## 6.4 Timing

### 6.4.1 UE transmit timing

#### 6.4.1.0 Minimum conformance requirements

6.4.1.0.1 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 6.4.1.0.1-1. 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 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 6.4.1.0.1-2.

Table 6.4.1.0.1-1: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals (KHz)** | **SCS of uplink signals s(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 6.4.1.0.1-2: 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 1: 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 section 4.2 in [3] and the value 39936 of  can also be provided for a FDD serving cell. | |

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 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 [200]ms.

where the maximum autonomous time adjustment step Tq and the aggregate adjustment rate Tp are specified in Table 6.4.1.0.1-3.

Table 6.4.1.0.1-3: 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 1: 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.

#### 6.4.1.1 NR SA FR1 UE transmit timing accuracy

6.4.1.1.1 Test purpose

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb 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 TS 38.133 [6] clause 7.1.2.

6.4.1.1.2 Test applicability

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

6.4.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.4.1.0.1.

The normative reference for this requirement is TS.38.133 [6] clause A.6.4.1.1

6.4.1.1.4 Test Description

6.4.1.1.4.1 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 38.521-1 [17].

This test can be run in one of the configurations defined in Table 6.4.1.1.4.1-1.

Table 6.4.1.1.4.1-1: Supported test configurations for FR1 PCell

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 6.4.1.1-1 | NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 6.4.1.1-2 | NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 6.4.1.1-3 | NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| Note: The UE is only required to be tested in one of the supported test configurations in FR1 depending on UE capability. | |

Configure the test equipment and the DUT according to the parameters in Table 6.4.1.1.4.1-2

Table 6.4.1.1.4.1-2: Initial conditions for NR SA FR1 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.1.2, 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 6.4.1.1.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | Without LTE link | |  |

1. Message contents are defined in clause 6 6.4.1.1.4.3.

2. A single NR cell is used. The connection setup is done according to the settings in Annex C.1.3, and the downlink signal levels as per Annex C.1. The general test parameters are given in Table 6.4.1.1.5-1 below.

6.4.1.1.4.2 Test procedure

The test consists of a single NR cell (PCell). The downlink timing of the NR Cell 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.

Following will be the test sequence for this test

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

2. Set up NR Cell according to parameters given in Table 6.4.1.1.4.1-1.

3. The SS shall transmit an RRCReconfiguration message configuring the UE with the message content defined in clause 6.4.1.1.4.3.

4. The UE shall transmit RRCReconfigurationComplete message.

5. 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 25600 for FR1

b. The Te values depend on the DL and UL SCS for which the test is being run and are given in Table 6.4.1.1.5-4

6. The test system shall adjust the timing of the DL path by values given in Table 6.4.1.1.4.2-1. For Test 2, the DL timing change shall be applied within the first half of the DRX cycle upon expiration of the preceding DRX ON duration.

Table 6.4.1.1.4.2-1: Adjustment Value for DL Timing

|  |  |  |
| --- | --- | --- |
| SCS of SSB signals (KHz) | Adjustment Value | |
|  | Test1 | Test2 |
| 15 | +64\*64Tc | +32\*64Tc |
| 30 | +32\*64Tc | +16\*64Tc |

7. The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Table 6.4.1.1.5-5. 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 6.4.1.0.1 and Table 6.4.1.0.1-3. To check that the minimum adjustment rate is within Rule 2 as specified in clause 6.4.1.0.1 and Table 6.4.1.0.1-3, 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 6.4.1.0.1 and Table 6.4.1.0.1-3, 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 6.4.1.0.1 and Table 6.4.1.0.1-3 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 6.4.1.1.4.2-1.

8. 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.

6.4.1.1.4.3 Message contents

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

Table 6.4.1.1.4.3-0: 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 6.4.1.1.4.3-1: *SRS-Config* : Additional test requirement for UE transmit timing accuracy for NR SA FR1 UE

|  |  |  |  |
| --- | --- | --- | --- |
| 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 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 | 14 |  | SCS15 |
|  | 25 |  | SCS30 |
| } |  |  |  |
| groupOrSequenceHopping | neither |  |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| periodicityAndOffset-p CHOICE { |  |  |  |
| sl1 | 0 |  | Test 1 |
| sl320 | 3 |  | Test 2 and SCS15 |
| sl640 | 5 |  | Test 2 and SCS30 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.1.1.4.3-2: *DRX-Config* : Additional test requirement for UE transmit timing accuracy Test 2 for NR SA FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-56 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= CHOICE { |  |  |  |
| drx-InactivityTimer | ms1 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms320 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

6.4.1.1.5 Test Requirements

Table 6.4.1.1.5-1: Cell Specific Test Parameters for UL Transmit Timing test

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Test1** | | **Test2** | |
| SSB ARFCN |  | 1,2,3 | Freq1 | | Freq1 | |
| NR Channel Number |  | 1,2,3 | 2 | | 2 | |
| TDD configuration |  | 1 | Not Applicable | | | |
| 2 | TDDConf.1.1 | | | |
| 3 | TDDConf.2.1 | | | |
| BWchannel | MHz | 1 | 10: NRB,c = 52 | | | |
| 2 | 10: NRB,c = 52 | | | |
| 3 | 40: NRB,c = 106 | | | |
| Initial BWP Configuration |  | 1,2,3 | DLBWP.0.1  ULBWP.0.1 | | | |
| Dedicated BWP Configuration |  | 1,2,3 | DLBWP.1.1  ULBWP.1.1 | | | |
| DRx Cycle | ms | 1,2,3 | N/A | | | DRX.8Note5 |
| PDSCH Reference measurement channel |  | 1 | SR.1.1 FDD | | | |
| 2 | SR.1.1 TDD | | | |
| 3 | SR.2.1 TDD | | | |
| RMSI CORESET Reference Channel |  | 1 | CR.1.1 FDD | | | |
| 2 | CR.1.1 TDD | | | |
| 3 | CR.2.1 TDD | | | |
| Dedicated CORESET Reference Channel |  | 1 | CCR.1.1 FDD | | | |
| 2 | CCR.1.1 TDD | | | |
| 3 | CCR.2.1 TDD | | | |
| OCNG Patterns |  | 1,2,3 | OP.1 | | | |
| SSB configuration |  | 1,2 | SSB.1 FR1 | | | |
| 3 | SSB.2 FR1 | | | |
| SMTC |  | 1 | SMTC.1 | | | |
| 3 | SMTC.2 | | | |
| TRS configuration |  | 1 | TRS.1.1 FDD | | | |
|  | 2 | TRS.1.1 TDD | | | |
|  | 3 | TRS.1.2 TDD | | | |
| EPRE ratio of PSS to SSS | dB | 1,2,3 | 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/15 kHz | 1,2,3 | -98 | | -98 | |
| Note2 | dBm/SCS | 1,2 | -98 | | -98 | |
| 3 | -95 | | -95 | |
|  |  | 1,2,3 | 3.3 | | 3.3 | |
|  |  | 1,2,3 | 3.3 | | 3.3 | |
| SS-RSRPNote3 | dBm/SCS | 1,2 | -95 | | -95 | |
| 3 | -92 | | -92 | |
| IoNote3 | dBm/9.36MHz | 1,2 | -65.08 | | -65.08 | |
| dBm/38.1MHz | 3 | -61.99 | | -61.99 | |
| Propagation condition |  | 1,2,3 | AWGN | | | |
| SRS Config |  | 1 | SRSConf.1Note6 | SRSConf.3Note6 | | |
|  |  | 2,3 | SRSConf.1Note6 | SRSConf.2Note6 | | |
| 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: DRx related parameters are given in Table 6.4.1.1.5-3 or Table A.5.-1  Note 6: SRS configs are given in Table 6.4.1.1.5-2 | | | | | | |

Table 6.4.1.1.5-2: SRS Configuration for Timing Accuracy Test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Field | SRSConf.1 | SRSConf.2 | SRSConf.3 | Comments |
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 | 0 |  |
| srs-ResourceIdList | 0 | 0 | 0 |  |
| resourceType | Periodic | Periodic | Periodic |  |
| Usage | Codebook | Codebook | Codebook |  |
| SRS-ResourceSetId | 0 | 0 | 0 |  |
| SRS-Resource | nrofSRS-Ports | Port1 | Port1 | Port1 |  |
| transmissionComb | n2 | n2 | n2 |  |
| combOffset-n2 | 0 | 0 | 0 |  |
| cyclicShift-n2 | 0 | 0 | 0 |  |
| resourceMapping  startPosition | 0 | 0 | 0 |  |
| resourceMapping  nrofSymbols | n1 | n1 | n1 |  |
| resourceMapping  repetitionFactor | n1 | n1 | n1 |  |
| freqDomainPosition | 0 | 0 | 0 |  |
| freqDomainShift | 0 | 0 | 0 |  |
| freqHopping  c-SRS | 14 for test configuration 1,2  25 for test configuration 3 | 25 | 14 | Matches NRB,c |
| freqHopping  b-SRS | 0 | 0 | 0 |  |
| freqHopping  b-hop | 0 | 0 | 0 |  |
| groupOrSequenceHopping | Neither | Neither | Neither |  |
| resourceType | Periodic | Periodic | Periodic |  |
| periodicityAndOffset-p | sl1 | sl640,5 | sl320,3 | Offset to align with DRx periodicity |
| sequenceId | 0 | 0 | 0 | Any 10 bit number |

Table 6.4.1.1.5-3: DRX-Configuration for UL Timing Tests

|  |  |
| --- | --- |
| **Field** | **Test 2** |
| **Value** |
| drx-onDurationTimer | 6 ms |
| drx-InactivityTimer | 1 ms |
| drx-RetransmissionTimerDL | 1 slot |
| drx-RetransmissionTimerUL | 1 slot |
| longDRX-CycleStartOffset | 320 ms |
| shortDRX | disable |
| TimeAlignmentTimer | Infinity |
| Note: The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [13] | |

Table 6.4.1.1.5-4: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals (KHz)** | **SCS of uplink signals (KHz)** | **Te** |
| 1 | 15 | 15 | 13.75\*64\*Tc |
| 30 | 11.75\*64\*Tc |
| 60 | 11.75\*64\*Tc |
| 30 | 15 | 9.75\*64\*Tc |
| 30 | 9.75\*64\*Tc |
| 60 | 8.75\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

Table 6.4.1.1.5-5: Tq Maximum Autonomous Time Adjustment Step and Tp Minimum Aggregate Adjustment rate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency Range** | **SCS of uplink signals (KHz)** | **Tq** | **Tp** | **Maximum Adjustement Rate** |
| 1 | 15 | 6.0\*64\*Tc | 1.9\*64\*Tc | 6.6\*64\*Tc |
| 30 | 6.0\*64\*Tc | 1.9\*64\*Tc | 6.6\*64\*Tc |
| 60 | 6.0\*64\*Tc | 1.9\*64\*Tc | 6.6\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6] | | | |  |

### 6.4.2 UE timer accuracy

### 6.4.3 Timing advance

#### 6.4.3.0 Minimum conformance requirement

##### 6.4.3.0.1 Minimum conformance requirement for timing advance adjustment

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 6.4.3.1.3-1, 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 6.4.3.1.3-1: 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 |

#### 6.4.3.1 NR SA FR1 timing advance adjustment accuracy

6.4.3.1.1 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].

6.4.3.1.2 Test applicability

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

6.4.3.1.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 6.4.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.4.3.1.

6.4.3.1.4 Test description

6.4.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.4.3.1.4.1-1.

Table 6.4.3.1.4.1-1: NR SA FR1 timing advance adjustment accuracy supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, 40MHz 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 6.4.3.1.4.1-2

Table 6.4.3.1.4.1-2: Initial conditions for NR SA FR1 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.1.2, 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 6.4.3.1.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | Without LTE Link | |  |

Table 6.4.3.1.4.1-3: General test parameters for timing advance

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF channel number |  | 1 |  |
| Initial DL BWP |  | DLBWP.0.1 | As specified in Table A.8.1-1 |
| Dedicated DL BWP |  | DLBWP.1.1 | As specified in Table A.8.1-2 |
| Initial UL BWP |  | ULBWP.0.1 | As specified in Table A.8.2-1 |
| Dedicated UL BWP |  | ULBWP.1.1 | As specified in Table A.8.2-2 |
| 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 | For SCS = 15kHz : *NTA\_new = NTA\_old + 8192\*Tc* (based on equation in TS38.213 section 4.2)  For SCS = 30kHz : *NTA\_new = NTA\_old + 4096\*Tc* (based on equation in TS38.213 section 4.2) |
| T1 | s | 5 |  |
| T2 | s | 5 |  |

1. Message contents are defined in clause 6.4.3.1.4.3.

2. Single Cell is used, which is NR FR1 PCell. The connection setup is done according to the settings in Annex C.1.2 and C.1.3.

3. The test parameters are given in Table 6.4.3.1.4.1-3 above.

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [10] clause 4.5.

6.4.3.1.4.2 Test Procedure

The test consists of single cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table 6.4.3.1.5-1 and table 6.4.3.1.4.1-3, 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. 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.

1. Set the parameters according to values in Tables 6.4.3.1.4.1-3.

2. SS shall transmit an RRCReconfiguration message.

3. The UE shall transmit RRCReconfigurationComplete message.

4. During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, 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 used by the UE is established.

5. During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value 39 as specified in table 6.4.3.1.4.1-3. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

6. 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 must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

7. 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.

8. 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 6.4.3.1.3-1 to the signalled timing advance value compared to the timing of preceding uplink transmission.

9. If the UE adjust the timing of its transmission within a relative accuracy greater than or equal to value specified in Table 6.4.3.1.3-1 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.

10. The SS shall transmit RRCRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

11. After the RRC connection release, the SS transmits in Cell a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE is in State RRC\_CONNECTED according to TS 38.508-1 [14] clause 4.5.4 or if the paging fails, switch off and on the UE and ensure the UE is in RRC\_CONNECTED according to TS 38.508-1 [14] clause 4.5.4.

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

6.4.3.1.4.3 Message Contents

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

Table 6.4.3.1.4.3-0: 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 6.4.3.1.4.3-1: 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 | 12 | Config 1,2 | |  |
|  | 24 | Config 3 | |  |
| } |  |  | |  |
| groupOrSequenceHopping | neither |  | |  |
| resourceType CHOICE { |  |  | |  |
| periodic SEQUENCE { | periodic |  | |  |
| periodicityAndOffset-p CHOICE { |  |  | |  |
| sl5 | 2 | Once every 5 Slots | | SCS15 |
| sl5 | 4 | Once every 5 Slots | | SCS30 |
| } |  | |  |  |
| } |  | |  |  |
| } |  | |  |  |
| } |  |  | |  |
| } |  |  | |  |
| } |  |  | |  |

6.4.3.1.5 Test Requirement

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k* slots after the reception of the timing advance command, where:

*k* = 5 for Config 1, 2, and 3

The Timing Advance adjustment accuracy shall be within the limits specified in Table 6.4.3.1.5-3.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

Table 6.4.3.1.5-1 and Table 6.4.3.1.5-2 define the primary level settings.

Table 6.4.3.1.5-1: Cell specific test parameters for timing advance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test1 | |
| T1 | T2 |
| Duplex mode | | Config 1 |  | FDD | |
| Config 2,3 | TDD | |
| TDD configuration | | Config 1 |  | Not Applicable | |
| Config 2 | TDDConf.1.1 | |
| Config 3 | TDDConf.2.1 | |
| BWchannel | | Config 1 | MHz | 10: NRB,c = 52 | |
| Config 2 | 10: NRB,c = 52 | |
| Config 3 | 40: NRB,c = 106 | |
| BWP BW | | Config 1 | MHz | 10: NRB,c = 52 | |
| Config 2 | 10: NRB,c = 52 | |
| Config 3 | 40: NRB,c = 106 | |
| DRx Cycle | | | ms | Not Applicable | |
| PDSCH Reference measurement channel | | Config 1 |  | SR.1.1 FDD | |
| Config 2 | SR.1.1 TDD | |
| Config 3 | SR2.1 TDD | |
| RMSI CORESET Reference Channel | | Config 1 |  | CR.1.1 FDD | |
| Config 2 | CR.1.1 TDD | |
| Config 3 | CR2.1 TDD | |
| Dedicated CORESET Reference Channel | | Config 1 |  | CCR.1.1 FDD | |
| Config 2 |  | CCR.1.1 TDD | |
| Config 3 |  | CCR.2.1 TDD | |
| TRS Configuration | | Config 1 |  | TRS.1.1 FDD | |
| Config 2 |  | TRS.1.1 TDD | |
| Config 3 |  | TRS.1.2 TDD | |
| OCNG Patterns | | |  | OCNG pattern 1 | |
| SMTC configuration | | Config 1,2 |  | SMTC.1 FR1 | |
| Config 3 | SMTC.2 FR1 | |
| PDSCH/PDCCH subcarrier spacing | | Config 1,2 | kHz | 15 kHz | |
| Config 3 | 30 kHz | |
| PUCCH/PUSCH subcarrier spacing | | Config 1,2 | kHz | 15 kHz | |
| Config 3 | 30 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) | | |
| Note2 | | | dBm/15kHz | -98 | |
| Note2 | Config 1,2 | | dBm/SCS | -98 | |
| Config 3 | | -95 | |
|  | | | dB | 3 | |
|  | | | dB | 3 | |
| IoNote3 | Config 1,2 | | dBm/  9.36MHz | -67.57 | |
| Config 3 | | dBm/  38.16MHz | -62.58 | |
| 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.  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: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | |

Table 6.4.3.1.5-2: Sounding Reference Symbol Configuration for timing advance

|  |  |  |  |
| --- | --- | --- | --- |
| Field | | Value | Comment |
| c-SRS | Config 1,2 | 12 | Frequency hopping is disabled |
| Config 3 | 24 |
| 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@2 for SCS 15kHz  sl5@4 for SCS 30kHz | 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. | | | |

Table 6.4.3.1.5-3: UE Timing Advance adjustment accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| Sub Carrier Spacing, SCS kHz | 15 | 30 | 60 |
| UE Timing Advance adjustment accuracy | ±344 Tc | ±344 Tc | ±216 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%.

## 6.5 Signaling characteristics

### 6.5.1 Radio link monitoring

#### 6.5.1.00 General

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 PCell as specified in [3]. 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.

The threshold Qout is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate (BLERout) as defined in Table 6.5.1-1.

The threshold Qin is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout and shall correspond to the in-sync block error rate (BLERin) as defined in Table 6.5.1-1.

The out-of-sync block error rate (BLERout) and in-sync block error rate (BLERin) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *RLM-IS-OOS-thresholdConfig* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in Table 6.5.1-1 as default. All requirements here are applicable for BLER Configuration #0 in Table 6.5.1-1.

Table 6.5.1-1: Out-of-sync and in-sync block error rates

|  |  |  |
| --- | --- | --- |
| Configuration | BLERout | BLERin |
| 0 | 10% | 2% |

UE shall be able to monitor up to XRLM-RS RLM-RS resources of the same or different types in each corresponding carrier frequency range, where XRLM-RS is specified in Table 6.5.1-2, and meet the requirements as specified in this section.

Table 6.5.1-2: Maximum number of RLM-RS resources XRLM-RS

|  |  |
| --- | --- |
| Maximum number of RLM-RS resources, XRLM-RS | Carrier frequency range of PCell/Pcell |
| 2 | FR1, ≤ 3 GHz |
| 4 | FR1, > 3 GHz |
| 8 | FR2 |

If different SCS is used for CSI-RS based RLM-RS and SSB, then CSI-RS based RLM-RS and SSB shall be TDMed. If same SCS is used for CSI-RS based RLM-RS and SSB, then CSI-RS based RLM-RS and SSB can be FDMed or TDMed.

Any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [4]) means uplink signal

- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [4]) means no uplink signal.

Introduction of Requirement on Radio Link Monitoring for UE Configured with Relaxed Measurement Criteria.

For the UE supports *rlm-Relaxation-r17*and configured with explicit signaling *goodServingCellEvaluationRLM*, which is always configured to the UE when the network enables RLM relaxation for the UE as specified in TS 38.331 [2], the relaxed requirements defined in clause 6.5.1.0.4 for SSB based radio link monitoring and the relaxed requirements defined in clause 6.5.1.0.5 for CSI-RS based radio link monitoring are allowed to apply to the relaxed RLM measurements on SpCell after fulfilling the following conditions:

- for the serving cells in intra-band carrier aggregation configured with SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell, when

- the good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell based on the measurements that are configured for SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on Scell in the intra-band carrier aggregation if the *lowMobilityEvaluationConnected* is not configured, or

- the UE is also configured with *lowMobilityEvaluationConnected* and both low mobility criterion defined in clause 5.7.13.1 of TS 38.331 [2] is fulfilled for a period of *TSearchDeltaP-Connected* and good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell based on the measurements that are configured for SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on Scell in the intra-band carrier aggregation.

- for other serving cells, when

- the good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the SpCell if the *lowMobilityEvaluationConnected* is not configured, or

- the UE is also configured with *lowMobilityEvaluationConnected*  and both low mobility criterion defined in clause 5.7.13.1 of TS 38.331 [2] is fulfilled for a period of TSearchDeltaP-Connected and good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the SpCell.

otherwise, UE shall apply the requirements defined in TS 38.133 [6] clause 8.1.2.2 for SSB based radio link monitoring and the requirements defined in TS 38.133 [6] clause 8.1.3.2 for CSI-RS based radio link monitoring. Note that when multiple resources are configured on a serving cell for RLM or BFD evaluation, the good serving cell quality critierion is considered as fulfilled for the serving cell when any resource configured for the cell fulfills the good serving defined in clause 5.7.13.2 of TS 38.331 [2].

The UE is no longer allowed to relax RLM measurements and apply the relaxed radio link monitoring provided that at least one of the following conditions is met:

- The UE sends out-of sync indications to the higher layers,

- The timer T310 is running.

- No DRX is used or DRX cycle is longer than 80ms

#### 6.5.1.0 Minimum conformance requirements

##### 6.5.1.0.1 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 section 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 6.5.1.0.1-1.

TEvaluate\_out\_SSB is defined in Table 6.5.1.0.1-1 for FR1.

Table 6.5.1.0.1-1: Evaluation period TEvaluate\_out for FR1

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

For FR1,

- P=1/(1 – TSSB/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

If the high layer in TS 38.331 [13] signaling 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 pervious conditions.

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 [13].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [8]. Two successive indications from Layer 1 shall be separated by at least TIndication\_interval.

If DRX is used, 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,

or

- the UE transitions between DRX and no DRX or DRX cycle periodicity changes,

for each RLM-RS resource, 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 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 section 8.1.2 if the RLM-RS resource is SSB.

When 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 [13], 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.

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 [13].

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

For UE which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [11] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for radio link monitoring.

The normative reference for this requirement is TS 38.133 [6] clauses 8.1.2, 8.1.4, 8.1.5, 8.1.6 and 8.1.7.

##### 6.5.1.0.2 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\_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 6.5.1.0.2-1 for FR1.

For FR1,

- P=1/(1 – TSSB/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

If the high layer in TS 38.331 [2] signaling 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 Mout and Min used in Table 6.5.1.2.3-1 are defined as:

- Mout = 20 and Min = 10, if the CSI-RS resource configured for RLM is transmitted with Density =3.

Table 6.5.1.0.2-1: Evaluation period TEvaluate\_out and TEvaluate\_in for FR1

|  |  |  |
| --- | --- | --- |
| **Configuration** | **TEvaluate\_out (ms)** | **TEvaluate\_in (ms)** |
| no DRX | max(200, ceil(Mout×P)×TCSI-RS) | max(100, ceil(Min×P) × TCSI-RS) |
| DRX ≤ 320ms | max(200, ceil(1.5×Mout×P)× max(TDRX, TCSI-RS)) | max(100, ceil(1.5×Min×P)× max(TDRX, TCSI-RS)) |
| DRX > 320ms | ceil(Mout×P) × TDRX | ceil(Min×P) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource configured for RLM. TDRX is the DRX cycle length. | | |

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

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 section 8.1.2 of TS 38.133 [6] if the RLM-RS resource is SSB, or TCSI-RS specified later in this if the RLM-RS resource is CSI-RS.

When 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.

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.

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 [13].

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

For UE which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [11] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for radio link monitoring.

The normative reference for this requirement is TS 38.133 [6] clauses 8.1.2, 8.1.4, 8.1.5, 8.1.6, 8.1.7 and A.7.5.1.

##### 6.5.1.0.3 Minimum conformance requirements for out-of-sync and in-sync CSI-RS based RLM

[TS 38.133 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.

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\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-1 for FR1.

For FR1,

- P=1/(1 – TCSI-RS/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

If the high layer in TS 38.331 [2] signaling 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 Mout and Min used in Table 8.1.3.2-1 are defined as:

- Mout = 20 and Min = 10, if the CSI-RS resource configured for RLM is transmitted with Density =3.

Table 6.5.1.0.3-1: Evaluation period TEvaluate\_out and TEvaluate\_in for FR1

|  |  |  |
| --- | --- | --- |
| **Configuration** | **TEvaluate\_out (ms)** | **TEvaluate\_in (ms)** |
| no DRX | max(200, ceil(Mout×P)×TCSI-RS) | max(100, ceil(Min×P) × TCSI-RS) |
| DRX ≤ 320ms | max(200, ceil(1.5×Mout×P)× max(TDRX, TCSI-RS)) | max(100, ceil(1.5×Min×P)× max(TDRX, TCSI-RS)) |
| DRX > 320ms | ceil(Mout×P) × TDRX | ceil(Min×P) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource configured for RLM. TDRX is the DRX cycle length. | | |

[TS 38.133 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 [2].

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 out-of-sync and 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 section 8.1.2 if the RLM-RS resource is SSB, or TCSI-RS specified in section 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.

[TS 38.133 clause 8.1.5]

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].

The normative reference for this requirement is TS 38.133 [6] clause 8.1.3.2, 8.1.6 and 8.1.5.

##### 6.5.1.0.4 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 6.5.1.0.4-1 for FR1.

TEvaluate\_out\_SSB\_Relax is defined in Table 6.5.1.0.4-2 for FR2 with scaling factor N=8.

The value of P is defined in TS 38.133 [6] clause 8.1.2.2.

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 6.5.1.0.4-1: Evaluation period TEvaluate\_out\_SSB\_Relax for FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_out\_SSB\_Relax (ms) |
| Max(TDRX,TSSB) ≤80ms | Max(200× K3 NOTE3, Ceil(15 × K1NOTE2 × P) × Max(TDRX,TSSB)) |
| 80ms < Max(TDRX,TSSB) ≤160ms | Ceil(15 × P) × 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: K1 = 4 for Max(TDRX,TSSB) ≤40ms and K1 = 2 for 40ms<Max(TDRX,TSSB) ≤80ms.  NOTE 3: K3 = K1, if K1 ≤ 2; otherwise K3 = 1. | |

Table 6.5.1.0.4-2: 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. | |

##### 6.5.1.0.5 Minimum requirement of CSI-RS based radio link monitoring for UE fulfilling relaxed measurement criteria

[TS 38.133 clause 8.1.3.4]

This clause contains minimum requirements for relaxed radio link monitoring based on CSI-RS.

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\_Relax [ms] period becomes worse than the threshold Qout\_CSI-RS within TEvaluate\_out\_CSI-RS\_Relax [ms] evaluation period.

TEvaluate\_out\_CSI-RS\_Relax is defined in Table 6.5.1.0.5-1 for FR1.

TEvaluate\_out\_CSI-RS\_Relax is defined in Table 6.5.1.0.5-2 for FR2 with scaling factor N=1.

The value of P is defined in TS 38.133 [6] clause 8.1.3.2.

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.

The values of Mout used in Table 6.5.1.0.5-1 and Table 6.5.1.0.5-2 are defined as:

- Mout = 20, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth ≥ 24 PRBs.

Table 6.5.1.0.5-1: Evaluation period TEvaluate\_out\_CSI-RS\_Relax for FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS\_Relax (ms) |
| Max(TDRX, TCSI-RS) ≤ 80 ms | Max(200 × K3 NOTE3, Ceil(1.5 × Mout × P × K1 NOTE2) × Max(TDRX, TCSI-RS) NOTE1) |
| NOTE1: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10ms, 20 ms or 40 ms. TDRX is the DRX cycle length and no longer than 80ms.  NOTE2: K1 = 2 for 40 ms < MAX(TDRX, TCSI-RS) ≤ 80 ms, K1 = 4 for MAX(TDRX, TCSI-RS) ≤ 40 ms  NOTE3: K3 = K1, if K1 ≤ 2; K3 = 1 otherwise. | |

Table 6.5.1.0.5-2: Evaluation period TEvaluate\_out\_CSI-RS\_Relax for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS\_Relax (ms) |
| Max(TDRX, TCSI-RS) ≤ 80 ms | Max(200 × K4 NOTE3, Ceil(1.5 × Mout × P × N × K2 NOTE2) × Max(TDRX, TCSI-RS) NOTE1) |
| NOTE1: TCSI-RS is the periodicity of the 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 and no longer than 80ms.  NOTE2: K2 = 2.  NOTE3: K4 = K2, if K2 ≤ 2; K4 = 1 otherwise. | |

#### 6.5.1.1 NR SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in non-DRX mode

6.5.1.1.1 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 PCell 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] section 8.1.2.

6.5.1.1.2 Test applicability

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

6.5.1.1.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 6.5.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.1.

6.5.1.1.4 Test description

There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 6.5.1.1.4-1 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. 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) in test 1.



Figure 6.5.1.1.4-1: SNR variation for out-of-sync testing

6.5.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.1.1.4.1-1.

Table 6.5.1.1.4.1-1: NA SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in non-DRX mode supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.1-1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.1-2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.1-3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1. | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.1.4.1-2.

Table 6.5.1.1.4.1-2: Initial conditions for NR SA FR1 radio link monitoring out-of-sync test for PCell 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.1.2, 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 6.5.1.1.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

Table 6.5.1.1.4.1-3: Void

1. Message contents are defined in clause 6.5.1.1.4.3.

2. Single Cell is used, which is NR FR1 Pcell. The connection setup is done according to the settings in Annex C.1.2 and C.1.3.

3. The test parameters are given in Table 6.5.1.1.4.1-4 below.

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

Table 6.5.1.1.4.1-4: General test parameters for FR1 out-of-sync testing in non-DRX mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| **Test 1** |
| Active PCell | | |  | Cell 1 |
| RF Channel Number | | |  | 1 |
| Duplex mode | | Config 1 |  | FDD |
| Config 2, 3 |  | TDD |
| BWchannel | | Config 1 | MHz | 10: NRB,c = 52 |
| Config 2 | 10: NRB,c = 52 |
| Config 3 | 40: NRB,c = 106 |
| DL initial BWP configuration | | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | | Config 1, 2, 3 |  | ULBWP.1.1 |
| TDD Configuration | | Config 1 |  | Not Applicable |
| Config 2 |  | TDDConf.1.1 |
| Config 3 |  | TDDConf.2.1 |
| RMSI CORESET Reference Channel | | Config 1 |  | CR.1.1 FDD |
| Config 2 |  | CR.1.1 TDD |
| Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | Config 1 |  | CCR.1.3 FDD |
| Config 2 |  | CCR.1.3 TDD |
| Config 3 |  | CCR.2.2 TDD |
| SSB Configuration | | Config 1 |  | SSB.1 FR1 |
| Config 2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | | Config 1, 2 |  | SMTC.1 |
| Config 3 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | | Config 1, 2 |  | 15 KHz |
| Config 3 |  | 30 KHz |
| PRACH Configuration | | Config 1, 2 |  | Table A.7.1-1, PRACH.1 FR1 |
| Config 3 |  | Table A.7.1-1, PRACH.1 FR1 |
| SSB index assigned as RLM RS | | |  | 0 |
| OCNG parameters | | |  | OP.1 |
| CP length | | |  | Normal |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format | |  | 1-0 |
| Number of Control OFDM symbols | |  | 2 |
| Aggregation level | | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average 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 configuration for CSI reporting | | Config 1, 4 |  | CSI-RS.1.1 FDD |
| Config 2, 5 |  | CSI-RS.1.1 TDD |
| Config 3, 6 |  | CSI-RS.2.1 TDD |
| CSI-RS for tracking | | Config 1, 4 |  | TRS.1.1 FDD |
| Config 2, 5 |  | TRS.1.1 TDD |
| Config 3, 6 |  | TRS.1.2 TDD |
| T1 | | | s | 0.2 |
| T2 | | | s | 0.48 |
| T3 | | | s | 0.48 |
| D1 | | | s | 0.44 |
| 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. | | | | |

6.5.1.1.4.2 Test Procedure

There is one cell (Cell 1), which is the active NR cell, in the test. Prior to the start of the time duration T1, the UE shall be fully synchronized to PCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 6.5.1.1.4.1-4.

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

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

3. The UE shall transmit RRCReconfigurationComplete message.

4. Set the parameters according to T1 in Table 6.5.1.1.5-1. 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 6.5.1.1.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.1.5-1. T3 starts.

7. If the SS:  
a) detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 higher than OFF power defined in TS 38.521-1 [17] clause 6.3.2.5 from time point C (D1 after the start of T3) until T3 expires,  
the number of successful tests is increased by one.

8. Otherwise the number of failed tests is increased by one.

9. When T3 expires the SS shall change the SNR value to T1 as specified in Table 6.5.1.1.5-1.

10. 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 state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* according to TS 38.508-1 [10] clause 4.5.

11. Repeat steps 4-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

6.5.1.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6.1 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 6.5.1.1.4.3-0: Common Exception messages for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in non-DRX mode 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, L3 FILTERING NEEDED, GAP\_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)  Table H.3.1-4 with A3-offset = 0  Table H.3.1-1  Table H.3.1-6 with conditions gapUE and RLM  Table H.3.5-4  Table H.3.5-9 |

Table 6.5.1.1.4.3-1: Void

Table 6.5.1.1.4.3-2: *RLF-TimersAndConstants*

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

Table 6.5.1.1.4.3-3: Void

Table 6.5.1.1.4.3-4 *SIB1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfo SEQUENCE { |  |  |  |
| q-RxLevMin | -53 | -106 is actual value in dBm (-53 \* 2 dBm) | dBm/15kHz |
|  | -51 | -102 is actual value in dBm (-51 \* 2 dBm) | dBm/30kHz |
| } |  |  |  |
| } |  |  |  |

6.5.1.1.5 Test Requirement

Table 6.5.1.1.5-1 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 6.5.1.1.5-1: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
| T1 | T2 | T3 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | 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-RS | Config 1 | dB | 1.9 | -6.1 | -15.9 |
| Config 2 | 1.9 | -6.1 | -15.9 |
| Config 3 | 1.9 | -6.1 | -15.9 |
|  | Config 1 | dBm/15kHz | -98 | | |
| Config 2 | -98 | | |
| Config 3 | -98 | | |
|  | Config 1 | dBm/SCS | -98 | | |
| Config 2 | -98 | | |
| Config 3 | -95 | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure 6.5.1.1.4-1.  Note 5: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR during T3 from D.4.1.1, is -18dB-TT = -18.9dB (including test tolerances). | | | | | |

Table 6.5.1.1.5-2: Measurement gap configuration for out-of-sync tests in non-DRX mode

|  |  |
| --- | --- |
| Field | Test 1 |
| Value |
| gapOffset | 0 |
| Note Ensure that RLM RS is partially overlapped with measurement gap | |

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%.

#### 6.5.1.2 NR SA FR1 radio link monitoring in-sync test for PCell configured with SSB-based RLM RS in non-DRX mode

6.5.1.2.1 Test purpose

The purpose of this test is to verify that the UE properly detects in sync for the purpose of monitoring downlink radio link quality of the PCell, when DRX is not used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.2.

6.5.1.2.2 Test applicability

This test applies to all types of NR UEs supporting Release 15 and forwared

6.5.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.2.

6.5.1.2.4 Test Description

There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.1.2.4-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Figure 6.5.1.2.4-1 - SNR variation for in-sync testing



6.5.1.2.4 Test Requirements

6.5.1.2.4.1 Initial Conditions

This test shall be tested using any of the test configurations in Table 6.5.1.2.4.1-1.

Table 6.5.1.2.4.1-1: Supported test configurations for FR1 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.2-1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.2-2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.2-3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.2.4.1-2.

