 60 | 15 | 30 | 60 |  |  | SCSSRS = 15 kHz | SCSSRS = 30 kHz | SCSSRS = 60 kHz |  |  |
| ±3 | ±3.5 | ±5 | ±7.5 | ±8 | ±9.5 | ≥1 | NR\_TDD\_FR1\_A, | -120 | -117 | -114 | N/A | -70 |
|  |  |  |  |  |  |  | NR\_TDD\_FR1\_C | -119 | -116 | -113 | N/A | -70 |
|  |  |  |  |  |  |  | NR\_TDD\_FR1\_D | -118.5 | -115.5 | -112.5 | N/A | -70 |
|  |  |  |  |  |  |  | NR\_TDD\_FR1\_E | -118 | -115 | -112 | N/A | -70 |
| ±6.5 | ±7 | ±8.5 | ±9.5 | ±10 | ±11.5 | ≥1 | NR\_TDD\_FR1\_A,  NR\_TDD\_FR1\_C, NR\_TDD\_FR1\_D, NR\_TDD\_FR1\_E | N/A | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2. | | | | | | | | | | | | |

Table 5.7.5.0.1-2: SRS-RSRP absolute accuracy in FR2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | | | Conditions | | | | |
| Normal condition | | Extreme condition | | SRS Ês/Iot | Io Note 1 range | | | |
|  | |  | |  | Minimum Io | | | Maximum Io |
| dB | | | | dB | dBm / SCSSRS Note 2 | | dBm/BWChannel | dBm/BWChannel |
| SCSSRS (kHz) | | SCSSRS (kHz) | |  | SCSSRS = | SCSSRS = |  |  |
| 60 | 120 | 60 | 120 |  | 60kHz | 120kHz |  |  |
| ±6 | ±8.5 | ±9 | ±11.5 | ≥1 | Same value as SRS\_RP in Table B.2.7-2, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±9 | ±11.5 | ±11 | ±13.5 | ≥1 | N/A | | -70 | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | | | |

5.7.5.0.1.1 SRS-RSRP report mapping

The reporting range of SRS-RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution. The mapping of measured quantity is defined in Table 5.7.7.0.1.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 5.7.7.0.1.2-1: SRS-RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| SRS-RSRP\_0 | SRS-RSRP<-140 | dBm |
| SRS-RSRP\_1 | -140≤ SRS-RSRP<-139 | dBm |
| SRS-RSRP\_2 | -139≤ SRS-RSRP<-138 | dBm |
| SRS-RSRP\_3 | -138≤ SRS-RSRP<-137 | dBm |
| SRS-RSRP\_4 | -137≤ SRS-RSRP<-136 | dBm |
| .. | .. | … |
| SRS-RSRP\_95 | -46≤ SRS-RSRP<-45 | dBm |
| SRS-RSRP\_96 | -45≤ SRS-RSRP<-44 | dBm |
| SRS-RSRP\_97 | -44≤ SRS-RSRP | dBm |
| SRS-RSRP\_98 | Infinity |  |
| Note: ‘Infinity’ means that UE cannot detect SRS due to too strong signal to measure. | | |

The normative reference for this requirement is TS 38.133 [6] clause 10.1.22.1.

#### 5.7.5.1 EN-DC FR2 SRS-RSRP measurement accuracy

Editor's Note: This test case is incomplete. Following aspects are either missing or TBD:

- The test procedure is incomplete

- The message content is FFS

- MU/TT analysis for UE PC3 and test frequency f ≤ 40.8 GHz is complete.

- MU/TT analysis for UE power class other than PC3 is incomplete.

- MU//TT analysis for test frequency f > 40.8 GHz is incomplete.

5.7.5.1.1 Test purpose

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits with SRS-RSRP measurement requirements in TS 38.133 [6] clause 10.1.22.1.1.

5.7.5.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards and CLI-SRS-RSRP

5.7.5.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.5.1.

5.7.5.1.4 Test description

5.7.5.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.5.1.4.1-1.

Table 5.7.5.1.4.1-1: EN-DC FR2 SRS-RSRP accuracy supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 5.7.5.1 - 1 | LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode |
| 5.7.5.1 - 2 | LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.5.1.4.1-2.

Table 5.7.5.1.4.1-2: Initial conditions EN-DC FR2 SRS-RSRP measurement accuracy

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.5.1.4.3.

2. In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2).

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.5.1.4.2 Test procedure

There are two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2)

The test parameters and applicability for Cell 1 are defined in A.3.7.2 of 38.133. The test parameters for the Cell 2 are given in Table 5.7.5.1.5-1 and 5.7.5.1.5-2 below. The test parameter for the (virtual) neighbour cell UE transmitting SRS are given in Table 5.7.5.1.5-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table 5.7.5.1.5-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.7.5.1.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

<rest of the steps are FFS>

5.7.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

FFS

5.7.5.1.5 Test requirement

Table 5.7.5.1.5-1 defines the cell specific settings for all tests. Table 5.7.5.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in table 5.7.5.1.5-3 and absolute accuracy requirements in table 5.7.5.1.5-4. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

Table 5.7.5.1.5-1: FR2 test parameters for SRS-RSRP accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | Test 2 |
| SSB GSCN | 1~2 |  | freq1 | freq1 |
| Duplex mode | 1~2 |  | TDD | TDD |
| TDD configuration | 1~2 |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.3 FR2 | SSB.3 FR2 |
| OCNG Patterns | 1~2 |  | OP.1 | OP.1 |
| TRS configuration | 1~2 |  | TRS.2.1 TDD | TRS.2.1 TDD |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.3  ULBWP.1.3 | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~2 |  | SMTC.1 | SMTC.1 |
| Time offset between DL from serving cell and SRS from test system | 1~2 | μs | 10.76 | 10.67 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Propagation condition | 1~2 |  | AWGN | AWGN |
| Antenna configuration | 1~2 |  | 1x2 | 1x2 |
| SRS configuration | 1~2 |  | SRSConf.1 | SRSConf.1 |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | | |

Table 5.7.5.1.5-2: SRS-RSRP accuracy OTA related test parameters for PSCell and Neighbour cell UE in FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | T1 | T2 |
| Angle of arrival configuration |  | Setup 1 defined A.9.1 | Setup 1 defined A.9.1 |
| Beam assumption Note 5 |  | Fine | Fine |
| Note1 | dBm/15kHzNote3 | -100 | N/A |
| Note1 | dBm/SCSNote3 | -91 | N/A |
|  | dB | 2 | N/A |
| Es | dBm/SCSNote3 |  | (Table B.2.7-2 Rx Beam Peak)+5 |
| SRS\_RPNote2 | dBm/SCS | -89 | (Table B.2.7-2 Rx Beam Peak) +5 |
| BB Note4 | dB | >1 | 1 |
| IoNote2 | dBm/95.04 MHz Note3 | -57.89 | (Table B.2.7-2 Rx Beam Peak +50.79dB) |
| Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SRS\_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 4: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor ∑MBP from TS 38.101-2 [19] Table 6.2.1.3-4.  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. | | | |

Table 5.7.5.1.5-3: SRS configuration parameters for FR2 SRS-RSRP accuracy

|  |  |  |
| --- | --- | --- |
|  | Field | SRSConf.1 |
| SRS-ResourceSet | srs-ResourceSetId | 0 |
|  | srs-ResourceIdList | 0 |
|  | resourceType | Periodic |
|  | Usage | Codebook |
| SRS-Resource | SRS-ResourceId | 0 |
|  | nrofSRS-Ports | Port1 |
|  | transmissionComb | n2 |
|  | combOffset-n2 | 0 |
|  | cyclicShift-n2 | 0 |
|  | resourceMapping  startPosition | 0 |
|  | resourceMapping  nrofSymbols | n1 |
|  | resourceMapping  repetitionFactor | n1 |
|  | freqDomainPosition | 0 |
|  | freqDomainShift | 0 |
|  | freqHopping  c-SRS | 12 |
|  | freqHopping  b-SRS | 0 |
|  | freqHopping  b-hop | 0 |
|  | groupOrSequenceHopping | Neither |
|  | resourceType | Periodic |
|  | periodicityAndOffset-p | sl160,25 |
|  | sequenceId | 0 |

Table 5.7.5.1.5-4: SRS-RSRP absolute accuracy test requirement

|  |  |
| --- | --- |
|  | Test requirement Notes1,2,3 |
| SRS | SRS\_RP -δ +Gmin ≤ Reported SRS-RSRP(dBm) ≤SRS\_RP +δ +Gmax |
| Note 1: SRS\_RP is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test  Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test  Note 3: Gmin and Gmax are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class | |

The SRS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 5.7.5.0.10.1 The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

For the test to pass, the ratio of successful reported values for each requirement shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.7.5.2 EN-DC FR2 CLI-RSSI measurement accuracy

Editor's Note: This test case is incomplete. Following aspects are either missing or TBD:

- The test procedure is incomplete

- The message content is FFS

- TT analysis is missing.