Table 6.5.1.2.4.1-2: Initial conditions for SA FR1 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. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.1.2.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

Table 6.5.1.2.4.1-3: Void

1. Message contents are defined in clause 6.5.1.2.4.3.

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

3. The general test parameters are given in Table 6.5.1.2.4.1-4 below.

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

Table 6.5.1.2.4.1-4: General test parameters for FR1 in-sync testing in non-DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value |
| Test 1 |
| Active PCell | | | |  | Cell 1 |
| RF Channel Number | | | |  | 1 |
| Duplex mode | | | Config 1 |  | FDD |
| Config 2, 3 |  | TDD |
| BWchannel | | | Config 1 | MHz | 10: NRB,c = 52 |
| Config 2 | 10: NRB,c = 52 |
| Config 3 | 40: NRB,c = 106 |
| DL initial BWP configuration | | | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | | | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | | | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | | | Config 1, 2, 3 |  | ULBWP.1.1 |
| TDD Configuration | | | Config 1 |  | Not Applicable |
| Config 2 |  | TDDConf.1.1 |
| Config 3 |  | TDDConf.2.1 |
| RMSI CORESET Reference Channel | | | Config 1 |  | CR.1.1 FDD |
| Config 2 |  | CR.1.1 TDD |
| Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | | Config 1 |  | CCR.1.1 FDD |
| Config 2 |  | CCR.1.1 TDD |
| Config 3 |  | CCR.2.1 TDD |
| SSB Configuration | | | Config 1 |  | SSB.1 FR1 |
| Config 2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | | | Config 1, 2 |  | SMTC.1 |
| Config 3 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | | | Config 1, 2 |  | 15 KHz |
| Config 3 |  | 30 KHz |
| PRACH Configuration | | | Config 1, 2 |  | Table A.7.1-1, PRACH.1 FR1 |
| Config 3 |  | Table A.7.1-1, PRACH.1 FR1 |
| SSB index assigned as RLM RS | | | |  | 0 |
| OCNG parameters | | | |  | OP.1 |
| CP length | | | |  | Normal |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |
| 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 | 1000 |
| T311 timer | | | | ms | 1000 |
| N310 | | | |  | 1 |
| N311 | | | |  | 1 |
| CSI-RS configuration for CSI reporting | | Config 1 | |  | CSI-RS.1.1 FDD |
| Config 2 | |  | CSI-RS.1.1 TDD |
| Config 3 | |  | CSI-RS.2.1 TDD |
| CSI-RS for tracking | | Config 1, 4 | |  | TRS.1.1 FDD |
| Config 2, 5 | | TRS.1.1 TDD |
| Config 3, 6 | | TRS.1.2 TDD |
| T1 | | | | s | 0.2 |
| T2 | | | | s | 0.2 |
| T3 | | | | s | 0.24 |
| T4 | | | | s | 0.2 |
| T5 | | | | s | 0.88 |
| D1 | | | | s | 0.84 |
| 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. | | | | | |

6.5.1.2.4.2 Test Procedure

There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.1.2.4-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states.. Prior to the start of the time duration T1, the UE shall be fully synchronized to PCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 6.5.1.2.4.1-4.

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

2. Set the parameters according to T1 in Table 6.5.1.2.5-1 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 6.5.1.2.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.2.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.1.2.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.1.2.5-1. T5 starts.

7. If the SS detects uplink power equal to or higher than the minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 in the subframe according the configured CQI reporting mode (PUCCH 2-0) 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.

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

9. 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.

6.5.1.2.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6.1 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 6.5.1.2.4.3-0: Common Exception messages for NR SA FR1 radio link monitoring in-sync test for PCell configured with SSB-based RLM RS in non-DRX mode test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.5-4  Table H.3.5-9 |

Table 6.5.1.2.4.3-1: Void

Table 6.5.1.2.4.3-2: *RLF-TimersAndConstants*

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

Table 6.5.1.2.4.3-3: Void

6.5.1.2.5 Test Requirement

The requirements in this section apply for each SSB based RLM-RS resource configured for the PCell, provided that the SSB configured for RLM are actually transmitted within UE active DL BWP during the entire evaluation period specified in section 6.5.1.2.3.

Table 6.5.1.2.5-1 defines the cell specific primary level settings.

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 confidence interval of 95%.

Table 6.5.1.2.5-1: Cell specific test parameters for FR1 for in-sync radio link monitoring tests in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 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 |
| SNR on RLM-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 2 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 3 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
|  | Config 1 | dBm/15 kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
|  | Config 1 | dBm/SCS | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -95 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure 6.5.1.2.4-1.  Note 5: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE wiht 4RX antennas connected under test, the SNR during T3 and T4 from D.4.1.1 are -18.0-TT and -8.0-TT, which are -18.8dB and -8.8dB(including test tolerances) | | | | | | | |

#### 6.5.1.3 NR SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in DRX mode

6.5.1.3.1 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 PCell 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] section 8.1.2.

6.5.1.3.2 Test applicability

This test applies to all types of NR UE Release 15 and forward supporting 5GS NR SA FR1 and long DRX cycle.

6.5.1.3.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 6.5.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.3.

6.5.1.3.4 Test description

There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 6.5.1.3.4-1 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. 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 6.5.1.3.4-1: SNR variation for out-of-sync testing

6.5.1.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.1.3.4.1-1.

Table 6.5.1.3.4.1-1: NA SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in DRX mode supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.3-1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.3-2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.3-3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1. | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.3.4.1-2.

Table 6.5.1.3.4.1-2: Initial conditions for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS 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.1.2, 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 6.5.1.3.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

Table 6.5.1.3.4.1-3: Void

1. Message contents are defined in clause 6.5.1.3.4.3.

2. Single Cell is used, which is NR FR1 PCell. The connection setup is done according to the settings in Annex C.1.2 and C.1.3.

3. The test parameters are given in Table 6.5.1.3.4.1-4 below.

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

Table 6.5.1.3.4.1-4: General test parameters for FR1 out-of-sync testing in DRX mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| **Test 1** |
| Active PCell | | |  | Cell 1 |
| RF Channel Number | | |  | 1 |
| Duplex mode | | Config 1 |  | FDD |
| Config 2, 3 |  | TDD |
| BWchannel | | Config 1 | MHz | 10: NRB,c = 52 |
| Config 2 | 10: NRB,c = 52 |
| Config 3 | 40: NRB,c = 106 |
| DL initial BWP configuration | | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | | Config 1, 2, 3 |  | ULBWP.1.1 |
| TDD Configuration | | Config 1 |  | Not Applicable |
| Config 2 |  | TDDConf.1.1 |
| Config 3 |  | TDDConf.2.1 |
| RMSI CORESET Reference Channel | | Config 1 |  | CR.1.1 FDD |
| Config 2 |  | CR.1.1 TDD |
| Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | Config 1 |  | CCR.1.3 FDD |
| Config 2 |  | CCR.1.3 TDD |
| Config 3 |  | CCR.2.2 TDD |
| SSB Configuration | | Config 1 |  | SSB.1 FR1 |
| Config 2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | | Config 1, 2 |  | SMTC.1 |
| Config 3 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | | Config 1, 2 |  | 15 KHz |
| Config 3 |  | 30 KHz |
| PRACH Configuration | | Config 1, 2 |  | Table A.7.1-1, PRACH.1 FR1 |
| Config 3 |  | Table A.7.1-1, PRACH.1 FR1 |
| SSB index assigned as RLM RS | | |  | 0 |
| OCNG parameters | | |  | OP.1 |
| CP length | | |  | Normal |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format | |  | 1-0 |
| Number of Control OFDM symbols | |  | 2 |
| Aggregation level | | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average 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 configuration | | Config 1 |  | CSI-RS.1.1 FDD |
| Config 2 |  | CSI-RS.1.1 TDD |
| Config 3 |  | CSI-RS.2.1 TDD |
| CSI-RS for tracking | | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| T1 | | | s | 0.2 |
| T2 | | | s | 0.68 |
| T3 | | | s | 0.68 |
| D1 | | | s | 0.64 |
| 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. | | | | |

6.5.1.3.4.2 Test Procedure

There is one cell (Cell 1), which is the active NR cell, in the test. Prior to the start of the time duration T1, the UE shall be fully synchronized to PCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 6.5.1.3.4.1-4.

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

2. Set the parameters according to T1 in Table 6.5.1.3.5-1. 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 6.5.1.3.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.3.5-1. T3 starts.

5. If the SS:  
a) detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 higher than OFF power defined in TS 38.521-1 [17] clause 6.3.2.5 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 6.5.1.3.5-1.

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 state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* according to TS 38.508-1 [10] clause 4.5.

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

6.5.1.3.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6.1 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 6.5.1.3.4.3-0: Common Exception messages for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in DRX mode test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.5-4  Table H.3.5-9  Table H.3.7-1 with condition DRX.3 |

Table 6.5.1.3.4.3-1: Void

Table 6.5.1.3.4.3-2: RLF-TimersAndConstant

|  |  |  |  |
| --- | --- | --- | --- |
| 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 | ms1000 |  |  |
| } |  |  |  |

Table 6.5.1.3.4.3-3: Void

Table 6.5.1.3.4.3-4 *SIB1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfoSEQUENCE { |  |  |  |
| q-RxLevMin | -53 | -106 is actual value in dBm (-53 \* 2 dBm) | dBm/15kHz |
|  | -51 | -102 is actual value in dBm (-51 \* 2 dBm) | dBm/30kHz |
| } |  |  |  |
| } |  |  |  |

6.5.1.3.5 Test Requirement

Table 6.5.1.3.5-1 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 6.5.1.3.5-1: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
| T1 | T2 | T3 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | 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-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 |
| Config 2 | 1.8 | -6.2 | -15.8 |
| Config 3 | 1.8 | -6.2 | -15.8 |
|  | Config 1 | dBm/15kHz | -98 | | |
| Config 2 | -98 | | |
| Config 3 | -98 | | |
|  | Config 1 | dBm/SCS | -98 | | |
| Config 2 | -98 | | |
| Config 3 | -95 | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure 6.5.1.3.4-1.  Note 5: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR during T3 from D.4.1.1, is -18dB-TT = -18.9dB (including test tolerances).. | | | | | |

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%.

#### 6.5.1.4 NR SA FR1 radio link monitoring in-sync test for PCell configured with SSB-based RLM RS in DRX mode

6.5.1.4.1 Test purpose

The purpose of this test is to verify that the UE properly detects in sync for the purpose of monitoring downlink radio link quality of the Pcell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.2.

6.5.1.4.2 Test applicability

This test applies to all types of NR UE Release 15 and forward supporting 5GS NR SA FR1 and long DRX cycle.

6.5.1.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.4.

6.5.1.4.4 Test Description

There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.1.4.4-1 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. 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.Editor note: whether to revise power level to be gradually changed

Figure 6.5.1.4.4-1 - SNR variation for in-sync testing



6.5.1.4.4.1 Initial Conditions

This test shall be tested using any of the test configurations in Table 6.5.1.4.4.1-1.

Table 6.5.1.4.4.1-1: Supported test configurations for NR FR1 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.4-1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.4-2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 6.5.1.4-3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1. | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.4.4.1-2.

Table 6.5.1.4.4.1-2: Initial conditions for SA FR1 radio link monitoring in-sync test for NR PCell configured with SSB-based RLM RS 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.1.2, 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 6.5.1.4.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

Table 6.5.1.4.4.1-3: Void

1. Message contents are defined in clause 6.5.1.4.4.3.

2. There is one cell (Cell 1), which is the active NR cell, in the test. The power levels and settings are set according to Annex A.6, Table A.6.1.1-1. The connection setup is done according to the settings in Annex C.1.3, and the downlink signal levels as per Annex C.1.2.

3. The general test parameters are given in Table 6.5.1.4.4.1-4 below.

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

Table 6.5.1.4.4.1-4: General test parameters for FR1 in-sync testing in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value |
| Test 1 |
| Active PCell | | | |  | Cell 1 |
| RF Channel Number | | | |  | 1 |
| Duplex mode | | | Config 1 |  | FDD |
| Config 2, 3 |  | TDD |
| BWchannel | | | Config 1 | MHz | 10: NRB,c = 52 |
| Config 2 | 10: NRB,c = 52 |
| Config 3 | 40: NRB,c = 106 |
| DL initial BWP configuration | | | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | | | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | | | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | | | Config 1, 2, 3 |  | ULBWP.1.1 |
| TDD Configuration | | | Config 1 |  | Not Applicable |
| Config 2 |  | TDDConf.1.1 |
| Config 3 |  | TDDConf.2.1 |
| RMSI CORESET Reference Channel | | | Config 1 |  | CR.1.1 FDD |
| Config 2 |  | CR.1.1 TDD |
| Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | | Config 1 |  | CCR.1.1 FDD |
| Config 2 |  | CCR.1.1 TDD |
| Config 3 |  | CCR.2.1 TDD |
| SSB Configuration | | | Config 1 |  | SSB.1 FR1 |
| Config 2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | | | Config 1, 2 |  | SMTC.1 |
| Config 3 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | | | Config 1, 2 |  | 15 KHz |
| Config 3 |  | 30 KHz |
| PRACH Configuration | | | Config 1, 2 |  | Table A.7.1-1, PRACH.1 FR1 |
| Config 3 |  | Table A.7.1-1, PRACH.1 FR1 |
| SSB index assigned as RLM RS | | | |  | 0 |
| OCNG parameters | | | |  | OP.1 |
| CP length | | | |  | Normal |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |
| 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.3 |
| Gap pattern ID | | | |  | N.A. |
| Layer 3 filtering | | | |  | *Enabled* |
| T310 timer | | | | ms | 2000 |
| T311 timer | | | | ms | 1000 |
| N310 | | | |  | 1 |
| N311 | | | |  | 1 |
| CSI-RS configuration for CSI reporting | | Config 1 | |  | CSI-RS.1.1 FDD |
| Config 2 | |  | CSI-RS.1.1 TDD |
| Config 3 | |  | CSI-RS.2.1 TDD |
| CSI-RS for tracking | | Config 1 | |  | TRS.1.1 FDD |
| Config 2 | |  | TRS.1.1 TDD |
| Config 3 | |  | TRS.1.2 TDD |
| T1 | | | | s | 0.2 |
| T2 | | | | s | 0.2 |
| T3 | | | | s | 0.64 |
| T4 | | | | s | 0.2 |
| T5 | | | | s | 0.88 |
| D1 | | | | s | 0.84 |
| 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. | | | | | |

6.5.1.4.4.2 Test Procedure

There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.1.4.4-1 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 PCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 6.5.1.4.4.1-4.

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

2. Set the parameters according to T1 in Table 6.5.1.4.5-1 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 6.5.1.4.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.4.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.1.4.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.1.4.5-1. T5 starts.

7. If the SS detects uplink power equal to or higher than the minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 (D1 second 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. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [6] clause 4.5.

9. 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.

6.5.1.4.4.3 Message Contents

Message contents are according to TS 38.508-1 [14] clause 4.6.1 and 7.3.1 with condition “Short\_DCI” and with the following exceptions:

Table 6.5.1.4.4.3-0: Common Exception messages for NR SA FR1 radio link monitoring in-sync test for PCell configured with SSB-based RLM RS in DRX mode test requirement

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.5-4  Table H.3.5-9  Table H.3.7-1 with condition DRX.3 |

Table 6.5.1.4.4.3-1: Void

Table 6.5.1.4.4.3-2: 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 |  |  |
| n310 | n1 |  |  |
| n311 | n1 |  |  |
| t311-v1530 | ms1000 |  |  |
| } |  |  |  |

Table 6.5.1.4.4.3-3: Void

6.5.1.4.5 Test Requirement

The requirements in this section apply for each SSB based RLM-RS resource configured for the PCell, provided that the SSB configured for RLM are actually transmitted within UE active DL BWP during the entire evaluation period specified in section 6.5.1.4.3.

Table 6.5.1.4.5-1 defines the cell specific primary level settings.

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 confidence interval of 95%.

Table 6.5.1.4.5-1: Cell specific test parameters for FR1 for in-sync radio link monitoring tests in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 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 |
| SNR on RLM-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 2 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 3 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
|  | Config 1 | dBm/15 kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
|  | Config 1 | dBm/SCS | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -95 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure 6.5.1.4.4-1.  Note 5: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR during T3 and T4 from D.4.1.1 are -18.0-TT and -8.0-TT, which are -18.8dB and -8.8dB(including test tolerances). | | | | | | | |

#### 6.5.1.5 NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

6.5.1.5.1 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 PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in TS 38.133 [6] clause 8.1.

6.5.1.5.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting CSI-RS based RLM.

6.5.1.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.5.

6.5.1.5.4 Test description

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 6.5.1.5.4-1 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 6.5.1.5.4-1: SNR variation for out-of-sync testing

6.5.1.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.1.5.4.1-1.

Table 6.5.1.5.4.1-1: Supported test configurations for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.5-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.5-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.5-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.5.4.1-2.

Table 6.5.1.5.4.1-2: Initial conditions for NR SA radio link monitoring NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.1.5.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.1.5.4.1-3. The measurement gap configuration is according to Table 6.5.1.5.4.1-4.

2. Message contents are defined in clause 6.5.1.5.4.3.

3. There are one cell in the test, where Cell 1 is the NR PCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table 6.5.1.5.5-1 for this test. Cell 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.1.5.4.1-3: General test parameters for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Test 1 |
| Active PCell | |  | Cell 1 |
| RF Channel Number | |  | 1 |
| Duplex mode | Config 1 |  | FDD |
| Config 2, 3 | TDD |
| TDD Configuration | Config 1 |  | Not Applicable |
| Config 2 | TDDConf.1.1 |
| Config 3 | TDDConf.2.1 |
| DL initial BWP configuration | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2, 3 |  | ULBWP.1.1 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.1.1 FDD |
| Config 2 | CR.1.1 TDD |
| Config 3 | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.1.3 FDD |
| Config 2 | CCR.1.3 TDD |
| Config 3 | CCR.2.2 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR1 |
| Config 2 | SSB.1 FR1 |
| Config 3 | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 |  | SMTC.1 |
| Config 3 | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 |  | 15 kHz |
| Config 3 | 30 kHz |
| TRS configuration | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| CSI-RS for RLM | Config 1 |  | Resource #4 in TRS.1.1 FDD |
| Config 2 |  | Resource #4 in TRS.1.1 TDD |
| Config 3 |  | Resource #4 in TRS.1.2 TDD |
| TCI configuration for PDCCH/PDSCH | |  | TCI.State.2 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format |  | 1-0 |
| Number of Control OFDM symbols |  | 2 |
| Aggregation level | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 |
| DMRS precoder granularity |  | REG bundle size |
| REG bundle size |  | 6 |
| DRX | |  | *OFF* |
| Gap pattern ID | |  | *gp0* |
| Layer 3 filtering | |  | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310 | |  | 1 |
| N311 | |  | 1 |
| CSI-RS configuration | Config 1 |  | CSI-RS.1.1 FDD |
| Config 2 | CSI-RS.1.1 TDD |
| Config 3 | CSI-RS.2.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 0.48 |
| T3 | | s | 0.48 |
| D1 | | s | 0.44 |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | |

Table 6.5.1.5.4.1-4: Measurement gap configuration for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX

|  |  |
| --- | --- |
| Field | Test 1 |
| Value |
| gapOffset | 0 |

6.5.1.5.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, 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 configuring the UE for inter-frequency measurements.

3. The UE shall transmit RRCReconfigurationComplete message.

4. Set the parameters of Cell 1 according to T1 in Table 6.5.1.5.5-1. 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 6.5.1.5.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.5.5-1. T3 starts.

7. If the SS:

a) detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 any uplink power higher than OFF power defined in TS 38.521-1 [17] clause 6.3.2.5 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 6.5.1.5.5-1.

9. 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 state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat steps 4-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

6.5.1.5.4.3 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 6.5.1.5.4.3-1: Common Exception messages for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED, GAP\_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)  Table H.3.1-4 with A3-offset = 0  Table H.3.1-6 with conditions gapUE and RLM  Table H.3.5-4  Table H.3.5-9 with Condition CSI-RS RLM |

Table 6.5.1.5.4.3-2 *SIB1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfoSEQUENCE { |  |  |  |
| q-RxLevMin | -46 | -92 is actual value in dBm (-46 \* 2 dBm) | dBm/15kHz or dBm/30kHz |
| } |  |  |  |
| } |  |  |  |

Table 6.5.1.5.4.3-2: *RLF-TimersAndConstants*

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |  |  |
| t311 | ms1000 |  |  |
| n311 | n1 |  |  |
| } |  |  |  |

6.5.1.5.5 Test requirement

Tables 6.5.1.5.4.1-3 and 6.5.1.5.5-1 define the primary level settings including test tolerances for Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode.

Table 6.5.1.5.5-1: Cell specific test parameters for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
| T1 | T2 | T3 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | 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-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 |
| Config 2 | 1.8 | -6.2 | -15.8 |
| Config 3 | 1.8 | -6.2 | -15.8 |
|  | Config 1 | dBm/15KHz | -98 | | |
| Config 2 | -98 | | |
| Config 3 | -98 | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.1.5.4-1.  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 from D.4.1.1 is -18 -TT, which is -18.8dB (including test tolerances). | | | | | |

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

During time durations T1, T2 and T3, 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 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

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

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

#### 6.5.1.6 NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

6.5.1.6.1 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 PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS in-sync radio link monitoring requirements in TS 38.133 [6] clause 8.1.

6.5.1.6.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting CSI-RS based RLM.

6.5.1.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.6.

6.5.1.6.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.1.6.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the Pcell to emulate out-of-sync and in-sync states.



Figure 6.5.1.6.4-1: SNR variation for In-sync testing

6.5.1.6.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.1.6.4.1-1.

Table 6.5.1.6.4.1-1: Supported test configurations for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.6-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.6-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.6-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.6.4.1-2.

Table 6.5.1.6.4.1-2: Initial conditions for for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-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, 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 6.5.1.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.1.6.4.1-3.

2. Message contents are defined in clause 6.5.1.6.4.3.

3. There is one cell in the test, where Cell 1 is the NR PCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table 6.5.1.6.5-1 for this test. Cell 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.1.6.4.1-3: General test parameters for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Test 1 |
| Active PCell | |  | Cell 1 |
| RF Channel Number | |  | 1 |
| Duplex mode | Config 1 |  | FDD |
| Config 2, 3 | TDD |
| TDD Configuration | Config 1 |  | Not Applicable |
| Config 2 | TDDConf.1.1 |
| Config 3 | TDDConf.2.1 |
| DL initial BWP configuration | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2, 3 |  | ULBWP.1.1 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.1.1 FDD |
| Config 2 | CR.1.1 TDD |
| Config 3 | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.1.1 FDD |
| Config 2 | CCR.1.1 TDD |
| Config 3 | CCR.2.1 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR1 |
| Config 2 | SSB.1 FR1 |
| Config 3 | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 |  | SMTC.1 |
| Config 3 | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 |  | 15 kHz |
| Config 3 | 30 kHz |
| TRS configuration | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| CSI-RS for RLM | Config 1 |  | Resource #4 in TRS.1.1 FDD |
| Config 2 |  | Resource #4 in TRS.1.1 TDD |
| Config 3 |  | Resource #4 in TRS.1.2 TDD |
| TCI configuration for PDCCH/PDSCH | |  | TCI.State.2 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format |  | 1-0 |
| Number of Control OFDM symbols |  | 2 |
| Aggregation level | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 |
| DMRS precoder granularity |  | REG bundle size |
| REG bundle size |  | 6 |
| 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 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 configuration | Config 1 |  | CSI-RS.1.1 FDD |
| Config 2 | CSI-RS.1.1 TDD |
| Config 3 | CSI-RS.2.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 0.2 |
| T3 | | s | 0.44 |
| T4 | | s | 0.2 |
| T5 | | s | 0.88 |
| D1 | | s | 0.84 |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | |

6.5.1.6.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is not enabled.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters of Cell 1 according to T1 in Table 6.5.1.6.5-1. 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 6.5.1.6.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.6.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.1.6.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.1.6.5-1. T5 starts.

7. If the SS detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point F (T6 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 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 [14] clause 4.5.

9. After T5 expires, repeat steps 2-7 for both subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

6.5.1.6.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with the following exceptions:

Table 6.5.1.6.4.3-1: Common Exception messages for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.5-4  Table H.3.5-9 with Condition CSI-RS RLM |

6.5.1.6.5 Test requirement

Tables 6.5.1.6.4.1-3 and 6.5.1.6.5-1 define the primary level settings including test tolerances for Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode.

Table 6.5.1.6.5-1: Cell specific test parameters for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | 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-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 2 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 3 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
|  | Config 1 | dBm/15kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.1.6.4-1.  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 and T4 from D.4.1.1 are -18.0-TT and -8.0-TT, which are -18.8dB and -8.8dB(including test tolerances). | | | | | | | |

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 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 on the PCell.

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

#### 6.5.1.7 NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

6.5.1.7.1 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 PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in TS 38.133 [6] clause 8.1.

6.5.1.7.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 5GS NR SA FR1, CSI-RS based RLM and long DRX cycle.

6.5.1.7.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.7.

6.5.1.7.4 Test description

The test consists three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 6.5.1.7.4-1 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 6.5.1.7.4-1: SNR variation for out-of-sync testing

6.5.1.7.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 6.5.1.7.4.1-1.

Table 6.5.1.7.4.1-1: Supported test configurations for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.7-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.7-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.7-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.7.4.1-2.

Table 6.5.1.7.4.1-2: Initial conditions for NR SA radio link monitoring for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.1.7.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.1.7.4.1-3.

2. Message contents are defined in clause 6.5.1.7.4.3.

3. There is one cell in the test, where Cell 1 is the NR PCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table 6.5.1.7.5-1 for this test. Cell 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.1.7.4.1-3: General test parameters for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| **Test 1** |
| Active PCell | |  | Cell 1 |
| RF Channel Number | |  | 1 |
| Duplex mode | Config 1 |  | FDD |
| Config 2, 3 | TDD |
| TDD Configuration | Config 1 |  | Not Applicable |
| Config 2 | TDDConf.1.1 |
| Config 3 | TDDConf.2.1 |
| DL initial BWP configuration | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2, 3 |  | ULBWP.1.1 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.1.1 FDD |
| Config 2 | CR.1.1 TDD |
| Config 3 | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.1.3 FDD |
| Config 2 | CCR.1.3 TDD |
| Config 3 | CCR.2.2 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR1 |
| Config 2 | SSB.1 FR1 |
| Config 3 | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 |  | SMTC.1 |
| Config 3 | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 |  | 15 kHz |
| Config 3 | 30 kHz |
| TRS configuration | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| CSI-RS for RLM | Config 1 |  | Resource #4 in TRS.1.1 FDD |
| Config 2 |  | Resource #4 in TRS.1.1 TDD |
| Config 3 |  | Resource #4 in TRS.1.2 TDD |
| TCI configuration for PDCCH/PDSCH | |  | TCI.State.2 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format |  | 1-0 |
| Number of Control OFDM symbols |  | 2 |
| Aggregation level | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 |
| DMRS precoder granularity |  | REG bundle size |
| REG bundle size |  | 6 |
| DRX | |  | DRX.3 |
| Gap pattern ID | |  | N.A. |
| Layer 3 filtering | |  | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310 | |  | 1 |
| N311 | |  | 1 |
| CSI-RS configuration for CSI reporting | Config 1 |  | CSI-RS.1.1 FDD |
| Config 2 | CSI-RS.1.1 TDD |
| Config 3 | CSI-RS.2.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 1.28 |
| T3 | | s | 1.28 |
| D1 | | s | 1.24 |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | |

6.5.1.7.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. Establish SRB2 and DRB in the RRC Reconfiguration message.

2. Set the parameters of Cell 1 according to T1 in Table 6.5.1.7.5-1. 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 6.5.1.7.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.7.5-1. T3 starts.

5. If the SS:

a) detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 in the On-duration part of every DRX cycle in the slots 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 any uplink power higher than OFF power defined in TS 38.521-1 [17] clause 6.3.2.5 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 6.5.1.7.5-1.

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 state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *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.

6.5.1.7.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with the following exceptions:

Table 6.5.1.7.4.3-1: Common Exception messages for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-9  Table H.3.5-4  Table H.3.5-9 with Condition CSI-RS RLM  Table H.3.7-1 with condition DRX.3 |

Table 6.5.1.7.4.3-2 *SIB1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfoSEQUENCE { |  |  |  |
| q-RxLevMin | -46 | -92 is actual value in dBm (-46 \* 2 dBm) | dBm/15kHz or dBm/30kHz |
| } |  |  |  |
| } |  |  |  |

Table 6.5.1.7.4.3-3: RLF-TimersAndConstant

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

6.5.1.7.5 Test requirement

Tables 6.5.1.7.4.1-3 and 6.5.1.7.5-1 define the primary level settings including test tolerances for Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode.

Table 6.5.1.7.5-1: Cell specific test parameters for FR1 for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | | |
| **T1** | **T2** | **T3** |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | 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-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 |
| Config 2 | 1.8 | -6.2 | -15.8 |
| Config 3 | 1.8 | -6.2 | -15.8 |
|  | Config 1 | dBm/15kHz | -98 | | |
| Config 2 | -98 | | |
| Config 3 | -98 | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.  Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.  Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.7.1-1.  Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 from D.4.1.1 is -18 -TT, which is -18.8dB (including test tolerances). | | | | | |

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

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

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

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

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

#### 6.5.1.8 NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

6.5.1.8.1 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 PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS in-sync radio link monitoring requirements in TS 38.133 [6] clause 8.1.

6.5.1.8.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 5GS NR SA FR1, CSI-RS based RLM and long DRX cycle.

6.5.1.8.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.8.

6.5.1.8.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.1.8.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate in-sync states.



Figure 6.5.1.8.4-1: SNR variation for In-sync testing

6.5.1.8.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 6.5.1.8.4.1-1.

Table 6.5.1.8.4.1-1: Supported test configurations for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.8-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.8-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.8-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.8.4.1-2.

Table 6.5.1.8.4.1-2: Initial conditions for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.1.8.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.1.8.4.1-3. The measurement gap configuration for subtest 2 is according to Table 6.5.1.8.4.1-4.

2. Message contents are defined in clause 6.5.1.8.4.3.

3. There are one cell in the test, where Cell 1 is the NR PCell 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 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.1.8.4.1-3: General test parameters for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| **Test 1** |
| Active PCell | |  | Cell 1 |
| RF Channel Number | |  | 1 |
| Duplex mode | Config 1 |  | FDD |
| Config 2, 3 | TDD |
| TDD Configuration | Config 1 |  | Not Applicable |
| Config 2 | TDDConf.1.1 |
| Config 3 | TDDConf.2.1 |
| DL initial BWP configuration | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2, 3 |  | ULBWP.1.1 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.1.1 FDD |
| Config 2 | CR.1.1 TDD |
| Config 3 | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.1.1 FDD |
| Config 2 | CCR.1.1 TDD |
| Config 3 | CCR.2.1 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR1 |
| Config 2 | SSB.1 FR1 |
| Config 3 | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 |  | SMTC.1 |
| Config 3 | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 |  | 15 kHz |
| Config 3 | 30 kHz |
| TRS configuration | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| CSI-RS for RLM | Config 1 |  | Resource #4 in TRS.1.1 FDD |
| Config 2 |  | Resource #4 in TRS.1.1 TDD |
| Config 3 |  | Resource #4 in TRS.1.2 TDD |
| TCI configuration for PDCCH/PDSCH | |  | TCI.State.2 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format |  | 1-0 |
| Number of Control OFDM symbols |  | 2 |
| Aggregation level | CCE | 8 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 |
| DMRS precoder granularity |  | REG bundle size |
| REG bundle size |  | 6 |
| 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 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 configuration for CSI reporting | Config 1 |  | CSI-RS.1.1 FDD |
| Config 2 |  | CSI-RS.1.1 TDD |
| Config 3 |  | CSI-RS.2.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 0.2 |
| T3 | | s | 1.24 |
| T4 | |  | 0.2 |
| T5 | |  | 1.88 |
| T6 | | s | 1.84 |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | |

Table 6.5.1.8.4.1-4: Measurement gap configuration for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Field | Test 1 |
| Value |
| gapOffset | 0 |
| Note 1: Void | |

6.5.1.8.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. 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 NR, 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 configuring the UE for inter-frequency measurements.

3. The UE shall transmit RRCReconfigurationComplete message.

4. Set the parameters of Cell 1 according to T1 in Table 6.5.1.8.5-1. 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 6.5.1.8.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.8.5-1. T3 starts.

7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.1.8.5-1. T4 starts.

8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.1.8.5-1. T5 starts.

9. If the SS detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 in the On-duration part of every DRX cycle in the configured slots for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point F (T6 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 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 [14] clause 4.5.

11. Repeat steps 4-10 for both subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

6.5.1.8.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with the following exceptions:

Table 6.5.1.8.4.3-1: Common Exception messages for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED, GAP\_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)  Table H.3.1-4 with A3-offset = 0  Table H.3.5-4  Table H.3.5-9 with Condition CSI-RS RLM  Table H.3.7-1 with condition DRX.3 and Gap |

Table 6.5.1.8.4.3-2: 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 |  |  |
| } |  |  |  |

6.5.1.8.5 Test requirement

Tables 6.5.1.8.4.1-3 and 6.5.1.8.5-1 define the primary level settings including test tolerances for Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode.

Table 6.5.1.8.5-1: Cell specific test parameters for NR SA FR1 radio link monitoring in-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | | | | |
| **T1** | **T2** | **T3** | **T4** | **T5** |
| 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 PBCH to PBCH DMRS | | 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-RS | Config 1 | dB | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 2 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
| Config 3 | 1.8 | -6.2 | -15.8 | -5.3 | 1.8 |
|  | Config 1 | dBm/15kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.1.8.4-1.  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 and T4 from D.4.1.1 are -18.0-TT and -8.0-TT, which are -18.8dB and -8.8dB(including test tolerances) | | | | | | | |

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 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 on the PCell.

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

#### 6.5.1.9 SA FR1 radio link monitoring out-of-sync Test for PSCell configured with CSI-RS-based RLM for UE fulfilling relaxed measurement criterion

Editor's Note: This test case is incomplete in following aspects:

- TT analysis is missing.

##### 6.5.1.9.1 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 PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in TS 38.133 [6] clause 8.1.3.4 for UE fulfilling good serving cell quality criterion.

##### 6.5.1.9.2 Test applicability

This test applies to all types of NR UE release 17 and forward supporting 5GS NR SA FR1, CSI-RS based RLM and long DRX cycle and supporting RLM relaxation criteria *rlm-Relaxation-r17*.

##### 6.5.1.9.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.1.0.5.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.1.9.

##### 6.5.1.9.4 Test description

There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 6.5.1.9.4-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.s.



Figure 6.5.1.9.4-1: SNR variation for CSI-RS out-of-sync testing

6.5.1.9.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 6.5.1.9.4.1-1.

Table 6.5.1.9.4.1-1: Supported test configurations for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.1.9-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.9-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.1.9-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.1.9.4.1-2.

Table 6.5.1.9.4.1-2: Initial conditions for NR SA radio link monitoring for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.1.9.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.7.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.1.9.4.1-3.