##### 5.7.5.2.1 Test purpose

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits with CLI-RSSI measurement requirements in TS 38.133 [6] clause 10.1.22.2.1.

##### 5.7.5.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards and CLI-CLI-RSSI

##### 5.7.5.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.5.2.

##### 5.7.5.2.4 Test description

5.7.5.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.5.2.4.1-1.

Table 5.7.5.2.4.1-1: Applicable NR configurations for FR2 CLI-RSSI accuracy test

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.5.2.4.1-2.

Table 5.7.5.2.4.1-2: Initial conditions EN-DC FR2 CLI-RSSI measurement accuracy

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.5.2.4.3.

2. In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2).

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.5.2.4.2 Test procedure

There are two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2)

The test parameters and applicability for Cell 1 are defined in A.3.7.2 of 38.133. The test parameters for the Cell 2 are given in Table 5.7.5.2.5-1 and 5.7.5.2.5-2 below. The test parameter for the (virtual) neighbour cell UE transmitting SRS are given in Table 5.7.5.2.5-2.

Before the test UE is configured to perform CLI-RSSI measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table 5.7.5.2.5-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.

2. Set the parameters according to Table 5.7.5.2.5-1 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

<rest of the steps are FFS>

5.7.5.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

FFS

##### 5.7.5.2.5 Test requirement

Table 5.7.5.2.5-1 defines the cell specific settings for all tests. Table 5.7.5.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in table 5.7.5.2.5-3 and absolute accuracy requirements in table 5.7.5.2.5-4. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table 5.7.5.2.5-4.

During T2:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table 5.7.5.2.5-4.

Table 5.7.5.2.5-1: FR2 test parameters for CLI-RSSI accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | Test 2 |
| SSB GSCN | 1~2 |  | freq1 | freq1 |
| Duplex mode | 1~2 |  | TDD | TDD |
| TDD configuration | 1~2 |  | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.3 FR2 | SSB.3 FR2 |
| OCNG Patterns Note2 | 1~2 |  | OP.1 | OP.1 |
| TRS configuration | 1~2 |  | TRS.2.1 TDD | TRS.2.1 TDD |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.3  ULBWP.1.3 | DLBWP.1.3  ULBWP.1.3 |
| SMTC configuration | 1~2 |  | SMTC.1 | SMTC.1 |
| Time offset between DL from serving cell and OCNG from test system | 1~2 | μs | 10.67 | 10.67 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS |  |  |  |  |
| EPRE ratio of PDSCH to PDSCH DMRS |  |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |  |
| Propagation condition | 1~2 |  | AWGN | AWGN |
| Antenna configuration | 1~2 |  | 1x2 | 1x2 |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: OCNG is not transmitted in the CLI-RSSI measurement resources. | | | | |

Table 5.7.5.2.5-2: CLI-RSSI accuracy OTA related test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | T1 | T2 |
| Angle of arrival configuration |  | Setup 1 defined A.9.1 | |
| Beam assumption Note 5 |  | Fine | |
| on CLI-RSSI measurement resource Note1 | dBm/15kHzNote3 | -100+TT | |
| on CLI-RSSI measurement resource Note1 | dBm/SCSNote3 | -91 | |
| on CLI-RSSI measurement resource | dB | -Infinity | |
| RSRP on CLI-RSSI measurement resource Note2 | dBm/SCS | -Infinity | |
| BBon CLI-RSSI measurement resource Note4 | dB | -Infinity | |
| Io on CLI-RSSI measurement resource Note2 | dBm/95.04 MHz Note3 | -62.01 | |
| Io on CLI-RSSI measurement resource Note2 | dBm/1.08 MHz | -81.46 | |
| Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SRS\_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 4: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor ∑MBP from TS 38.101-2 [19] Table 6.2.1.3-4.  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. | | | |

Table 5.7.5.2.5-3: CLI-RSSI measurement resource configuration for FR2 CLI-RSSI accuracy

|  |  |  |
| --- | --- | --- |
|  | Field | SRSConf.1 |
| CLI-RSSI measurement resource | rssi-ResourceId | 0 |
| rssi-SCS | 120kHz |
| startPRB | 0 |
| nrofPRBs | 66 |
| startPosition | 3 |
| nrofSymbols | 11 |
| rssi-PeriodicityAndOffset | sl160, 25 |

Table 5.7.5.2.5-4: CLI-RSSI absolute accuracy test requirement

|  |  |
| --- | --- |
|  | Test requirement Notes1,2,3 |
|  | Io -δ +Gmin ≤ Reported CLI-RSSI(dBm) ≤Io +δ +Gmax |
| Note 1: Io is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for 1.08MHz  Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test  Note 3: Gmin and Gmax are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class | |

The CLI-RSSI measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.2.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table 5.7.5.2.5-4.

During T2:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table 5.7.5.2.5-4.

### 5.7.6 L1-SINR measurement for beam reporting

#### 5.7.6.0 Minimum conformance requirements

##### 5.7.6.0.1 L1-SINR accuracy requirements with CSI-RS based CMR and no dedicated IMR configured

5.7.6.0.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-SINR in this clause apply to all CSI-RS resources configured as CMR and no dedicated resource configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements in Table 5.7.6.0.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.

- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in Table 5.7.6.0.1.1-1.

Table 5.7.6.0.1.1-1: L1-SINR absolute accuracy for CSI-RS based CMR only in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI-RS  CMR  Ês/Iot Note 3 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±5.5 | ±6.5 | ≥-3 | Same value as CSI-RS\_RP in Table in B.2.8.1, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the CSI-RS CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

5.7.6.0.1.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-SINR is defined as the L1-SINR measured from one CSI-RS compared to the largest measured value of L1-SINR among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 5.7.6.0.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.

- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in Table 5.7.6.0.1.2-1.

Table 5.7.6.0.2.1-1: L1-SINR relative accuracy for CSI-RS based CMR only in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI-RS  CMR  Ês/Iot Note 2, Note 4 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 3 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±[4.5] | ±[5.5] | ≥-3 | Same value as CSI-RS\_RP in Table in B.2.8.1, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CSI-RS CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the CSI-RS CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

##### 5.7.6.0.2 L1-SINR accuracy requirements with SSB based CMR and dedicated IMR configured

5.7.6.0.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-SINR in this clause apply to all SSBs configured as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in Table 5.7.6.0.2.1-1 for SSB based CMR and NZP-IMR and in Table 5.7.6.0.2.1-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.2.1-1 and 5.7.6.0.2.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.

- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.

- SSB based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.2.1-1 and 5.7.6.0.2.1-2.

Table 5.7.6.0.2.1-1: L1-SINR absolute accuracy for SSB based CMR and NZP-IMR in FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | |
| Normal condition | Extreme condition | SSB  CMR  Ês/Iot Note 3 | NZP-IMR  Ês/Iot Note 3 | Io Note 1 range | | | |
|  |  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dB | dBm / SCSSSB Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  |  | SCSSSB = 120kHz | SCSSSB = 240kHz |  |  |
| ±4.0 | ±5.0 | ≥0 | ≥0 | Same value as SSB\_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | | |

Table 5.7.6.0.2.1-2: L1-SINR absolute accuracy for SSB based CMR and ZP-IMR in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | SSB  CMR  Ês/Iot Note 3 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSSSB Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSSSB = 120kHz | SCSSSB = 240kHz |  |  |
| ±4.5 | ±5.5 | ≥-3 | Same value as SSB\_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

5.7.6.0.2.2 Relative Accuracy

The relative accuracy of SSB based L1-SINR is defined as the L1-SINR measured from one SSB configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all SSB based CMRs and IMRs of the serving cell.

The accuracy requirements are defined in Table 5.7.6.0.2.2-1 for SSB based CMR and NZP-IMR and in Table 5.7.6.0.2.2-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.2.2-1 and 5.7.6.0.2.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.

- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.

- SSB based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.2.2-1 and 5.7.6.0.2.2-2.

Table 5.7.6.0.2.2-1: L1-SINR relative accuracy for SSB based CMR and NZP-IMR in FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | |
| Normal condition | Extreme condition | SSB  CMR  Ês/Iot Note 2, Note 4 | NZP-IMR  Ês/Iot Note 4 | Io Note 1 range | | | |
|  |  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dB | dBm / SCSSSB Note 3 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  |  | SCSSSB = 120kHz | SCSSSB = 240kHz |  |  |
| ±[3.0] | ±[4.0] | ≥0 | ≥0 | Same value as SSB\_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter SSB CMR Ês/Iot is the minimum SSB CMR Ês/Iot of the pair of SSBs to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the SSB CMR Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | | |

Table 5.7.6.0.2.2-2: L1-SINR relative accuracy for SSB based CMR and ZP-IMR in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | SSB  CMR  Ês/Iot Note 2, Note 4 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSSSB Note 3 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSSSB = 120kHz | SCSSSB = 240kHz |  |  |
| ±[3.5] | ±[4.5] | ≥-3 | Same value as SSB\_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter SSB CMR Ês/Iot is the minimum SSB CMR Ês/Iot of the pair of SSBs to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the SSB CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

##### 5.7.6.0.3 L1-SINR accuracy requirements with CSI-RS based CMR and dedicated IMR configured

5.7.6.0.3.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-SINR in this clause apply to all CSI-RS resources as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in Table 5.7.6.0.3.1-1 for CSI-RS based CMR and NZP-IMR and in Table 5.7.6.0.3.1-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.3.1-1 and 5.7.6.0.3.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.

- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.

- CSI-RS based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.3.1-1 and 5.7.6.0.3.1-2.

Table 5.7.6.0.3.1-1: L1-SINR absolute accuracy for CSI-RS based CMR and NZP-IMR in FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | |
| Normal condition | Extreme condition | CSI-RS CMR Ês/Iot Note 3 | NZP-IMR  Ês/Iot Note 3 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dB | dBm / SCSCSI-RS Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±4.0 | ±5.0 | ≥0 | ≥0 | Same value as CSI-RS\_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the CSI-RS Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | | |

Table 5.7.6.0.3.1-2: L1-SINR absolute accuracy for CSI-RS based CMR and ZP-IMR in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI-RS CMR Ês/Iot Note 3 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 2 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±4.5 | ±5.5 | ≥-3 | Same value as CSI-RS\_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

5.7.6.0.3.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-SINR is defined as the L1-SINR measured from one CSI-RS configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all CSI-RS based CMRs and IMRs of the serving cell.

The accuracy requirements are defined in Table 5.7.6.0.3.2-1 for CSI-RS based CMR and NZP-IMR and in Table 5.7.6.0.3.2-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.3.2-1 and 5.7.6.0.3.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.

- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.

- CSI-RS based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.3.2-1 and 5.7.6.0.3.2-2.

Table 5.7.6.0.3.2-1: L1-SINR relative accuracy for CSI-RS based CMR and NZP-IMR in FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | |
| Normal condition | Extreme condition | CSI-RS CMR Ês/Iot Note 2, Note 4 | NZP-IMR  Ês/Iot Note 4 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dB | dBm / SCSCSI-RS Note 3 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±[3.0] | ±[4.0] | ≥0 | ≥0 | Same value as CSI-RS\_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CSI-RS CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the CSI-RS CMR Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | | |

Table 5.7.6.0.3.2-2: L1-SINR relative accuracy for CSI-RS based CMR and ZP-IMR in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI-RS CMR Ês/Iot Note 2, Note 4 | Io Note 1 range | | | |
|  |  | Minimum Io | | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 3 | | dBm/BWChannel | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |  |
| ±[3.5] | ±[4.5] | ≥-3 | Same value as CSI-RS\_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival | | N/A | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CSI-RS CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.  NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  NOTE 4: In the test cases, the CSI-RS CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | |

#### 5.7.6.1 EN-DC FR2 CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off L1-SINR measurement accuracy

Editor’s Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.7.6.1.1 Test purpose

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits.

5.7.6.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards, and supporting L1-SINR measurement.

5.7.6.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.6.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.6.1.

5.7.6.1.4 Test description

5.7.6.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.6.1.4.1-1.

Table 5.7.6.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.6.1.4.1-2.

Table 5.7.6.1.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Annex C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.6.1.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for CSI-RS-based L1-SINR measurements. The UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.6.1.4.2 Test procedure

Prior to the start of testing, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH format 2 with a reporting periodicity as mentioned in Table 5.7.6.1.5-1.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.6.1.5-1.

2. Set the parameters according to Table 5.7.6.1.5-1.

3. After 640 ms from step 2, the UE shall start sending L1-SINR report including results of both CSI-RS#0 and CSI-RS#1.

4. The SS shall check the L1-SINR reported values of CSI-RS0 and CSI-RS1 in the periodic L1-SINR reports for the following requirements:

- R1: The L1-SINR value of CSI-RS0 reported by the UE is compared to the expected L1-SINR value for CSI-RS0. If the value is outside the limits in Table 5.7.6.1.5-3 or the UE fails to report the measurement value for CSI-RS0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The DIFF SINR value of CSI-RS1 reported by the UE is compared to the expected DIFF SINR value. If the resulting value is outside the limits in Table 5.7.6.1.5-4 or the UE fails to report the measurement value for CSI-RS1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-SINR report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

5.7.6.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.6.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6A-1 with conditions PERIODIC and CSI-SINR  Table H.3.6A-2 with conditions CSI-RS and PERIODIC  Table H.3.4-1  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.6.1.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| csi-RS-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.6.1.5 Test requirement

Table 5.7.6.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each L1-SINR measurement report for each of the tests in Table 5.7.6.1.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.6.1.5-3 for all test configurations, and the corresponding relative accuracy requirements in Table 5.7.6.1.5-4 for all test configurations.

Table 5.7.6.1.5-1: FR2 CSI-RS based L1-SINR general test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 |
| SSB GSCN | 1~2 |  | freq1 |
| Duplex mode | 1~2 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 |
| OCNG Patterns | 1~2 |  | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.1  ULBWP.1.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 |
| SMTC configuration | 1~2 |  | SMTC.1 |
| CSI-RS | 1~2 |  | CSI-RS.3.2 TDD |
| reportConfigType | 1~2 |  | periodic |
| reportQuantity-r16 | 1~2 |  | cri-SINR-r16 |
| nrofReportedRS | 1~2 |  | 2 |
| L1-RSRP reporting period | 1~2 |  | slot640 |
| Propagation condition | 1~2 |  | AWGN |
| Antenna configuration | 1~2 |  | 1x2 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | |

Table 5.7.6.1.5-2: FR2 CSI-RS based L1-SINR OTA related test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | |
| CSI-RS0 | CSI-RS1 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9 | |
| Assumption for UE beamsNote 4 |  |  | Rough | |
|  | 1~2 | dBm/15kHz | -104.1 | |
|  | 1~2 | dBm/SSB SCS | -95.1 | |
|  | 1~2 | dB | 10 | -1.8 |
| CSI-RS-RSRPNote1 | 1~2 | dBm/SCS | -85.07 | -96.87 |
| IoNote1 | 1~2 | dBm/  95.04MHz | -55.67 | -63.88 |
|  | 1~2 | dB | 10 | -1.8 |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 3: Void.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

Table 5.7.6.1.5-3: L1-SINR absolute accuracy requirements for the reported values for the absolute accuracy rules R1

|  |  |
| --- | --- |
| UE power class 3 | |
| Normal Conditions | Test 1  All bands |
| Lowest reported value (CSI-RS0) | 53 |
|
|
| Highest reported value (CSI-RS0) | 76 |
|
|
|
|
| Extreme Conditions | Test 1  All bands |
| Lowest reported value (CSI-RS0) | 51 |
|
|
| Highest reported value (CSI-RS0) | 78 |
|
|
|
|

Table 5.7.6.1.5-4: Evaluation limits for the reported values for T1 and T2 relative accuracy rules R2

|  |  |
| --- | --- |
| UE power class 3 | |
| Normal Conditions | Test 1  All bands |
| Lowest DIFF L1-SINR reported value | 6 |
| Highest DIFF L1-SINR reported value | 15 |
| Extreme Conditions | Test 1  All bands |
| Lowest DIFF L1-SINR reported value | 5 |
| Highest DIFF L1-SINR reported value | 15 |

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.7.6.2 EN-DC FR2 SSB based CMR and dedicated IMR L1-SINR absolute measurement accuracy

Editor’s Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.7.6.2.1 Test purpose

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits.

5.7.6.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards, and supporting L1-SINR measurement.

5.7.6.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.6.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.6.2.

5.7.6.2.4 Test description

5.7.6.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.6.2.4.1-1. Test environment parameters are given in Table 5.7.6.2.4.1-3.

Table 5.7.6.2.4.1-1: Supported test configurations

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

Configure the test equipment and the DUT according to the parameters in Table 5.7.6.2.4.1-2.

Table 5.7.6.2.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Annex C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.6.2.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for SSB-based L1-SINR measurements. The UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.6.2.4.2 Test procedure

Prior to the start of testing, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in Table 5.7.6.2.5-1.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.6.2.5-1.