2. Message contents are defined in clause 6.5.1.9.4.3.

3. There is one cell in the test, where Cell 1 is the NR PCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table 6.5.1.9.5-1 for this test. Cell 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.1.9.4.1-3: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
|  | |  | Test 1 |
| Active PCell | |  | Cell 1 |
| RF Channel Number | |  | 1 |
| Duplex mode | Config 1 |  | FDD |
|  | Config 2, 3 |  | TDD |
| TDD Configuration | Config 1 |  | Not Applicable |
|  | Config 2 |  | TDDConf.1.1 |
|  | Config 3 |  | TDDConf.2.1 |
| DL initial BWP configuration | Config 1, 2, 3 |  | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1, 2, 3 |  | DLBWP.1.1 |
| UL initial BWP configuration | Config 1, 2, 3 |  | ULBWP.0.1 |
| UL dedicated BWP configuration | Config 1, 2, 3 |  | ULBWP.1.1 |
| RMSI CORESET Reference Channel | Config 1 |  | CR.1.1 FDD |
|  | Config 2 |  | CR.1.1 TDD |
|  | Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | Config 1 |  | CCR.1.3 FDD |
|  | Config 2 |  | CCR.1.3 TDD |
|  | Config 3 |  | CCR.2.2 TDD |
| SSB Configuration | Config 1 |  | SSB.1 FR1 |
|  | Config 2 |  | SSB.1 FR1 |
|  | Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 |  | SMTC.1 |
|  | Config 3 |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 |  | 15 kHz |
|  | Config 3 |  | 30 kHz |
| TRS configuration | Config 1 |  | TRS.1.1 FDD |
|  | Config 2 |  | TRS.1.1 TDD |
|  | Config 3 |  | TRS.1.2 TDD |
| CSI-RS for RLM | Config 1 |  | Resource #4 in TRS.1.1 FDD |
|  | Config 2 |  | Resource #4 in TRS.1.1 TDD |
|  | Config 3 |  | Resource #4 in TRS.1.2 TDD |
| TCI configuration for PDCCH/PDSCH | |  | TCI.State. 2 |
| OCNG parameters | |  | OP.1 |
| CP length | |  | Normal |
| Correlation Matrix and Antenna Configuration | |  | 2x2 Low |
| Out of sync transmission parameters | DCI format |  | 1-0 |
|  | Number of Control OFDM symbols |  | 2 |
|  | Aggregation level | CCE | 8 |
|  | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 |
|  | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 |
|  | DMRS precoder granularity |  | REG bundle size |
|  | REG bundle size |  | 6 |
| DRX | |  | [DRX.X1] |
| Gap pattern ID | |  | N.A. |
| Layer 3 filtering | |  | Enabled |
| T310 timer | | ms | 0 |
| T311 timer | | ms | 1000 |
| N310 | |  | 1 |
| N311 | |  | 1 |
| CSI-RS configuration for CSI reporting | Config 1 |  | CSI-RS.1.1 FDD |
|  | Config 2 |  | CSI-RS.1.1 TDD |
|  | Config 3 |  | CSI-RS.2.1 TDD |
| T1 | | s | 0.2 |
| T2 | | s | 2.48 |
| T3 | | s | 4.88 |
| D1 | | s | 4.84 |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | |

6.5.1.9.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.s.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. Establish SRB2 and DRB in the RRC Reconfiguration message.

2. Set the parameters of Cell 1 according to T1 in Table 6.5.1.9.5-1. 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 6.5.1.9.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.1.9.5-1. T3 starts.

5. If the SS:

a) detects uplink power equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 in the On-duration part of every DRX cycle in the slots 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 any uplink power higher than OFF power defined in TS 38.521-1 [17] clause 6.3.2.5 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 6.5.1.9.5-1.

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 state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *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.

6.5.1.9.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and 7.3.1 with the following exceptions:

Table 6.5.1.9.4.3-1: Common Exception messages for NR SA FR1 radio link monitoring out-of-sync test for PCell configured with CSI-RS-based RLM RS in DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-9  Table H.3.5-4  Table H.3.5-9 with Condition CSI-RS RLM  Table H.3.7-1 with condition DRX.X |

Table 6.5.1.9.4.3-2 *SIB1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfoSEQUENCE { |  |  |  |
| q-RxLevMin | -46 | -92 is actual value in dBm (-46 \* 2 dBm) | dBm/15kHz or dBm/30kHz |
| } |  |  |  |
| } |  |  |  |

Table 6.5.1.9.4.3-3: RLF-TimersAndConstant

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

Table 6.5.1.9.4.3-4: CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 6.5.1.9.5 Test requirement

Tables 6.5.1.9.4.1-3 and 6.5.1.9.5-1 define the primary level settings including test tolerances for Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode.

Table 6.5.1.9.5-1: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | |
|  | |  | T1 | T2 | T3 |
| EPRE ratio of PDCCH DMRS to SSSPDCCH\_beta | | dB | 4 | | |
| EPRE ratio of PDCCH to PDCCH DMRSPDCCH\_DMRS\_beta | | dB | 4 | | |
| EPRE ratio of PBCH DMRS to SSSPBCH\_beta | | dB | 0 | | |
| EPRE ratio of PBCH to PBCH DMRSPSS\_beta | | dB |  | | |
| EPRE ratio of PSS to SSSSSS\_beta | | dB |  | | |
| EPRE ratio of PDSCH DMRS to SSS PDSCH\_beta | | dB |  | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |  | | |
| EPRE ratio of OCNG DMRS to SSS | | dB |  | | |
| EPRE ratio of OCNG to OCNG DMRS | | dB |  | | |
| SNR on RLM-RS | Config 1 | dB | 1+TT | 1+TT | -15+TT |
|  | Config 2 |  | 1+TT | 1+TT | -15+TT |
|  | Config 3 |  | 1+TT | 1+TT | -15+TT |
|  | Config 1 | dBm/15kHz | -98 | | |
|  | Config 2 |  | -98 | | |
|  | Config 3 |  | -98 | | |
| goodServingCellEvaluationRLM | |  | configured | | |
| offset in goodServingCellEvaluationRLM | | dB | Not configured | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.  Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.  Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.  Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.  Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure 6.5.1.9.4-1.  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 from D.4.1.1 is -18 -TT, which is TBD dB (including test tolerances).. | | | | | |

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

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

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

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

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

### 6.5.2 Interruption

#### 6.5.2.0 Minimum conformance requirements

##### 6.5.2.0.1 Minimum conformance requirements for interruptions during measurements on deactivated NR SCC

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* [13] is 640 ms or longer.

If the PCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on PCell immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 6.5.2.0.1-1

If the PCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PCell no earlier than X slots before TSMTC\_duration and no later than X slots after TSMTC\_duration, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and TSMTC\_duration are given by Table 6.5.2.0.1-2. The interruption shall not exceed requirements in Table 6.5.2.0.1-2.

Interruptions on active SCells due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [13] is 640 ms or longer.

If the activated SCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on an activated SCell immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 6.5.2.0.1-1

If the activated SCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on the activated SCell no earlier than X slots before TSMTC\_duration and no later than X slots after TSMTC\_duration, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and TSMTC\_duration are given by Table 6.5.2.0.1-2. The interruption shall not exceed requirements in Table 6.5.2.0.1-2.

Table 6.5.2.0.1-1: Interruption duration for SCell activation/deactivation for inter-band CA

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) of victim cell | Interruption length (slot) | |
| 0 | 1 |  | 1 |
| 1 | 0.5 |  | 1 |
| 2 | 0.25 | Both aggressor cell and victim cell are on FR2 | 2 |
| Either aggressor cell or victim cell is on FR1 | 3 |
| 3 | 0.125 | Aggressor cell is on FR2 | 4 |
| Aggressor cell is on FR1 | 5 |

Table 6.5.2.0.1-2: Interruption duration for SCell activation/deactivation for intra-band CA

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 + TSMTC\_duration \* |
| 1 | 0.5 | 1 + TSMTC\_duration \* |
| 2 | 0.25 | 2 + TSMTC\_duration \* |
| 3 | 0.125 | 4 + TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and TSMTC duration for the SCell being activated is [x]ms. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, TSMTC duration for the SCell being activated is 0ms; - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated.  NOTE 2: is as defined in TS 38.211 [7]. | | |

The normative reference for this requirement is TS 38.133 [6] clause 8.2.2.2.

##### 6.5.2.0.2 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 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.

- 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 if UE is not capable of Per-FR gap, or on active serving cell(s) 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 6.5.2.0.1-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) 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 6.5.2.0.1-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) 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 6.5.2.0.1-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) 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 6.5.2.0.1-2.

Table 6.5.2.0.1-1: 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 aggressor cell (kHz) | |
|  |  |  | 15 | 30 |
| 0 | 1 | ≤ 200 | 2 | 2 |
|  |  | 300, 500 | 2 | 2 |
|  |  | 900 | 2 | 2 |
| 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 6.5.2.0.1-2: Interruption length X2 (slot)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | NR Slot | SRS carrier | Interruption length X2 (slots) | | |
|  | length (ms) of victim cell | switching time (us) Note 1 | Sub carrier spacing for aggressor 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 6.5.2.0.1-1 and in Table 6.5.2.0.1-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1, interruptions in Table 6.5.2.0.1-1 and in Table 6.5.2.0.1-2 shall apply.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.2.9.

#### 6.5.2.1 NR SA FR1 interruptions during measurements on deactivated NR SCC

6.5.2.1.1 Test purpose

To verify UE’s ability to complete NR PCell interruptions during the measurement on the deactivated NR SCC within the missed ACK/NACK rate in standalone NR requirements.

6.5.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 2DL CA.

6.5.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.2.1.

6.5.2.1.4 Test description

6.5.2.1.4.1 Initial conditions

Test 6.5.2.1 can be run in one of the configurations defined in this clause. Supported test configurations for NR PCell are shown in Table 6.5.2.1.4.1-1. Supported test configurations for NR SCell are shown in Table 6.5.2.1.4.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

Table 6.5.2.1.4.1-1: Supported test configurations for NR PCell

|  |  |
| --- | --- |
| Config | Description |
| 6.5.2.1-1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 6.5.2.1-2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 6.5.2.1-3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Table 6.5.2.1.4.1-1A: Supported test configurations for NR SCell

|  |  |
| --- | --- |
| ConfigSCell | Description |
| 6.5.2.1-1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 6.5.2.1-2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 6.5.2.1-3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.2.1.4.1-2.

Table 6.5.2.1.4.1-2: Initial conditions for NR SA FR1 interruptions during measurements on deactivated NR SCC

|  |  |  |  |
| --- | --- | --- | --- |
| 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.8.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 6.5.2.1.4.1-3

2. Message contents are defined in clause 6.5.2.1.4.3.

3. There are two NR carriers and two cells specified in the test. Cell 1 is the PCell on one NR carrier, Cell 2 is the SCell on the other NR carrier. Cell 1 and Cell 2 shall be configured according to Annex C.1.1 and C.1.2.

Table 6.5.2.1.4.1-3: General test parameters for NR SA FR1 interruptions during measurements on deactivated NR SCC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1, 2 | Two NR RF channels |
| Active PCell |  | Cell1 | PCell on NR RF channel number 1. |
| Configured deactivated SCell |  | Cell2 | Deactivated SCell on NR RF channel number 2. |
| CP length |  | Normal | Applicable to Cell1 and Cell 2 |
| DRX |  | OFF |  |
| Measurement gap pattern Id |  | OFF |  |
| SCell measurement cycle (measCycleSCell) | ms | 640 |  |
| T1 | s | 10 |  |

6.5.2.1.4.2 Test procedure

The test consists of two cells: Cell1 and Cell2. Cell1 is PCell and Cell2 is deactivated 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 to Cell1 and Cell2 and the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector. Cell1 shall be configured as PCell and Cell2 shall be configured as SCell.. During T1, PCell is continuously scheduled in DL.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, 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 including measCycleSCell or allowInterruptions for the deactivated NR SCell.

3. The UE shall transmit RRCReconfigurationComplete message.

4. Set the parameters according to Table 6.5.2.1.5-1. Propagation conditions are set according to Annex C.2.1. T1 starts.

5. SS schedules on PCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PCell.

6. 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”.

7. 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

- For PCell test configuration 6.5.2.1-1,

- X = interruption length+k1 if k1 ≤ interruption length

- X = interruption length if k1 > interruption length

Note: UE expects that the SS won't use k1 = 3 for PCell test configuration 4.5.2.3-1 and 4.5.2.3-4.

- For PCell test configuration 6.5.2.1-2 and 6.5.2.1-3,

- X = interruption length.

- interruption length is given in table 6.5.2.1.5-2 for inter-band case and in 6.5.2.1.5-3 for intra-band case.

8. 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 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 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 *NR*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

9. Repeat step 2-8 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.

6.5.2.1.4.3 Message contents

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

Table 6.5.2.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-2 with Condition Deactivated SCell;  Table H.3.1-4 with A3-offset = 15 |
| Specific message contents exceptions for SCell Test Configuration 6.5.2.1-1, 6.5.2.1-2 | Table H.3.1-3 with Condition Deactivated SCell and SSB.1 FR1  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |
| Specific message contents exceptions for SCell Test Configuration 6.5.2.1-3 | Table H.3.1-3 with Condition Deactivated SCell and SSB.2 FR1  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.2.1.4.3-2: ServingCellConfig (Cell 2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition MEAS | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| servingCellMO | 2 | MeasObjectId for SCell in Table H.3.1-2 |  |
| } |  |  |  |

6.5.2.1.5 Test requirement

Table 6.5.2.1.5-1 and Table 6.5.2.1.5-1A defines the primary level settings including test tolerances for NR SA FR1 interruptions during measurements on deactivated NR SCC.

Table 6.5.2.1.5-1: NR cell specific test parameters for NR PCell for NR SA FR1 interruptions during measurements on deactivated NR SCC

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell1** |
| Frequency Range | |  | FR1 |
| Duplex mode | Config 1 |  | FDD |
| Config 2,3 | TDD |
| TDD configuration | Config 1 |  | Not Applicable |
| Config 2 | TDDConf.1.1 |
|  | Confiq 3 |  | TDDConf.2.1 |
| BWchannel | |  | Note 9 |
| BWoccupied | Config 1,2 | RB | 52 Note 7 |
|  | Config 3 |  | 106 Note 8 |
| Initial DL BWP Configuration | |  | DLBWP.0.1 |
| Dedicated DL BWP Configuration | |  | DLBWP.1.1 |
| Initial UL BWP Configuration | |  | ULBWP.0.1 |
| Dedicated UL BWP Configuration | |  | ULBWP.1.1 |
| PDSCH Reference measurement channel | Config 1 |  | SR.1.1 FDD |
| Config 2 | SR.1.2 TDD |
| Config 3 | SR.2.1 TDD |
| CSI-RS for tracking | Config 1 |  | TRS.1.1 FDD |
|  | Config 2 |  | TRS.1.1 TDD |
|  | Config 3 |  | TRS.1.2 TDD |
| RMSI CORESET parameters | Config 1 |  | CR.1.1 FDD |
| Config 2 | CR.1.1 TDD |
| Config 3 | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 |  | CCR.1.1 FDD |
| Config 2 | CCR.1.1 TDD |
| Config 3 | CCR.2.1 TDD |
| OCNG Patterns | Config 1,2 |  | OP.1Note 7 |
|  | Config 3 |  | OP.1 Note 8 |
| SMTC Configuration | |  | SMTC.1 |
| SSB Configuration | Config 1,2 |  | SSB.1 FR1 |
| Config 3 | SSB.2 FR1 |
| 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 | |
| NocNote 2 | | dBm/15 kHz | -104 |
| SS-RSRP Note 3 | | dBm/15 kHz | -87 |
| Ês/Iot | | dB | 17 |
| Ês/Noc | | dB | 17 |
| NocNote 2 | Config 1,2 | dBm/SCS | -104 |
| Config 3 | -101 |
| IoNote3 | Config 1,2 | dBm/9.36MHz | -58.96 |
| Config 3 | dBm/38.16MHz | -52.86 |
| Time offset to Cell1 Note 5 | | μs | - |
| 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.  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 modeled as AWGN of appropriate power for Noc to be fulfilled within BWoccupied.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.  Note 4: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.  Note 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of TS 38.213 [3].  Note 7: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 8: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 9: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel. | | | |

Table 6.5.2.1.5-1A: NR cell specific test parameters for NR SCell for NR SA FR1 interruptions during measurements on deactivated NR SCC

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell2** |
| Frequency Range | |  | FR1 |
| Duplex mode | ConfigSCell 1 |  | FDD |
| ConfigSCell 2,3 | TDD |
| TDD configuration | ConfigSCell 1 |  | Not Applicable |
| ConfigSCell 2 | TDDConf.1.1 |
|  | ConfiqSCell 3 |  | TDDConf.2.1 |
| BWchannel | |  | Note 9 |
| BWoccupied | ConfigSCell 1,2 | RB | 52 Note 7 |
|  | ConfigSCell 3 |  | 106 Note 8 |
| Initial DL BWP Configuration | |  | DLBWP.0.1 |
| Dedicated DL BWP Configuration | |  | DLBWP.1.1 |
| Initial UL BWP Configuration | |  | N/A |
| Dedicated UL BWP Configuration | |  | N/A |
| PDSCH Reference measurement channel | ConfigSCell 1 |  | SR.1.1 FDD |
| ConfigSCell 2 | SR.1.2 TDD |
| ConfigSCell 3 | SR.2.1 TDD |
| CSI-RS for tracking | ConfigSCell 1 |  | TRS.1.1 FDD |
|  | ConfigSCell 2 |  | TRS.1.1 TDD |
|  | ConfigSCell 3 |  | TRS.1.2 TDD |
| RMSI CORESET parameters | ConfigSCell 1 |  | CR.1.1 FDD |
| ConfigSCell 2 | CR.1.1 TDD |
| ConfigSCell 3 | CR.2.1 TDD |
| Dedicated CORESET parameters | ConfigSCell 1 |  | CCR.1.1 FDD |
| ConfigSCell 2 | CCR.1.1 TDD |
| ConfigSCell 3 | CCR.2.1 TDD |
| OCNG Patterns | ConfigSCell 1,2 |  | OP.1 Note 7 |
|  | ConfigSCell 3 |  | OP.1 Note 8 |
| SMTC Configuration | |  | SMTC.4 |
| SSB Configuration | ConfigSCell 1,2 |  | SSB.5 FR1 |
| ConfigSCell 3 | SSB.6 FR1 |
| 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 | |
| NocNote 2 | | dBm/15 kHz | -104 |
| SS-RSRP Note 3 | | dBm/15 kHz | -87 |
| Ês/Iot | | dB | 17 |
| Ês/Noc | | dB | 17 |
| NocNote 2 | ConfigSCell 1,2 | dBm/SCS | -104 |
| ConfigSCell 3 | -101 |
| IoNote3 | ConfigSCell 1,2 | dBm/9.36MHz | -58.96 |
| ConfigSCell 3 | dBm/38.16MHz | -52.86 |
| Time offset to Cell1 Note 5 | | μs | 3 |
| 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.  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 modeled as AWGN of appropriate power for Noc to be fulfilled within BWoccupied.  Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.  Note 4: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.  Note 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of TS 38.213 [3].  Note 7: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 8: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 9: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel. | | | |

The UE shall be continuously scheduled on PCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on PCell.

If the NR PCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PCell immediately before and immediately after an SMTC. Each interruption on NR PCell shall not exceed the value defined in Table 6.5.2.1.5-2.

If the NR PCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PCell no earlier than 1 slot before an SMTC and no later than 1 slot after the SMTC. the interruption on NR PCell shall not exceed the value defined in Table 6.5.2.1.5-3.

Table 6.5.2.1.5-2: Interruption duration if the PCell is not in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

Table 6.5.2.1.5-3: Interruption duration if the PCell is in the same band as the deactivated SCell

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length |
| 0 | 1 | 2 + SMTC duration |
| 1 | 0.5 | 2 + SMTC duration |

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

#### 6.5.2.2 SA FR1 interruptions at NR SRS carrier based switching

Editor's Note: This test case is incomplete in following aspects:

- Message contents are missing.

- TT analysis is missing.

- Test Procedure is FFS.

- Test applicability needs to be updated

- Cell mapping is missing in Annex E

6.5.2.2.1 Test purpose

The purpose of this test is to verify PCell 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.

6.5.2.2.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting 2 DL CA.

6.5.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 5.5.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.2.2.

6.5.2.2.4 Test description

6.5.2.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.2.2.4.1-1.

Table 6.5.2.2.4.1-1: Supported test configurations for SA interruptions at NR SRS carrier based switching

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.2.2-1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD – TDD duplex mode |
| 6.5.2.2-2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD – TDD duplex mode |
| 6.5.2.2-3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD – 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 6.5.2.2.4.1-2.

Table 6.5.2.2.4.1-2: Initial conditions for SA interruptions at NR SRS carrier based switching

|  |  |  |  |
| --- | --- | --- | --- |
| 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2.. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.2.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in clause C.2.2. |
| Connection Diagram | TE Part | A.3.1.8.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 6.5.2.2.4.1-3.

2. Message contents are defined in clause 6.5.2.2.4.3.

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 FR1 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 6.5.2.2.4.1-3: General test parameters for SA interruptions at NR SRS carrier based switching

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1,2 | Two NR radio channel (1, 2) are used for this test |
| Active PCell |  | Cell 1 | Primary cell on NR RF channel number 1 |
| Configured SCell |  | Cell 2 | Activated secondary cell on NR RF channel number 2 |
| CP length |  | Normal |  |
| DRX |  | OFF | Continuous monitoring of primary cell |
| Cell2 timing offset to cell1 | μs | 0 |  |
| Time alignment error between cell2 and cell1 | μs | ≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1. | The value of time alignment error depends upon the type of carrier aggregation. |
| T1 | s | 5 |  |
| T2 | ms | 40 | UE shall perform SRS switching during T2 |

6.5.2.2.4.2 Test procedure

TBD

6.5.2.2.4.3 Message contents

TBD

6.5.2.2.5 Test requirement

Table 6.5.2.2.5-1 defines the primary level settings including test tolerances for SA FR1 interruptions at NR SRS carrier based switching.

Table 6.5.2.2.5-1: Cell specific test parameters for SA interruptions at NR SRS carrier based switching

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | T1 | | T2 | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Duplex mode | | Config 1 | |  | FDD | TDD | FDD | TDD |
| Config 2,3 | | TDD | | | |
| TDD configuration | | Config 1 | |  | N/A | [TDDConf.1.2] | N/A | [TDDConf.1.2] |
| Config 2 | | [TDDConf.1.2] | | | |
| Config 3 | | [TDDConf.2.3] | | | |
| BWchannel | | Config 1,2 | | MHz | 10: NRB,c = 52 | | | |
| Config 3 | | 40: NRB,c = 106 | | | |
| 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 | | | |
| TCI state | | | |  | TCI.State.0 | | | |
| TRS Configuration | | | |  | TRS.1.1 TDD | | | |
| PDSCH Reference measurement channel | | Config 1 | |  | SR.1.1 FDD | SR.1.1 TDD | SR.1.1 FDD | SR.1.1 TDD |
| Config 2 | | SR.1.1 TDD | SR.1.1 TDD | SR.1.1 TDD | SR.1.1 TDD |
| Config 3 | | SR2.1 TDD | SR2.1 TDD | SR2.1 TDD | SR2.1 TDD |
| Dedicated CORESET parameters | | Config 1 | |  | CCR.1.1 FDD | CCR.1.1 TDD | CCR.1.1 FDD | CCR.1.1 TDD |
| Config 2 | | CCR.1.1 TDD | CCR.1.1 TDD | CCR.1.1 TDD | CCR.1.1 TDD |
| Config 3 | | CCR.2.1 TDD | CCR.2.1 TDD | CCR.2.1 TDD | CCR.2.1 TDD |
| RMSI CORESET parameters | | Config 1 | |  | CR.1.1 FDD | CR.1.1 TDD | CR.1.1 FDD | CR.1.1 TDD |
| Config 2 | | CR.1.1 TDD | CR.1.1 TDD | CR.1.1 TDD | CR.1.1 TDD |
| Config 3 | | CR2.1 TDD | CR2.1 TDD | CR2.1 TDD | CR2.1 TDD |
| OCNG Patterns | | | |  | OP.1 | | | |
| SRS Configuration | Config 1,2 | | |  | SRS.1 TDD | | | |
|  | Config 3 | | |  | SRS.2 TDD | | | |
| SSB Configuration | Config 1,2 | | |  | SSB.1 FR1 | | | |
| Config 3 | | | SSB.2 FR1 | | | |
| SMTC configuration | | | |  | 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) | | | |
| Note2 | | | Config 1,2,4,5 | dBm/15kHz | -104 | | | |
| Config 3,6 | -101 | | | |
|  | | | | dB | 17 | | | |
|  | | | | dB | 17 | | | |
| SS-RSRPNote3 | | | Config 1,2,4,5 | dBm/SCS | -87 | | | |
| Config 3,6 | -84 | | | |
| SCH\_RP Note 3 | | | | dBm/15 kHz | -87 | | | |
| 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.  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 SCH\_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2. | | | | | | | | |

The UE shall be scheduled on PCell continuously throughout the test. During the time duration T2, the interruption on PCell shall not be more than the values specified for SA in TS 38.133 [6] clause 8.2.2.2.9.

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

### 6.5.3 SCell activation and deactivation delay

#### 6.5.3.0 Minimum conformance requirements

##### 6.5.3.0.1 Minimum conformance requirements for SCell activation and deactivation delay

Same as in clause 4.5.3.0.1.

#### 6.5.3.1 NR SA FR1 SCell activation and deactivation of known SCell in non-DRX for 160ms SCell measurement cycle

6.5.3.1.1 Test purpose

This test is to verify that the SCell activation and deactivation times are within the requirements in TS 38.133 [6] clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

6.5.3.1.2 Test applicability

This test applies to all types of NR UE from Release 15 onwards and supporting 2DL CA.

6.5.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.3.1.

6.5.3.1.4 Test description

6.5.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in this clause. The supported test configurations for NR PCell are shown in Table 6.5.3.1.4.1-1. Supported test configurations for NR SCell are shown in Table 6.5.3.1.4.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

Table 6.5.3.1.4.1-1: supported test configurations for NR PCell

|  |  |
| --- | --- |
| Config | Description |
| 6.5.3.1-1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 6.5.3.1-2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 6.5.3.1-3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations.  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration. | |

Table 6.5.3.1.4.1-1A: Supported test configurations for NR PCell

|  |  |
| --- | --- |
| **ConfigSCell** | **Description** |
| 6.5.3.1-1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 6.5.3.1-2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 6.5.3.1-3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.3.1.4.1-2 and Table 6.5.3.1.4.1-3.

Table 6.5.3.1.4.1-2: Initial conditions for known FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.3.1.5-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.1 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part. | |  |

Table 6.5.3.1.4.1-3: General test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF Channel Number |  | 1,2 | Two NR radio channel (1, 2) are used for this test |
| Active PCell |  | Cell 1 | Primary cell on NR RF channel number 1. |
| Configured deactivated SCell |  | Cell 2 | Configured deactivated secondary cell on NR RF channel number 2 |
| CP length |  | Normal |  |
| DRX |  | OFF | Continuous monitoring of primary cell |
| Cell-individual offset for cells on NR channel number | dB | 0 | Individual offset for cells on primary component carrier. |
| SCell measurement cycle (measCycleSCell) | ms | 160 |  |
| Cell2 timing offset to cell1 | μs | 0 |  |
| Time alignment error between cell2 and cell1 | μs | ≤ Time alignment error as specified in TS 38.104 [13] 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 PCell 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 | PCell Config 1: 2  PCell Config 2: 3  PCell Config 3: 2.5 | k1NR 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] that will meet the timing constraints of this test case. |
| 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 [13]. |

1. Message contents are defined in clause 6.5.3.1.4.3.

2. There are two NR carriers, each with one cell. Cell 1 is NR FR1 PCell and Cell 2 is the deactivated SCell. Cell 1 and Cell 2 are configured according to Annex C.1.2 and C.1.3.

6.5.3.1.4.2 Test procedure

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. Before the test starts the UE is connected to Cell 1, but is not aware of Cell2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot , as defined in TS 38.133 [6] clause 8.3. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot to , as defined in TS 38.133 [6] clause 8.3, where is the interruption length given in TS 38.133 [6] clause 8.2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot , as defined in TS 38.133 [6] clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot to , as defined in TS 38.133 [6] clause 8.3.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, 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 Tables 6.5.3.1.4.1-3 and 6.5.3.1.5**-**1. Propagation conditions are set according to Annex C clauses C.2.2..

3. T1 starts. Immediately after, the SS shall configure SCell (Cell 2) on the SCC as per TS 38.508-1 [14] clause 7.5.1 and provide measurement configurations.

3a. The UE sends a *MeasurementReport* message.

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 n and T2 starts in slot n. 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 PCell 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 ,

- 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 slot 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 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 m and T3 starts in slot m. 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 PCell 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 a RRCRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

10. Set Cell 2 physical cell identity = ((current cell 2 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.

11. 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 NR, Connected without release *On* and Test Mode *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 NR, Connected without release *On* and Test Mode *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 NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

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.

6.5.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with condition SCELL\_CSI\_ON\_SPCELL with the following exceptions:

Table 6.5.3.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-7 with Condition Deactivated SCell; |

Table 6.5.3.1.4.3-2: *RRCReconfiguration*: SCell addition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition NR\_MEAS and SCell\_add | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| measConfig | | MeasConfig | Table 6.5.3.1.4.3-2A |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig-SCell | Table 6.5.3.1.4.3-5 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.3.1.4.3-2A: MeasConfig (Table 6.5.3.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.3.1.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |
| reportConfigToAddModList SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod { | 1 entry |  |  |
| ReportConfigToAddMod[1] SEQUENCE { |  | entry 1 |  |
| reportConfigId | ReportConfigId |  |  |
| reportConfig CHOICE { |  |  |  |
| reportConfigNR | ReportConfigNR | Table 6.5.3.1.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.1.4.3-3: 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 6.5.3.1.4.3-4: 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 6.5.3.1.4.3-5: CellGroupConfig-SCell (Table 6.5.3.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 | Not present | PCell always uses servCellIndex=0 |  |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| rlmInSyncOutOfSyncThreshold | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 6.5.3.1.4.3-6 |  |
| } |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig-SCell | Table 6.5.3.1.4.3-7 |  |
| smtc | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.1.4.3-6: ServingCellConfig-SpCell (Table 6.5.3.1.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.3.1.4.3-7: ServingCellConfig-SCell (Table 6.5.3.1.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |  |  |
| } |  |  |  |

6.5.3.1.5 Test requirement

Table 6.5.3.1.5-1 and Table 6.5.3.1.5-2 defines the primary level settings including test tolerances for all tests.

Table 6.5.3.1.5-1: Cell specific test parameters for NR PCell for known FR1 SCell activation case, 160ms SCell measurement cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | | |
| T1 | T2 | T3 |
| Duplex mode | Config 1 |  | FDD | | |
| Config 2,3 | TDD | | |
| TDD configuration | Config 1 |  | Not applicable | | |
| Config 2 | TDDConf.1.1 | | |
| Config 3 | TDDConf.2.1 | | |
| BWchannel | | MHz | Note 7 | | |
| BWoccupied | Config 1,2 | RB | 52 Note 5 | | |
|  | Config 3 |  | 106 Note 6 | | |
| Initial BWP configuration | |  | DLBWP.0.1 | | |
| TCI state | |  | TCI.State.0 | | |
| TRS Configuration | Config 1 |  | TRS.1.1 FDD | | |
| Config 2 | TRS.1.1 TDD | | |
| Config 3 | TRS.1.2 TDD | | |
| PDSCH Reference measurement channel | Config 1 |  | SR.1.1 FDD | | |
| Config 2 | SR.1.1 TDD | | |
| Config 3 | SR.2.1 TDD | | |
| Dedicated CORESET parameters | Config 1 |  | CCR.1.1 FDD | | |
| Config 2 | CCR.1.1 TDD | | |
| Config 3 | CCR.2.1 TDD | | |
| RMSI CORESET parameters | Config 1 |  | CR.1.1 FDD | | |
| Config 2 | CR.1.1 TDD | | |
| Config 3 | CR.2.1 TDD | | |
| OCNG Patterns | Config 1,2 |  | OP.1Note 5 | | |
|  | Config 3, |  | OP.1 Note 6 | | |
| SSB Configuration | Config 1,2 |  | SSB.1 FR1 | | |
| Config 3 | SSB.2 FR1 | | |
| CSI-RS configuration for CSI reporting Note 8 | Config 1 |  | CSI-RS.1.1 FDD | | |
| Config 2 |  | CSI-RS.1.1 TDD | | |
| Config 3 |  | CSI-RS.2.1 TDD | | |
| SMTC configuration | |  | SMTC.1 | | |
| reportConfigType | |  | periodic | | |
| reportQuantity | |  | cri-RI-PMI-CQI | | |
| CSI reporting periodicity | Config 1,2 | slot | 5 | | |
| Config 3 | 10 | | |
| CSI reporting offset | Config 1,2 | slot | 3 | | |
| Config 3 | 5 | | |
| 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 | |
| Note2 | Config 1,2 | dBm/SCS | -104 | | |
| Config 3 | -101 | | |
|  | | dB | 17 | | |
|  | | dB | 17 | | |
| SS-RSRPNote3 | Config 1,2 | dBm/SCS | -87 | | |
| Config 3 | -84 | | |
| SCH\_RP Note 3 | | dBm/15 kHz | -87 | | |
| Io Note3 | Config 1,2 | dBm/  9.36MHz | -58.96 | | |
| Config 3 | dBm/  38.16MHz | -52.87 | | |
| Correlation Matrix and Antenna configuration |  |  | 2x2 Low | | |
| 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.  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 within BWoccupied.  Note 3: SS-RSRP and SCH\_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.  Note 5: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 6: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 7: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel.  Note 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in TS 38.214 cl. 5.2.2.5. | | | | | |

Table 6.5.3.1.5-2: Cell specific test parameters for NR SCell for known FR1 SCell activation case, 160ms SCell measurement cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 | | |
| T1 | T2 | T3 |
| Duplex mode | ConfigSCell 1 |  | FDD | | |
| ConfigSCell 2,3 | TDD | | |
| TDD configuration | ConfigSCell 1 |  | Not applicable | | |
| ConfigSCell 2 | TDDConf.1.1 | | |
| ConfigSCell 3 | TDDConf.2.1 | | |
| BWchannel | | MHz | Note 7 | | |
| BWoccupied | ConfigSCell 1,2 | RB | 52 Note 5 | | |
|  | ConfigSCell 3 |  | 106 Note 6 | | |
| Initial BWP configuration | |  | DLBWP.0.1 | | |
| TCI state | |  | TCI.State.0 | | |
| TRS Configuration | ConfigSCell 1 |  | TRS.1.1 FDD | | |
| ConfigSCell 2 | TRS.1.1 TDD | | |
| ConfigSCell 3 | TRS.1.2 TDD | | |
| PDSCH Reference measurement channel | ConfigSCell 1 |  | N/A | | |
| ConfigSCell 2 | N/A | | |
| ConfigSCell 3 | N/A | | |
| Dedicated CORESET parameters | ConfigSCell 1 |  | N/A | | |
| ConfigSCell 2 | N/A | | |
| ConfigSCell 3 | N/A | | |
| RMSI CORESET parameters | ConfigSCell 1 |  | N/A | | |
| ConfigSCell 2 | N/A | | |
| ConfigSCell 3 | N/A | | |
| OCNG Patterns | ConfigSCell 1,2 |  | OP.1Note 5 | | |
|  | ConfigSCell 3, |  | OP.1 Note 6 | | |
| SSB Configuration | ConfigSCell 1,2 |  | SSB.1 FR1 | | |
| ConfigSCell 3 | SSB.2 FR1 | | |
| CSI-RS configuration for CSI reporting Note 8 | ConfigSCell 1 |  | CSI-RS.1.1 FDD | | |
| ConfigSCell 2 |  | CSI-RS.1.1 TDD | | |
| ConfigSCell 3 |  | CSI-RS.2.1 TDD | | |
| SMTC configuration | |  | SMTC.1 | | |
| reportConfigType | |  | N/A | | |
| reportQuantity | |  | N/A | | |
| CSI reporting periodicity | ConfigSCell 1,2 | slot | N/A | | |
| ConfigSCell 3 | N/A | | |
| CSI reporting offset | ConfigSCell 1,2 | slot | N/A | | |
| ConfigSCell 3 | N/A | | |
| 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 | |
| Note2 | ConfigSCell 1,2 | dBm/SCS | -104 | | |
| ConfigSCell 3 | -101 | | |
|  | | dB | 17 | | |
|  | | dB | 17 | | |
| SS-RSRPNote3 | ConfigSCell 1,2 | dBm/SCS | -87 | | |
| ConfigSCell 3 | -84 | | |
| SCH\_RP Note 3 | | dBm/15 kHz | -87 | | |
| Io Note3 | ConfigSCell 1,2 | dBm/  9.36MHz | -58.96 | | |
| ConfigSCell 3 | dBm/  38.16MHz | -52.87 | | |
| Correlation Matrix and Antenna configuration |  | 2x2 Low |  | | |
| 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.  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 within BWoccupied.  Note 3: SS-RSRP and SCH\_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.  Note 5: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 6: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 7: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel.  Note 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in TS 38.214 cl. 5.2.2.5. | | | | | |

During T2 the UE shall send the first CSI report for SCell no later than the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot 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 was interrupted or not is checked by monitoring ACK/NACK sent in PCell in slot .

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot , Tactivation\_time = TFirstSSB+ 5ms, as defined in TS 38.133 [6] section 8.3.

During T2 interruption of PCell/PSCell during SCell activation shall not happen outside the slot to , as defined in TS 38.133 [6] section 8.3.