2. Set the parameters according to Table 5.7.6.2.5-1.

3. After 640 ms from step 2, the UE shall start sending L1-SINR report including results of both SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1.

4. The SS shall check the L1-SINR reported values of SSB#0 and SSB#1 in the periodic L1-SINR reports for the following requirements:

- R1: The L1-SINR value of SSB#0+CSI-RS#0 reported by the UE is compared to the expected L1-SINR value for SSB#0+CSI-RS#0. If the value is outside the limits in Table 5.7.6.2.5-4 or the UE fails to report the measurement value for SSB#0+CSI-RS#0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The DIFF L1-SINR value of SSB#1+CSI-RS#1 reported by the UE is compared to the expected DIFF L1-SINR value. If the resulting value is outside the limits in Table 5.7.6.2.5-5 or the UE fails to report the measurement value for SSB#0+CSI-RS#0 or SSB#1+CSI-RS#1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-SINR report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

5.7.6.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.6.2.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6A-1 with conditions PERIODIC and SS-SINR and CSI-RS\_IMR  Table H.3.6A-2 with conditions SSB and PERIODIC  Table H.3.6A-3 with conditions PERIODIC  Table H.3.4-1 |

Table 5.7.6.2.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| ssb-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.6.2.5 Test requirement

Table 5.7.6.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

Table 5.7.6.2.5-1: FR2 L1-SINR measurement test parameters with SSB based CMR and CSI-IM based IMR

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 |
| SSB GSCN | 1~4 |  | freq1 |
| Duplex mode | 1~4 |  | TDD |
| TDD Configuration | 1~4 |  | TDDConf.3.1 |
| BWchannel | 1~4 | MHz | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~4 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~4 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~4 |  | CCR.3.1 TDD |
| SSB configuration | 1,2 |  | SSB.1 FR2 |
| 3,4 | SSB.2 FR2 |
| CSI-RS configuration | 1~4 |  | CSI-RS 3.1A TDD |
| OCNG Patterns | 1~4 |  | OP.1 |
| Initial BWP Configuration | 1~4 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~4 |  | DLBWP.1.3  ULBWP.1.3 |
| TRS Configuration | 1~4 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~4 |  | TCI.State.2 |
| SMTC configuration | 1~4 |  | SMTC.1 |
| reportConfigType | 1~4 |  | periodic |
| reportQuantity-r16 | 1~4 |  | ssb-Index-SINR-r16 |
| Number of reported RS | 1~4 |  | 2 |
| L1-SINR reporting period | 1~4 |  | slot640 |
| Propagation condition | 1~4 |  | AWGN |
| Antenna configuration | 1~4 |  | 1x2 |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | |

Table 5.7.6.2.5-2: FR2 SSB specific test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | |
| SSB#0 | SSB#1 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | |
| Assumption for UE beamsNote 4 |  |  | Rough | |
|  | 1~4 | dBm/15kHz | -104.1 | |
|  | 1,2 | dBm/SSB SCS | -95.1 | |
| 3,4 | -92.1 | |
|  | 1~4 | dB | 10 | 1.2 |
| SSB RSRPNote1 | 1,2 | dBm/SCS | -85.07 | -93.87 |
| 3,4 | -82.07 | -90.87 |
| IoNote1 | 1~4 | dBm/  95.04MHz | -55.67 | -62.43 |
|  | 1~4 | dB | 10 | 1.2 |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

Table 5.7.6.2.5-3: FR2 CSI-RS specific test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | |
| CSI-RS#0 | CSI-RS#1 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | |
| Assumption for UE beamsNote 4 |  |  | Rough | |
|  | 1~4 | dBm/15kHz | -104.1 | |
|  | 1~4 | dBm/CSI-RS SCS | -95.1 | |
|  | 1~4 | dB | 10 | 1.2 |
| CSI-RS RSRPNote1 | 1~4 | dBm/SCS | -85.07 | -93.87 |
| IoNote1 | 1~4 | dBm/  95.04MHz | -55.67 | -62.43 |
|  | 1~4 | dB | 10 | 1.2 |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

Table 5.7.6.2.5-4: L1-SINR absolute accuracy requirements for the reported values for the absolute accuracy rules R1

|  |  |
| --- | --- |
| UE power class 3 | |
| Normal Conditions | Test 1  All bands |
| Lowest reported value (SSB#0+CSI-RS#0) | 56 |
|  |
|  |
| Highest reported value (SSB#0+CSI-RS#0) | 73 |  |
|  |
|  |
|  |
|  |
| Extreme Conditions | Test 1  All bands |  |
| Lowest reported value (SSB#0+CSI-RS#0) | 54 |  |
|  |
|  |
| Highest reported value (SSB#0+CSI-RS#0) | 75 |  |
|  |
|  |
|  |
|  |

Table 5.7.6.2.5-5: Evaluation limits for the reported values for T1 and T2 relative accuracy rules R2

|  |  |
| --- | --- |
| UE power class 3 | |
| Normal Conditions | Test 1  All bands |
| Lowest DIFF L1-SINR reported value | 5 |
| Highest DIFF L1-SINR reported value | 12 |
| Extreme Conditions | Test 1  All bands |
| Lowest DIFF L1-SINR reported value | 4 |
| Highest DIFF L1-SINR reported value | 13 |

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

#### 5.7.6.3 EN-DC FR2 CSI-RS based CMR and dedicated IMR L1-SINR measurement accuracy

Editor’s Note: This test case has been completed for the following configurations:

- Test frequency f ≤ 40.8 GHz

- UE PC3

- Normal conditions

- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

5.7.6.3.1 Test purpose

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits.

5.7.6.3.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards, and supporting L1-SINR measurement.

5.7.6.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.6.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.6.3.

5.7.6.3.4 Test description

5.7.6.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.6.3.4.1-1.

Table 5.7.6.3.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.6.3.4.1-2.

Table 5.7.6.3.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Annex C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in clause 5.7.6.3.4.3.

2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for CSI-RS-based L1-SINR measurements. The UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.6.3.4.2 Test procedure

Prior to the start of testing, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH format 2 with a reporting periodicity as mentioned in Table 5.7.6.3.5-1.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On,* according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.6.3.5-1.

2. Set the parameters according to T1 in Table 5.7.6.3.5-1.

3. After 640 ms from step 2, the UE shall start sending L1-SINR report including results of both CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM#1.

4. The SS shall check the L1-SINR reported values of CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM#1 in the periodic L1-SINR reports for the following requirements:

- R1: The L1-SINR value of CSI-RS#0+CSI-IM#0 reported by the UE is compared to the expected L1-SINR value for CSI-RS#0+CSI-IM#0. If the value is outside the limits in Table 5.7.6.3.5-3 or the UE fails to report the measurement value for CSI-RS#0+CSI-IM#0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.

- R2: The DIFF L1-SINR value of CSI-RS#1+CSI-IM#1 reported by the expected DIFF L1-SINR. If the resulting value is outside the limits in Table 5.7.6.3.5-4 or the UE fails to report the measurement value for CSI-RS#1+CSI-IM#1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-SINR report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

5.7.6.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with the following exceptions:

Table 5.7.6.3.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.6A-1 with conditions PERIODIC and CSI-SINR  Table H.3.6A-2 with conditions CSI-RS and PERIODIC  Table H.3.6A-4 with conditions APERIODIC  Table H.3.4-1  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 5.7.6.3.4.3-2: RadioLinkMonitoringConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-133 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RadioLinkMonitoringConfig ::= SEQUENCE { |  |  |  |
| failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { | 1 entry |  |  |
| purpose | both | UE is configured to perform RLM and BFD based on the SSBs. |  |
| detectionResource CHOICE { |  |  |  |
| csi-RS-Index | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.7.6.3.5 Test requirement

Table 5.7.6.3.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each L1-SINR measurement report for each of the tests in Table 5.7.6.3.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.6.3.5-3 for all test configurations, and the corresponding relative accuracy requirements in Table 5.7.6.1.5-4 for all test configurations.

Table 5.7.6.3.5-1: FR2 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 |
| SSB GSCN | 1~2 |  | freq1 |
| Duplex mode | 1~2 |  | TDD |
| TDD Configuration | 1~2 |  | TDDConf.3.1 |
| BWchannel | 1~2 | MHz | 100: NRB,c = 66 |
| PDSCH Reference measurement channel | 1~2 |  | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 |  | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 |  | CCR.3.1 TDD |
| SSB configuration | 1~2 |  | SSB.1 FR2 |
| OCNG Patterns | 1~2 |  | OP.1 |
| Initial BWP Configuration | 1~2 |  | DLBWP.0.1  ULBWP.0.1 |
| Dedicated BWP configuration | 1~2 |  | DLBWP.1.1  ULBWP.1.1 |
| TRS Configuration | 1~2 |  | TRS.2.1 TDD |
| PDCCH/PDSCH TCI Configuration | 1~2 |  | TCI.State.2 |
| SMTC configuration | 1~2 |  | SMTC.1 |
| CSI-RS configuration as CMR | 1~2 |  | CSI-RS.3.2 TDD |
| CSI-IM configuration as IMR | 1~2 |  | CSI-IM.3.3 TDD |
| reportConfigType | 1~2 |  | periodic |
| reportQuantity-r16 | 1~2 |  | cri-SINR-r16 |
| nrofReportedRS | 1~2 |  | 2 |
| L1-RSRP reporting period | 1~2 |  | slot640 |
| Propagation condition | 1~2 |  | AWGN |
| Antenna configutaion | 1~2 |  | 1x2 |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | |

Table 5.7.6.3.5-2: FR2 CSI-RS based L1-SINR OTA related test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | |
| CSI-RS0 | CSI-RS1 |
| Angle of arrival configuration |  |  | Setup 1 according to A.9.1 | |
| Assumption for UE beamsNote 4 |  |  | Rough | |
|  | 1~2 | dBm/15kHz | -104.1 | |
|  | 1~2 | dBm/SSB SCS | -95.1 | |
|  | 1~2 | dB | 10 | -1.8 |
| CSI-RS-RSRPNote1 | 1~2 | dBm/SCS | -85.07 | -96.87 |
| IoNote1 | 1~2 | dBm/  95.04MHz | -55.67 | -63.88 |
|  | 1~2 | dB | 10 | -1.8 |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 3: No additional noise is added by the test system in Test 2.  Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | |

Table 5.7.6.3.5-3: L1-SINR absolute accuracy requirements for the reported values for the absolute accuracy rules R1

|  |  |
| --- | --- |
| UE power class 3 | |
| Normal Conditions | Test 1  All bands |
| Lowest reported value (CSI-RS0) | 55 |
|
|
| Highest reported value (CSI-RS0) | 74 |
|
|
|
|
| Extreme Conditions | Test 1  All bands |
| Lowest reported value (CSI-RS0) | 53 |
|
|
| Highest reported value (CSI-RS0) | 76 |
|
|
|
|

Table 5.7.6.3.5-4: Evaluation limits for the reported values for T1 and T2 relative accuracy rules R2

|  |  |
| --- | --- |
| UE power class 3 | |
| Normal Conditions | Test 1  All bands |
| Lowest DIFF L1-SINR reported value | 7 |
| Highest DIFF L1-SINR reported value | 15 |
| Extreme Conditions | Test 1  All bands |
| Lowest DIFF L1-SINR reported value | 6 |
| Highest DIFF L1-SINR reported value | 15 |

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

### 5.7.8 CSI-RSRQ

### 5.7.8.0 Minimum conformance requirements

#### 5.7.8.0.1 Intra-frequency CSI-RSRQ accuracy requirements

##### [TS 38.133, Clause 10.1.8.2 and Clause 10.1.11]

##### 5.7.8.0.1.1 Absolute CSI-RSRQ accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RSRQ in this clause apply to the intra-frequency measurement defined in 9.10.2.1 in FR2 in TS 38.133 [6].

The accuracy requirements in Table 5.7.8.0.1.1-1 are valid under the following conditions:

- Conditions defined in Clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 in TS 38.133 [6] for a corresponding Band for each relevant SSB.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 in TS 38.133 [6] for a corresponding Band for each relevant CSI-RS.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.8.0.1.1-1.

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

Note: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in Clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.8.0.1.1-1: CSI-RSRQ Intra frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 2 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 1 | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±2.5 | ±4 | ≥-3 | Same value as CSI\_RP in Table B.2.8-2 in TS 38.133 [6], according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-6 |  | |  |
| Note 1: Values based on Refsens and EIS spherical coverage as defined in Clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  Note 2: Io specified at the reference point and assumed to have constant EPRE across the bandwidth.  Note 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of CSI-RSRQ measurement is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 5.7.8.0.1.1-2. The range in the signaling may be larger than the guaranteed accuracy range.

Table 5.7.8.0.1.1-2: CSI-RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| CSI-RSRQ\_0 | CSI-RSRQ<-43 | dB |
| CSI-RSRQ\_1 | -43≤ CSI-RSRQ<-42.5 | dB |
| CSI-RSRQ\_2 | -42.5≤ CSI-RSRQ<-42 | dB |
| CSI-RSRQ\_3 | -42≤ CSI-RSRQ<-41.5 | dB |
| CSI-RSRQ\_4 | -41.5≤ CSI-RSRQ<-41 | dB |
| .. | .. | … |
| CSI-RSRQ\_122 | 17.5≤ CSI-RSRQ<18 | dB |
| CSI-RSRQ\_123 | 18≤ CSI-RSRQ<18.5 | dB |
| CSI-RSRQ\_124 | 18.5≤ CSI-RSRQ<19 | dB |
| CSI-RSRQ\_125 | 19≤ CSI-RSRQ<19.5 | dB |
| CSI-RSRQ\_126 | 19.5≤ CSI-RSRQ<20 | dB |
| CSI-RSRQ\_127 | 20 ≤ CSI-RSRQ | dB |

#### 5.7.8.0.2 Inter-frequency CSI-RSRQ accuracy requirements

##### [TS 38.133, Clause 10.1.10.2 and Clause 10.1.11]

##### 5.7.8.0.2.1 Absolute CSI-RSRQ accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RSRQ in this clause apply the inter-frequency measurement defined in 9.10.3.1 in FR2 in TS 38.133 [6].

The accuracy requirements in Table 5.7.8.0.2.1-1 are valid under the following conditions:

- Conditions defined in Clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 in TS 38.133 [6] for a corresponding Band for associated SSB.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 in TS 38.133 [6] for a corresponding Band for each relevant CSI-RS.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.8.0.2.1-1.

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

Note: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 5.7.8.0.2.1-1: CSI-RSRQ Inter frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 2 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 1 | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±2.5 | ±4 | ≥-3 | Same value as CSI\_RP in Table B.2.9-2 in TS 38.133 [6], according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-4 |  | |  |
| Note 1: Values based on Refsens and EIS spherical coverage as defined in Clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  Note 2: Io specified at the reference point and assumed to have constant EPRE across the bandwidth.  Note 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

The reporting range of CSI-RSRQ measurement is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 5.7.8.0.2.1-2. The range in the signaling may be larger than the guaranteed accuracy range.

Table 5.7.8.0.2.1-2: CSI-RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| CSI-RSRQ\_0 | CSI-RSRQ<-43 | dB |
| CSI-RSRQ\_1 | -43≤ CSI-RSRQ<-42.5 | dB |
| CSI-RSRQ\_2 | -42.5≤ CSI-RSRQ<-42 | dB |
| CSI-RSRQ\_3 | -42≤ CSI-RSRQ<-41.5 | dB |
| CSI-RSRQ\_4 | -41.5≤ CSI-RSRQ<-41 | dB |
| .. | .. | … |
| CSI-RSRQ\_122 | 17.5≤ CSI-RSRQ<18 | dB |
| CSI-RSRQ\_123 | 18≤ CSI-RSRQ<18.5 | dB |
| CSI-RSRQ\_124 | 18.5≤ CSI-RSRQ<19 | dB |
| CSI-RSRQ\_125 | 19≤ CSI-RSRQ<19.5 | dB |
| CSI-RSRQ\_126 | 19.5≤ CSI-RSRQ<20 | dB |
| CSI-RSRQ\_127 | 20 ≤ CSI-RSRQ | dB |

##### 5.7.8.0.2.2 Relative CSI-RSRQ accuracy

The relative accuracy of CSI-RSRQ is defined as the CSI-RSRQ measured from one cell compared to the CSI-RSRQ measured from another cell with the same center frequency, or between any two CSI-RSRQ levels measured on the same cell in FR2.

The accuracy requirements in Table 5.7.8.0.2.2-1 are valid under the following conditions:

- Conditions defined in Clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 in TS 38.133 [6] for a corresponding Band for the associated SSB.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 in TS 38.133 [6] for a corresponding Band for each relevant CSI-RS.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

• The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.8.0.2.2-1.

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

Note: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 5.7.8.0.2.2-1: CSI-RSRQ Inter frequency relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 2 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 1 | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±3 | ±4 | ≥-3 | Same value as CSI\_RP in Table B.2.9-2 in TS 38.133 [6], according to UE Power class, operating band and angle of arrival | | -50 |
| ±4 | ±4 | ≥-4 |  | |  |
| Note 1: Values based on Refsens and EIS spherical coverage as defined in Clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  Note 2: Io specified at the reference point and assumed to have constant EPRE across the bandwidth.  Note 3: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.  Note 4: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | |

#### 5.7.8.1 EN-DC intra-frequency measurement accuracy with FR2 serving cell and FR2 target cell

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing

- TT analysis is missing

##### 5.7.8.1.1 Test purpose

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.8 in TS 38.133 [6] for inter-frequency measurement.