Figures 6.5.3.1.5-1 shows the derivation of the Test procedure requirement for DTX during T2, based on the core requirements for interruption.

Chart, waterfall chart

Description automatically generated

Figure 6.5.3.1.5-1: Procedure derivation for Activation

1) Activation command for SCell

2) ACK for MAC-CE for SCell1 activation

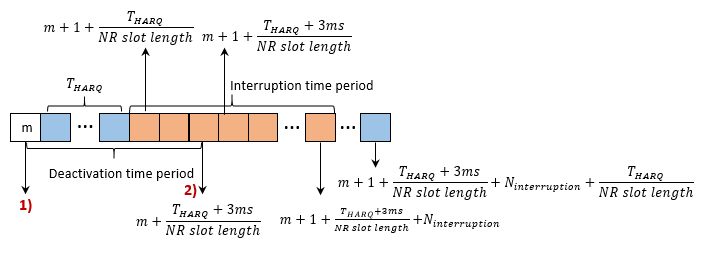
3) First CSI report timing (could be invalid CQI)

4) First non-zero CSI report transmission

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot , as defined in TS 38.133 [6] section 8.3.

During T3 interruption of PCell during SCell deactivation shall not happen outside the slot to , as defined in TS 38.133 [6] section 8.3.

Figures 6.5.3.1.5-2 shows the derivation of the Test procedure requirement for NR PSCell DTX during T3, based on the core requirements for interruption.



**Figure 6.5.3.1.5-2: Procedure derivation for Deactivation**

1) Deactivation command for SCell

2) Latest slot stop sending CSI reports for SCell

The interruption on any activated serving cell shall not be more than the values specified for SA in TS 38.133 [6] clause 8.2.2.2.2.

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 and SCell deactivation 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] section 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

#### 6.5.3.2 NR SA FR1 SCell activation and deactivation of known SCell in non-DRX for 640ms SCell measurement cycle

6.5.3.2.1 Test purpose

This test is to verify that the SCell activation and deactivation times are within the requirements in TS 38.133 [6] clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

6.5.3.2.2 Test applicability

This test applies to all types of NR UE from Release 15 onwards and supporting 2DL CA.

6.5.3.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.3.2.

6.5.3.2.4 Test description

6.5.3.2.4.1 Initial conditions

Same initial conditions as described in section 6.5.3.1.4.1 with following exception:

- The listed parameter values in Tables 6.5.3.2.4.1-2 will replace the values of corresponding parameters in Tables 6.5.3.1.4.1-3.

Table 6.5.3.2.4.1-1: Void

Table 6.5.3.2.4.1-2: General test parameters for known FR1 SCell activation case, 640ms SCell measurement cycle

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| SCell measurement cycle (measCycleSCell) | ms | 640 |  |

6.5.3.2.4.2 Test procedure

Same test procedure as described in section 6.5.3.1.4.2.

6.5.3.2.4.3 Message contents

Same message contents as described in section 6.5.3.1.4.3 with following exception:

* Table 6.5.3.1.4.3-3 is replaced by Table 6.5.3.2.4.3-1.

Table 6.5.3.2.4.3-1: 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 |  |  |
|  |  |  |  |

6.5.3.2.5 Test requirement

Same test requirement as described in section 6.5.3.1.5, except Tactivation\_time will be replaced with the value TFirstSSB\_MAX + Trs + 5ms.

#### 6.5.3.3 NR SA FR1 SCell activation and deactivation of unknown SCell in non-DRX

6.5.3.3.1 Test purpose

This test is to verify that the SCell activation and deactivation times are within the requirements stated in TS 38.133 [6] clause 8.3, when the SCell in FR1 is unknown by the UE at the time of activation.

6.5.3.3.2 Test applicability

This test applies to all types of NR UE from Release 15 onwards and supporting 2DL CA.

6.5.3.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.3.3.

6.5.3.3.4 Test description

6.5.3.3.4.1 Initial conditions

Same initial conditions as described in section 6.5.3.1.4.1 with following exception:

- The listed parameter values in Tables 6.5.3.3.4.1-2 will replace the values of corresponding parameters in Tables 6.5.3.1.4.1-3.

Table 6.5.3.3.4.1-1: Void

Table 6.5.3.3.4.1-2: General test parameters for unknown FR1 SCell activation case, 160ms SCell measurement cycle

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| T1 | ms | 100 | During this time the PSCell shall be known and the SCell configured, but not detected. |

6.5.3.3.4.2 Test procedure

Same test procedure as described in section 6.5.3.1.4.2, except step3 and step 5 are replaced by following steps:

3. T1 starts. Immediately after, the SS shall configure SCell (Cell 2) on the SCC as per TS 38.508-1 [14] clause 7.5.1. The SCell (Cell 2) shall be powered OFF till T2 starts.

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 n, power ON the SCell (Cell2), T2 starts in slot n. If the SS receives ACK for MAC-CE sent by the UE, the test proceeds to step 6, otherwise go to step 9.

and,

- step 3a is removed.

6.5.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with condition SCELL\_CSI\_ON\_SPCELL with the following exceptions:

Table 6.5.3.3.4.3-1: *RRCReconfiguration* in step 3: SCell addition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition SCell\_add | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig | Table 6.5.3.3.4.3-2 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.3.3.4.3-2: CellGroupConfig (Table 6.5.3.3.4.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-19 with condition SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 6.5.3.3.4.3-3 |  |
| } |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig-SCell | Table 6.5.3.3.4.3-4 |  |
| smtc | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.3.4.3-3: ServingCellConfig-SpCell (Table 6.5.3.3.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 | | | |
| 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 |  |  |
| } |  |  |  |

Table 6.5.3.3.4.3-4: ServingCellConfig-SCell (Table 6.5.3.3.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |  |  |
| } |  |  |  |

6.5.3.3.5 Test requirement

Same test requirement as described in section 6.5.3.1.5, except Tactivation\_time will be replaced with the value TFirstSSB\_MAX + TSMTC\_MAX + 2\*Trs + 5ms

#### 6.5.3.4 Direct SCell activation at SCell addition of known SCell in FR1

6.5.3.4.1 Test purpose

The purpose of this test is to verify that the direct SCell activation delay and interruption is within the requirements, when the SCell in FR1 is known by the UE at the time of activation.

6.5.3.4.2 Test applicability

This test applies to all types of NR UE from Release 16 onwards and supporting 2DL CA and direct SCell activation.

6.5.3.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.3.4.

6.5.3.4.4 Test description

6.5.3.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in this clause. The supported test configurations for NR PCell are shown in Table 6.5.3.4.4.1-1. Supported test configurations for NR SCell are shown in Table 6.5.3.4.4.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

Table 6.5.3.4.4.1-1: supported test configurations for NR PCell

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations.  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration. | |

Table 6.5.3.4.4.1-1A: Supported test configurations for NR PSCell

|  |  |
| --- | --- |
| **ConfigSCell** | **Description** |
| 1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.3.4.4.1-2 and Table 6.5.3.4.4.1-3.

Table 6.5.3.4.4.1-2: Initial conditions for known FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.3.4.5-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.1 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part. | |  |

Table 6.5.3.4.4.1-3: General test parameters for known FR1 SCell activation case

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1, 2 | Two NR radio channels are used for this test |
| Active PCell |  | Cell 1 | Primary cell on NR RF channel number 1. |
| Inter-frequency neighbour cell (SCell to-be) |  | Cell 2 | Inter-frequency neighbour cell on NR RF channel number 2 |
| CP length |  | Normal |  |
| DRX |  | OFF | Continuous monitoring of primary cell |
| Measurement gap pattern |  | gp0 | Measurement gap is used during parts of time period T1 for detection of Cell 2. |
| CSI reporting periodicity | ms | 2 | CSI reporting periodicity for periodic reporting of CQI for PCell and, when added, SCell. |
| SCell measurement cycle (measCycleSCell) | ms | 160 | Measurement cycle for SCell does not come into effect in direct activation at SCell addition. |
| Timing offset between Cell 1 and Cell 2 | ms | £ MRTD | The value of maximum timing offset depends upon the carrier aggregation scenario. |
| T1 | s | 7 | During this time period the PCell shall be known and Cell 2 shall be detected as an inter-frequency neighbour cell. |
| T2 | s | 1 | During this time period Cell 2 shall be configured and directly activated as SCell. |
| A3-offset | dB | -15 |  |
| THARQ | ms | k1×NR 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 | 2 | the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [13] |
| k | ms |  | As specified in clause 4.3 of TS 38.213 [8] |

1. Message contents are defined in clause 6.5.3.4.4.3.

2. There are two NR carriers, each with one cell. Cell 1 is NR FR1 PCell and Cell 2 is the SCell. Cell 1 and Cell 2 are configured according to Annex C.1.2 and C.1.3.

6.5.3.4.4.2 Test procedure

The test consists of two successive time periods with duration T1 and T2, respectively. There are two carriers, each with one cell. Cell 1 (PCell) is on RF channel 1 (PCC), and Cell 2 (SCell) is on RF channel 2 (SCC). Cell 1 and Cell 2 both operate according to one of the configurations in Table 6.5.3.4.4.1-1. Before the test starts the UE is connected to Cell 1 on RF channel 1. The UE is only monitoring RF channel 1 and is not aware of Cell 2 on RF channel 2. The UE is continuously scheduled in PCell throughout the test.

At the beginning of T1 the UE is configured to measure RF channel 2 in measurement gaps. During T1, the UE detects and measures Cell 2 on RF channel 2 and sends a measurement report containing Cell 2 to the test equipment. After having received a measurement report containing Cell 2, the test equipment deconfigures the measurement gaps and thereafter sends a RRCReconfiguration message to the UE by which it configures the SCell (Cell 2) in activated state (*sCellState* is set to *activated*). The time between reception of the last measurement report carrying SCell and transmission of the RRCReconfiguration message directly activating SCell is kept short enough to allow the SCell to remain known to the UE.

Time period T2 starts when the UE receives the RRC connection reconfiguration message at the UE antenna connector. The corresponding slot at which the message is received at the UE antenna connector is denoted *m.* The UE shall complete activation of the SCell no later than in slot *m +* , where is defined as the time taken for direct SCell activation as specified in clause 8.3.4, TS 38.133 [6]. From slot *m+* and onwards the UE shall report valid CSI both for PCell and SCell. The test equipment verifies the activation time by counting the slots between the RRC connection reconfiguration message is sent and until CSI report with non-zero CQI for both PCell and SCell is received. The test equipment verifies that interruptions on other serving cells are within the requirements by counting ACK/NACKs transmitted in PCell.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, 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 Tables 6.5.3.4.4.1-3 and 6.5.3.4.5**-**1. Propagation conditions are set according to Annex C clauses C.2.2.
3. T1 starts. Immediately after, the SS shall configure SCell (Cell 2) on the SCC as per TS 38.508-1 [14] clause 7.5.1 and provide measurement configurations.

3a. The UE sends a *MeasurementReport* message.

1. The SS shall configure transmission of PDSCH with a maximum number of 1 HARQ transmission.
2. After having received a measurement report containing Cell 2, the SS activates SCC by sending a RRCReconfiguration message to the UE by which it configures the SCell (Cell 2) in activated state as defined in message contents table 6.5.3.4.4.3-5.

6. The UE shall start reporting CSI in PSCell in slot (m+k+TRRC\_process), where TRRC\_process is the RRC procedure delay defined in clause 12 of TS 38.331 [13], and Tx is the time to the end of the first complete the SSB burst as specified in TS 38.133 [6] clause 8.3.4. UE shall report CQI index 0 (out-of-range) until the SCell activation has been completed, and the SS shall monitor CSI reports for SCell sent from the UE 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 7.

7. When T2 expires, or Activation in step 5 was not acknowledged, or a failure was counted for the event "Activation" in step 6, the SS shall transmit a RRCRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

8. Set Cell 2 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 is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* and Test Mode *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 NR, Connected without release *On* and Test Mode *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 NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat steps 2-9 until a test verdict has been achieved.

Each of 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.

6.5.3.4.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3 with condition SCELL\_CSI\_ON\_SPCELL , with the following exceptions:

Table 6.5.3.4.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-7 with Condition Deactivated SCell; |

Table 6.5.3.4.4.3-2: *RRCReconfiguration*: SCell addition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition NR\_MEAS and SCell\_add | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| measConfig | | MeasConfig | Table 6.5.3.4.4.3-2A |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig-SCell | Table 6.5.3.4.4.3-5 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.3.4.4.3-2A: MeasConfig (Table 6.5.3.4.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.3.4.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |
| reportConfigToAddModList SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod { | 1 entry |  |  |
| ReportConfigToAddMod[1] SEQUENCE { |  | entry 1 |  |
| reportConfigId | ReportConfigId |  |  |
| reportConfig CHOICE { |  |  |  |
| reportConfigNR | ReportConfigNR | Table 6.5.3.4.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.4.4.3-3: 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 6.5.3.4.4.3-4: 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 6.5.3.4.4.3-5: CellGroupConfig-SCell (Table 6.5.3.4.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 | Not present | PCell always uses servCellIndex=0 |  |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| rlmInSyncOutOfSyncThreshold | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 6.5.3.4.4.3-6 |  |
| } |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig-SCell | Table 6.5.3.4.4.3-7 |  |
| smtc | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| sCellState-r16 | activated |  |  |
| … |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.4.4.3-6: ServingCellConfig-SpCell (Table 6.5.3.4.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.3.4.4.3-7: ServingCellConfig-SCell (Table 6.5.3.4.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |  |  |
| } |  |  |  |

##### 6.5.3.4.5 Test requirement

Tables 6.5.3.4.5-1 and 6.5.3.4.5-2 defines the primary level settings including test tolerances for all tests.



Table 6.5.3.4.5-1: NR Cell specific test parameters for NR PCell

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Cell 1** | |
| **T1** | **T2** |
| Duplex mode | | Config 1 |  | FDD | |
| Config 2,3 | TDD | |
| TDD configuration | | Config 2 |  | TDDConf.1.1 | |
| Config 3 | TDDConf.2.1 | |
| BWchannel | | Config 1,2 | MHz | 10: NRB,c = 52 | |
| Config 3 | 40: NRB,c = 106 | |
| BWP configuration | | Initial DL |  | DLBWP.0.1 | |
| Initial UL | ULBWP.0.1 | |
| Dedicated DL | DLBWP.1.1 | |
| Dedicated UL | ULBWP.1.1 | |
| TCI state | | |  | TCI.State.0 | |
| CSI-RS configuration for CSI reporting | | Config 1 |  | CSI-RS.1.1 FDD | |
| Config 2 | CSI-RS.1.1 TDD | |
| Config 3 | CSI-RS.2.1 TDD | |
| TRS Configuration | | Config 1 |  | TRS.1.1 FDD | |
| Config 2 | TRS.1.1 TDD | |
| Config 3 | TRS.1.2 TDD | |
| PDSCH Reference measurement channel | | Config 1 |  | SR.1.1 FDD | |
| Config 2 | SR.1.1 TDD | |
| Config 3 | SR.2.1 TDD | |
| Dedicated CORESET parameters | | Config 1 |  | CCR.1.1 FDD | |
| Config 2 | CCR.1.1 TDD | |
| Config 3 | CCR.2.1 TDD | |
| RMSI CORESET parameters | | Config 1 |  | CR.1.1 FDD | |
| Config 2 | CR.1.1 TDD | |
| Config 3 | CR.2.1 TDD | |
| OCNG Pattern | | |  | OP.1 | |
| SSB Configuration | | Config 1,2 |  | SSB.1 FR1 | |
| Config 3 | SSB.2 FR1 | |
| SMTC configuration | | |  | SMTC.1 | |
| reportConfigType | | |  | periodic | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| CSI reporting periodicity | | Config 1,2 | slot | 5 | |
| Config 3 | 10 | |
| CSI reporting offset | | Config 1,2 | slot | 3 | |
| Config 3 | 5 | |
| 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 Note1 | | |
| EPRE ratio of OCNG to OCNG DMRS Note1 | | |
| *Noc* Note2 | Config 1,2 | | dBm/SCS | -104+~~TT~~ | |
| Config 3 | | -101+~~TT~~ | |
| *Ês/Iot* | | | dB | 17+~~TT~~ | |
| *Ês/Noc* | | | dB | 17+~~TT~~ | |
| SS-RSRP Note3 | Config 1,2 | | dBm/SCS | -87+~~TT~~ | |
| Config 3 | | -84+~~TT~~ | |
| Io Note3 | Config 1,2 | | dBm/9.36 MHz | -59.0+~~TT~~ | |
| Config 3 | | dBm/38.16 MHz | -52.9+~~TT~~ | |
| Propagation condition | | |  | AWGN | |
| Correlation Matrix and Antenna Configuration | | |  | 1x2 Low | |
| 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, SCH\_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves. | | | | | |

Table 6.5.3.4.5-2: NR Cell specific test parameters for NR SCell

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Cell 2** | |
| **T1** | **T2** |
| Duplex mode | | ConfigSCell 1 |  | FDD | |
| ConfigSCell 2,3 | TDD | |
| TDD configuration | | ConfigSCell 2 |  | TDDConf.1.1 | |
| ConfigSCell 3 | TDDConf.2.1 | |
| BWchannel | | ConfigSCell 1,2 | MHz | 10: NRB,c = 52 | |
| ConfigSCell 3 | 40: NRB,c = 106 | |
| BWP configuration | | Initial DL |  | N/A | DLBWP.0.1 |
| Initial UL | N/A |
| Dedicated DL | DLBWP.1.1 |
| Dedicated UL | N/A |
| TCI state | | |  | N/A | TCI.State.0 |
| CSI-RS configuration for CSI reporting | | ConfigSCell 1 |  | N/A | CSI-RS.1.1 FDD |
| ConfigSCell 2 | CSI-RS.1.1 TDD |
| ConfigSCell 3 | CSI-RS.2.1 TDD |
| TRS Configuration | | ConfigSCell 1 |  | N/A | TRS.1.1 FDD |
| ConfigSCell 2 | TRS.1.1 TDD |
| ConfigSCell 3 | TRS.1.2 TDD |
| PDSCH Reference measurement channel | | ConfigSCell 1 |  | N/A | SR.1.1 FDD |
| ConfigSCell 2 | SR.1.1 TDD |
| ConfigSCell 3 | SR.2.1 TDD |
| Dedicated CORESET parameters | | ConfigSCell 1 |  | N/A | CCR.1.1 FDD |
| ConfigSCell 2 | CCR.1.1 TDD |
| ConfigSCell 3 | CCR.2.1 TDD |
| RMSI CORESET parameters | | ConfigSCell 1 |  | N/A | |
| ConfigSCell 2 |
| ConfigSCell 3 |
| OCNG Pattern | | |  | OP.1 | |
| SSB Configuration | | ConfigSCell 1,2 |  | SSB.1 FR1 | |
| ConfigSCell 3 | SSB.2 FR1 | |
| SMTC configuration | | |  | SMTC.1 | |
| reportConfigType | | |  | N/A | |
| reportQuantity | | |  | N/A | |
| CSI reporting periodicity | ConfigSCell 1,2 | | slot | N/A | |
| ConfigSCell 3 | | N/A | |
| CSI reporting offset | ConfigSCell 1,2 | | slot | N/A | |
| ConfigSCell 3 | | N/A | |
| 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 Note1 | | |
| EPRE ratio of OCNG to OCNG DMRS Note1 | | |
| *Noc* Note2 | | ConfigSCell 1,2 | dBm/SCS | -104+~~TT~~ | |
| ConfigSCell 3 | -101+~~TT~~ | |
| *Ês/Iot* | | | dB | 17+~~TT~~ | |
| *Ês/Noc* | | | dB | 17+~~TT~~ | |
| SS-RSRP Note3 | | ConfigSCell 1,2 | dBm/SCS | -87+~~TT~~ | |
| ConfigSCell 3 | -84+~~TT~~ | |
| Io Note3 | | ConfigSCell 1,2 | dBm/9.36 MHz | -59.0+~~TT~~ | |
| ConfigSCell 3 | dBm/38.16 MHz | -52.9+~~TT~~ | |
| Propagation condition | | |  | AWGN | |
| Correlation Matrix and Antenna Configuration | | |  | 1x2 Low | |
| 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, SCH\_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves. | | | | | |

The UE shall complete the direct activation of the SCell no later than at slot *n +* .

The UE shall report non-zero CQI for SCell from slot *n +*  and onwards throughout time period T2.

The interruption on PCell during direct activation of the SCell shall occur within the interruption window specified in TS 38.133 [6] clause 8.3.4 and shall not exceed the length specified in TS 38.133 [6] clause 8.2.2.2.11.

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

#### 6.5.3.5 Direct SCell activation at handover with known SCell in FR1

Editor’s note: This test case is incomplete. The following aspects are missing

- TT analysis is missing

- measurement uncertainty are missing

6.5.3.5.1 Test purpose

The purpose of this test is to verify the requirement for the FDD-FDD and TDD-TDD intra frequency handover with direct SCell activation requirements specified in is TS 38.133 [6] subclause 8.3.5.

6.5.3.5.2 Test applicability

This test applies to all types of NR UE from Release 16 onwards and supporting 2DL CA and direct SCell activation.

6.5.3.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.3.5.

6.5.3.5.4 Test description

6.5.3.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in this clause. The supported test configurations for NR PCell are shown in Table 6.5.3.5.4.1-1. Supported test configurations for NR SCell are shown in Table 6.5.3.5.4.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

Table 6.5.3.5.4.1-1: Intra-frequency handover with direct SCell activation from FR1-to-FR1 test configurations for NR PCell

|  |  |
| --- | --- |
| Config | Description |
| 1 | Source PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode  Target PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 2 | Source PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode  Target PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 3 | Source PCell: NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode  Target PCell: NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Table 6.5.3.5.4.1-1A: Intra-frequency handover with direct SCell activation from FR1-to-FR1 test configurations for NR SCell

|  |  |
| --- | --- |
| ConfigSCell | Description |
| 1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration. | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.3.5.4.1-2 and Table 6.5.3.5.4.1-3.

Table 6.5.3.5.4.1-2: Initial conditions for known FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.3.5.4.1-1 | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.1 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part. | |  |

Table 6.5.3.5.4.1-3: General test parameters Intra-frequency handover with direct SCell activation from FR1 to FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| Initial conditions | PCell |  | Cell 1 |  |
| SCell |  | Cell 2 |  |
| Target cell |  | Cell 3 |  |
| Final condition | PCell |  | Cell 3 |  |
| SCell |  | Cell 2 |  |
| neighbour cell |  | Cell 1 |  |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| PRACH configuration index | |  | FR1 PRACH configuration 1 | As specified in Table 6.3.3.2-3 in TS 38.211 [6] |
| Time offset between cells | |  | 3 ms | Synchronous cells |
| T1 | | s | 5 | UE is in connected mode with PCell and SCell1 (cell 2) is in activated state. UE receives a handover command |
| T2 | | s | Ndirect | UE shall accomplish the activation of the SCell |
| T3 | | s | 1 |  |
| A3-offset | | dB | -15 |  |
| THARQ | | slot | k | k 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 | 2 | the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [13] |
| k | | ms |  | As specified in clause 4.3 of TS 38.213 [8] |

1. Message contents are defined in clause 6.5.3.5.4.3.

2. There are three NR carriers, each with one cell. Cell 1 is NR FR1 PCell and Cell 2 is the SCell. Cell 1 and Cell 2 are configured according to Annex C.1.2 and C.1.3. Cell 3 is NR FR1 target Cell, and its power levels and settings are also set according to Annex C.1.2 and C.1.3.

6.5.3.5.4.2 Test Procedure

This test is to verify the requirement for the FDD-FDD and TDD-TDD intra frequency handover with direct SCell activation requirements specified in TS 38.133 [6] subclause 8.3.5.

Supported test configurations for NR PCell are shown in table 6.5.3.5.4.1-1. Supported test configurations for NR SCell are shown in table 6.5.3.5.4.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. Both handover with direct SCell activation requirements are tested by using the parameters in table 6.5.3.5.4.1-3, 6.5.3.5.5-1 and 6.5.3.5.5-2.

The test scenario comprises of two FR1 carriers and the 3 cells as given in tables 6.5.3.5.4.1-1 and 6.5.3.5.4.1-3. 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 is in connected mode with PCell and SCell1 (cell 2) is in activated state and UE is reporting CQI for both PCell and SCell1.

Time period T2 starts when UE receives a handover command to Cell 3 that also activates SCell1 (Cell2). This is done using an *RRCReconfiguration* message with parameter *sCellState* set to *activated* for the SCell1 (Cell 2). The message is sent from the test equipment to the UE and is received in a subframe # denoted m at the UE antenna connector. The UE shall accomplish the activation of the SCell no later than subframe (m +Ndirect), where Ndirect is the time for direct SCell activation at handover as defined in TS 38.133 [6] clause 8.3.5.

Time period T3 starts at (m +Ndirect), at which point UE shall be reporting a valid CQI for both PCell and SCell1. The test equipment verifies the activation time by counting the slots between the RRC connection reconfiguration message is sent and until CSI report with non-zero CQI for both PCell and SCell is received. The test equipment verifies that interruptions on other serving cells are within the requirements by counting ACK/NACKs transmitted in PCell.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. Establish SRB2 and DRB in the RRC Reconfiguration message
2. Set the parameters according to T1 in Tables 6.5.3.5.4.1-3, 6.5.3.5.5**-**1, and 6.5.3.5.5**-**2. Propagation conditions are set according to Annex C clauses C.2.2..
3. T1 starts. Immediately after, the SS shall configure SCell (Cell 2) on the SCC as per TS 38.508-1 [14] clause 7.5.1 and provide measurement configurations.

3a. The UE sends a *MeasurementReport* message.

1. The SS shall configure transmission of PDSCH with a maximum number of 1 HARQ transmission.
2. After having received a measurement report containing Cell 2, the SS activates SCC by sending a RRCReconfiguration message to the UE by which it configures the SCell (Cell 2) in activated state as defined in message contents table 6.5.3.5.4.3-5, and also implying handover to Cell 3.

6. The UE shall transmit the uplink PRACH channel to Cell 3 less than 62 ms from the beginning of time period T2. The UE shall start reporting CSI in PSCell in slot (m+k+ 1+Tinterrupt +TRRC\_process), where TRRC\_process is the RRC procedure delay defined in clause 12 of TS 38.331 [13], and Tx is the time to the end of the first complete the SSB burst as specified in TS 38.133 [6] clause 8.3.5. Tinterrupt is the interruption time during handover as specified in TS 38.133 [6] clause 6.1.1, T2 is the delay from slot until UE has obtained a valid TA command for the target PCell and T3 is the delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213[8], UE shall report CQI index 0 (out-of-range) until the SCell activation has been completed, and the SS shall monitor CSI reports for SCell sent from the UE 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, where is the interruption length given in TS 38.133 [6] clause 8.2.

- 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 7.

7. When T2 expires, or Activation in step 5 was not acknowledged, or a failure was counted for the event "Activation" in step 6, the SS shall transmit a RRCRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.

8. Set Cell 2 physical cell identity = ((current cell 2 physical cell identity + 1) mod 1008), and Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 14 + 2) 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 is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* and Test Mode *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 NR, Connected without release *On* and Test Mode *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 NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat steps 2-9 until a test verdict has been achieved.

Each of 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.

6.5.3.5.4.3 Message contents



Message contents are according to TS 38.508-1 [14] clause 7.3 with condition SCELL\_CSI\_ON\_SPCELL , with the following exceptions:

Table 6.5.3.5.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-7 with Condition Deactivated SCell;  Table H.3.2-2 with Condition RBConfig\_KeyChange |

Table 6.5.3.5.4.3-2: *RRCReconfiguration*: SCell addition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition NR\_MEAS and SCell\_add | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| measConfig | | MeasConfig | Table 6.5.3.5.4.3-2A |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig-SCell | Table 6.5.3.5.4.3-5 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.3.5.4.3-2A: MeasConfig (Table 6.5.3.5.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.3.5.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |
| reportConfigToAddModList SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod { | 1 entry |  |  |
| ReportConfigToAddMod[1] SEQUENCE { |  | entry 1 |  |
| reportConfigId | ReportConfigId |  |  |
| reportConfig CHOICE { |  |  |  |
| reportConfigNR | ReportConfigNR | Table 6.5.3.5.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.5.4.3-3: 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 6.5.3.5.4.3-4: 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 6.5.3.5.4.3-5: CellGroupConfig-SCell (Table 6.5.3.5.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 | Not present | PCell always uses servCellIndex=0 |  |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| rlmInSyncOutOfSyncThreshold | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 6.5.3.5.4.3-6 |  |
| } |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig-SCell | Table 6.5.3.5.4.3-7 |  |
| smtc | SSB-MTC specified in TS 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1 |  |  |
| sCellState-r16 | activated |  |  |
| … |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.3.5.4.3-6: ServingCellConfig-SpCell (Table 6.5.3.5.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.3.5.4.3-7: ServingCellConfig-SCell (Table 6.5.3.5.4.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |  |  |
| } |  |  |  |

6.5.3.5.5 Test requirements

Table 6.5.3.5.5-1 and 6.5.3.5.5-2 defines the primary level settings including test tolerances for all tests.

Table 6.5.3.5.5-1: Cell specific test parameters for NR PCell for NR FR1-FR1 Intra frequency handover with direct SCell activation test case

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | | | Cell 3 | | |
| T1 | T2 | T3 | T1 | T2 | T3 |
| NR RF Channel Number | |  | 1 | | | 1 | | |
| Duplex mode | Config 1 |  | FDD | | | | | |
| Config 2,3 | TDD | | | | | |
| TDD configuration | Config 1 |  | Not Applicable | | | | | |
| Config 2 | TDDConf.1.1 | | | | | |
| Config 3 | TDDConf.2.1 | | | | | |
| BWchannel | Config 1 | MHz | 10: NRB,c = 52 | | | | | |
| Config 2 | 10: NRB,c = 52 | | | | | |
| Config 3 | 40: NRB,c = 106 | | | | | |
| BWP BW | Config 1 | MHz | 10: NRB,c = 52 | | | | | |
| Config 2 | 10: NRB,c = 52 | | | | | |
| Config 3 | 40: NRB,c = 106 | | | | | |
| DRx Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1 |  | SR.1.1 FDD | | | | | |
| Config 2 | SR.1.1 TDD | | | | | |
| Config 3 | SR.2.1 TDD | | | | | |
| CORESET Reference Channel | Config 1 |  | CR.1.1 FDD | | | | | |
| Config 2 | CR.1.1 TDD | | | | | |
| Config 3 | CR.2.1 TDD | | | | | |
| TRS configuration | Config 1 |  | TRS.1.1 FDD | | | | | |
| Config 2 |  | TRS.1.1 TDD | | | | | |
| Config 3 |  | TRS.1.2 TDD | | | | | |
| OCNG Patterns | |  | OCNG pattern 1 | | | | | |
| SMTC Configuration | |  | SMTC pattern 1 | | | | | |
| SSB Configuration | Config 1,2 |  | SSB.1 FR1 | | | | | |
| Config 3 | SSB.2 FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| Config 3 | 30 kHz | | | | | |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| Config 3 | 30 kHz | | | | | |
| PRACH configuration | |  | FR1 PRACH configuration 1 | | | | | |
| 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 | | | | | |
| CSI-RS configuration for CSI reporting | Config 1 |  | CSI-RS.1.1 FDD | | | | | |
| Config 2 |  | CSI-RS.1.1 TDD | | | | | |
| Config 3 |  | CSI-RS.2.1 TDD | | | | | |
| reportConfigType | |  | periodic | | | | | |
| reportQuantity | |  | cri-RI-PMI-CQI | | | | | |
| CSI reporting periodicity | Config 1,2 | slot | 5 | | | | | |
| Config 3 | 10 | | | | | |
| CSI reporting offset | Config 1,2 | slot | 3 | | | | | |
| Config 3 | 5 | | | | | |
| 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) | |
| Note2 | | dBm/15kHz | -98+TT | | | | | |
| Note2 | Config 1,2 | dBm/SCS | -98+TT | | | | | |
| Config 3 | -95+TT | | | | | |
|  | | dB | 8+TT | 8+TT | 8+TT | 8+TT | 8+TT | 8+TT |
|  | | dB | 8+TT | 8+TT | 8+TT | 8+TT | 8+TT | 8+TT |
| SSB\_RP | Config 1,2 | dBm/SCS | -90+TT | -90+TT | -90+TT | -90+TT | -90+TT | -90+TT |
| Config 3 | dBm/SCS | -87+TT | -87+TT | -87+TT | -87+TT | -87+TT | -87+TT |
| IoNote3 | Config 1,2 | dBm/  9.36MHz | -61.41+TT | -57.06+TT | -57.06+TT | -57.06+TT | -57.06+TT | -61.41+TT |
| Config 3 | dBm/  38.16MHz | -55.31+TT | -50.96+TT | -50.96+TT | -50.96+TT | -50.96+TT | -55.31+TT |
| 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: 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: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |

Table 6.5.3.5.5-2: Cell specific test parameters for NR SCell for NR FR1-FR1 Intra frequency handover with direct SCell activation test case

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 2 | | |
| T1 | T2 | T3 |
| NR RF Channel Number | |  | 2 | | |
| Duplex mode | ConfigSCell 1 |  | FDD | | |
| ConfigSCell 2,3 | TDD | | |
| TDD configuration | ConfigSCell 1 |  | Not Applicable | | |
| ConfigSCell 2 | TDDConf.1.1 | | |
| ConfigSCell 3 | TDDConf.2.1 | | |
| BWchannel | ConfigSCell 1 | MHz | 10: NRB,c = 52 | | |
| ConfigSCell 2 | 10: NRB,c = 52 | | |
| ConfigSCell 3 | 40: NRB,c = 106 | | |
| BWP BW | ConfigSCell 1 | MHz | 10: NRB,c = 52 | | |
| ConfigSCell 2 | 10: NRB,c = 52 | | |
| ConfigSCell 3 | 40: NRB,c = 106 | | |
| DRx Cycle | | ms | Not Applicable | | |
| PDSCH Reference measurement channel | ConfigSCell 1 |  | SR.1.1 FDD | | |
| ConfigSCell 2 | SR.1.1 TDD | | |
| ConfigSCell 3 | SR.2.1 TDD | | |
| CORESET Reference Channel | ConfigSCell 1 |  | CR.1.1 FDD | | |
| ConfigSCell 2 | CR.1.1 TDD | | |
| ConfigSCell 3 | CR.2.1 TDD | | |
| TRS configuration | ConfigSCell 1 |  | TRS.1.1 FDD | | |
| ConfigSCell 2 |  | TRS.1.1 TDD | | |
| ConfigSCell 3 |  | TRS.1.2 TDD | | |
| OCNG Patterns | |  | OCNG pattern 1 | | |
| SMTC Configuration | |  | SMTC pattern 1 | | |
| SSB Configuration | ConfigSCell 1,2 |  | SSB.1 FR1 | | |
| ConfigSCell 3 | SSB.2 FR1 | | |
| PDSCH/PDCCH subcarrier spacing | ConfigSCell 1,2 | kHz | 15 kHz | | |
| ConfigSCell 3 | 30 kHz | | |
| PUCCH/PUSCH subcarrier spacing | ConfigSCell 1,2 | kHz | 15 kHz | | |
| ConfigSCell 3 | 30 kHz | | |
| PRACH configuration | |  | FR1 PRACH configuration 1 | | |
| 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 | | |
| 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) | |
| Note2 | | dBm/15kHz | -98+TT | | |
| Note2 | ConfigSCell 1,2 | dBm/SCS | -98+TT | | |
| ConfigSCell 3 | -95+TT | | |
|  | | dB | 8+TT | 8+TT | 8+TT |
|  | | dB | 8+TT | 8+TT | 8+TT |
| SSB\_RP | ConfigSCell 1,2 | dBm/SCS | -90+TT | -90+TT | -90+TT |
| ConfigSCell 3 | dBm/SCS | -87+TT | -87+TT | -87+TT |
| IoNote3 | ConfigSCell 1,2 | dBm/  9.36MHz | -61.41+TT | -57.06+TT | -61.41+TT |
| ConfigSCell 3 | dBm/  38.16MHz | -55.31+TT | -50.96+TT | -55.31+TT |
| 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.  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: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | |

The UE shall be capable to transmit valid CSI report for the directly activated SCell1 no later than in subframe m+Ndirect. The rate of correct observed SCell1 direct activation delay during repeated tests shall be at least 90%.