##### 5.7.8.1.2 Test applicability

This test applies to all types of NR UE Rel-16 and forward.

##### 5.7.8.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in Clause 5.7.8.0.1.

The normative reference for this requirement is in TS 38.133 [6] A.5.7.8.1.

##### 5.7.8.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.8.1.4.1 Initial conditions

Supported test configuration are shown in Table 5.7.8.1.4.1-1.

Table 5.7.8.1.4.1-1: CSI-RSRQ intra frequency CSI-RSRQ supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | FDD LTE PCell, Cell 2&3 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, Cell 2&3 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.8.1.4.1-2.

Table 5.7.8.1.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] Clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] Clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in Clause 5.7.8.1.4.3.

2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the CSI-RSRQ measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] Clause C.1.0 and C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.8.1.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] Clause 4.5.

2. Set the parameters according to Table 5.7.8.1.5-1 and Table 5.7.8.1.5-2 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the CSI-RSRQ reported values in the periodic MeasurementReport. The CSI-RSRQ value of Cell 3 reported by the UE is compared to the expected CSI-RSRQ. If the value is outside the limits (determined by Table 5.7.8.0.1.1-1 and Table 5.7.8.0.1.1-2) or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.8.1.5-1 and Table 5.7.8.1.5-2 as appropriate and repeat steps 5-7.

5.7.8.1.4.3 Message contents

[TBD]

##### 5.7.8.1.5 Test Requirements

The absolute accuracy of CSI-RSRQ intra-frequency measurement is test by using the parameters in Table 5.7.8.1.5-1. The CSI-RSRQ intra frequency OTA related test parameters are provided in Table 5.7.8.1.5-2.

The CSI-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal CSI-RSRQ +2.5dB to Nominal CSI-RSRQ –3.5dB and the CSI-RSRQ measurement accuracy in test 2 shall be within the range Nominal CSI-RSRQ +3.5dB to Nominal CSI-RSRQ –4.5dB according to the requirements in Clause 5.7.8.0.1 with an additional -1dB margin reflecting the possible impact of UE self-noise in the test. Nominal CSI-RSRQ is the value shown in Table 5.7.8.1.5-2.

Table 5.7.8.1.5-1: CSI-RSRQ intra frequency test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 | |
| SSB ARFCN | |  | **Freq1** | | **Freq1** | | |
| Duplex mode | |  | TDD | | TDD | | |
| TDD configuration | |  | TDDConf.3.1 | | TDDConf.3.1 | | |
| BWchannel | | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | | |
| BWP configuration | Initial DL BWP |  | DLBWP.0.1 | | | | |
| Dedicated DL BWP | DLBWP.1.1 | | | | |
| Initial UL BWP | ULBWP.0.1 | | | | |
| Dedicated UL BWP | ULBWP.1.1 | | | | |
| TRS configuration | |  | TRS.2.1 TDD |  | TRS.2.1 TDD |  | |
| CSI-RS configuration for RRM | |  | CSI-RS.RRM.FR2.1 TDD | | | | |
| TCI state | |  | TCI.State.0 |  | TCI.State.0 |  | |
| PDSCH Reference measurement channel | |  | SR.3.1 TDD |  | SR.3.1 TDD |  | |
| RMSI CORESET Reference Channel | |  | CR.3.1 TDD | - | CR.3.1 TDD | - | |
| Control channel RMC | |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - | |
| OCNG Patterns | |  | OP.1 | OP.1 | OP.1 | OP.1 | |
| SMTC configuration | |  | SMTC.1 | | | | |
| SSB configuration | |  | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | |
| Time offset with Cell 2 | | μs | - | 0.58 | - | 0.58 |
|  | |  |  |  |  |  | |
| PDSCH/PDCCH subcarrier spacing | | kHz | 120 | 120 | 120 | 120 | |
| SS-RSSI-Measurement | |  | Not Applicable | | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | 0 | 0 | |
| EPRE ratio of PBCH\_DMRS to SSS | |
| EPRE ratio of PBCH to PBCH\_DMRS | |
| EPRE ratio of PDCCH\_DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH\_DMRS | |
| EPRE ratio of PDSCH\_DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH\_DMRS | |
| EPRE ratio of OCNG DMRS to SSSNote 1 | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | |
|  | | dB | 3 | 3 | -3 | -3 | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 5: Void | | | | | | | |

Table 5.7.8.1.5-2: CSI-RSRQ intra frequency OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 according to Clause A.3.15.1 in TS 38.133 [6] | | | |
| Assumption for UE beamsNote 9 |  | Rough | | | |
| Note1 | dBm/15kHzNote4 | -95 | | -95 | |
| Note1 | dBm/SCSNote3 | -86 | | -86 | |
| CSI-RSRPNote2 | dBm/SCS Note4 | -83 | -83 | -89 | -89 |
| CSI-RSRQ Note2 | dB | -14.77 | -14.77 | -16.81 | -16.81 |
|  | dB | -1.76 | -1.76 | -4.76 | -4.76 |
| IoNote2 | dBm/95.04 MHz Note4 | -50 | | -54 | -54 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.  Note 6: NR operating band groups are as defined in Clause 3.5.2 in TS 38.133 [6].  Note 7: Void  Note 8: Void  Note 9: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation. | | | | | |

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

#### 5.7.8.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing

- TT analysis is missing

##### 5.7.8.2.1 Test purpose

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.10 in TS 38.133 [6] for inter-frequency measurement.

##### 5.7.8.2.2 Test applicability

This test applies to all types of NR UE Rel-16 and forward.

##### 5.7.8.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in Clause 5.7.8.0.2.

The normative reference for this requirement is in TS 38.133 [6] A.5.7.8.2.

##### 5.7.8.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.8.2.4.1 Initial conditions

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table 5.7.8.2.4.1-1.

Table 5.7.8.2.4.1-1: CSI-RSRQ Inter frequency CSI-RSRQ supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.7.8.2.4.1-2.

Table 5.7.8.2.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] Clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.2 and Table E.3-1 and TS 38.508-1 [14] Clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. The general test parameter settings are set up according to Table 5.7.8.2.5-1.

2. Message contents are defined in Clause 5.7.8.2.4.3.

3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-RSRQ measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] Clause C.1.0 and C.1.1.

4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.8.2.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] Clause 4.5.

2. Set the parameters according to Table 5.7.8.2.5-1 and Table 5.7.8.2.5-2 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the CSI-RSRQ reported values in the periodic MeasurementReport. The CSI-RSRQ value of Cell 3 reported by the UE is compared to the expected CSI-RSRQ. If the value is outside the limits (determined by Table 5.7.8.0.2.1-1 and Table 5.7.8.0.2.1-2) or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.8.2.5-1 and Table 5.7.8.2.5-2 as appropriate and repeat steps 5-7.

5.7.8.2.4.3 Message contents

[TBD]

##### 5.7.8.2.5 Test Requirements

Both absolute accuracy and relative accuracy requirements of CSI-RSRQ inter-frequency measurement are tested by using test setup in Table 5.7.8.2.5-1 and Table 5.7.8.2.5-2.

The CSI-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal CSI-RSRQ +2.5dB to Nominal CSI-RSRQ -3.5dB and the CSI-RSRQ measurement accuracy in test 2 shall be within the range Nominal CSI-RSRQ +3.5dB to Nominal CSI-RSRQ -4.5dB according to the requirements in Clause 5.7.8.0.2.1 with an additional -1dB margin reflecting the possible impact of UE self-noise in the test.

The CSI-RSRQ relative measurement accuracy shall fulfil the requirements in Clause 5.7.8.0.2.2.