NOTE: The SCell activation delay, Ndirect, can be expressed as: Ndirect = TRRC\_process + Tinterrupt + T2 + T3 + Tactivation\_time + TCSI\_Reporting - 3ms, where:

TRRC\_Process: RRC procedure delay defined in clause 12 of TS 38.331 [13],

Tinterrupt: Interruption time during handover as specified in TS 38.133 [6] clause 6.1.1,

T2: Delay from slot until UE has obtained a valid TA command for the target PCell,

T3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213[8],

Tactivation\_timeand TCSI\_Reportingare specified in TS 38.133 [6] clause 8.3.2, where the following definitions of *TFirstSSB* and *TFirstSSB\_MAX* as defined in TS 38.133 [6] section 8.3.5 shall apply:

- TFirstSSB: the time to the end of the first complete SSB burst indicated by the SMTC after slot m + (𝑇𝑅𝑅𝐶\_𝑃𝑟𝑜𝑐𝑒𝑠𝑠+𝑇𝑖𝑛𝑡𝑒𝑟𝑟𝑢𝑝𝑡+𝑇2+𝑇3)/(*N*𝑅 𝑠𝑙𝑜𝑡 𝑙𝑒𝑛𝑔𝑡ℎ)

- TFirstSSB\_MAX: the time to the end of the first complete SSB burst indicated by the SMTC after slot m + (𝑇𝑅𝑅𝐶𝑃𝑟𝑜𝑐𝑒𝑠𝑠+𝑇𝑖𝑛𝑡𝑒𝑟𝑟𝑢𝑝𝑡+𝑇2+𝑇3)/(*N*𝑅 𝑠𝑙𝑜𝑡 𝑙𝑒𝑛𝑔𝑡ℎ)

This gives a total of Ndirect = 10 + 52 *+* TIU + T2 + T3+ Tactivation\_time + TCSI\_Reporting - 3 ms = 62 + 10 + 13 + 6 + 20 + 2 - 3 = 94 ms for test configurations 1 and 2.

This gives a total of Ndirect = 10 + 52 *+* TIU + T2 + T3+ Tactivation\_time + TCSI\_Reporting - 3 ms = 62 + 10 + 13 + 6 + 20 + 2 - 3 = 94 ms for test configuration 3.

During T3 the UE shall send valid CSI reports for PCell and SCell1 with non-zero CQI index and continue to send CSI reports for PCell and SCell1 (Cell 2) with non-zero CQI index until the end of T3.

All the above test requirements shall be fulfilled for the observed SCell1 direct activation delay to be counted as correct.

### 6.5.4 UE UL carrier RRC reconfiguration delay

#### 6.5.4.0 Minimum conformance requirements

##### 6.5.4.0.1 Minimum conformance requirements for UL carrier RRC reconfiguration delay

[TS 38.133, clause 8.4.2]

When the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within TUL\_carrier\_config from the end of the last slot containing the RRC command.

TUL\_carrier\_config equals the maximum RRC procedure delay defined in clause x.y in TS 38.331 [2] plus the interruption time specified in TS 38.133 [6] section 8.2.1.2.6.

[TS 38.133, clause 8.4.3]

When the UE receives a RRC message implying NR UL or Supplementary UL carrier deconfiguration RRC signalling, the UE shall stop UL signalling on the deconfigured UL carrier within TUL\_carrier\_deconfig from the end of the last slot containing the RRC command.

TUL\_carrier\_deconfig equals the maximum RRC procedure delay defined in clause x.y in TS 38.331 [2].

The normative reference for this requirement is TS 38.133 [6] clause 8.4.

#### 6.5.4.1 NR SA FR1 UE UL carrier RRC reconfiguration delay

6.5.4.1.1 Test purpose

To verify that when the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in TS 38.133 [6] section 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

6.5.4.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting SUL.

6.5.4.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.4.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.4.1.

6.5.4.1.4 Test description

6.5.4.1.4.1 Initial conditions

The Test shall be tested using any of the test configuration in Table 6.5.4.1.4.1-1.

Table 6.5.4.1.4.1-1: Supported test configurations

|  |  |  |
| --- | --- | --- |
| Configuration | PSCell (Cell 1) | SCell (Cell 2) |
| 6.5.4.1-1 | 15 kHz SSB SCS, ≥10MHz bandwidth, FDD duplex mode | DL and UL: 15kHz SSB SCS, ≥10MHz bandwidth, FDD duplex mode;  SUL: 15kHz SCS, ≥10MHz bandwidth, SUL duplex mode |
| 6.5.4.1-2 | 15 kHz SSB SCS, ≥10MHz bandwidth, FDD duplex mode | DL and UL: 15kHz SSB SCS, ≥10MHz bandwidth, TDD duplex mode;  SUL: 15kHz SCS, ≥10MHz bandwidth, SUL duplex mode |
| 6.5.4.1-3 | 15 kHz SSB SCS, ≥10MHz bandwidth, FDD duplex mode | DL and UL: 30kHz SSB SCS, ≥40MHz bandwidth, TDD duplex mode;  SUL: 30kHz SCS, ≥40MHz bandwidth, SUL duplex mode |
| 6.5.4.1-4 | 15 kHz SSB SCS, ≥10MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, ≥10MHz bandwidth, FDD duplex mode;  SUL: 15kHz SCS, ≥10MHz bandwidth, SUL duplex mode |
| 6.5.4.1-5 | 15 kHz SSB SCS, ≥10MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, ≥10MHz bandwidth, TDD duplex mode;  SUL: 15kHz SCS, ≥10MHz bandwidth, SUL duplex mode |
| 6.5.4.1-6 | 15 kHz SSB SCS, ≥10MHz bandwidth, TDD duplex mode | DL and UL: 30kHz SSB SCS, ≥40MHz bandwidth, TDD duplex mode;  SUL: 30kHz SCS, ≥40MHz bandwidth, SUL duplex mode |
| 6.5.4.1-7 | 30 kHz SSB SCS, ≥40MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, ≥10MHz bandwidth, FDD duplex mode;  SUL: 15kHz SCS, ≥10MHz bandwidth, SUL duplex mode |
| 6.5.4.1-8 | 30 kHz SSB SCS, ≥40MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, ≥10MHz bandwidth, TDD duplex mode;  SUL: 15kHz SCS, ≥10MHz bandwidth, SUL duplex mode |
| 6.5.4.1-9 | 30 kHz SSB SCS, ≥40MHz bandwidth, TDD duplex mode | DL and UL: 30kHz SSB SCS, ≥40MHz bandwidth, TDD duplex mode;  SUL: 30kHz SCS, ≥40MHz bandwidth, SUL duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations.  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration. | | |

Configure the test requirement and the DUT according to the parameters in Table 6.5.4.1.4.1-2.

Table 6.5.4.1.4.1-2: Initial conditions for NR SA FR1 UE UL carrier RRC reconfiguration delay

|  |  |  |  |
| --- | --- | --- | --- |
| 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.4.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.1. |
| Connection Diagram | TE Part | A.3.1.8.2 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | N/A | |  |

1. The general test parameter settings are set up according to Table 6.5.4.1.4.1-3.

2. Message contents are defined in clause 6.5.4.1.4.3.

3. There are two NR FR1 carriers and two cells in the test. Cell 1 is PCell on the primary component carrier, Cell 2 is SCell on the secondary component carrier. Cell 1 is the cell used for connection setup with the power levels set according to Table A.6.5.4.1.5-1 for this test. Cell 2 is configured according to Annex C.1.1 and C.1.2.

Table 6.5.4.1.4.1-3: General test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on Pcell

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 1, 2 | Two radio channels are used for these two tests. |
| Active cell |  | Config 1,2,3, 4, 5, 6, 7, 8, 9 | Cell 1: FR1 PCell  Cell 2: FR1 SCell | FR1 PCell on RF channel number 1  FR1 SCell on RF channel number 2 |
| CP length |  | Config 1,2,3, 4, 5, 6, 7, 8, 9 | Normal |  |
| DRX |  | Config 1,2,3, 4, 5, 6, 7, 8, 9 | OFF |  |
| Measurement gap pattern Id |  | Config 1,2,3, 4, 5, 6, 7, 8, 9 | OFF |  |
| Filter coefficient |  | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 0 | L3 filtering is not used |
| T1 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 |  |
| T2 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 |  |
| T3 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 |  |

6.5.4.1.4.2 Test procedure

There are two cells: FR1 PCell (cell 1) and FR1 SCell (cell 2). Both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* In test 1, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of cell 2 is configured to UE*.* At the start of T2, a supplementary uplink of cell 2 is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

In test 2, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, supplementary uplink on cell 2 is configured to UE*.* At the start of T2, a NR uplink is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the NR uplink is released through *RRCReconfiguration*.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Setup PCell (Cell 1) according to parameters given in Table 6.5.4.1.5-1. Propagation conditions are set according to Annex C clause C.2.2.

3. For SCell (Cell 2), both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB*.

4. For Test 1: NR uplink of SCell is configured to UE during T1

4.1 During time duration T1, NR uplink of SCell is configured to UE. Setup SCell (Cell 2) according to parameters given in Table 6.5.4.1.5-2

4.2 At the start of T2, a supplementary uplink of SCell (Cell 2) is configured to UE through RRCReconfiguration, then UE shall start transmission on both the NR uplink and supplementary uplink on SCell (Cell 2) within 20ms. If UE transmits data on both the NR uplink and supplementary uplink on SCell (Cell 2) within 20ms from the start of T2, then count a success for the event “reconfiguration” otherwise count a failure for event “reconfiguration”

4.3 At the start of T3, the supplementary uplink is released through RRCReconfiguration, then UE shall transmit data only on the NR uplink carrier on SCell (Cell 2) within 20ms. If UE stop transmitting data on supplementary uplink carrier on SCell (Cell 2) within 20ms from the start of T3, then count a success for the event “deconfiguration” otherwise count a failure for event “deconfiguration”.

5. For Test 2: Supplementary uplink of SCell is configured to UE during T1

5.1 During time duration T1, Supplementary uplink of SCell is configured to UE. Setup SCell (Cell 2) according to parameters given in Table 6.5.4.1.5-2

5.2 At the start of T2, a NR uplink of SCell (Cell 2) is configured to UE through RRCReconfiguration, then UE shall start transmission on both the NR uplink and supplementary uplink on SCell (Cell 2) within 20ms. If UE transmits data on both the NR uplink and supplementary uplink on SCell (Cell 2) within 20ms from the start of T2, then count a success for the event “reconfiguration” otherwise count a failure for event “reconfiguration”

5.3 At the start of T3, the NR uplink is released through RRCReconfiguration, then UE shall transmit data only on the Supplementary uplink carrier on SCell (Cell 2) within 20ms. If UE stop transmitting data on NR uplink carrier on SCell (Cell 2) within 20ms from the start of T3, then count a success for the event “deconfiguration” otherwise count a failure for event “deconfiguration”.

6. Repeat steps 1-5 until a test verdict has been achieved.

Each of the events “reconfiguration” and “deconfiguration” 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.2.3-1in 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.

6.5.4.1.4.3 Message contents

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

Table 6.5.4.1.4.3-1: Common Exception messages

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.8-1  Table H.3.8-2 |

6.5.4.1.5 Test requirement

Table 6.5.4.1.5.1-1 and 6.5.4.1.5-2 define the primary level settings including test tolerances for UE UL carrier RRC reconfiguration delay test.

Table 6.5.4.1.5-1: NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on PCell (Cell 1)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test Configuration** | **Test 1** | | | **Test 2** | | |
| **T1** | **T2** | **T3** | **T1** | **T2** | **T3** |
| Channel number |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 | | | 1 | | |
| TDD configuration |  | Conf 1, 2, 3 | N/A | | | N/A | | |
| Conf 4, 5, 6 | TDD Conf.1.1 | | | TDD Conf.1.1 | | |
| Conf 7, 8, 9 | TDD Conf.2.1 | | | TDD Conf.2.1 | | |
| BWchannel | MHz | Conf 1, 2, 3 | Note 6 | | | Note 6 | | |
| Conf 4, 5, 6 | Note 6 | | | Note 6 | | |
| Conf 7, 8, 9 | Note 6 | | | Note 6 | | |
| BWoccupied | RB | Conf 1, 2, 3 | 52 Note 4 | | | 52 Note 4 | | |
| Conf 4, 5, 6 | 52 Note 4 | | | 52 Note 4 | | |
| Conf 7, 8, 9 | 106 Note 5 | | | 106 Note 5 | | |
| PDSCH reference measurement channel as defined in A.3.1.1 |  | Conf 1, 2, 3 | SR.1.1 FDD | | | SR.1.1 FDD | | |
| Conf 4, 5, 6 | SR.1.1 TDD | | | SR.1.1 TDD | | |
| Conf 7, 8, 9 | SR 2.1 TDD | | | SR 2.1 TDD | | |
| RMSI CORESET reference measurement channel as defined in A.3.1.2 |  | Conf 1, 2, 3 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| Conf 4, 5, 6 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| Conf 7, 8, 9 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| RMC CORESET reference measurement channel as defined in A.3.1.3 |  | Conf 1, 2, 3 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| Conf 4, 5, 6 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| Conf 7, 8, 9 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern Note 1 |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | OP.1 | | | OP.1 | | |
| SSB configuration |  | Conf 1, 2, 3, 4, 5, 6 | SSB.1 FR1 | | | SSB.1 FR1 | | |
| Conf 7, 8, 9 | SSB.2 FR1 | | | SSB.2 FR1 | | |
| SMTC configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | SMTC.1 | | | SMTC.1 | | |
| CSI-RS for tracking |  | Conf 1 | TRS.1.1 FDD | | | TRS.1.1 FDD | | |
| Conf 2 | TRS.1.1 FDD | | | TRS.1.1 FDD | | |
| Conf 3 | TRS.1.1 FDD | | | TRS.1.1 FDD | | |
| Conf 4 | TRS.1.1 TDD | | | TRS.1.1 TDD | | |
| Conf 5 | TRS.1.1 TDD | | | TRS.1.1 TDD | | |
| Conf 6 | TRS.1.1 TDD | | | TRS.1.1 TDD | | |
| Conf 7 | TRS.1.2 TDD | | | TRS.1.2 TDD | | |
| Conf 8 | TRS.1.2 TDD | | | TRS.1.2 TDD | | |
| Conf 9 | TRS.1.2 TDD | | | TRS.1.2 TDD | | |
| DL initial BWP configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.0.1 | | | DLBWP.0.1 | | |
| DL dedicated BWP configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.1.1 | | | DLBWP.1.1 | | |
| UL dedicated BWP configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | ULBWP.1.1 | | | ULBWP.1.1 | | |
| EPRE ratio of PSS to SSS | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 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 SSS |
| EPRE ratio of OCNG to OCNG DMRS |
| Note 2 | dBm / 15kHz | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | -102 | | | -102 | | |
| dBm/ SCS | Conf 1,2,3,4,5,6 | -102 | | | -102 | | |
| Conf 7,8,9 | -99 | | | -99 | | |
|  | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| Note 3 | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| SS-RSRP Note 3 | dBm/ SCS | Conf 1,2,3,4,5,6 | -86 | -86 | -86 | -86 | -86 | -86 |
| Conf 7,8,9 | -83 | -83 | -83 | -83 | -83 | -83 |
| Io Note 3 | dBm/ 9.36 MHz | Conf 1,2,3,4,5,6 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| dBm/ 38.16MHz | Conf 7,8,9 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | AWGN | | | AWGN | | |
| Antenna configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 x 2 | | | 1 x 2 | | |
| 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 within BWoccupied.  NOTE 3: , Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  NOTE 5: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  NOTE 6: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel. | | | | | | | | |

Table 6.5.4.1.5-2 : NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on SCell (Cell 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test Configuration | Test 1 | | | | Test 2 | | |
| T1 | T2 | | T3 | T1 | T2 | T3 |
| Channel number |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 2 | | | | 2 | | |
| TDD configuration |  | Conf 1, 4, 7 | N/A | | | | N/A | | |
| Conf 2, 5, 8 | TDDConf.1.1 | | | | TDDConf.1.1 | | |
| Conf 3, 6, 9 | TDDConf.2.1 | | | | TDDConf.2.1 | | |
| BWchannel | MHz | Conf 1, 4, 7 | Note 6 | | | | Note 6 | | |
| Conf 2, 5, 8 | Note 6 | | | | Note 6 | | |
| Conf 3, 6, 9 | Note 6 | | | | Note 6 | | |
| BWoccupied | RB | Conf 1, 4, 7 | 52 Note 4 | | | | 52 Note 4 | | |
| Conf 2, 5, 8 | 52 Note 4 | | | | 52 Note 4 | | |
| Conf 3, 6, 9 | 106 Note 5 | | | | 106 Note 5 | | |
| PUSCH parameters for NR UL carrier |  | Conf 1, 4, 7 | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] | | N/A | G-FR1-A3-10 in [28] | N/A |
| Conf 2, 5, 8 | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] | | N/A | G-FR1-A3-10 in [28] | N/A |
| Conf 3, 6, 9 | G-FR1-A3-14 in [28] | G-FR1-A3-14 in [28] | G-FR1-A3-14 in [28] | | N/A | G-FR1-A3-14 in [28] | N/A |
| PUCCH parameters For NR UL carrier |  | Conf 1, 4, 7 | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] | | N/A | N/A | N/A |
| Conf 2, 5, 8 | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] | | N/A | N/A | N/A |
| Conf 3, 6, 9 | Table 8.3.3.1.2-2 in [28] | Table 8.3.3.1.2-2 in [28] | Table 8.3.3.1.2-2 in [28] | | N/A | N/A | N/A |
| PUSCH parameters for supplementary UL |  | Conf 1, 4, 7 | N/A | G-FR1-A3-10 in [28] | N/A | | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] |
| Conf 2, 5, 8 | N/A | G-FR1-A3-10 in [28] | N/A | | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] | G-FR1-A3-10 in [28] |
| Conf 3, 6, 9 | N/A | G-FR1-A3-14 in [28] | N/A | | G-FR1-A3-14 in [28] | G-FR1-A3-14 in [28] | G-FR1-A3-14 in [28] |
| PUCCH parameters for supplementary UL |  | Conf 1, 4, 7 | N/A | N/A | N/A | | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] |
| Conf 2, 5, 8 | N/A | N/A | N/A | | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] | Table 8.3.3.1.2-1 in [28] |
| Conf 3, 6, 9 | N/A | N/A | N/A | | Table 8.3.3.1.2-2 in [28] | Table 8.3.3.1.2-2 in [28] | Table 8.3.3.1.2-2 in [28] |
| PDSCH reference measurement channel as defined in A.3.1.1 |  | Conf 1, 4, 7 | SR.1.1 FDD | | | | SR.1.1 FDD | | |
| Conf 2, 5, 8 | SR.1.1 TDD | | | | SR.1.1 TDD | | |
| Conf 3, 6, 9 | SR 2.1 TDD | | | | SR 2.1 TDD | | |
| RMSI CORESET reference measurement channel as defined in A.3.1.2 |  | Conf 1, 4, 7 | CR.1.1 FDD | | | | CR.1.1 FDD | | |
| Conf 2, 5, 8 | CR.1.1 TDD | | | | CR.1.1 TDD | | |
| Conf 3, 6, 9 | CR.2.1 TDD | | | | CR.2.1 TDD | | |
| RMC CORESET reference measurement channel as defined in A.3.1.3 |  | Conf 1, 4, 7 | CCR.1.1 FDD | | | | CCR.1.1 FDD | | |
| Conf 2, 5, 8 | CCR.1.1 TDD | | | | CCR.1.1 TDD | | |
| Conf 3, 6, 9 | CCR.2.1 TDD | | | | CCR.2.1 TDD | | |
| OCNG Pattern Note 1 |  | Conf 1, 2, 4, 5, 7, 8 | OP.1 Note 4 | | | | OP.1 Note 4 | | |
|  | Conf 3, 6, 9 | OP.1 Note 5 | | | | OP.1 Note 5 | | |
| SSB configuration |  | Conf 1, 2, 4, 5, 7,8 | SSB.1 FR1 | | | | SSB.1 FR1 | | |
| Conf 3, 6, 9 | SSB.2 FR1 | | | | SSB.2 FR1 | | |
| SMTC configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | SMTC.1 | | | | SMTC.1 | | |
| CSI-RS for tracking |  | Conf 1 | TRS.1.1 FDD | | | | TRS.1.1 FDD | | |
|  | Conf 2 | TRS.1.1 TDD | | | | TRS.1.1 TDD | | |
|  | Conf 3 | TRS.1.2 TDD | | | | TRS.1.2 TDD | | |
|  | Conf 4 | TRS.1.1 FDD | | | | TRS.1.1 FDD | | |
|  | Conf 5 | TRS.1.1 TDD | | | | TRS.1.1 TDD | | |
|  | Conf 6 | TRS.1.2 TDD | | | | TRS.1.2 TDD | | |
|  | Conf 7 | TRS.1.1 FDD | | | | TRS.1.1 FDD | | |
|  | Conf 8 | TRS.1.1 TDD | | | | TRS.1.1 TDD | | |
|  | Conf 9 | TRS.1.2 TDD | | | | TRS.1.2 TDD | | |
| DL initial BWP configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.0.1 | | | | DLBWP.0.1 | | |
| DL dedicated BWP configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.1.1 | | | | DLBWP.1.1 | | |
| UL dedicated BWP configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | ULBWP.1.1 | | | | ULBWP.1.1 | | |
| EPRE ratio of PSS to SSS | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 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 SSS |
| EPRE ratio of OCNG to OCNG DMRS |
| Note 2 | dBm / 15kHz | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | -102 | | | | -102 | | |
| dBm/ SCS | Conf 1, 2, 4, 5, 7,8 | -102 | | | | -102 | | |
| Conf 3, 6, 9 | -99 | | | | -99 | | |
|  | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | | 16 | 16 | 16 | 16 |
| Note 3 | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | | 16 | 16 | 16 | 16 |
| SS-RSRP Note 3 | dBm/ SCS | Conf 1, 2, 4, 5, 7,8 | -86 | -86 | | -86 | -86 | -86 | -86 |
| Conf 3, 6, 9 | -83 | -83 | | -83 | -83 | -83 | -83 |
| Io Note 3 | dBm/ 9.36 MHz | Conf 1, 2, 4, 5, 7,8 | -57.9 | -57.9 | | -57.9 | -57.9 | -57.9 | -57.9 |
| dBm/ 38.16MHz | Conf 3, 6, 9 | -51.8 | -51.8 | | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | AWGN | | | | AWGN | | |
| Antenna configuration |  | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 x 2 | | | | 1 x 2 | | |
| 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 within BWoccupied.  NOTE 3: , Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  NOTE 4: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  NOTE 5: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  NOTE 6: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel. | | | | | | | | | |

In test 1 the UE shall be ready to start transmission on the supplementary uplink carrier on SCell within 20 ms from the start of T2.

In test 1 the UE shall stop the transmission on the supplementary uplink carrier on SCell within 20 ms from the start of T3.

In test 2 the UE shall be ready to start transmission on the NR uplink carrier on SCell within 20 ms from the start of T2.

In test 2 the UE shall stop the transmission on the NR uplink carrier on SCell within 20 ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

### 6.5.5 Link recovery procedures

#### 6.5.5.0 Minimum conformance requirements

##### 6.5.5.0.1 Minimum conformance requirements for SSB-based BFD and link recovery procedures

Same as in the clause 4.5.5.0.1.

##### 6.5.5.0.3 Scheduling availability of UE during beam failure detection and candidate beam detection

Same as in the clause 4.5.5.0.3.

##### 6.5.5.0.4 Requirements for Beam Failure Recovery in SCell

Same as in the clause 4.5.5.0.4.

##### 6.5.5.0.2 Minimum conformance requirements for CSI-RS-based BFD and link recovery procedures

UE shall be able to evaluate whether the downlink radio link quality on the configured 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 8.5.3.2-1 for FR1.

For FR1,

- P=1/(1 – TCSI-RS/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

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

The values of MBFD used in Table 6.5.5.0.2-1 is defined as

- MBFD = 10, if the CSI-RS resource configured for BFD is transmitted with Density = 3.

Table 6.5.5.0.2-1: Evaluation period TEvaluate\_BFD\_CSI-RS for FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_CSI-RS (ms) |
| no DRX | max([50], [MBFD \*P] \* TCSI-RS) |
| DRX cycle ≤ 320ms | max([50], [1.5×MBFD \*P]\*max(TDRX, TCSI-RS)) |
| DRX cycle > 320ms | [MBFD\*P] \* TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

When the radio link quality on all the configured 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. A Layer 3 filter may be applied to the beam failure instance indications as specified in TS 38.331 [13].

The beam failure instance evaluation for the configured RS resources in set  shall be performed as specified in section 6 in TS 38.213 [8]. 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, TBFD-RS,M), where TBFD-RS,M is the shortest periodicity of all configured 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, TIndication\_interval\_BFD is max(1.5\*DRX\_cycle\_length, 1.5\*TBFD-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.

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 Annex Table B.2.4.2 for a corresponding band.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 6.5.5.0.2-2 for FR1.

For FR1,

- P=1/(1 – TCSI-RS/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

In both FR1 and FR2, if different SCS is used for SSB and CSI-RS, and the UE does not support *simultaneousRxDataSSB-DiffNumerology*, it is assumed that the CSI-RS configured for candidate beam detection and each SSB shall be TDMed transmitted.

The values of MCBD used in Table 6.5.5.0.2-2 is defined as

- MCBD = 3, if the CSI-RS resource configured in the set  is transmitted with Density = 3.

Table 6.5.5.0.2-2: Evaluation period TEvaluate\_CBD\_CSI-RS for FR1

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_CSI-RS (ms)** |
| non-DRX | max([25], ceil(MCBD \*P) \* TCSI-RS) |
| DRX cycle ≤ 320ms | ceil(MCBD \*P\*N) \* max(TDRX, TCSI-RS) |
| DRX cycle > 320ms | ceil(MCBD \*P) \*TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

The normative reference for this requirement is TS 38.133 [6] clause 8.5.3.2, 8.5.4 and 8.5.6.2.

#### 6.5.5.1 NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX

6.5.5.1.1 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 cell 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, 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 FR1 serving cell requirements in TS 38.133 [6] clause 8.5.

6.5.5.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 5GS NR SA FR1 and link recovery.

6.5.5.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.1.

6.5.5.1.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.5.1.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate SSB based beam failure. Figure 6.5.5.1.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery



Figure 6.5.5.1.4-1: SNR and L1-RSRP variation for NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX mode

6.5.5.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.1.4.1-1.

Table 6.5.5.1.4.1-1: Supported test configurations for NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX mode

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.5.1-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.1-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.1-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.1.4.1-2.

Table 6.5.5.1.4.1-2: Initial conditions for NR SA FR1 SSB-based beam failure detection and link recovery 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.1.4.1-3.

2. Message contents are defined in clause 6.5.5.1.4.3.

3. There is one NR carrier and one NR cells specified in the test. Cell 1 is the NR cell used for connection setup with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.1.4.1-3: General test parameters for NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Value | Comment |
| Test 1 |  |
| Active PSCell | | | | |  | Cell 1 |  |
| RF Channel Number | | | | |  | 1 |  |
| Duplex mode | | | | Config 1 |  | FDD |  |
| Config 2, 3 | TDD |  |
| BWchannel | | | | Config 1 | MHz | 10: NRB,c = 52 |  |
| Config 2 | 10: NRB,c = 52 |  |
| Config 3 | 40: NRB,c = 106 |  |
| DL initial BWP configuration | | | | Config 1, 2, 3 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | | | Config 1, 2, 3 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | | | Config 1, 2, 3 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | | | Config 1, 2, 3 |  | ULBWP.1.1 |  |
| TDD Configuration | | | | Config 1 |  | Not Applicable |  |
| Config 2 | TDDConf.1.1 |  |
| Config 3 | TDDConf.2.1 |  |
| CORESET Reference Channel | | | | Config 1 |  | CR.1.1 FDD |  |
| Config 2 | CR.1.1 TDD |  |
| Config 3 | CR.2.1 TDD |  |
| SSB Configuration | | | | Config 1 |  | SSB.3 FR1 |  |
| Config 2 | SSB.3 FR1 |  |
| Config 3 | SSB.4 FR1 |  |
| SMTC Configuration | | | | Config 1, 2 |  | SMTC.1 |  |
| Config 3 | SMTC.1 |  |
| PDSCH/PDCCH subcarrier spacing | | | | Config 1, 2 |  | 15 KHz |  |
| Config 3 | 30 KHz |  |
| PRACH Configuration | | | | Config 1, 2 |  | PRACH.2 FR1 |  |
| Config 3 | PRACH.2 FR1 |  |
| SSB Index assigned as BFD RS (q0) | | | | |  | 0 |  |
| SSB Index assigned as CBD RS (q1) | | | | |  | 1 |  |
| OCNG parameters | | | | |  | OP.1 |  |
| CP length | | | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | | DCI format | | |  | 1-0 |  |
| Number of Control OFDM symbols | | |  | 2 |  |
| Aggregation level | | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | | dB | 0 |  |
| DMRS precoder granularity | | |  | REG bundle size |  |
| REG bundle size | | |  | 6 |  |
| DRX | | | | |  | OFF |  |
| Gap pattern ID | | | | |  | gp0 |  |
| gapOffset | | | | |  | 0 |  |
| rlmInSyncOutOfSyncThreshold | | | | |  | absent | When the field is absent, the UE applies the value 0. |
| rsrp-ThresholdSSB | Config 1, 2 | | | | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | | | | dBm/SCS kHz | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | | |  | n1 | see clause 5.17 of TS 38.321 [12] |
| beamFailureDetectionTimer | | | | |  | pbfd4 | see clause 5.17 of TS 38.321 [12] |
| CSI-RS configuration for CSI reporting | | | Config 1 | |  | CSI-RS.1.1 FDD |  |
| Config 2 | |  | CSI-RS.1.1 TDD |  |
| Config 3 | |  | CSI-RS.2.1 TDD |  |
| CSI-RS for tracking | | | Config 1 | |  | TRS.1.1 FDD |  |
| Config 2 | |  | TRS.1.1 TDD |  |
| Config 3 | |  | TRS.1.2 TDD |  |
| SSB Index assigned as RLM RS | | | | |  | 0, 1 |  |
| T310 Timer | | | | | ms | 1000 |  |
| N310 | | | | |  | 2 |  |
| T1 | | | | | s | 0.2 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | | | s | 0.37 |  |
| T3 | | | | | s | 0.24 |  |
| T4 | | | | | s | 0 |  |
| T5 | | | | | s | 0.17 |  |
| D1 | | | | | s | 0.13 |  |
| 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. | | | | | | | |

6.5.5.1.4.2 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. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. The SS sends an *RRCReconfiguration* message to the UE to configure inter-frequency measurement.

3. The UE sends an *RRCReconfigurationComplete* message.

4. Set the parameters of NR Cell 1 according to T1 in Table 6.5.5.1.5-1. 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 6.5.5.1.5-1. T2 starts.

6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.5.1.5-1. T3 starts.

7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.5.1.5-1. T4 starts.

8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.5.1.5-1. T5 starts.

9. If the SS:

a) detects uplink power on NR carrier equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 q1before 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.

10. Switch the UE off and on. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

11. Repeat steps 4-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

6.5.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and clause 7.3 with the following exceptions:

Table 6.5.5.1.4.3-1: Common Exception messages for NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX mode

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |
| Default RRC messages and information elements contents exceptions | Table H.3.1-6 with Condition BFD  Table H.3.1-1  Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED, GAP\_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)  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.3.5-4  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.5.1.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.1.4.3-3: *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 6.5.5.1.4.3-4: Void

Table 6.5.5.1.4.3-5: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.1.4.3-6: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

6.5.5.1.5 Test requirement

Tables 6.5.5.1.4.1-3 and 6.5.5.1.5-1 define the primary level settings including test tolerances for NR SA FR1 SSB-based beam failure detection and link recovery in DRX.

Table 6.5.5.1.5-1: NR Cell specific test parameters for NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PSS to SSS | | dB |
| EPRE ratio of PDSCH DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |
| EPRE ratio of OCNG DMRS to SSS | | dB |
| EPRE ratio of OCNG to OCNG DMRS | | dB |
| SNR\_ SSB of set q0 | Config 1 | dB | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 2 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 3 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| SNR\_SSB of set q1 | Config 1 | dB | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 2 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 3 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| SSB\_RP of set q1 | Config 1 | dBm/SCS kHz | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 2 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 3 | -105.2 | -105.2 | -84.8 | -84.8 | -84.8 |
|  | Config 1 | dBm/15 kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.5.1.4-1.  Note 9: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR for RS in set q0 during T3, T4, and T5 from D.4.1.1, is -15dB-TT = -15.8dB (including test tolerances). | | | | | | | |

Table 6.5.5.1.5-2: 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 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 = 130 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%.

#### 6.5.5.2 NR SA FR1 SSB-based beam failure detection and link recovery in DRX

6.5.5.2.1 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 cell 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, 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 FR1 serving cell requirements in TS 38.133 [6] clause 8.5.

6.5.5.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 5GS NR SA FR1, link recovery and long DRX cycle.

6.5.5.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.2.

6.5.5.2.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.5.2.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate SSB based beam failure. Figure 6.5.5.2.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery.



Figure 6.5.5.2.4-1: SNR and L1-RSRP variation for NR SA FR1 SSB-based beam failure detection and link recovery in DRX

6.5.5.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.2.4.1-1.

Table 6.5.5.2.4.1-1: Supported test configurations for NR SA FR1 SSB-based beam failure detection and link recovery in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.5.2-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.2-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.2-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.2.4.1-2.

Table 6.5.5.2.4.1-2: Initial conditions for NR SA FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2 Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.2.4.1-3.

2. Message contents are defined in clause 6.5.5.2.4.3.

3. There is one NR carrier and one NR cells specified in the test. Cell 1 is the NR cell used for connection setup with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.2.4.1-3: General test parameters for NR SA FR1 SSB-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | Comment |
| Test 1 |  |
| Active PSCell | | | |  | Cell 1 |  |
| RF Channel Number | | | |  | 1 |  |
| Duplex mode | | | Config 1 |  | FDD |  |
| Config 2, 3 | TDD |  |
| BWchannel | | | Config 1 | MHz | 10: NRB,c = 52 |  |
| Config 2 | 10: NRB,c = 52 |  |
| Config 3 | 40: NRB,c = 106 |  |
| DL initial BWP configuration | | | Config 1, 2, 3 |  | DLBWP.0.1 |  |
| DL dedicated BWP configuration | | | Config 1, 2, 3 |  | DLBWP.1.1 |  |
| UL initial BWP configuration | | | Config 1, 2, 3 |  | ULBWP.0.1 |  |
| UL dedicated BWP configuration | | | Config 1, 2, 3 |  | ULBWP.1.1 |  |
| TDD Configuration | | | Config 1 |  | Not Applicable |  |
| Config 2 | TDDConf.1.1 |  |
| Config 3 | TDDConf.2.1 |  |
| CORESET Reference Channel | | | Config 1 |  | CR.1.1 FDD |  |
| Config 2 | CR.1.1 TDD |  |
| Config 3 | CR.2.1 TDD |  |
| SSB Configuration | | | Config 1 |  | SSB.3 FR1 |  |
| Config 2 | SSB.3 FR1 |  |
| Config 3 | SSB.4 FR1 |  |
| SMTC Configuration | | | Config 1, 2 |  | SMTC.1 |  |
| Config 3 | SMTC.1 |  |
| PDSCH/PDCCH subcarrier spacing | | | Config 1, 2 |  | 15 KHz |  |
| Config 3 | 30 KHz |  |
| PRACH Configuration | | | Config 1, 2 |  | PRACH.2 FR1 |  |
| Config 3 | PRACH.2 FR1 |  |
| SSB Index assigned as BFD RS (q0) | | | |  | 0 |  |
| SSB Index assigned as CBD RS (q1) | | | |  | 1 |  |
| OCNG parameters | | | |  | OP.1 |  |
| CP length | | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | | |  | 1-0 |  |
| Number of Control OFDM symbols | | |  | 2 |  |
| Aggregation level | | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | | dB | 0 |  |
| DMRS precoder granularity | | |  | REG bundle size |  |
| REG bundle size | | |  | 6 |  |
| DRX | | | |  | DRX.7 | see clause A.3.3.7 of TS 38.133 [6] |
| Gap pattern ID | | | |  | N.A. |  |
| rlmInSyncOutOfSyncThreshold | | | |  | absent | When the field is absent, the UE applies the value 0. |
| rsrp-ThresholdSSB | | Config 1, 2 | | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | | dBm/SCS kHz | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | |  | n1 | see clause 5.17 of TS 38.321 [12] |
| beamFailureDetectionTimer | | | |  | pbfd4 | see clause 5.17 of TS 38.321 [12] |
| CSI-RS configuration for CSI reporting | | Config 1 | |  | CSI-RS.1.1 FDD |  |
| Config 2 | |  | CSI-RS.1.1 TDD |  |
| Config 3 | |  | CSI-RS.2.1 TDD |  |
| CSI-RS for tracking | | Config 1 | |  | TRS.1.1 FDD |  |
| Config 2 | |  | TRS.1.1 TDD |  |
| Config 3 | |  | TRS.1.2 TDD |  |
| SSB Index assigned as RLM RS | | | |  | 0, 1 |  |
| T310 Timer | | | | ms | 1000 |  |
| N310 | | | |  | 2 |  |
| T1 | | | | s | 1 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | | s | 5.17 |  |
| T3 | | | | s | 3.24 |  |
| T4 | | | | s | 0 |  |
| T5 | | | | s | 1.97 |  |
| D1 | | | | s | 1.93 |  |
| 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. | | | | | | |

6.5.5.2.4.2 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 *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters of NR Cell 1 according to T1 in Table 6.5.5.2.5-1. 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 6.5.5.2.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.5.2.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.5.2.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.5.2.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 q1before 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. Switch the UE off and on. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

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.