Table 5.7.8.2.5-1: CSI-RSRQ Inter frequency general test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | | Test 2 | |
| Cell 2 | | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN |  | Freq1 | | freq2 | freq1 | Freq2 |
| Duplex mode |  | TDD | | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | | 100: NRB,c = 66 | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | | - | CR.3.1 TDD | - |
| OCNG Patterns |  | OP.1 | | OP.1 | OP.1 | OP.1 |
| SMTC configuration |  | SMTC.1 FR2 | | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 |
| CSI-RS configuration for RRM |  | CSI-RS.RRM.FR2.1 TDD | | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | | 120 | 120 | 120 |
| Time offset with Cell 2 | μs | | - | 0.58 | - | 0.58 |
| EPRE ratio of PSS to SSS | dB | 0 | | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
|  |
|  | dB | -1.75 | | -1.75 | -3 | -3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: CSI-RSRQ, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | |

Table 5.7.8.2.5-2: CSI-RSRQ Inter frequency OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| AoA setup |  | Setup 1 in Clause A.3.15 in TS 38.133 [6] | | Setup 1 in Clause A.3.15 in TS 38.133 [6] | |
| Assumption for UE beamsNote 8 |  | Rough | | Rough | |
| Note1 | dBm/15kHzNote4 | -94.03 | | -94.03 | |
| Note1 | dBm/SCSNote3 | -85.0 | | -85.0 | |
| CSI-RPNote2 | dBm/SCS Note4 | -86.75 | -86.75 | -88 | -88 |
| CSI-RSRQNote2 | dB | -14.75 | -14.75 | -15.56 | -15.56 |
|  | dB | -1.75 | -1.75 | -3 | -3 |
| IoNote2 | dBm/95.04 MHz Note4 | -53.8 | -53.8 | -54.25 | -54.25 |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: CSI-RSRQ, CSI-RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: CSI-RSRQ and CSI-RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.  Note 6: Void  Note 7: Void  Note 8: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6] and does not limit UE implementation or test system implementation. | | | | | |

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

### 5.7.9 CSI-SINR

#### 5.7.9.0 Minimum conformance requirements

##### 5.7.9.0.1 Intra-frequency CSI-SINR accuracy requirements

[TS 38.133, Clause 10.1.13.2 and Clause 10.1.16]

###### 5.7.9.0.1.1 Absolute CSI-SINR accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.9.0.1.1-1 are valid under the following conditions:

- Conditions defined in Clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.12 in TS 38.133 [6] for a corresponding Band.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in Clause 7.3.4 of TS 38.101-2 [3].

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

- Note: The reference measurement timing for intra-frequency measurement is serving cell timing.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.9.0.1.1-1.

Table 5.7.9.0.1.1-1: CSI-SINR Intra frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 2 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 1 | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±3 | ±4 | ≥-3 | Same value as CSI\_RP in Table B.2.8-2 in TS 38.133 [6], according to UE Power class, operating band and angle of arrival | | -50 |
| ±3.5 | ±4 | ≥-6 |
| Note 1: Values based on Refsens and EIS spherical coverage as defined in Clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  Note 2: Io specified at the reference point and assumed to have constant EPRE across the bandwidth.  Note 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  Note 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5\*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5\*CP but no larger than CP. | | | | | |

The reporting range of CSI-SINR for reporting is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 5.7.9.0.1.1-2. The range in the signaling may be larger than the guaranteed accuracy range.

Table 5.7.9.0.1.1-2: CSI-SINR measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| CSI-SINR\_0 | CSI-SINR <-23 | dB |
| CSI-SINR\_1 | -23≤ CSI-SINR <-22.5 | dB |
| CSI-SINR\_2 | -22.5≤ CSI-SINR <-22 | dB |
| CSI-SINR\_3 | -22≤ CSI-SINR <-21.5 | dB |
| CSI-SINR\_4 | -21.5≤ CSI-SINR <-21 | dB |
| .. | .. | … |
| CSI-SINR\_123 | 38≤ CSI-SINR <38.5 | dB |
| CSI-SINR\_124 | 38.5≤ CSI-SINR <39 | dB |
| CSI-SINR\_125 | 39≤ CSI-SINR <39.5 | dB |
| CSI-SINR\_126 | 39.5≤ CSI-SINR <40 | dB |
| CSI-SINR\_127 | 40≤ CSI-SINR | dB |

##### 5.7.9.0.2 Inter-frequency CSI-SINR accuracy requirements

[TS 38.133, Clause 10.1.15.2 and Clause 10.1.16]

###### 5.7.9.0.2.1 Absolute CSI-SINR accuracy

The requirements for absolute accuracy of CSI-SINR in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 5.7.9.0.2.1-1 are valid under the following conditions:

- Conditions defined in Clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 in TS 38.133 [6] for a corresponding Band.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in Clause 7.3.4 of TS 38.101-2 [3].

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

- Note: The reference measurement timing for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.9.0.2.1-1.

Table 5.7.9.0.2.1-1: CSI-SINR Inter frequency absolute accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 2 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 1 | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±3 | ±4 | ≥-3 | Same value as CSI\_RP in Table B.2.9-2 in TS 38.133 [6], according to UE Power class, operating band and angle of arrival | | -50 |
| 3.5 | ±4 | ≥-4 |
| Note 1: Values based on Refsens and EIS spherical coverage as defined in Clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  Note 2: Io specified at the reference point and assumed to have constant EPRE across the bandwidth.  Note 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  Note 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5\*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5\*CP but no larger than CP. | | | | | |

The reporting range of CSI-SINR for reporting is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 5.7.9.0.2.1-2. The range in the signaling may be larger than the guaranteed accuracy range.

Table 5.7.9.0.2.1-2: CSI-SINR measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| CSI-SINR\_0 | CSI-SINR <-23 | dB |
| CSI-SINR\_1 | -23≤ CSI-SINR <-22.5 | dB |
| CSI-SINR\_2 | -22.5≤ CSI-SINR <-22 | dB |
| CSI-SINR\_3 | -22≤ CSI-SINR <-21.5 | dB |
| CSI-SINR\_4 | -21.5≤ CSI-SINR <-21 | dB |
| .. | .. | … |
| CSI-SINR\_123 | 38≤ CSI-SINR <38.5 | dB |
| CSI-SINR\_124 | 38.5≤ CSI-SINR <39 | dB |
| CSI-SINR\_125 | 39≤ CSI-SINR <39.5 | dB |
| CSI-SINR\_126 | 39.5≤ CSI-SINR <40 | dB |
| CSI-SINR\_127 | 40≤ CSI-SINR | dB |

###### 5.7.9.0.2.2 Relative CSI-SINR accuracy

The relative accuracy of CSI-SINR in inter frequency case is defined as the CSI-SINR measured from one cell on a frequency in FR2 compared to the CSI-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 5.7.9.0.2.2-1 are valid under the following conditions:

- Conditions defined in Clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 in TS 38.133 [6] for a corresponding Band.

- |CSI\_RP1dBm - CSI\_RP2dBm| £ 27 dB

- |Channel 1\_Io ‑Channel 2\_Io | £ 20 dB

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in Clause 7.3.4 of TS 38.101-2 [3].

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

- Note: The reference measurement timing for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.9.0.2.2-1.

Table 5.7.9.0.2.2-1: CSI-SINR Inter frequency relative accuracy in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 2 range | | |
|  |  |  | Minimum Io | | Maximum Io |
| dB | dB | dB | dBm / SCSCSI-RS Note 1 | | dBm/BWChannel |
|  |  |  | SCSCSI-RS = 60kHz | SCSCSI-RS = 120kHz |  |
| ±3.5 | ±4 | ≥-3 | Same value as CSI\_RP in Table B.2.9-2 in TS 38.133 [6], according to UE Power class, operating band and angle of arrival | | -50 |
| ±4 | ±4 | ≥-6 |
| Note 1: Values based on Refsens and EIS spherical coverage as defined in Clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.  Note 2: Io specified at the reference point and assumed to have constant EPRE across the bandwidth.  Note 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  Note 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5\*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5\*CP but no larger than CP. | | | | | |

#### 5.7.9.1 EN-DC intra-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing

- TT analysis is missing

##### 5.7.9.1.1 Test purpose

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.13.2.1 in TS 38.133 [6].

##### 5.7.9.1.2 Test applicability

This test applies to all types of NR UE Rel-16 and forward.

##### 5.7.9.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in Clause 5.7.9.0.1.

The normative reference for this requirement is in TS 38.133 [6] A.5.7.9.1.

##### 5.7.9.1.4 Test description

5.7.9.1.4.1 Initial conditions

Supported test configurations are shown in Table 5.7.9.1.4.1-1.

Table 5.7.9.1.4.1-1: CSI-SINR Intra frequency CSI-SINR supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | FDD LTE PCell, Cell 2&3 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, Cell 2&3 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations. | |

Configure the test equipment and the DUT according to the parameters in Table 5.7.9.1.4.1-2.

Table 5.7.9.1.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] Clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] Clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in Clause 5.7.9.1.4.3.

2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier which is specified in Clause A.3.7.2.1 in TS 38.133 [6], Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the CSI-SINR measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] Clause C.1.0 and C.1.1.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.9.1.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] Clause 4.5.

2. Set the parameters according to Table 5.7.9.1.5-1 and Table 5.7.9.1.5-2 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the CSI-SINR reported values in the periodic MeasurementReport. The CSI-SINR value of Cell 3 reported by the UE is compared to the expected CSI-SINR. If the value is outside the limits (determined by Table 5.7.9.0.1.1-1 and Table 5.7.9.0.1.1-2) or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.9.1.5-1 and Table 5.7.9.1.5-2 as appropriate and repeat steps 5-7.