6.5.5.2.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 4.6 and clause 7.3 with the following exceptions:

Table 6.5.5.2.4.3-1: Common Exception messages for NR SA FR1 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.3.5-4  Table H.3.7-1 with Condition DRX.7  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.5.2.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.2.4.3-3: *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 6.5.5.2.4.3-4: Void

Table 6.5.5.2.4.3-5: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.2.4.3-6: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

6.5.5.2.5 Test requirement

Tables 6.5.5.2.4.1-3 and 6.5.5.2.5-1 define the primary level settings including test tolerances for NR SA FR1 SSB-based beam failure detection and link recovery in DRX.

Table 6.5.5.2.5-1: NR Cell specific test parameters for NR SA FR1 SSB-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PSS to SSS | | dB |
| EPRE ratio of PDSCH DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |
| EPRE ratio of OCNG DMRS to SSS | | dB |
| EPRE ratio of OCNG to OCNG DMRS | | dB |
| SNR\_ SSB of set q0 | Config 1 | dB | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 2 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 3 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| SNR\_SSB of set q1 | Config 1 | dB | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 2 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 3 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| SSB\_RP of set q1 | Config 1 | dBm/SCS kHz | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 2 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 3 | -105.2 | -105.2 | -84.8 | -84.8 | -84.8 |
|  | Config 1 | dBm/15 kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.5.2.4-1.  Note 9: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR for RS in set q0 during T3, T4, and T5 from D.4.1.1, is -15dB-TT = -15.8dB (including test tolerances). | | | | | | | |

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 = 1930 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%.

#### 6.5.5.3 NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX

6.5.5.3.1 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. 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 FR1 serving cell requirements in TS 38.133 [6] clause 8.5.

6.5.5.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 5GS NR SA FR1, CSI-RS based RLM and link recovery.

6.5.5.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.3.

6.5.5.3.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.5.3.4-1 shows the five different time durations and the corresponding variation of the downlink SNR of the CSI-RS in set q0 in the active cell to emulate CSI-RS based beam failure and the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.



Figure 6.5.5.3.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX

6.5.5.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.3.4.1-1.

Table 6.5.5.3.4.1-1: Supported test configurations for NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.5.3-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.3-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.3-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.3.4.1-2.

Table 6.5.5.3.4.1-2: Initial conditions for NR SA FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.3.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.3.4.1-3.

2. Message contents are defined in clause 6.5.5.3.4.3.

3. There is one NR carrier and one NR cell specified in the test. Cell 1 is the NR cell used for connection setup with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.3.4.1-3: General test parameters for NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** | **Comment** |
|  | **Test 1** |  |
| Active PCell | | |  | Cell 1 |  |
| RF Channel Number | | |  | 1 |  |
| Duplex mode | Config 1 | |  | FDD |  |
| Config 2, 3 | | TDD |  |
| TDD Configuration | Config 1 | |  | Not Applicable |  |
| Config 2 | | TDDConf.1.1 |  |
| Config 3 | | TDDConf.2.1 |  |
| CORESET Reference Channel | Config 1 | |  | CR.1.1 FDD |  |
| Config 2 | | CR.1.1 TDD |
| Config 3 | | CR.2.1 TDD |
| SSB Configuration | Config 1 | |  | SSB.3 FR1 |  |
| Config 2 | | SSB.3 FR1 |
| Config 3 | | SSB.4 FR1 |
| SMTC Configuration | Config 1, 2 | |  | SMTC.1 |  |
| Config 3 | | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | |  | 15 KHz |  |
| Config 3 | | 30 KHz |  |
| PRACH Configuration | Config 1, 2 | |  | PRACH.4 FR1 |  |
| Config 3 | | PRACH.4 FR1 |
| csi-RS-Index assigned as beam failure detection RS in set q0 | | |  | 0 |  |
| OCNG parameters | | |  | OP.1 |  |
| CP length | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | |  | 1-0 |  |
| Number of Control OFDM symbols | |  | 2 |  |
| Aggregation level | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | dB | 0 |  |
| DMRS precoder granularity | |  | REG bundle size |  |
| REG bundle size | |  | 6 |  |
| DRX | | |  | OFF |  |
| Gap pattern ID | | |  | N.A. |  |
| csi-RS-Index assigned as candidate beam detection RS in set q1 | | |  | 1 | N |
| rlmInSyncOutOfSyncThreshold | | |  | absent | When the field is absent, the UE applies the value 0. |
| rsrp-ThresholdSSB | | Config 1, 2 | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | dBm/SCS kHz | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | |  | n1 | see TS 38.321 [12], section 5.17 |
| beamFailureDetectionTimer | | |  | pbfd4 | see TS 38.321 [12], section 5.17 |
| CSI-RS configuration for q0 and q1 | Config 1 | |  | CSI-RS.1.2 FDD |  |
| Config 2 | | CSI-RS.1.2 TDD |
| Config 3 | | CSI-RS.2.2 TDD |
| CSI-RS configuration for CSI reporting | Config 1 | |  | CSI-RS.1.1 FDD |  |
| Config 2 | |  | CSI-RS.1.1 TDD |
| Config 3 | |  | CSI-RS.2.1 TDD |
| TRS configuration | Config 1 | |  | TRS.1.1 FDD |  |
| Config 2 | |  | TRS.1.1 TDD |  |
| Config 3 | |  | TRS.1.2 TDD |  |
| CSI-RS-Index assigned as RLM RS | Config 1 | |  | CSI-RS.1.2 FDD |  |
| Config 2 | |  | CSI-RS.1.2 TDD |
| Config 3 | |  | CSI-RS.2.2 TDD |
| T310 Timer | | | ms | 1000 |  |
| N310 | | |  | 2 |  |
| T1 | | | s | 0.2 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | s | 0.18 |  |
| T3 | | | s | 0.14 |  |
| T4 | | | s | 0 |  |
| T5 | | | s | 0.08 |  |
| D1 | | | s | 0.04 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

6.5.5.3.4.2 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 *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters of NR Cell 1 according to T1 in Table 6.5.5.3.5-1. 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 6.5.5.3.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.5.3.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.5.3.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.5.3.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 q1before 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. Switch the UE off and on. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

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.

6.5.5.3.4.3 Message contents

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

Table 6.5.5.3.4.3-1: Common Exception messages for NR SA FR1 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 H.3.5-4  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.5.3.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.3.4.3-3: *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 6.5.5.3.4.3-4: Void

Table 6.5.5.3.4.3-5: *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 6.5.5.3.4.3-6: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.3.4.3-7: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

6.5.5.3.5 Test requirement

Tables 6.5.5.3.4.1-3 and 6.5.5.3.5-1 define the primary level settings including test tolerances for NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX.

Table 6.5.5.3.5-1: NR Cell specific test parameters for NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PSS to SSS | | dB |
| EPRE ratio of PDSCH DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |
| EPRE ratio of OCNG DMRS to SSS | | dB |
| EPRE ratio of OCNG to OCNG DMRS | | dB |
| SNR\_CSI-RS of set q0 | Config 1 | dB | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 2 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 3 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| SNR\_CSI-RS of set q1 | Config 1 | dB | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 2 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 3 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| CSI-RS\_RP of set q1 | Config 1 | dBm/SCS kHz | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 2 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 3 | -105.2 | -105.2 | -84.8 | -84.8 | -84.8 |
|  | Config 1 | dBm/15 kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.5.3.4-1.  Note 9: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR for RS in set q0 during T3, T4, and T5 from D.4.1.1, is -15dB-TT = -15.8dB (including test tolerances). | | | | | | | |

The UE behaviour in each test 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 = 40 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%.

#### 6.5.5.4 NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX

6.5.5.4.1 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. 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 FR1 serving cell requirements in TS 38.133 [6] clause 8.5.

6.5.5.4.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 5GS NR SA FR1, CSI-RS based RLM, link recovery and long DRX cycle.

6.5.5.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.4.

6.5.5.4.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.5.4.4-1 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 6.5.5.4.4-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q1 of the candidate beam used for link recovery.



Figure 6.5.5.4.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX

6.5.5.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.4.4.1-1.

Table 6.5.5.4.4.1-1: Supported test configurations for NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.5.4-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.4-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.4-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.4.4.1-2.

Table 6.5.5.4.4.1-2: Initial conditions for NR SA FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.4.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.4.4.1-3.

2. Message contents are defined in clause 6.5.5.4.4.3.

3. There is one NR carrier and one NR cells specified in the test. Cell 1 is the NR cell used for connection setup with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.4.4.1-3: General test parameters for NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value | Comment |
| Test 1 |
| Active PCell | | |  | Cell 1 |  |
| RF Channel Number | | |  | 1 |  |
| Duplex mode | Config 1 | |  | FDD |  |
| Config 2, 3 | | TDD |  |
| TDD Configuration | Config 1 | |  | Not Applicable |  |
| Config 2 | | TDDConf.1.1 |  |
| Config 3 | | TDDConf.2.1 |  |
| CORESET Reference Channel | Config 1 | |  | CR.1.1 FDD |  |
| Config 2 | | CR.1.1 TDD |
| Config 3 | | CR.2.1 TDD |
| SSB Configuration | Config 1 | |  | SSB.3 FR1 |  |
| Config 2 | | SSB.3 FR1 |
| Config 3 | |  | SSB.4 FR1 |
| SMTC Configuration | Config 1, 2 | |  | SMTC.1 |  |
| Config 3 | | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | |  | 15 KHz |  |
| Config 3 | | 30 KHz |  |
| PRACH Configuration | Config 1, 2 | |  | PRACH.4 FR1 |  |
| Config 3 | | PRACH.4 FR1 |
| csi-RS-Index assigned as beam failure detection RS in set q0 | | |  | 0 |  |
| OCNG parameters | | |  | OP.1 |  |
| CP length | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | |  | 1-0 |  |
| Number of Control OFDM symbols | |  | 2 |  |
| Aggregation level | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | dB | 0 |  |
| DMRS precoder granularity | |  | REG bundle size |  |
| REG bundle size | |  | 6 |  |
| DRX | | |  | DRX.7 |  |
| Gap pattern ID | | |  | N.A. |  |
| csi-RS-Index assigned as candidate beam detection RS in set q1 | | |  | 1 |  |
| rlmInSyncOutOfSyncThreshold | | |  | absent | When the field is absent, the UE applies the value 0. |
| rsrp-ThresholdSSB | | Config 1, 2 | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | dBm/SCS kHz | -95 | Threshold used for Qin\_LR\_SSB |
| powerControlOffsetSS | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | |  | n1 | see TS 38.321 [12], section 5.17 |
| beamFailureDetectionTimer | | |  | pbfd4 | see TS 38.321 [12], section 5.17 |
| CSI-RS configuration for q0 and q1 | Config 1 | |  | CSI-RS.1.2 FDD |  |
| Config 2 | | CSI-RS.1.2 TDD |
| Config 3 | | CSI-RS.2.2 TDD |
| CSI-RS configuration for CSI reporting | Config 1 | |  | CSI-RS.1.1 FDD |  |
| Config 2 | |  | CSI-RS.1.1 TDD |
| Config 3 | |  | CSI-RS.2.1 TDD |
| TRS configuration | Config 1 | |  | TRS.1.1 FDD |  |
| Config 2 | |  | TRS.1.1 TDD |  |
| Config 3 | |  | TRS.1.2 TDD |  |
| CSI-RS-Index assigned as RLM RS | Config 1 | |  | CSI-RS.1.2 FDD |  |
| Config 2 | |  | CSI-RS.1.2 TDD |
| Config 3 | |  | CSI-RS.2.2 TDD |
| T310 Timer | | | ms | 1000 |  |
| N310 | | |  | 2 |  |
| T1 | | | s | 1 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | s | 8.37 |  |
| T3 | | | s | 6.44 |  |
| T4 | | | s | 0 |  |
| T5 | | | s | 1.97 |  |
| D1 | | | s | 1.93 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

6.5.5.4.4.2 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 *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters of NR Cell 1 according to T1 in Table 6.5.5.4.5-1. 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 6.5.5.4.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 6.5.5.4.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 6.5.5.4.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 6.5.5.4.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 q1before 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. Switch the UE off and on. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

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.

6.5.5.4.4.3 Message contents

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

Table 6.5.5.4.4.3-1: Common Exception messages for NR SA FR1 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.3.5-4  Table H.3.7-1 with Condition DRX.7Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.5.4.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.4.4.3-3: *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 6.5.5.4.4.3-4: Void

Table 6.5.5.3.4.3-5: *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 6.5.5.4.4.3-6: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.4.4.3-7: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

6.5.5.4.5 Test requirement

Tables 6.5.5.4.4.1-3 and 6.5.5.4.5-1 define the primary level settings including test tolerances for NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX.

Table 6.5.5.4.5-1: NR Cell specific test parameters for NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
| T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |
| EPRE ratio of PBCH DMRS to SSS | | dB |
| EPRE ratio of PBCH to PBCH DMRS | | dB |
| EPRE ratio of PSS to SSS | | dB |
| EPRE ratio of PDSCH DMRS to SSS | | dB |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |
| EPRE ratio of OCNG DMRS to SSS | | dB |
| EPRE ratio of OCNG to OCNG DMRS | | dB |
| SNR\_CSI-RS of set q0 | Config 1 | dB | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 2 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 3 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| SNR\_CSI-RS of set q1 | Config 1 | dB | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 2 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 3 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| CSI-RS\_RP of set q1 | Config 1 | dBm/SCS kHz | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 2 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 3 | -105.2 | -105.2 | -84.8 | -84.8 | -84.8 |
|  | Config 1 | dBm/15 kHz | -98 | | | | |
| Config 2 | -98 | | | | |
| Config 3 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the 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 6.5.5.4.4-1.  Note 9: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR for RS in set q0 during T3, T4, and T5 from D.4.1.1, is -15dB-TT = -15.8dB (including test tolerances). | | | | | | | |

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 = 1930 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%.

#### 6.5.5.5 NR SA FR1 Scell CSI-RS-based beam failure detection and SSB-based link recovery in non-DRX

6.5.5.5.1 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 SSB-based link recovery based on beam candidate set q1. To test the downlink monitoring for beam failure detection within the UEs active DL BWP without *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in TS 38.133 [6] clause 8.5.

6.5.5.5.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting 5GS NR SA FR1, CSI-RS based RLM, SSB link recovery and SCell beam failure recovery.

6.5.5.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.2 and 6.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.5.

6.5.5.5.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.5.5.4-1 shows the SNR of the CSI-RS in set q0 in the active SCell to emulate beam failure. Figure 6.5.5.5.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery.

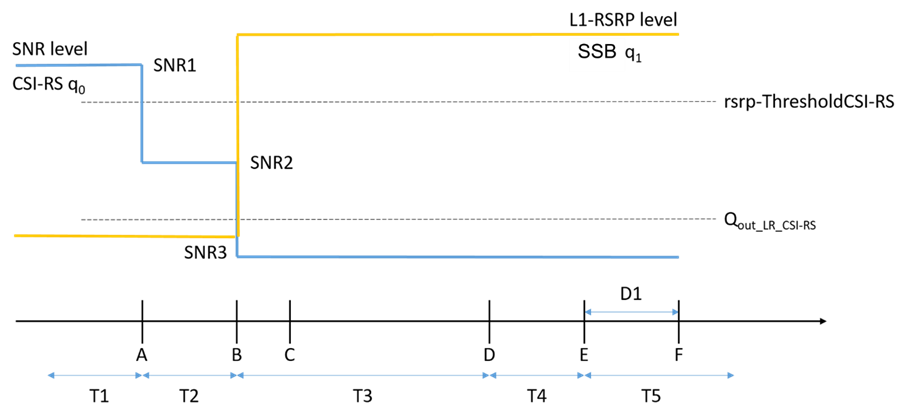


Figure 6.5.5.5.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery in non-DRX

6.5.5.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.5.4.1-1.

Table 6.5.5.5.4.1-1: Supported test configurations for FR1 PCell and SCell

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.5.5-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.5-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.5-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.5.4.1-2.

Table 6.5.5.5.4.1-2: Initial conditions for NR SA FR1 CSI-RS-based beam failure detection and SSB-based 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.5.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.5.4.1-3.

2. Message contents are defined in clause 6.5.5.5.4.3.

3. There is one NR carrier and two NR cells specified in the test. Cell 1 is the NR cell (PCell) used for connection setup and Cell 2 is the NR cell (SCell) with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.5.4.1-3: General test parameters for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery in non-DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | | **Unit** | **Value** | **Comment** |
| **Test 1** |
| Active PCell | | | |  | Cell 1 |  |
| RF Channel Number for PCell | | | |  | 1 |  |
| Active SCell | | | |  | Cell 2 |  |
| RF Channel Number for SCEll | | | |  | 2 |  |
| Duplex mode | Config 1 | | |  | FDD |  |
| Config 2, 3 | | | TDD |  |
| BW channel | Config 1 | | |  | 10: NRB,c = 52 |  |
|  | Config 2 | | | MHz | 10: NRB,c = 52 |  |
|  | Config 3 | | |  | 40: NRB,c = 106 |  |
| TDD Configuration | Config 1 | | |  | Not Applicable |  |
| Config 2 | | | TDDConf.1.1 |  |
| Config 3 | | | TDDConf.2.1 |  |
| CORESET Reference Channel | Config 1 | | |  | CR.1.1 FDD | A.1.2 |
| Config 2 | | | CR.1.1 TDD |
| Config 3 | | | CR.2.1 TDD |
| SSB Configuration | Config 1 | | |  | SSB.1 FR1 | A.3 |
| Config 2 | | | SSB.1 FR1 |
| Config 3 | | | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 | | |  | SMTC.1 | A.4 |
| Config 3 | | | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | | kHz | 15 |  |
| Config 3 | | | 30 |  |
| PRACH Configuration | Config 1, 2 | | |  | PRACH.2 FR1 | Table A.7.1-1 |
| Config 3 | | |  | PRACH.2 FR1 | Table A.7.1-1 |
| csi-RS-Index assigned as beam failure detection RS in set q0 in activated SCell | | | |  | 0 |  |
| OCNG parameters | | | |  | OP.1 | A.2.1 |
| CP length | | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | | |  | 1-0 |  |
| Number of Control OFDM symbols | | |  | 2 |  |
| Aggregation level | | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | | dB | 0 |  |
| DMRS precoder granularity | | |  | REG bundle size |  |
| REG bundle size | | |  | 6 |  |
| DRX | | | |  | OFF |  |
| Gap pattern ID | | | |  | N.A. |  |
| schedulingRequestID-BFR-SCell-r16 | | | |  | absent | When the field is absent, the random access procedure will be triggered for SCell BFR |
| SSB Index assigned as CBD RS (q1) in activated SCell | | | |  | 0 |  |
| rlmInSyncOutOfSyncThreshold | | | |  | absent | When the field is absent, the UE applies the value 0. (TS 38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdBFR | | Config 1, 2 | | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | | -95 |
| powerControlOffsetSS | | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | |  | n1 | see clause 5.17 of TS 38.321 [12] |
| beamFailureDetectionTimer | | | |  | pbfd4 | see clause 5.17 of TS 38.321 [12] |
| CSI-RS configuration for q0 in activated SCell | | | Config 1 |  | CSI-RS.1.2 FDD | A.1.4 |
| Config 2 | CSI-RS.1.2 TDD |
| Config 3 | CSI-RS.2.2 TDD |
| CSI-RS configuration for CSI reporting | | | Config 1 |  | CSI-RS.1.1 FDD | A.1.4 |
| Config 2 |  | CSI-RS.1.1 TDD |
| Config 3 |  | CSI-RS.2.1 TDD |
| TRS configuration | | | Config 1 |  | TRS.1.1 FDD |  |
| Config 2 |  | TRS.1.1 TDD |  |
| Config 3 |  | TRS.1.2 TDD |  |
| CSI-RS-Index assigned as RLM RS in PCell | | | Config 1 |  | CSI-RS.1.2 FDD | A.1.4 |
| Config 2 |  | CSI-RS.1.2 TDD |
| Config 3 |  | CSI-RS.2.2 TDD |
| T310 Timer | | | | ms | 1000 |  |
| N310 | | | |  | 2 |  |
| T1 | | | | s | 0.2 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | | s | 0.18 |  |
| T3 | | | | s | 0.14 |  |
| T4 | | | | s | 0 |  |
| T5 | | | | s | 0.17 |  |
| D1 | | | | s | 0.13 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | | |

6.5.5.5.4.2 Test procedure

Same test procedure as described in section 6.5.5.3.4.2, except following exception and steps 7 and 8:

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 not enabled.

7. If the SS:

a) detects uplink power on the PCell equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 the PCell before time point B

and

c) detects preamble on the preconfigured PRACH resource before time point F (D1 after the start of T5).

And

d) SS transmits a RAR to UE after receiving the preamble transmitted by the UE. SS detects the MAC-CE on the PCell transmitted by the UE providing the index for the activated SCell, and the index for the SSB provided by higher layer.

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

8. If the iteration or random access procedure for BFD fails, the SS shall first attempt to release and add the FR1 SCell, by ensuring the UE is in state RRC\_CONNECTED with generic procedure parameter *Connectivity* NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [6] clause 4.5. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration.

6.5.5.5.4.3 Message contents

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

Table 6.5.5.5.4.3-1: Common Exception messages for NR SA FR1 SCell CSI-RS-based beam failure detection and SSB-based 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 SSB  Table H.3.1-10A  Table H.3.5-4  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.5.5.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.5.4.3-3: *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 6.5.5.5.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.5.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

6.5.5.5.5 Test requirement

Tables 6.5.5.5.4.1-3 and 6.5.5.5.5-1 define the primary level settings including test tolerances for NR SA FR1 SCell CSI-RS-based beam failure detection and SSB-based link recovery in non-DRX.

Table 6.5.5.5.5-1: NR Cell specific test parameters for NR SA FR1 SCell CSI-RS-based beam failure detection and SSB-based link recovery in non-DRX

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | **Cell1** | Test 1 Cell2 | | | | |
|  | **T1 to T5** | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  |
| EPRE ratio of PBCH DMRS to SSS | | dB |  |
| EPRE ratio of PBCH to PBCH DMRS | | dB |  |
| EPRE ratio of PSS to SSS | | dB | 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 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 2 |  | 5 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 3 |  | 5 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| SNR\_SSB of set q1 | Config 1 | dB | -10 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 2 |  | -10 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 3 |  | -10 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| SSB\_RP of set q1 | Config 1 | dBm/ | -108 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 2 | SCS  kHz | -108 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 3 |  | -105 | -105.2 | -105.2 | -84.8 | -84.8 | -84.8 |
|  | Config 1 | dBm/ | -98 | -98 | | | | |
| Config 2 | 15kHz | -98 | -98 | | | | |
| Config 3 |  | -98 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 4: 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 6.5.5.5.4-1.  Note 9: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR for RS in set q0 during T3, T4, and T5 from D.4.1.1, is -15dB-TT = -15.8dB (including test tolerances). | | | | | | | | |

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 = 120+10 ms after the start of T5, the UE shall transmit preamble for UL-SCH resource application, followed by MAC-CE on the assigned uplink resources containing  a beam associated with the candidate beam set q1. The UE shall not transmit preamble earlier than time point B.

During T5, the System Simulator shall transmit a Random Access Response to UE after the System Simulator receives the preamble from UE. The UE shall transmit the msg.3 containing candidate beam set q1 for SCell BFR if UE receives the Random Access Response.

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%.

#### 6.5.5.6 NR SA FR1 Scell CSI-RS-based beam failure detection and SSB-based link recovery in DRX

6.5.5.6.1 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 a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q1. To test the downlink monitoring for beam failure detection within the UEs active DL BWP without *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in TS 38.133 [6] clause 8.5.

6.5.5.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting 5GS NR SA FR1, CSI-RS based RLM, SSB link recovery and SCell beam failure recovery.

6.5.5.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.2 and 6.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.6.

6.5.5.6.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 6.5.5.6.4-1 shows the SNR of the CSI-RS in set q0 in the active SCell to emulate beam failure. Figure 6.5.5.6.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery.

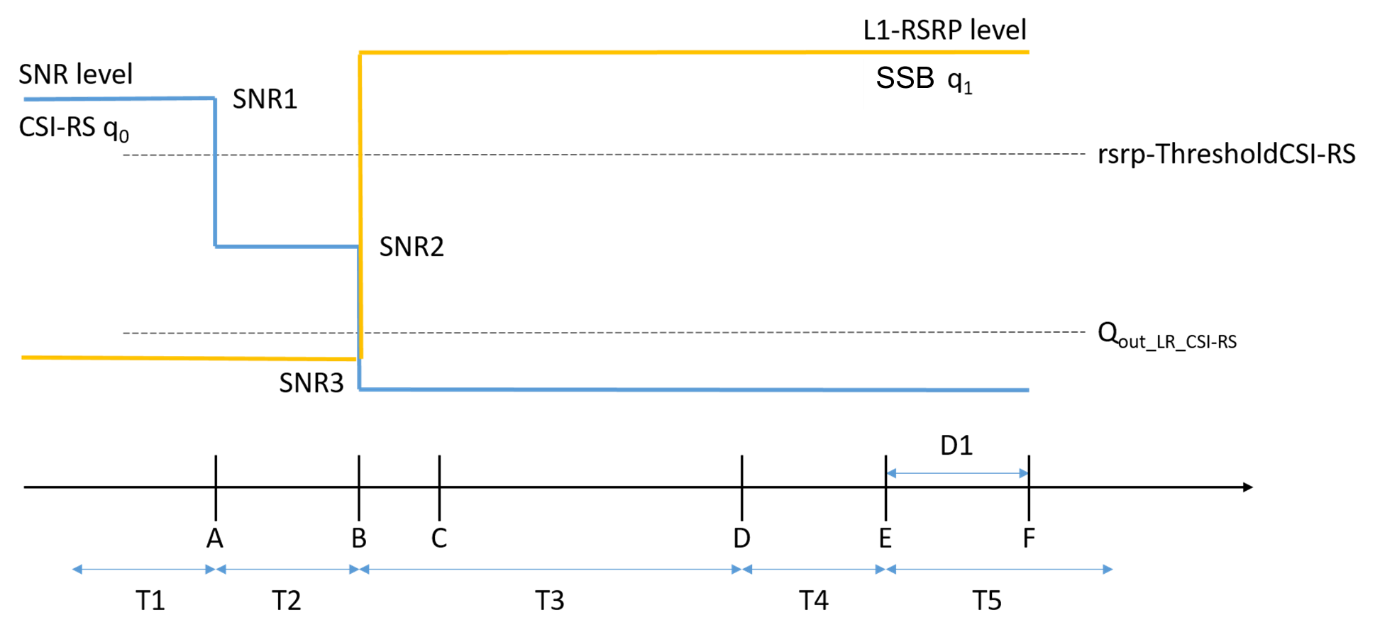


Figure 6.5.5.6.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery for SCell in DRX

6.5.5.6.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.6.4.1-1.

Table 6.5.5.6.4.1-1: Supported test configurations for FR1 PCell and SCell

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.5.6-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.6-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.5.6-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.6.4.1-2.

Table 6.5.5.6.4.1-2: Initial conditions for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery for SCell 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.6.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.6.4.1-3.

2. Message contents are defined in clause 6.5.5.6.4.3.

3. There is one NR carrier and two NR cells specified in the test. Cell 1 is the NR cell (PCell) used for connection setup and Cell 2 is the NR cell (SCell) with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.6.4.1-3: General test parameters for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery for SCell in DRX

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | | **Unit** | **Value** | **Comment** |
| **Test 1** |
| Active PCell | | | |  | Cell 1 |  |
| RF Channel Number for PCell | | | |  | 1 |  |
| Active SCell | | | |  | Cell 2 |  |
| RF Channel Number for SCell | | | |  | 2 |  |
| Duplex mode | Config 1 | | |  | FDD |  |
| Config 2, 3 | | | TDD |  |
| BWchannel | Config 1 | | | MHz | 10: NRB,c = 52 |  |
|  | Config 2 | | |  | 10: NRB,c = 52 |  |
|  | Config 3 | | |  | 40: NRB,c = 106 |  |
| TDD Configuration | Config 1 | | |  | Not Applicable |  |
| Config 2 | | | TDDConf.1.1 |  |
| Config 3 | | | TDDConf.2.1 |  |
| CORESET Reference Channel | Config 1 | | |  | CR.1.1 FDD | A.1.2 |
| Config 2 | | | CR.1.1 TDD |
| Config 3 | | | CR.2.1 TDD |
| SSB Configuration | Config 1 | | |  | SSB.1 FR1 | A.3 |
| Config 2 | | | SSB.1 FR1 |
| Config 3 | | | SSB.2 FR1 |
| SMTC Configuration | Config 1, 2 | | |  | SMTC.1 | A.4 |
| Config 3 | | | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | | kHz | 15 |  |
| Config 3 | | | 30 |  |
| PRACH Configuration | Config 1, 2 | | |  | PRACH.2 FR1 | Table A.7.1-1 |
| Config 3 | | |  | PRACH.2 FR1 | Table A.7.1-1 |
| csi-RS-Index assigned as beam failure detection RS in set q0 in activated SCell | | | |  | 0 |  |
| OCNG parameters | | | |  | OP.1 | A.2.1 |
| CP length | | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | | |  | 1-0 |  |
| Number of Control OFDM symbols | | |  | 2 |  |
| Aggregation level | | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | | dB | 0 |  |
| DMRS precoder granularity | | |  | REG bundle size |  |
| REG bundle size | | |  | 6 |  |
| DRX | | | |  | DRX.7 | A.5 |
| Gap pattern ID | | | |  | N.A. |  |
| schedulingRequestID-BFR-SCell-r16 | | | |  | absent | When the field is absent, the random access procedure will be triggered for SCell BFR |
| SSB Index assigned as CBD RS (q1) in activated SCell | | | |  | 0 |  |
| rlmInSyncOutOfSyncThreshold | | | |  | absent | When the field is absent, the UE applies the value 0. (TS 38.133 [6] Table 8.1.1-1). |
| rsrp-ThresholdBFR | | Config 1, 2 | | dBm/SCS | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | | -95 |
| powerControlOffsetSS | | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | |  | n1 | see clause 5.17 of TS 38.321 [12] |
| beamFailureDetectionTimer | | | |  | pbfd4 | see clause 5.17 of TS 38.321 [12] |
| CSI-RS configuration for q0 in activated SCell | | | Config 1 |  | CSI-RS.1.2 FDD | A.1.4 |
| Config 2 | CSI-RS.1.2 TDD |
| Config 3 | CSI-RS.2.2 TDD |
| CSI-RS configuration for CSI reporting | | | Config 1 |  | CSI-RS.1.1 FDD | A.1.4 |
| Config 2 |  | CSI-RS.1.1 TDD |
| Config 3 |  | CSI-RS.2.1 TDD |
| TRS configuration | | | Config 1 |  | TRS.1.1 FDD |  |
| Config 2 |  | TRS.1.1 TDD |  |
| Config 3 |  | TRS.1.2 TDD |  |
| CSI-RS-Index assigned as RLM RS in PCell | | | Config 1 |  | CSI-RS.1.2 FDD | A.1.4 |
| Config 2 |  | CSI-RS.1.2 TDD |
| Config 3 |  | CSI-RS.2.2 TDD |
| T310 Timer | | | | ms | 1000 |  |
| N310 | | | |  | 2 |  |
| T1 | | | | s | 1 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | | s | 8.37 |  |
| T3 | | | | s | 6.44 |  |
| T4 | | | | s | 0 |  |
| T5 | | | | s | 1.97 |  |
| D1 | | | | s | 1.93 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | | |

6.5.5.6.4.2 Test procedure

Same test procedure as described in section 6.5.5.3.4.2, except following exception and step 7 and 8:

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 not enabled.

7. If the SS:

a) detects uplink power on the PCell equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 the PCell before time point B

and

c) detects preamble on the preconfigured PRACH resource before time point F (D1 after the start of T5).

And

d) SS transmits a RAR to UE after receiving the preamble transmitted by the UE. SS detects the MAC-CE on the PCell transmitted by the UE providing the index for the activated SCell, and the index for the SSB provided by higher layer.

the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

8. If the iteration or random access procedure for BFD fails, the SS shall first attempt to release and add the FR1 SCell, by ensuring the UE is in state RRC\_CONNECTED with generic procedure parameters *Connectivity* NR, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [6] clause 4.5. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration.

6.5.5.6.4.3 Message contents

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

Table 6.5.5.6.4.3-1: Common Exception messages for NR SA FR1 SCell CSI-RS-based beam failure detection and SSB-based 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 SSB  Table H.3.1-10A  Table H.3.5-4  Table H.3.7-1 with Condition ‘DRX.7’  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1 |

Table 6.5.5.6.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.6.4.3-3: *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 6.5.5.6.4.3-4: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.6.4.3-5: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

6.5.5.6.5 Test requirement

Tables 6.5.5.6.4.1-3 and 6.5.5.6.5-1 define the primary level settings including test tolerances for NR SA FR1 SCell CSI-RS-based beam failure detection and SSB-based link recovery in DRX.

Table 6.5.5.6.5-1: NR Cell specific test parameters for NR SA FR1 SCell CSI-RS-based beam failure detection and SSB-based link recovery in DRX

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Test 1 Cell2 | | | | |
|  | **T1 to T5** | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB |  | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  |
| EPRE ratio of PBCH DMRS to SSS | | dB |  |
| EPRE ratio of PBCH to PBCH DMRS | | dB |  |
| EPRE ratio of PSS to SSS | | dB | 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 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 2 | dB | 5 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| Config 3 | dB | 5 | 5.8 | -2.2 | -12.8 | -12.8 | -12.8 |
| SNR\_SSB of set q1 | Config 1 | dB | -10 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 2 | dB | -10 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| Config 3 | dB | -10 | -10.2 | -10.2 | 10.2 | 10.2 | 10.2 |
| SSB\_RP of set q1 | Config 1 | dBm/ | -110 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 2 | SCS kHz | -110 | -108.2 | -108.2 | -87.8 | -87.8 | -87.8 |
| Config 3 |  | -107 | -105.2 | -105.2 | -84.8 | -84.8 | -84.8 |
|  | Config 1 | dBm/15 | -98 | -98 | | | | |
| Config 2 | kHz | -98 | -98 | | | | |
| Config 3 |  | -98 | -98 | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 4: 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 6.5.5.6.4-1.  Note 9: The SNR values are specified for a UE with 2RX antennas connected under test. For a UE with 4RX antennas connected under test, the SNR for RS in set q0 during T3, T4, and T5 from D.4.1.1, is -15dB-TT = -15.8dB (including test tolerances). | | | | | | | | |

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 = 120+10 ms after the start of T5, the UE shall transmit preamble for UL-SCH resource application, followed by MAC-CE on the assigned uplink resources containing  a beam associated with the candidate beam set q1. The UE shall not transmit preamble earlier than time point B.

During T5, the System Simulator shall transmit a Random Access Response to UE after the System Simulator receives the preamble from UE. The UE shall transmit the msg.3 containing candidate beam set q1 for SCell BFR if UE receives the Random Access Response.

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%.

#### 6.5.5.7 NR SA FR1 PCell TRP Specific CSI-RS-based Beam Failure Detection and Link Recovery in DRX

Editor's Note: This test case is incomplete in following aspects:

- TT analysis has not been provided

- TS 38.522 applicability spec update is pending

6.5.5.7.1 Test purpose

The purpose of this test is to verify that the UE properly detects TRP specific CSI-RS-based beam failure in the sets q0,0  and q0,1  configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q1,0 andq1,1. The purpose is to test the downlink monitoring for beam failure detection on TRP1 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 TRP specific beam failure detection and link recovery for an FR1 serving cell requirements in TS 38.133 [6] clause 8.18 with *schedulingRequestID-BFR-r17* configured.

6.5.5.7.2 Test applicability

This test applies to all types of NR UE release 17 and forward supporting 5GS NR SA FR1, CSI-RS based RLM, TRP Specific CSI-RS-based link recovery and PCell beam failure recovery.

6.5.5.7.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.5.7.

6.5.5.7.4 Test description

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.7.1-1 shows the variation of the downlink SNR of the CSI-RS in set q0,0  and q0,1  for TRP1 and TRP2 respectively to emulate CSI-RS based beam failure on TRP1. Figure A.6.5.5.7.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q1,0 andq1,1 of the candidate beam used for link recovery.

Chart

Description automatically generated with medium confidence

Figure 6.5.5.7.4-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

6.5.5.7.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.5.7.4.1-1.

Table 6.5.5.7.1-1: Supported test configurations for FR1 PCell

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

Configure the test equipment and the DUT according to the parameters in Table 6.5.5.7.4.1-2.

Table 6.5.5.7.4.1-2: Initial conditions for NR SA FR1 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.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.5.7.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE Part | |  |

1. The general test parameter settings are set up according to Table 6.5.5.7.4.1-3.

2. Message contents are defined in clause 6.5.5.7.4.3.

3. There is one NR carrier and one NR cells specified in the test. Cell 1 is the NR cell used for connection setup with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.5.7.4.1-3: General test parameters for FR1 PCell for CSI-RS-based TRP specific beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | | **Unit** | **Value** | **Comment** |
|  | | | |  | **Test1** |  |
| Active PCell | | | |  | Cell 1 |  |
| RF Channel Number | | | |  | 1 |  |
| Duplex mode | | Config 1 | |  | FDD |  |
|  | | Config 2, 3 | |  | TDD |  |
| TDD Configuration | | Config 1 | |  | Not Applicable |  |
|  | | Config 2 | |  | TDDConf.1.1 |  |
|  | | Config 3 | |  | TDDConf.2.1 |  |
| RMSI CORESET Reference Channel | | Config 1 | |  | CR.1.1 FDD |  |
|  | | Config 2 | |  | CR.1.1 TDD |  |
|  | | Config 3 | |  | CR.2.1 TDD |  |
| Dedicated CORESET Reference Channel | | Config 1 | |  | CCR.1.1 FDD |  |
|  | | Config 2 | |  | CCR.1.1 TDD |  |
|  | | Config 3 | |  | CCR.2.1 TDD |  |
| SSB Configuration | | Config 1 | |  | SSB.3 FR1 |  |
|  | | Config 2 | |  | SSB.3 FR1 |
|  | | Config 3 | |  | SSB.4 FR1 |
| SMTC Configuration | | Config 1, 2 | |  | SMTC.1 |  |
|  | | Config 3 | |  | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | | Config 1, 2 | |  | 15 KHz |  |
| Config 3 | |  | 30 KHz |  |
| PRACH  Configuration | | Config 1, 2,3 | |  | FR1 PRACH configuration 4 |  |
| OCNG parameters | | | |  | OP.1 |  |
| CP length | | | |  | Normal |  |
| Correlation Matrix and Antenna Configuration | | | |  | 2x2 Low |  |
| Beam failure detection transmission parameters | DCI format | | |  | 1-0 |  |
| Number of Control OFDM symbols | | |  | 2 |  |
| Aggregation level | | | CCE | 8 |  |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | | | dB | 0 |  |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | | | dB | 0 |  |
| DMRS precoder granularity | | |  | REG bundle size |  |
| REG bundle size | | |  | 6 |  |
| DRX | | | |  | DRX.7 |  |
| Gap pattern ID | | | |  | N.A. |  |
| schedulingRequestID-BFR- r17 | | | |  | Configured |  |
| Periodicity of PUCCH for SR configuration for BFR on PCell | | | Config 1 | slot | 5 | 5ms |
| Config 2, 3 | 10 |
| rlmInSyncOutOfSyncThreshold | | | |  | absent | When the field is absent, the UE applies the value 0. |
| rsrp-ThresholdSSB | | Config 1, 2 | | dBm/SCS kHz | -98 | Threshold used for Qin\_LR\_SSB |
| Config 3 | | -95 |
| powerControlOffsetSS | | | |  | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | |  | n1 | see clause 5.17 of TS 38.321 [12] |
| beamFailureDetectionTimer | | | |  | pbfd4 | see clause 5.17 of TS 38.321 [12] |
| CSI-RS configuration for TRP0 | | Config 1 | |  | CSI-RS.1.2 FDD |  |
| Config 2 | |  | CSI-RS.1.2 TDD |
| Config 3 | |  | CSI-RS.2.2 TDD |
| CSI-RS configuration for TRP1 | | Config 1 | |  | CSI-RS.1.7 FDD |  |
| Config 2 | |  | CSI-RS.1.6 TDD |  |
| Config 3 | |  | CSI-RS.2.7 TDD |  |
| CSI-RS Index assigned as BFD RS (q0,0) | | | |  | 0 |  |
| CSI-RS Index assigned as CBD RS (q1,0) | | | |  | 1 |  |
| CSI-RS Index assigned as BFD RS (q0,1) | | | |  | 2 |  |
| CSI-RS Index assigned as CBD RS (q1,1) | | | |  | 3 |  |
| CSI-RS index assigned as RLM RS | | | |  | 0,1,2,3 |  |
| CSI-RS configuration for CSI reporting | | Config 1 | |  | CSI-RS.1.1 FDD |  |
| Config 2 | |  | CSI-RS.1.1 TDD |  |
| Config 3 | |  | CSI-RS.2.1 TDD |  |
| TRS configuration | | Config 1 | |  | TRS.1.1 FDD |  |
| Config 2 | |  | TRS.1.1 TDD |  |
| Config 3 | |  | TRS.1.2 TDD |  |
| T310 Timer | | | | ms | 1000 |  |
| N310 | | | |  | 2 |  |
| T1 | | | | s | 1 | During this time the UE shall be fully synchronized to cell 1 |
| T2 | | | | s | 8.37 |  |
| T3 | | | | s | 6.44 |  |
| T4 | | | | s | 0 |  |
| T5 | | | | s | 1.97 |  |
| D1 | | | | s | 1.93 |  |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | | |

6.5.5.7.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. 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 *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters of NR Cell 1 according to T1 in Table 6.5.5.7.5-1. 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 6.5.5.7.5-1. T2 starts.

4. When T2 expires the SS shall change the SNR1 and SNR2 values to T3 as specified in Table 6.5.5.7.5-1. T3 starts.

5. When T3 expires the SS shall change the SNR1 and SNR2 values to T4 as specified in Table 6.5.5.7.5-1. T4 starts.

6. When T4 expires the SS shall change the SNR1 and SNR2 values to T5 as specified in Table 6.5.5.7.5-1. T5 starts.

7. If the SS:

a) detects uplink power on NR carrier equal to or higher than minimum output power defined in TS 38.521-1 [17] clause 6.3.1.5 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 q10 and q11 before time point B

and

c) detects preamble on 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.

8. If iteration or the random access procedure for BFD fails, switch the UE off and on. Ensure the UE is in RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

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.

6.5.5.7.4.3 Message contents

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

Table 6.5.5.7.4.3-1: Common Exception messages for NR SA FR1 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.3.1-8A with Condition CSI-RS BFD  Table H.3.1-10 with Condition CSI-RS  Table H.3.1-10A  Table H.3.1-11 with Condition CSI-RS  Table H.3.5-4  Table H.3.7-1 with Condition DRX.7  Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1, |

Table 6.5.5.4.4.3-2: 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 | 4 | BFR |  |
| controlResourceSetId | 2 | BFR |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbol 0 |  |
| 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 6.5.5.4.4.3-3: *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 6.5.5.4.4.3-4: Void

Table 6.5.5.3.4.3-5: *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 6.5.5.4.4.3-6: *PDCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [14],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[2] | ControlResourceSet | entry 2, 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 6.5.5.4.4.3-7: ControlResourceSet for BFR

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.501-1 [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 |  |  |
| } |  |  |  |

Table 6.5.5.4.4.3-8:*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 |  |  |
| } |  |  |  |

6.5.5.7.5 Test requirement

Tables 6.5.5.7.4.1-3 and 6.5.5.7.5-1 define the primary level settings including test tolerances for NR SA FR1 TRP specific CSI-RS-based beam failure detection and link recovery in DRX.

Table 6.5.5.7.5-1: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | |
|  | |  | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PDCCH DMRS to SSS | | dB | 0 | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB |  | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB |  | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB |  | | | | |
| EPRE ratio of PSS to SSS | | dB |  | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB |  | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB |  | | | | |
| EPRE ratio of OCNG DMRS to SSS | | dB |  | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | dB |  | | | | |
| SNR\_CSI-RS of set q0,0 | Config 1 | dB | 5+TT | -3+TT | -12+TT | -12+TT | -12+TT |
|  | Config 2 |  | 5+TT | -3+TT | -12+TT | -12+TT | -12+TT |
|  | Config 3 |  | 5+TT | -3+TT | -12+TT | -12+TT | -12+TT |
| SNR\_CSI-RS of set q0,1 | Config 1 | dB | 5+TT | 5+TT | 5+TT | 5+TT | 5+TT |
|  | Config 2 |  | 5+TT | 5+TT | 5+TT | 5+TT | 5+TT |
|  | Config 3 |  | 5+TT | 5+TT | 5+TT | 5+TT | 5+TT |
| SNR\_CSI-RS of set q1,0 | Config 1 | dB | 0.2+TT | 0.2+TT | 20.2+TT | 20.2+TT | 20.2+TT |
|  | Config 2 |  | 0.2+TT | 0.2+TT | 20.2+TT | 20.2+TT | 20.2+TT |
|  | Config 3 |  | 0.2+TT | 0.2+TT | 20.2+TT | 20.2+TT | 20.2+TT |
| CSI-RS\_RP of set q1,0 | Config 1 | dB/SCS kHz | -110+TT | -110+TT | -88+TT | -88+TT | -88+TT |
|  | Config 2 |  | -110+TT | -110+TT | -88+TT | -88+TT | -88+TT |
|  | Config 3 |  | -107+TT | -107+TT | -85+TT | -85+TT | -85+TT |
|  | Config 1 | dBm/15 KHz | -98+TT | | | | |
|  | Config 2 |  | -98+TT | | | | |
|  | Config 3 |  | -98+TT | | | | |
| Propagation condition | |  | TDL-C 300ns 100Hz | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.  Note 4: 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 6.5.5.7.4-1.  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 TS38.133 A.3.6. | | | | | | | |

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 q1,0.

No later than time point F occurring no later than D1 = 1920+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%.

### 6.5.6 Active BWP switch delay

#### 6.5.6.1 DCI-based and time-based active BWP switch

##### 6.5.6.1.0 Minimum conformance requirements

6.5.6.1.0.1 Minimum conformance requirements for DCI-based and time-based active BWP switch

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 which starts from the beginning of DL slot n.

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* [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* [13] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [13], UE shall finish BWP switch within the time duration TBWPswitchDelay defined in Table 6.5.6.1.0.1-1.

Table 6.5.6.1.0.1-1: BWP switch delay

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | BWP switch delay TBWPswitchDelay (slots) | |
| 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 |
| 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 TS 38.133 [6] Clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in TS 38.133 [6] Clause 8.10 in the new BWP.

If the BWP switch is triggered within 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

- TBWPswitchDelay, provided that the BWP switching request is received in any of the first 3 OFDM symbols of a slot corresponding to the serving cell where BWP switching occurs, or

- TBWPswitchDelay + 1, provided that the BWP switching request is received after the first 3 OFDM symbols of a slot corresponding to the serving cell where BWP switching occurs

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this section apply for each BWP switch.

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in Table 6.5.6.1.0.1-3, the UE is allowed to cause interruption of up to X slot to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 6.5.6.1.0.1-3 and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 6.5.6.1.0.1-2. The starting time of interruption is only allowed within the BWP switching delay TBWPswitchDelay as defined in TS 38.133 [6] clause 8.6.2. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [13] expires, UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 6.5.6.1.0.1-3 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 6.5.6.1.0.1-3 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 6.5.6.1.0.1-2. The starting time of interruption is only allowed within the BWP switching delay TBWPswitchDelay as defined in TS 38.133 [6] clause 8.6.2. Interruptions are not allowed during BWP switch involving any other parameter change.

Table 6.5.6.1.0.1-2: Interruption length X

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | interruption length X (slots) |
|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 3 |
| 3 | 0.125 | 5 |
| Note1: void | | |

Table 6.5.6.1.0.1-3: Parameters which cause interruption other than SCS

|  |  |
| --- | --- |
| Parameters | Comment |
| *locationAndBandwidth* | From TS 38.331 [13] |
| *nrofSRS-Ports* |
| *maxMIMO-Layers-r16* |

The normative reference for this requirement is TS 38.133 [6] clauses 8.6.2 and 8.2.1.2.7

##### 6.5.6.1.1 NR SA FR1-FR1 DCI-based DL active BWP switch in non-DRX

6.5.6.1.1.1 Test purpose

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS 38.133 [6] clause 8.6, and interruption requirement on other active serving cell defined in TS 38.133 [6] clause 8.2.2.2.5.

6.5.6.1.1.2 Test applicability

This test applies to all types of NR UE release 15 onwards supporting BWP adaptation of at least 2 BWPs, DCI and timer-based active BWP switching delay Type1 or Type2 and 2DL CA.

6.5.6.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.6.1.1.

6.5.6.1.1.4 Test description

6.5.6.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in this clause. The supported test configurations for PCell are shown in Table 6.5.6.1.1.4.1-1. Supported test configurations for NR SCell are shown in Table 6.5.6.1.1.4.1-1A below. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

Table 6.5.6.1.1.4.1-1: Supported test configurations for NR PCell for NR SA FR1-FR1 DCI-based DL active BWP switch with SCell in non-DRX

|  |  |
| --- | --- |
| **Config** | **Description** |
| 6.5.6.1.1-1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 6.5.6.1.1-2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 6.5.6.1.1-3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Table 6.5.6.1.1.4.1-1A: Supported test configurations for NR SCell for NR SA FR1-FR1 DCI-based DL active BWP switch with SCell in non-DRX

|  |  |
| --- | --- |
| **ConfigSCell** | **Description** |
| 1 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations  Note 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration, | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.6.1.1.4.1-2.

Table 6.5.6.1.1.4.1-2: Initial conditions for NR SA FR1-FR1 DCI-based DL active BWP switch 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.6.1.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.8.2 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part. | |  |

1. The general test parameter settings are set up according to Table 6.5.6.1.1.4.1-3.

2. Message contents are defined in clause 6.5.6.1.1.4.3.

3. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2). Cell 1 and Cell 2 are configured according to Annex C.1.2 and C.1.3.

4. By step 4 of the test procedure:

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).

- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PCell, BWP-0 in Cell 1 before starting the test.

- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 in SCell.

- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-0 in PCell.

- UE is configured with a bwp-InactivityTimer timer value for SCell.

Table 6.5.6.1.1.4.1-3: General test parameters for DL BWP switch in SA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1, 2 | Two NR radio channels are used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| Active SCell |  | Cell 2 | SCell on RF channel number 2. |
| CP length |  | Normal |  |
| DRX |  | OFF | For both PCell 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 SCC. |
| Cell2 timing offset to cell1 | μs | 3 | Time alignment error as specified in TS 38.104 [28] clause 6.5.3.1. |
| T1 | s | 0.2 |  |
| T2 | s | 0.2 |  |
| T3 | s | 0.2 |  |

6.5.6.1.1.4.2 Test procedure

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

All cells have constant signal levels throughout the test.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. The SS shall configure SCell (Cell 2) on the SCC as per TS 38.508-1 [14] clause 7.5.1. Set the parameters according to Tables 6.5.6.1.1.4.1-3 and 6.5.6.1.1.5-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. The SS shall transmit an *RRCReconfiguration* message releasing the dedicated configuration of the *initialDownlinkBWP* and the *initialUplinkBWP* of Cell 2. This message also configures 2 different UE-specific bandwidth parts for Cell 2, BWP-1 and BWP-2, which always include the bandwidth of the initial DL BWP and SSB. The SS indicates BWP-1 as the active DL BWP using *firstActiveDownlinkBWP-Id*, according to Table 6.5.6.1.1.4.3-2. UE is configured with a *bwp-InactivityTimer* timer value for SCell.

4. The SS shall send a DCI format 1\_1 command for SCell DL BWP switch.

5. The UE shall receive the DCI format 1\_1 command in SCell’s slot # denoted i, then T1 starts and the UE switch its bandwidth part from BWP-1 to BWP-2:

a) If the UE starts to report valid ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot (*i+*TBWPswitchDelay+k1)

and

b) If the UE starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (*i+*TBWPswitchDelay+ Interruption length + k1)

and

c) If the number of consecutive missing ACK/NACK for PCell is no more than 1

Then, the number of successful subtests is increased by one. Otherwise, count a fail for the test, switch off/on the UE and go to step 1.

6. If the UE sends valid ACK/NACK for the SCell on BWP-2, T2 starts. During T2, the SS shall not transmit DCI format for PDSCH reception on SCell.

7. T3 starts from the first slot #j of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires and the SS restarts to send DCI format for PDSCH reception on SCell. Then, the UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1:

a) If the UE starts to report valid ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot (*j+*TBWPswitchDelay+k1)

and

b) If the UE starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (*j+*TBWPswitchDelay+ Interruption length + k1)

and

c) If the number of consecutive missing ACK/NACK for PCell is no more than 1.

Then, the number of successful subtests is increased by one. Otherwise, count a fail for the test, switch off/on the UE and go to step 1.

8. Repeat steps 4-7 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

The SS verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The SS verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of SCell, respectively.

Interruption length is defined in TS 38.133 [6] Table 8.2.2.2.5-1-1.

If all subtests pass, the test passes. If one subtest fails, the test fails.

6.5.6.1.1.4.3 Message contents

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

Table 6.5.6.1.1.4.3-1: Common Exception messages for NR SA FR1-FR1 DCI-based DL active BWP switch in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |

Table 6.5.6.1.1.4.3-1A: *RRCReconfiguration* (Step 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.8.1-1B | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig | Table 6.5.6.1.1.4.3-1B |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.6.1.1.4.3-1B: *CellGroupConfig* (Table 6.5.6.1.1.4.3-1A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.8.1-2 with condition SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellConfigDedicated | ServingCellConfig | Table 6.5.6.1.1.4.3-2 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.1.4.3-2: *ServingCellConfig* (Table 6.5.6.1.1.4.3-1B)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 SEQUENCE { | 2 entries |  |  |
| BWP-Downlink[1] | BWP-Downlink with condition BWP1 | entry 1  Table 6.5.6.1.1.4.3-3 |  |
| BWP-Downlink[2] | BWP-Downlink with condition BWP2 | entry 2  Table 6.5.6.1.1.4.3-3 |  |
| } |  |  |  |
| firstActiveDownlinkBWP-Id | 1 | According to BWP-1 |  |
| bwp-InactivityTimer | ms200 |  |  |
| defaultDownlinkBWP-Id | 1 | According to BWP-1 |  |
| } |  |  |  |

Table 6.5.6.1.1.4.3-3: *BWP-Downlink* (Table 6.5.6.1.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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-1 | BWP1 |
|  | 2 | BWP-2 | BWP2 |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters | RIV defined in TS 38.214 [9] that corresponds to DLBWP.1.1 |  | BWP1 |
|  | RIV defined in TS 38.214 [9] that corresponds to DLBWP.1.3 |  | BWP2 |
| pdsch-ConfigCommon CHOICE { |  |  |  |
| setup | PDSCH-ConfigCommon | Table 6.5.6.1.1.4.3-9 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.1.4.3-4: *Void*

Table 6.5.6.1.1.4.3-5: *Void*

Table 6.5.6.1.1.4.3-6: *PDSCH-TimeDomainResourceAllocationList* (Table 6.5.6.1.1.4.3-9)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-103 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation { | 4 entries |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 72 | S=2, L=6 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[3] SEQUENCE { |  | entry 3 |  |
| k0 | TBWPswitchDelay | Defined in Table 6.5.6.1.0.1-1 | The DCI indicating BWP switch |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[4] SEQUENCE { |  | entry 4 |  |
| k0 | 1 |  | First DCI right after DCI-based BWP switch |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.1.4.3-7: Void

Table 6.5.6.1.1.4.3-8: *Void*



Table 6.5.6.1.1.4.3-9: *PDSCH-ConfigCommon* (Table 6.5.6.1.1.4.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-101 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| pdsch-TimeDomainAllocationList | PDSCH-TimeDomainResourceAllocationList | Table 6.5.6.1.1.4.3-6 |  |
| } |  |  |  |

6.5.6.1.1.5 Test requirements

Tables 6.5.6.1.1.4.1-3 and 6.5.6.1.1.5-1 and 6.5.6.1.1.5-2 define the primary level settings including test tolerances.

Table 6.5.6.1.1.5-1: NR Cell specific test parameters for NR PCell for DL BWP switch in SA

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell 1** |
| Frequency Range | |  | FR1 |
| Duplex mode | Config 1 |  | FDD |
|  | Config 2,3 |  | TDD |
| TDD configuration | Config 1 |  | Not Applicable |
|  | Config 2 |  | TDDConf.1.1 |
|  | Config 3 |  | TDDConf.1.2 |
| BWchannel | |  | Note 7 |
| BWoccupied | Config 1,2 | RB | 52 Note 5 |
|  | Config 3 |  | 106 Note 6 |
| Active BWP ID | |  | 0 |
| Initial DL BWP Configuration | |  | DLBWP.0.2Note4 |
| Initial UL BWP Configuration | |  | ULBWP.0.2Note4 |
| Active DL BWP-0 Configuration | |  | DLBWP.0.2Note4 |
| Active DL BWP-1 Configuration | |  | N.A. |
| Active DL BWP-2 Configuration | |  | N.A. |
| Active UL BWP-0 Configuration | |  | ULBWP.0.2Note4 |
| Active UL BWP-1 Configuration | |  | N.A. |
| Active UL BWP-2 Configuration | |  | N.A. |
| PDSCH Reference | Config 1 |  | SR.1.1 FDD |
| measurement channel | Config 2 |  | SR.1.1 TDD |
|  | Config 3 |  | SR.2.1 TDD |
| RMSI CORESET | Config 1 |  | CR.1.1 FDD |
| parameters | Config 2 |  | CR.1.1 TDD |
|  | Config 3 |  | CR.2.1 TDD |
| Dedicated CORESET | Config 1 |  | CCR.1.2 FDD |
| parameters | Config 2 |  | CCR.1.2 TDD |
|  | Config 3 |  | CCR.2.4 TDD |
| TRS Configuration | Config 1 |  | TRS.1.1 FDD |
|  | Config 2 |  | TRS.1.1 TDD |
|  | Config 3 |  | TRS.1.2 TDD |
| OCNG Patterns | Config 1,2 |  | OP.1 Note 5 |
|  | Config 3 |  | OP.1 Note 6 |
| SSB Configuration | Config 1,2 |  | SSB.1 FR1 |
|  | Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | |  | SMTC.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) | |  |  |
| NocNote 2 | Config 1,2 | dBm/SCS | -104 |
|  | Config 3 |  | -101 |
| NocNote 2 | | dBm/15KHz | -104 |
| SS-RSRP Note 3 | Config 1,2 | dBm/SCS | -87 |
|  | Config 3 |  | -84 |
| Ês/Iot | | dB | 17 |
| Ês/Noc | | dB | 17 |
| IoNote3 | Config 1,2 | dBm/  9.36MHz | -58.96 |
|  | Config 3 | dBm/  38.16MHz | -52.86 |
| 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.  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 within BWoccupied.  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 [3].  Note 5: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 6: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 7: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel. | | | |

Table 6.5.6.1.1.5-2: NR Cell specific test parameters for NR SCell for DL BWP switch in SA

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell2** |
| Frequency Range | |  | FR1 |
| Duplex mode | ConfigSCell 1 |  | FDD |
|  | ConfigSCell 2,3 |  | TDD |
| TDD configuration | ConfigSCell 1 |  | Not Applicable |
|  | ConfigSCell 2 |  | TDDConf.1.1 |
|  | ConfigSCell 3 |  | TDDConf.1.2 |
| BWchannel | |  | Note 7 |
| BWoccupied | ConfigSCell 1,2 | RB | 52 Note 5 |
|  | ConfigSCell 3 |  | 106 Note 6 |
| Active BWP ID | |  | 1, 2 |
| Initial DL BWP Configuration | |  | DLBWP.0.2Note4 |
| Initial UL BWP Configuration | |  | N.A. |
| Active DL BWP-0 Configuration | |  | N.A. |
| Active DL BWP-1 Configuration | |  | DLBWP.1.1Note4 |
| Active DL BWP-2 Configuration | |  | DLBWP.1.3Note4 |
| Active UL BWP-0 Configuration | |  | N.A. |
| Active UL BWP-1 Configuration | |  | N.A. |
| Active UL BWP-2 Configuration | |  | N.A. |
| PDSCH Reference | ConfigSCell 1 |  | SR.1.1 FDD |
| measurement channel | ConfigSCell 2 |  | SR.1.1 TDD |
|  | ConfigSCell 3 |  | SR.2.1 TDD |
| RMSI CORESET | ConfigSCell 1 |  | CR.1.1 FDD |
| parameters | ConfigSCell 2 |  | CR.1.1 TDD |
|  | ConfigSCell 3 |  | CR.2.1 TDD |
| Dedicated CORESET | ConfigSCell 1 |  | CCR.1.2 FDD |
| parameters | ConfigSCell 2 |  | CCR.1.2 TDD |
|  | ConfigSCell 3 |  | CCR.2.4 TDD |
| TRS Configuration | ConfigSCell 1 |  | TRS.1.1 FDD |
|  | ConfigSCell 2 |  | TRS.1.1 TDD |
|  | ConfigSCell 3 |  | TRS.1.2 TDD |
| OCNG Patterns | ConfigSCell 1,2 |  | OP.1 Note 5 |
|  | ConfigSCell 3 |  | OP.1 Note 6 |
| SSB Configuration | ConfigSCell 1,2 |  | SSB.1 FR1 |
|  | ConfigSCell 3 |  | SSB.2 FR1 |
| SMTC Configuration | |  | SMTC.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 | |  |  |
| NocNote 2 | ConfigSCell 1,2 | dBm/SCS | -104 |
|  | ConfigSCell 3 |  | -101 |
| NocNote 2 | | dBm/15KHz | -104 |
| SS-RSRP Note 3 | ConfigSCell 1,2 | dBm/SCS | -87 |
|  | ConfigSCell 3 |  | -84 |
| Ês/Iot | | dB | 17 |
| Ês/Noc | | dB | 17 |
| IoNote3 | ConfigSCell 1,2 | dBm/  9.36MHz | -58.96 |
|  | ConfigSCell 3 | dBm/  38.16MHz | -52.86 |
| 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.  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 within BWoccupied.  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 [3].  Note 5: All UL/DL transmission shall be confined within BWoccupied (i.e. 10 MHz, 52 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 6: All UL/DL transmission shall be confined within BWoccupied (i.e. 40 MHz, 106 RBs) from FC,low, and Io is independent of the BWchannel configured.  Note 7: NRB,c. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BWchannel. | | | |

During T1, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot (*i+*TBWPswitchDelay+k1).

During T3, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot (*j+*TBWPswitchDelay+k1).

Where, k1 is the timing between DL data receiving and acknowledgement as specified in [9].

Depending on UE capability *bwp-SwitchingDelay* [13], UE shall finish BWP switch within the time duration TBWPswitchDelay defined in TS 38.133 [6] Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch delay to be counted as correct.

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

During T1 and T3, the start time of PCell interruption during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS 38.133 [6] clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch interruption 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/NACK in the first UL slot that occurs after the beginning of DL slot (*i+* TBWPswitchDelay+k1), (*j+* TBWPswitchDelay+k1), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

##### 6.5.6.1.2 NR SA FR1 DCI-based DL active BWP switch in non-DRX

6.5.6.1.2.1 Test purpose

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS 38.133 [6] clause 8.6.

6.5.6.1.2.2 Test applicability

This test applies to all types of NR UE release 15 onwards supporting BWP adaptation of at least 2 BWPs, DCI and timer-based active BWP switching delay Type1 or Type2.

6.5.6.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.6.1.2.

6.5.6.1.2.4 Test description

6.5.6.1.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.6.1.2.4.1-1.

Table 6.5.6.1.2.4.1-1: Supported test configurations for NR SA FR1 DCI-based DL active BWP switch in non-DRX

|  |  |
| --- | --- |
| Config | Description |
| 6.5.6.1.2-1 | NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 6.5.6.1.2-2 | NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 6.5.6.1.2-3 | NR 30 kHz SSB SCS, 40 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 A.6.5.6.1.1 can skip the test cases in A.6.5.6.1.2 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.6.1.2.4.1-2.

Table 6.5.6.1.2.4.1-2: Initial conditions for NR SA FR1 DCI-based DL active BWP switch 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.6.1.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.8.2 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part. | |  |

1. The general test parameter settings are set up according to Table 6.5.6.1.2.4.1-3.

2. Message contents are defined in clause 6.5.6.1.2.4.3.

3. The test scenario comprises of one NR PCell (Cell 1). Cell 1 is configured according to Annex C.1.2 and C.1.3.

4. By step 4 of the test procedure:

- UE is connected to Cell 1 on radio channel 1.

- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1.

- UE is configured with a bwp-InactivityTimer timer value for PCell.

Table 6.5.6.1.2.4.1-3: General test parameters for DL BWP switch in SA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active Cell |  | Cell 1 | Cell1 on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| *bwp-InactivityTimer* | ms | 200 |  |
| T1 | s | 0.2 |  |
| T2 | s | 0.2 |  |
| T3 | s | 0.2 |  |

6.5.6.1.2.4.2 Test procedure

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

The Cell 1 has constant signal levels throughout the test.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Tables 6.5.6.1.2.4.1-3 and 6.5.6.1.2.5-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. The SS shall transmit an *RRCReconfiguration* message releasing the dedicated configuration of the *initialDownlinkBWP* and the *initialUplinkBWP*. This message also configures 2 different UE-specific bandwidth parts, BWP-1 and BWP-2, which always include the bandwidth of the initial DL BWP and SSB. The SS indicates BWP-1 as the active DL BWP using *firstActiveDownlinkBWP-Id*, according to Table 6.5.6.1.2.4.3-2. UE is configured with a bwp-InactivityTimer timer value for PCell.

4. The SS shall send a DCI format 1\_1 command for Cell 1 DL BWP switch.

5. The UE shall receive the DCI format 1\_1 command in slot # denoted i, then T1 starts and the UE switch its bandwidth part from BWP-1 to BWP-2:

If the UE starts to report valid ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot (*i+*TBWPswitchDelay+k1). The number of successful subtests is increased by one. Otherwise, count a fail for the test, switch off/on the UE and go to step 1.

6. If the UE sends valid ACK/NACK for the Cell 1 on BWP-2, T2 starts. During T2, the SS shall not transmit DCI format for PDSCH reception on Cell 1.

7. T3 starts from the first slot #j of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires and the SS restarts to send DCI format for PDSCH reception on PCell. Then, the UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part, BWP-1:

If the UE starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (*j+*TBWPswitchDelay+k1). The number of successful subtests is increased by one and go to step 8 after T3 expires. Otherwise, count a fail for the test, switch off/on the UE and go to step 1.

8. Repeat steps 4-7 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

The SS verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

If all subtests pass, the test passes. If one subtest fails, the test fails.

6.5.6.1.2.4.3 Message contents

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

Table 6.5.6.1.2.4.3-1: Common Exception messages for NR SA FR1 DCI-based DL active BWP switch in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |

Table 6.5.6.1.2.4.3-1A: *Void*

Table 6.5.6.1.2.4.3-1B: *Void*

Table 6.5.6.1.2.4.3-1C: *RRCReconfiguration* (Step 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.8.1-1B | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig | Table 6.5.6.1.2.4.3-1D |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.6.1.2.4.3-1D: *CellGroupConfig* (Table 6.5.6.1.2.4.3-1C)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.8.1-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated | ServingCellConfig | Table 6.5.6.1.2.4.3-2 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.2.4.3-2: *ServingCellConfig* (Table 6.5.6.1.2.4.3-1D)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 SEQUENCE { | 2 entries |  |  |
| BWP-Downlink[1] | BWP-Downlink with condition BWP1 | entry 1  Table 6.5.6.1.2.4.3-3 |  |
| BWP-Downlink[2] | BWP-Downlink with condition BWP2 | entry 2  Table 6.5.6.1.2.4.3-3 |  |
| } |  |  |  |
| firstActiveDownlinkBWP-Id | 1 | According to BWP-1 |  |
| bwp-InactivityTimer | ms200 |  |  |
| defaultDownlinkBWP-Id | 1 | According to 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 SEQUENCE { |  |  |  |
| BWP-Uplink[1] | BWP-Uplink with condition BWP1 | entry 1  Table 6.5.6.1.2.4.3-4 |  |
| BWP-Uplink[2] | BWP-Uplink with condition BWP2 | entry 2  Table 6.5.6.1.2.4.3-4 |  |
| firstActiveUplinkBWP-Id | 1 | According to BWP-1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.2.4.3-3: *BWP-Downlink* (Table 6.5.6.1.2.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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-1 | BWP1 |
|  | 2 | BWP-2 | BWP2 |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters | RIV defined in TS 38.214 [9] that corresponds to DLBWP.1.1 |  | BWP1 |
|  | RIV defined in TS 38.214 [9] that corresponds to DLBWP.1.3 |  | BWP2 |
| pdsch-ConfigCommon CHOICE { |  |  |  |
| setup | PDSCH-ConfigCommon | Table 6.5.6.1.2.4.3-8 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.2.4.3-4: *BWP-Uplink* (Table 6.5.6.1.2.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| 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-1 | BWP1 |
|  | 2 | BWP-2 | BWP2 |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters | RIV defined in TS 38.214 [9] that corresponds to ULBWP.1.1 | BWP-1 | BWP1 |
|  | RIV defined in TS 38.214 [9] that corresponds to ULBWP.1.3 | BWP-2 | BWP2 |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.2.4.3-5: *Void*

Table 6.5.6.1.2.4.3-6: *PDSCH-TimeDomainResourceAllocationList* (Table 6.5.6.1.1.4.3-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-103 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation { | 4 entries |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 72 | S=2, L=6 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[3] SEQUENCE { |  | entry 3 |  |
| k0 | TBWPswitchDelay | Defined in Table 6.5.6.1.0.1-1 | The DCI indicating BWP switch |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[4] SEQUENCE { |  | entry 4 |  |
| k0 | 1 |  | First DCI right after DCI-based BWP switch |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.1.2.4.3-7: *Void*



Table 6.5.6.1.2.4.3-8: *PDSCH-ConfigCommon* (Table 6.5.6.1.1.4.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-101 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| pdsch-TimeDomainAllocationList | PDSCH-TimeDomainResourceAllocationList | Table 6.5.6.1.2.4.3-6 |  |
| } |  |  |  |

6.5.6.1.2.5 Test requirements

Tables 6.5.6.1.2.4.1-3 and 6.5.6.1.2.5-1 define the primary level settings including test tolerances.