5.7.9.1.4.3 Message contents

[TBD]

##### 5.7.9.1.5 Test Requirements

The CSI-SINR absolute measurement accuracy in test 1 shall be within the range Nominal CSI-SINR+3dB to Nominal CSI-SINR -4dB and the CSI-SINR measurement accuracy in test 2 shall be within the range Nominal CSI-SINR +3.5dB to Nominal CSI-SINR -4.5dB according to the requirements in Clause 5.7.9.0.1.1 with an additional -1dB margin reflecting the possible impact of UE self-noise in the test. Nominal CSI-SINR is the value shown in Table 5.7.9.1.5-2.

Table 5.7.9.1.5-1: CSI-SINR Intra frequency test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN |  | **Freq2** | | **Freq2** | |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | | | |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | | | |
| Uplink initial BWP configuration |  | ULBWP.0.1 | | | |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | | | |
| DRX cycle configuration | ms | Not applicable | | | |
| TRS configuration |  | TRS.2.1 TDD | | | |
| TCI state |  | TCI.State.0 | | | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD |  | SR.3.1 TDD |  |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated RMSI CORESET Reference Channel |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns |  | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration |  | SMTC.1 | | | |
| SSB configuration |  | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 |
| CSI-RS for mobility |  | - | CSI-RS.RRM.FR2.1 TDD | - | CSI-RS.RRM.FR2.1 TDD |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 |
| Time offset with Cell 2 | μs | - | 0.29 | - | 0.29 |
| CSI-RSSI-Measurement |  | Not Applicable | | | |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
|  | dB | 4.54 | 2.66 | -3 | -3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | |

Table 5.7.9.1.5-2: CSI-SINR Intra frequency OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration |  | Setup 1 according to Clause A.3.15.1 in TS 38.133 [6] | | Setup 1 according to Clause A.3.15.1 in TS 38.133 [6] | |
| Assumption for UE beamsNote 7 |  | Rough | | Rough | |
| Note1 | dBm/15kHz Note4 | -105 | | N/A | |
| Note1 | dBm/SCS Note3 | -96 | | N/A | |
|  | dB | 4.54 | 2.66 | -3 | -3 |
| CSI-RSRPNote2 | dBm/SCS Note4 | -91.46 | -93.34 | -99 | -99 |
| CSI-SINR Note2 | dB | 0 | -3.2 | -4.76 | -4.76 |
|  | dB | 0 | -3.2 | -4.76 | -4.76 |
| IoNote2 | dBm/95.04 MHz Note4 | -59.2 | | -64 | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.  Note 6: NR operating band groups are as defined in Clause 3.5.2 in TS 38.133 [6].  Note 7: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6] and does not limit UE implementation or test system implementation. | | | | | |

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

#### 5.7.9.2 EN-DC inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing

- TT analysis is missing

##### 5.7.9.2.1 Test purpose

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.15.2.1 and 10.1.15.2.2 in TS 38.133 [6] for inter-frequency measurement.

##### 5.7.9.2.2 Test applicability

This test applies to all types of NR UE Rel-16 and forward.

##### 5.7.9.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in Clause 5.7.9.0.2.

The normative reference for this requirement is in TS 38.133 [6] A.5.7.9.2.

##### 5.7.9.2.4 Test description

5.7.9.2.4.1 Initial conditions

Supported test configurations are shown in Table 5.7.9.2.4.1-1.

Table 5.7.9.2.4.1-1: CSI-SINR inter frequency CSI-SINR supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 5.7.9.2.4.1-2.

Table 5.7.9.2.4.1-2: Initial conditions

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comment |
| Test environment | NC | As specified in TS 36.508 [25] Clause 4.1. |
| Test frequencies | As specified in Annex E, E.1.1, E.1.3.2 and Table E.3-1 and TS 38.508-1 [14] Clause 4.3.1 for E-UTRA and 7.2.3 for NR. | |
| Channel bandwidth | As specified by the selected test configuration. | |
| Propagation conditions | AWGN | As specified in Clause C.2.1 |
| Connection Diagram | TE Part: A.3.3.1.1  DUT Part: A.3.4.1.1 | As specified in TS 38.508-1 [14] Annex A. |
| Exceptions to connection diagram | N/A |  |

1. Message contents are defined in Clause 5.7.9.2.4.3.

2. There are two carriers and three cells specified in the test. In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier which is specified in Clause A.3.7.2.1 in TS 38.133 [6]. The TCI status for Cell 1 is defined in Table A.3.16.2-1 in TS 38.133 [6] and TRS configuration for Cell 1 is defined in Table A.3.17.2.1-1 in TS 38.133 [6]. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] Clause C.1.0 and C.1.1. Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the CSI-SINR measurements.

3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.9.2.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] Clause 4.5.

2. Set the parameters according to Table 5.7.9.2.5-1 and Table 5.7.9.2.5-2 as appropriate.

3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.

4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5. The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the CSI-SINR reported values in the periodic MeasurementReport. The CSI-SINR value of Cell 3 reported by the UE is compared to the expected CSI-SINR. If the value is outside the limits (determined by Table 5.7.9.0.2.1-1 and Table 5.7.9.0.2.1-2) or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.

7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.9.2.5-1 and Table 5.7.9.2.5-2 as appropriate and repeat steps 5-7.

5.7.9.2.4.3 Message contents

[TBD]

##### 5.7.9.2.5 Test Requirements

The CSI-SINR absolute measurement accuracy in test 1 shall be within the range Nominal CSI-SINR+3dB to Nominal CSI-SINR -4dB and the CSI-SINR measurement accuracy in test 2 shall be within the range Nominal CSI-SINR+3.5dB to Nominal CSI-SINR -4.5dB according to the requirements in Clause 5.7.9.0.2.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test. Nominal CSI-SINR is the value shown in Table 5.7.9.2.5-2.

The CSI-SINR relative measurement accuracy shall fulfil the requirements in Clause 5.7.9.0.2.2.

Table 5.7.9.2.5-1: CSI-SINR inter frequency general test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN |  | Freq1 | freq2 | freq1 | Freq2 | freq1 | Freq2 |
| Duplex mode |  | TDD | | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | | | | | |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | | | | | |
| Uplink initial BWP configuration |  | ULBWP.0.1 | | | | | |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | | | | | |
| DRX cycle configuration | ms | Not applicable | | | | | |
| TRS configuration |  | TRS.2.1 TDD | | | | | |
| TCI state |  | TCI.State.0 | | | | | |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| OCNG Patterns |  | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| Time offset with cell 2 | μs | - | 0.29 | - | 0.29 | - | 0.29 |
| SMTC configuration |  | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 |
| CSI-RS for mobility |  | - | CSI-RS.RRM.FR2.1 TDD | - | CSI-RS.RRM.FR2.1 TDD | - | CSI-RS.RRM.FR2.1 TDD |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |
| EPRE ratio of PBCH to PBCH\_DMRS |
| EPRE ratio of PDCCH\_DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH\_DMRS |
| EPRE ratio of PDSCH\_DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH\_DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
|  | dB | -0.5 | -0.5 | 11.0 | 11.0 | -3.0 | -3.0 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: CSI-SINR, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

Table 5.7.9.2.5-2: CSI-SINR Inter frequency OTA related test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
| Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration | degrees | Setup 1 according to A.3.15.1 in TS 38.133 [6] | | Setup 1 according to A.3.15.1 in TS 38.133 [6] | | Setup 1 according to A.3.15.1 in TS 38.133 [6] | |
| Assumption for UE beamsNote 7 |  | Rough | | Rough | | Rough | |
| Note1 | dBm/15kHz Note4 | -105 | | -105 | | -105 | |
| Note1 | dBm/SCS Note3 | -96 | | -96 | | -96 | |
|  | dB | -0.5 | -0.5 | 11.0 | 11.0 | -3.0 | -3.0 |
| CSI-RSRPNote2 | dBm/SCS Note4 | -96.5 | -96.5 | -85 | -85 | -99 | -99 |
| CSI-SINRNote2 | dB | -0.5 | -0.5 | 11 | 11 | -3.0 | -3.0 |
|  | dB | -0.5 | -0.5 | 11 | 11 | -3.0 | -3.0 |
| IoNote2 | dBm/95.04 MHz Note4 | -69.3 | | -55.4 | | -65.24 | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.  Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.  Note 6: NR operating band groups are as defined in Clause 3.5.2 in TS 38.133 [6].  Note 7: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6] and does not limit UE implementation or test system implementation. | | | | | | | |

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.