Table 6.5.6.1.2.5-1: NR Cell specific test parameters for DL BWP switch in SA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Cell 1 |
| Frequency Range | | | |  | FR1 |
| Duplex mode | | | Config 1 |  | FDD |
| Config 2,3 | TDD |
| TDD configuration | | | Config 1 |  | Not Applicable |
| Config 2 | TDDConf.1.1 |
| Config 3 | TDDConf.2.1 |
| BWchannel | | | Config 1 |  | 10 MHz: NRB,c = 52 |
| Config 2 | 10 MHz: NRB,c = 52 |
| Config 3 | 40 MHz: NRB,c = 106 |
| Active BWP ID | | | |  | 1, 2 |
| Initial DL BWP Configuration | | | Config 1,2,3 |  | DLBWP.0.2 Note 4 |
| Active DL BWP-1 Configuration | | | Config 1,2,3 |  | DLBWP.1.1 Note 4 |
| Active DL BWP-2 Configuration | | | Config 1,2,3 |  | DLBWP.1.3 Note 4 |
| Initial UL BWP Configuration | | | Config 1,2,3 |  | ULBWP.0.2 Note 4 |
| Active UL BWP-1 Configuration | | | Config 1,2,3 |  | ULBWP.1.1 Note 4 |
| Active UL BWP-2 Configuration | | | Config 1 |  | N/A |
| Config 2,3 | ULBWP.1.3 Note 4 |
| PDSCH Reference measurement channel | | | Config 1 |  | SR.1.1 FDD |
| Config 2 | SR.1.1 TDD |
| Config 3 | SR.2.1 TDD |
| RMSI CORESET parameters | | | Config 1 |  | CR.1.1 FDD |
| Config 2 | CR.1.1 TDD |
| Config 3 | CR.2.1 TDD |
| Dedicated CORESET parameters | | | Config 1 |  | CCR.1.2 FDD |
| Config 2 | CCR.1.2 TDD |
| Config 3 | CCR.2.4 TDD |
| OCNG Patterns | | | |  | OP.1 |
| SSB Configuration | | | Config 1,2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC Configuration | | |  |  | SMTC.1 |
| Correlation Matrix and Antenna Configuration | | | |  | 1x2 Low |
| TRS Configuration | | Config 1,4 | |  | TRS.1.1 FDD |
| Config 2,5 | |  | TRS.1.1 TDD |
| Config 3,6 | |  | TRS.1.2 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 | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| NocNote 2 | Config 1,2 | | | dBm/SCS | -104 |
| Config 3 | | | -101 |
| NocNote 2 | | | | dBm/15kHz | -104 |
| SS-RSRP Note 3 | Config 1,2 | | | dBm/SCS | -87 |
| Config 3 | | | -84 |
| Ês/Iot | | | | dB | 17 |
| Ês/Noc | | | | dB | 17 |
| IoNote3 | | | Config 1,2 | dBm/  9.36MHz | -58.96 |
| Config 3 | dBm/  38.16MHz | -52.86 |
| 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.  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]. | | | | | |

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (*i+*TBWPswitchDelay+k1).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs right after the beginning of DL slot (*j+*TBWPswitchDelay+k1).

Where, k1 is the timing between DL data receiving and acknowledgement as specified in 38.214[9].

Depending on UE capability *bwp-SwitchingDelay* [13], UE shall finish BWP switch within the time duration *TBWPswitchDelay* defined in TS 38.133 [6] Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell 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/NACK in the first UL slot that occurs after beginning of DL slot (*i+* TBWPswitchDelay+k1), (*j+* TBWPswitchDelay+k1), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

#### 6.5.6.2 RRC-based active BWP switch

##### 6.5.6.2.0 Minimum conformance requirements

6.5.6.2.0.1 Minimum conformance requirements for RRC-based active BWP switch

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, 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 a time duration of slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [13], 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.

The normative reference for this requirement is TS 38.133 [6] clauses 8.6.3.

##### 6.5.6.2.1 NR SA FR1 RRC-based DL active BWP switch in non-DRX

6.5.6.2.1.1 Test purpose

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in TS 38.133 [6] clause 8.6.

6.5.6.2.1.2 Test applicability

This test applies to all types of NR UE release 15 onwards supporting BWP adaptation of at least 2 BWPs.

6.5.6.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.6.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.6.2.1.

6.5.6.2.1.4 Test description

6.5.6.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.6.2.1.4.1-1.

Table 6.5.6.2.1.4.1-1: Supported test configurations for NR SA FR1 RRC-based DL active BWP switch in non-DRX

|  |  |
| --- | --- |
| Config | Description |
| 6.5.6.2.1-1 | NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 6.5.6.2.1-2 | NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 6.5.6.2.1-3 | NR 30 kHz SSB SCS, 40 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 6.5.6.2.1.4.1-2.

Table 6.5.6.2.1.4.1-2: Initial conditions for NR SA FR1 RRC-based DL active BWP switch 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.6.2.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.8.2 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link  - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part. | |  |

1. The general test parameter settings are set up according to Table 6.5.6.2.1.4.1-3.

2. Message contents are defined in clause 6.5.6.2.1.4.3.

3. The test scenario comprises of one NR Cell (Cell 1). Cell 1 is configured according to Annex C.1.2 and C.1.3.

4. By step 4 of the test procedure:

- UE is connected to Cell 1 on radio channel 1.

- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.

- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 of initial condition in Cell

Table 6.5.6.2.1.4.1-3: General test parameters for DL BWP switch in SA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active Cell |  | Cell 1 | PCell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| T1 | s | 0.2 |  |

6.5.6.2.1.4.2 Test procedure

The test consists of 1 time period, with duration of T1.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Cell 1 has constant signal level throughout the test.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Set the parameters according to Tables 6.5.6.2.1.4.1-3 and 6.5.6.2.1.5-1. Propagation conditions are set according to Annex C clauses C.2.2.

3. The SS shall send an *RRCReconfiguration* 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 6.5.6.2.1.5-1.

4. The UE shall transmit an *RRCReconfigurationComplete* message.

5. The SS shall send an *RRCReconfiguration* message with updated bandwidth part configuration for DL BWP switch, change the BWP according to the final condition of Active BWP-1 in Table 6.5.6.2.1.5-1. T1 starts.

6. The UE shall receive the *RRCReconfiguration* in PCell’s slot # denoted i and reconfigure its bandwidth part with the updated bandwidth part configuration.

7 If the UE starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot i + X + k1 then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one. Where:

- X = 16 for test configuration 6.5.6.2.1-1 and 6.5.6.2.1-2

- X = 32 for test configuration 6.5.6.2.1-3.

8. After the SS receives the ACK/NACK in step 7) or when T1 expires, the SS shall transmit *RRCRelease* message to release the RRC connection.

9. After the RRC connection release, the SS:

-transmits in NR Cell 1 a Paging message for the UE and ensures the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, 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 *NR*, 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 *NR*, Connected without release *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.

The SS verifies the DL BWP switch time in PCell by counting the slots from the time when the RRC Reconfiguration message including updated BWP configuration is sent till a valid ACK/NACK is received.

6.5.6.2.1.4.3 Message contents

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

Table 6.5.6.2.1.4.3-1: Common Exception messages for NR SA FR1 RRC-based DL active BWP switch in non-DRX

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |

Table 6.5.6.2.1.4.3-1A: *Void*

Table 6.5.6.2.1.4.3-1B: *Void*

Table 6.5.6.2.1.4.3-1C: *RRCReconfiguration* (1, Step 3, Step 5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition NR | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| radioBearerConfig | | Not present |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig | Table 6.5.6.2.1.4.3-1D |  |
| dedicatedNAS-MessageList | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.5.6.2.1.4.3-1D: *CellGroupConfig* (Table 6.5.6.2.1.4.3-1C)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.6.2.1.4.3-1E |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.2.1.4.3-1E: *ServingCellConfig* (Table 6.5.6.2.1.4.3-1D)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 6.5.6.2.1.4.3-1F |  |
| } |  |  |  |
| 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 6.5.6.2.1.4.3-1G |  |
| } |  |  |  |
| firstActiveUplinkBWP-Id | 1 | BWP-1 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.2.1.4.3-1F: *BWP-Downlink* (Table 6.5.6.2.1.4.3-1E)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 5 |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.2.1.4.3-1G: *BWP-Uplink* (Table 6.5.6.2.1.4.3-1E)

|  |  |  |  |
| --- | --- | --- | --- |
| 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 5 |
| } |  |  |  |
| } |  |  |  |

Table 6.5.6.2.1.4.3-2: *Void*

6.5.6.2.1.5 Test requirements

Tables 6.5.6.2.1.4.1-3 and 6.5.6.2.1.5-1 define the primary level settings including test tolerances.

Table 6.5.6.2.1.5-1: NR Cell specific test parameters for DL BWP switch

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Cell 1 |
| Frequency Range | | | | |  | FR1 |
| Duplex mode | | | Config 1 | |  | FDD |
| Config 2,3 | | TDD |
| TDD configuration | | | Config 1 | |  | Not Applicable |
| Config 2 | | TDDConf.1.1 |
| Config 3 | | TDDConf.2.1 |
| BWchannel | | | Config 1 | |  | 10 MHz: NRB,c = 52 |
| Config 2 | | 10 MHz: NRB,c = 52 |
| Config 3 | | 40 MHz: NRB,c = 106 |
| Active BWP ID | | | | |  | 1 |
| Initial DL BWP Configuration | | | Config 1,2,3 | |  | DLBWP.0.2 |
| Initial UL BWP Configuration | | | Config 1,2,3 | |  | ULBWP.0.2 |
| Initial Condition | Active DL BWP-1 Configuration | | Config 1,2,3 | |  | DLBWP.1.3 |
| Active UL BWP-1 Configuration | | Config 1,2,3 | |  | ULBWP.1.3 |
| Final Condition | Active DL BWP-1 Configuration | | Config 1,2,3 | |  | DLBWP.1.1 |
| Active UL BWP-1 Configuration | | Config 1,2,3 | |  | ULBWP.1.1 |
| PDSCH Reference measurement channel | | | Config 1 | |  | SR.1.1 FDD |
| Config 2 | | SR.1.1 TDD |
| Config 3 | | SR.2.1 TDD |
| RMSI CORESET parameters | | | Config 1 | |  | CR.1.1 FDD |
| Config 2 | | CR.1.1 TDD |
| Config 3 | | CR.2.1 TDD |
| Dedicated CORESET parameters | | | Config 1 | |  | CCR.1.1 FDD |
| Config 2 | | CCR.1.1 TDD |
| Config 3 | | CCR.2.3 TDD |
| OCNG Patterns | | | | |  | OP.1 |
| SSB Configuration | | | Config 1,2 | |  | SSB.1 FR1 |
| Config 3 | | SSB.2 FR1 |
| SMTC Configuration | | | | |  | SMTC.1 |
| TRS Configuration | | | | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| Antenna Configuration | | | | |  | 1x2 Low |
| 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) | | | | |
| NocNote 2 | | Config 1,2 | | | dBm/SCS | -104 |
| Config 3 | | | -101 |
| SS-RSRP Note 3 | | Config 1,2 | | | dBm/SCS | -87 |
| Config 3 | | | -84 |
| Ês/Iot | | | | | dB | 17 |
| Ês/Noc | | | | | dB | 17 |
| IoNote3 | | | Config 1,2 | | dBm/  9.36MHz | -58.96 |
| Config 3 | | dBm/  38.16MHz | -52.86 |
| 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: 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]. | | | | | | |

During T1, the UE shall be ready for the reception of uplink grant for Cell from the first DL slot that occurs right after the beginning of slot and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot .

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [12].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

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

### 6.5.7 DL interruptions at switching between two uplink carriers

#### 6.5.7.0 Minimum conformance requirements

The DL interruption requirements at dynamic switching between two uplink carriers specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [9], where NR uplink carrier 1 is capable of one transmit antenna connector and NR uplink carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [13]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR carrier 1 or carrier 2 as indicated in RRC signalling [13]. The DL interruption lengths of X are defined in Table 6.5.7.0-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [2].

Table 6.5.7.0-1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) | Uplink Tx switching period Note1 | | |
|  |  | 35us | 140us | 210us |
| 0 | 1 | 2 | 3 | 4 |
| 1 | 0.5 | 3 | 6 | 7 |
| 2 | 0.25 | 4 | 10 | 14 |
| Note 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod* | | | | |

The normative reference for this requirement is TS 38.133 [6] clauses 8.2.2.2.10.

##### 6.5.7.1 NR SA FR1 DL Interruptions at switching between two uplink carriers in FDD-TDD CA

6.5.7.1.1 Test purpose

The purpose of this test is to verify the DL interruption requirements during UE dynamic switching between two uplink carriers.

6.5.7.1.2 Test applicability

This test applies to all types of NR UE release 16 onwards, configured with *uplinkTxSwitchingPeriod*.

6.5.7.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.7.0.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.2.2.10 and A.6.5.7.1

6.5.7.1.4 Test description

6.5.7.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.7.1.4.1-1.

Table 6.5.7.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 6.5.7.1-1 | NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode  NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 6.5.7.1.4.1-2.

Table 6.5.7.1.4.1-2: Initial conditions for DL interruptions at switching between two uplink carriers in FDD-TDD CA

|  |  |  |  |
| --- | --- | --- | --- |
| 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.7.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.8.2a | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part.  - Without LTE link  - Without Faders | |  |

1. The general test parameter settings are set up according to Table 6.5.7.1.4.1-3.

2. Message contents are defined in clause 6.5.7.1.4.3.

3. The test scenario comprises of two NR Cells. (Cell 1 and Cell 2). Cell 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.7.1.4.1-3: General test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | Config 1 | 1, 2 | Two radio channels are used for this test. |
| Active cell |  | Config 1 | Cell 1: FR1 PCell  Cell 2: FR1 SCell | FR1 PCell on RF channel number 1  FR1 SCell on RF channel number 2 |
| CP length |  | Config 1 | Normal |  |
| DRX |  | Config 1 | OFF |  |
| Measurement gap pattern Id |  | Config 1 | OFF |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| CSI-RS configuration for L1-RSRP reporting |  | Config 1 | Cell 1: CSI-RS.1.5 FDD  Cell 2: CSI-RS.2.5 TDD |  |
| T1 | s | Config 1 | 5 |  |

6.5.7.1.4.2 Test procedure

The test consists of two active NR cells: Cell1( PCell) and Cell2(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 to Cell1 and Cell2 and the RRC message including *uplinkTxSwitching* is received at the UE antenna connector.

UE is configured to transmit SRS on both PCell and SCell on the last 2 symbols of special slot. DL interruption is expected to take place prior to the SRS symbols.

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.

2. Configure PCell (Cell1) and SCell(Cell2) according to Table 6.5.7.1.5-1. Propagation conditions are set according to Annex C clause C.2.2.

3. The SS shall transmit an RRCReconfiguration message to configure PCell (Cell1) and SCelll(Cell2) as per TS 38.508-1 [7] clause 7 with the message content exceptions defined in clause 6.5.7.1.4.3. *UplinkTxSwitching* is configured to the UE.

4. The UE shall transmit *RRCReconfigurationComplete* message.

5. Set the parameters according to T1 in Tables 6.5.7.1.5-1. T1 starts.

6. SS schedules UL transmission on PCell continuously on the DL slots of SCell.

7. SS triggers aperiodic CSI-RS for L1-RSRP reporting with power boosting 6dB on following symbol on the special slot on PCell and SCell:

PCell (Cell1)

* symbol#12 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
* otherwise,

- symbol #8 if UE capability uplinkTxSwitchingPeriod is 210us or

- symbol #9 if UE capability uplinkTxSwitchingPeriod is 140us or

- symbol #10 if UE capability uplinkTxSwitchingPeriod is 35us.

SCell(Cell2)

* symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
* otherwise,
* symbol #4 if UE capability uplinkTxSwitchingPeriod is 210us or
* symbol #5 if UE capability uplinkTxSwitchingPeriod is 140us or
* symbol #8 if UE capability uplinkTxSwitchingPeriod is 35us.

8. After SS transmits the DCI trigger, the UE shall send L1-RSRP report containing valid L1-RSRP report for CSI-RS#0 and CSI-RS#1 at slot 5 from the reception of DCI trigger, if so increase the number of passed iterations by one otherwise increase the number of failed iterations by one and switch off the UE.

9. 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 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 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 *NR*, 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.

6.5.7.1.4.3 Message contents

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

Table 6.5.7.1.4.3-1: Common Exception messages for DL interruptions at switching between two uplink carriers in FDD-TDD CA

|  |  |
| --- | --- |
| Default Message Contents | |
| Common contents of system information blocks exceptions |  |

Table 6.5.7.1.4.3-2: *ServingCellConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| uplinkTxSwitching-r16 SEQUENCE { |  |  |  |
| uplinkTxSwitchingPeriodLocation-r16 | TRUE |  |  |
| uplinkTxSwitchingCarrier-r16 | carrier1 | TE configures one of the two uplink carriers involved in dynamic UL TX switching as carrier1 and the other as carrier2 |  |
| carrier2 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.7.1.4.3-3: *CellGroupConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], , Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| uplinkTxSwitchingOption-r16 | switchedUL |  | UE reports ‘*switchedUL*’ or ‘*both*’ for capability IE *uplinkTxSwitching-OptionSupport-r16* |
| dualUL |  | UE reports ‘*dualUL’* for capability IE *uplinkTxSwitching-OptionSupport-r16* |
| } |  |  |  |

6.5.7.1.4.3-4: TDD-UL-DL-ConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 7.3.1-1 with condition TDDConf.2.1 | | | |
| Information Element | Value/remark | Comment | Condition |
| TDD-UL-DL-ConfigCommon ::= SEQUENCE { |  |  |  |
| pattern1 SEQUENCE { |  |  |  |
| nrofDownlinkSymbols | 11 |  |  |
| nrofUplinkSymbols | 2 |  |  |
| } |  |  |  |
| } |  |  |  |

6.5.7.1.4.3-5: 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 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 |  |
| nrofSRS-Ports | ports2 |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| startPosition | 0 |  |  |
| nrofSymbols | n2 |  |  |
| } |  |  |  |
| freqHopping SEQUENCE { |  |  |  |
| c-SRS | 0 |  |  |
| } |  |  |  |
| groupOrSequenceHopping | neither |  |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| periodicityAndOffset-p CHOICE { |  |  |  |
| sl8 | 3 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.7.1.4.3-6: *CSI-MeasConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-38 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-MeasConfig::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-Resource { |  |  |  |
| NZP-CSI-RS-Resource[1] SEQUENCE { |  | entry 1 |  |
| nzp-CSI-RS-ResourceId | 0 |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000001 |  |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 12 |  | UE does not report uplinkTxSwitching-DL-Interruption-r16 |
| 8 |  | UE capability uplinkTxSwitchingPeriod is 210us |
|  | 9 |  | UE capability uplinkTxSwitchingPeriod is 140us |
|  | 10 |  | UE capability uplinkTxSwitchingPeriod is 35us |
| firstOFDMSymbolInTimeDomain2 | Not present |  |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three |  |  |  |
| } |  |  |  |
| freqBand SEQUENCE { |  |  |  |
| startingRB | 0 |  |  |
| nrofRBs | 106 |  |  |
| } |  |  |  |
| } |  |  |  |
| powerControlOffset | 0 |  |  |
| powerControlOffsetSS | db6 |  | UE configured with CSI-RS power boosting of 6dB |
| scramblingID | 0 |  |  |
| periodicityAndOffset | Not Present |  |  |
| qcl-InfoPeriodicCSI-RS | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| NZP-CSI-RS-Resource[2] SEQUENCE { |  | entry 2 |  |
| nzp-CSI-RS-ResourceId | 1 |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000001 |  |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 10 |  | UE does not report uplinkTxSwitching-DL-Interruption-r16 |
|  | 4 |  | UE capability uplinkTxSwitchingPeriod is 210us |
|  | 5 |  | UE capability uplinkTxSwitchingPeriod is 140us |
|  | 8 |  | UE capability uplinkTxSwitchingPeriod is 35us |
| firstOFDMSymbolInTimeDomain2 | Not present |  |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three |  |  |  |
| } |  |  |  |
| freqBand SEQUENCE { |  |  |  |
| startingRB | 0 |  |  |
| nrofRBs | 52 |  |  |
| } |  |  |  |
| } |  |  |  |
| powerControlOffset | 0 |  |  |
| powerControlOffsetSS | db6 |  | UE configured with CSI-RS power boosting of 6dB |
| scramblingID | 0 |  |  |
| periodicityAndOffset | Not Present |  |  |
| qcl-InfoPeriodicCSI-RS | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| nzp-CSI-RS-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSetId { | 1 entry |  |  |
| NZP-CSI-RS-ResourceSet[1] | NZP-CSI-RS-ResourceSet | entry 1  6.5.7.1.4.3-7 |  |
| } |  |  |  |
| csi-ResourceConfigToAddModList SEQUENCE (SIZE (1..maxNrofCSI-ResourceConfigurations)) OF CSI-ResourceConfig { | 1 entry |  |  |
| CSI-ResourceConfig[1] |  | entry 1  Table 6.5.7.1.4.3-8 |  |
| } |  |  |  |
| csi-ReportConfigToAddModList SEQUENCE (SIZE (1..maxNrofCSI-ReportConfigurations)) OF CSI-ReportConfig { | 1 entry |  |  |
| CSI-ReportConfig[1] | CSI-ReportConfig | entry 1  Table 6.5.7.1.4.3-9 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.7.1.4.3-7: *NZP-CSI-RS-ResourceSet*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-87 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp-CSI-ResourceSetId | 0 | For CSI-RS#0 |  |
| 1 | For CSI-RS#1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry |  |  |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1 |  |
| } |  |  |  |
| repetition | off |  |  |
| aperiodicTriggeringOffset | 6 |  |  |
| trs-Info | Not present |  |  |
| } |  |  |  |

Table 6.5.7.1.4.3-8: *CSI-ResourceConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| csi-ResourceConfigId | 0 | For CSI-RS#0 |  |
| 1 | For CSI-RS#1 |  |
| csi-RS-ResourceSetList CHOICE { |  |  |  |
| nzp-CSI-RS-SSB SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceSetList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig)) OF NZP-CSI-RS-ResourceSetId { |  |  |  |
| NZP-CSI-RS-ResourceSetId [1] | 0 |  |  |
| } |  |  |  |
| csi-SSB-ResourceSetList | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| bwp-Id | 0 |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.5.7.1.4.3-9: *CSI-ReportConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigId | 0 |  |  |
| carrier | ServCellIndex |  |  |
| resourcesForChannelMeasurement | 0 |  |  |
| csi-IM-ResourcesForInterference | Not present |  |  |
| nzp-CSI-RS-ResourcesForInterference | Not present |  |  |
| reportConfigType CHOICE { |  |  |  |
| Aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER { |  |  |  |
| INTEGER | 5 |  |  |
| INTEGER | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| reportQuantity CHOICE { |  |  |  |
| cri-RSRP | NULL |  |  |
| } |  |  |  |
| reportFreqConfiguration | Not present |  |  |
| timeRestrictionForChannelMeasurements | Not present |  |  |
| timeRestrictionForInterferenceMeasurements | Not present |  |  |
| codebookConfig | Not present |  |  |
| dummy | Not present |  |  |
| groupBasedBeamReporting | Not present |  |  |
| cqi-Table | Not present |  |  |
| subbandSize | Not present |  |  |
| non-PMI-PortIndication | Not present |  |  |
| semiPersistentOnPUSCH-v1530 | Not present |  |  |
| semiPersistentOnPUSCH-v1610 | Not present |  |  |
| aperiodic-v1610 SEQUENCE { |  |  |  |
| reportSlotOffsetListDCI-0-2-r16 | Not present |  |  |
| reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1..maxNrofUL-Allocations-r16)) OF INTEGER { |  |  |  |
| INTEGER | 5 |  |  |
| INTEGER | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| reportQuantity-r16 | Not present |  |  |
| codebookConfig-r16 | Not present |  |  |
| } |  |  |  |

6.5.7.1.5 Test requirements

Table 6.5.7.1.5-1 defines the primary level settings including test tolerances for DL interruptions at switching between two uplink carriers in FDD-TDD CA.

Table 6.5.7.1.5-1: Cell specific test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell1 | Cell2 |
| Frequency Range | |  | FR1 | FR1 |
| Duplex mode | Config 1 |  | FDD | TDD |
| TDD configuration | Config 1 |  | N/A | TDDConf.2.1 except that:  S=’11DL:1GP:2UL’;  *nrofDownlinkSymbols:11*  *nrofUplinkSymbols: 2* |
| BWchannel | Config 1 |  | 10 MHz: NRB,c = 52 | 40 MHz: NRB,c = 106 |
| Initial BWP Configuration | Config 1 |  | DLBWP.0.1 | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1 |  | DLBWP.1.1 | DLBWP.1.1 |
| UL dedicated BWP configuration | Config 1 |  | ULBWP.1.1 | ULBWP.1.1 |
| SRS configuration | Config 1 |  | SRS configuration in Table 4.4.1.1.5-2 is applied except that:  resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 | SRS configuration in Table 4.4.1.1.5-2 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2 |
| PDSCH Reference measurement channel | Config 1 |  | SR.1.1 FDD | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1 |  | CR.1.1 FDD | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 |  | CCR.1.1 FDD | CCR.2.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 |
| SMTC Configuration | |  | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1 |  | SSB.1 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 2x2 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) | |  |  |  |
| NocNote 2 | | dBm/15 kHz | -105.1 | -105.1 |
| SS-RSRP Note 3 | | dBm/ SSB SCS | -88.1 | 85.1 |
| CSI-RS RSRP Note6 | | dBm/SCS | -82.1 | 79.1 |
| Ês/Iot | | dB | 17 | 17 |
| Ês/Noc | | dB | 17 | 17 |
| NocNote 2 | Config 1 | dBm/SCS | 105.1 | -102.1 |
| IoNote3 on symbols without CSI-RS | Config 1 | dBm/9.36 MHz | 60.06 | - |
|  |  | dBm/  38.16MHz | - | -53. 96 |
| IoNote6 on symbols with CSI-RS | Config 1 | dBm/9.36 MHz | -57.68 | - |
|  | dBm/  38.16MHz | - | -51.58 |
| Time offset to Cell1 Note 5 | | μs | - | 0 |
| 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: 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: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.  Note 6: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | |

UE shall send L1-RSRP report while meeting the accuracy requirements defined in TS 38.133 clause 10.1.19.2.

The DL interruption lengths of X are defined in Table 6.5.7.1.5-2

Table 6.5.7.1.5-2: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) | Uplink Tx switching period Note1 | | |
|  |  | 35us | 140us | 210us |
| 0 | 1 | 2 | 3 | 4 |
| 1 | 0.5 | 3 | 6 | 7 |
| 2 | 0.25 | 4 | 10 | 14 |
| Note 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod* | | | | |

The UE shall send L1-RSRP report at slot 5 from the reception of DCI trigger. The L1-RSRP report shall include the results of CSI-RS#0. Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 6.5.7.1.5-4.

Table 6.5.7.1.5-3: L1-RSRP absolute accuracy requirements for the reported valuesof CSI-RS#0

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#0) | 64 |
| Highest reported value (CSI-RS#0) | 84 |

Table 6.5.7.1.5-4: L1-RSRP absolute accuracy requirements for the reported values of CSI-RS#1

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#0) | 67 |
| Highest reported value (CSI-RS#0) | 87 |

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

##### 6.5.7.2 NR SA FR1 DL Interruptions at switching between two uplink carriers in TDD-TDD CA

6.5.7.2.1 Test purpose

The purpose of this test is to verify the DL interruption requirements during UE dynamic switching between two uplink carriers.

6.5.7.2.2 Test applicability

This test applies to all types of NR UE release 16 onwards, configured with *uplinkTxSwitchingPeriod*.

6.5.7.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.7.0.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.2.2.10 and A.6.5.7.2

6.5.7.2.4 Test description

6.5.7.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.7.2.4.1-1.

Table 6.5.7.2.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 6.5.7.2-1 | NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode  NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |

Configure the test equipment and the DUT according to the parameters in Table 6.5.7.2.4.1-2.

Table 6.5.7.2.4.1-2: Initial conditions for DL interruptions at switching between two uplink carriers in TDD-TDD CA

|  |  |  |  |
| --- | --- | --- | --- |
| 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.4-1 and TS 38.508-1 [14] clause 4.3.1. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.7.2.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2 |
| Connection Diagram | TE Part | A.3.1.8.2a | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - For 4Rx capable UEs without any 2Rx RF bands use A.3.2.5.2 for DUT part and A.3.1.8.4 for TE part.  - Without LTE link  - Without Faders | |  |

1. The general test parameter settings are set up according to Table 6.5.7.2.4.1-3.

2. Message contents are defined in clause 6.5.7.2.4.3.

3. The test scenario comprises of one NR Cell (Cell 1). Cell 1 is configured according to Annex C.1.2 and C.1.3.

Table 6.5.7.2.4.1-3: General test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| RF Channel Number |  | Config 1 | 1, 2 | Two radio channels are used for this test. |
| Active cell |  | Config 1 | Cell 1: FR1 PCell  Cell 2: FR1 SCell | FR1 PCell on RF channel number 1  FR1 SCell on RF channel number 2 |
| CP length |  | Config 1 | Normal |  |
| DRX |  | Config 1 | OFF |  |
| Measurement gap pattern Id |  | Config 1 | OFF |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| CSI-RS configuration for L1-RSRP reporting |  | Config 1 | Cell 1: CSI-RS.2.5 TDD  Cell 2: CSI-RS.2.5 TDD |  |
| T1 | s | Config 1 | 5 |  |

6.5.7.2.4.2 Test procedure

Same as in 6.5.7.1.4.2 with the following exception in step 7.

7. SS triggers aperiodic CSI-RS for L1-RSRP reporting with power boosting 6dB on following symbol on the special slot on PCell and SCell:

- symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;

- otherwise,

- symbol #4 if UE capability uplinkTxSwitchingPeriod is 210us or

- symbol #5 if UE capability uplinkTxSwitchingPeriod is 140us or

- symbol #8 if UE capability uplinkTxSwitchingPeriod is 35us.

6.5.7.2.4.3 Message contents

Same as in 6.5.7.1.4.2 with the following exception:

Table 6.5.7.2.4.3-6: *CSI-MeasConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-38 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-MeasConfig::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-Resource { |  |  |  |
| NZP-CSI-RS-Resource[1] SEQUENCE { |  | entry 1 |  |
| nzp-CSI-RS-ResourceId | 0 |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000001 |  |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 10 |  | UE does not report uplinkTxSwitching-DL-Interruption-r16 |
| 4 |  | UE capability uplinkTxSwitchingPeriod is 210us |
|  | 5 |  | UE capability uplinkTxSwitchingPeriod is 140us |
|  | 8 |  | UE capability uplinkTxSwitchingPeriod is 35us |
| firstOFDMSymbolInTimeDomain2 | Not present |  |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three |  |  |  |
| } |  |  |  |
| freqBand SEQUENCE { |  |  |  |
| startingRB | 0 |  |  |
| nrofRBs | 106 |  |  |
| } |  |  |  |
| } |  |  |  |
| powerControlOffset | 0 |  |  |
| powerControlOffsetSS | db6 |  |  |
| scramblingID | 0 |  |  |
| periodicityAndOffset | Not Present |  |  |
| qcl-InfoPeriodicCSI-RS | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| NZP-CSI-RS-Resource[2] SEQUENCE { |  | entry 2 |  |
| nzp-CSI-RS-ResourceId | 1 |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000001 |  |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 10 |  | UE does not report uplinkTxSwitching-DL-Interruption-r16 |
|  | 4 |  | UE capability uplinkTxSwitchingPeriod is 210us |
|  | 5 |  | UE capability uplinkTxSwitchingPeriod is 140us |
|  | 8 |  | UE capability uplinkTxSwitchingPeriod is 35us |
| firstOFDMSymbolInTimeDomain2 | Not present |  |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three |  |  |  |
| } |  |  |  |
| freqBand SEQUENCE { |  |  |  |
| startingRB | 0 |  |  |
| nrofRBs | 52 |  |  |
| } |  |  |  |
| } |  |  |  |
| powerControlOffset | 0 |  |  |
| powerControlOffsetSS | db6 |  |  |
| scramblingID | 0 |  |  |
| periodicityAndOffset | Not Present |  |  |
| qcl-InfoPeriodicCSI-RS | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| nzp-CSI-RS-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSetId { | 1 entry |  |  |
| NZP-CSI-RS-ResourceSet[1] | NZP-CSI-RS-ResourceSet | entry 1  6.5.7.1.4.3-7 |  |
| } |  |  |  |
| csi-ResourceConfigToAddModList SEQUENCE (SIZE (1..maxNrofCSI-ResourceConfigurations)) OF CSI-ResourceConfig { | 1 entry |  |  |
| CSI-ResourceConfig[1] |  | entry 1  Table 6.5.7.1.4.3-8 |  |
| } |  |  |  |
| csi-ReportConfigToAddModList SEQUENCE (SIZE (1..maxNrofCSI-ReportConfigurations)) OF CSI-ReportConfig { | 1 entry |  |  |
| CSI-ReportConfig[1] | CSI-ReportConfig | entry 1  Table 6.5.7.1.4.3-9 |  |
| } |  |  |  |
| } |  |  |  |

6.5.7.2.5 Test requirements

Table 6.5.7.1.5-1 defines the primary level settings including test tolerances for DL interruptions at switching between two uplink carriers in FDD-TDD CA.

Table 6.5.7.2.5-1:Cell specific test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell1 | Cell2 |
| Frequency Range | |  | FR1 | FR1 |
| Duplex mode | Config 1 |  | TDD | TDD |
| TDD configuration | Config 1 |  | TDDConf.2.1 except that  S=’11DL:1GP:2UL’;  *nrofDownlinkSymbols:11*  *nrofUplinkSymbols: 2* | TDDConf.2.2 |
| BWchannel | Config 1 |  | 40 MHz: NRB,c = 106 | 40 MHz: NRB,c = 106 |
| Initial BWP Configuration | Config 1 |  | DLBWP.0.1 | DLBWP.0.1 |
| DL dedicated BWP configuration | Config 1 |  | DLBWP.1.1 | DLBWP.1.1 |
| UL dedicated BWP configuration | Config 1 |  | ULBWP.1.1 | ULBWP.1.1 |
| SRS configuration | Config 1 |  | SRS configuration in Table 4.4.1.1.5-2 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2 | SRS configuration in Table 4.4.1.1.5-2 is applied except that:  resourceMappingstartPosition: 0  resourceMappingnrofSymbols: n2 |
| PDSCH Reference measurement channel | Config 1 |  | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1 |  | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 |  | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | |  | OP.1 | OP.1 |
| SMTC Configuration | |  | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1 |  | SSB.2 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 2x2 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) | |  |  |  |
| NocNote 2 | | dBm/15 kHz | -105.1 | -105.1 |
| SS-RSRP Note 3 | | dBm/ SSB SCS | -85.1 | -85.1 |
| CSI-RS RSRP Note6 | | dBm/SCS | -79.1 | -79.1 |
| Ês/Iot | | dB | 17 | 17 |
| Ês/Noc | | dB | 17 | 17 |
| NocNote 2 | Config 1 | dBm/SCS | -102.1 | -102.1 |
| IoNote3 on symbols without CSI-RS | Config 1 | dBm/  38.16MHz | -53.96 | -53.96 |
| IoNote6 on symbols with CSI-RS | Config 1 | dBm/  38.16MHz | -51.58 | -51.58 |
| Time offset to Cell1 Note 5 | | μs | - | 0 |
| 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: 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: Void  Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.  Note 6: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | |

UE shall send L1-RSRP report while meeting the accuracy requirements defined in TS 38.133 clause 10.1.19.2.

The DL interruption lengths of X are defined in Table 6.5.7.2.5-2

Table 6.5.7.2.5-2: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) | Uplink Tx switching period Note1 | | |
|  |  | 35us | 140us | 210us |
| 0 | 1 | 2 | 3 | 4 |
| 1 | 0.5 | 3 | 6 | 7 |
| 2 | 0.25 | 4 | 10 | 14 |
| Note 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod* | | | | |

The UE shall send L1-RSRP report at slot 5 from the reception of DCI trigger. The L1-RSRP report shall include the results of CSI-RS#0 and CSI-RS#1. Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 6.5.7.1.5-4.

Table 6.5.7.2.5-3: L1-RSRP absolute accuracy requirements for the reported values of CSI-RS#0 and CSI-RS#1

|  |  |
| --- | --- |
| Normal Conditions | T1 |
| Lowest reported value (CSI-RS#0) | 67 |
| Highest reported value (CSI-RS#0) | 87 |

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

### 6.5.8 UE specific CBW change

#### 6.5.8.0 Minimum conformance requirements

##### 6.5.8.0.1 Minimum conformance requirements for UE specific CBW change

The requirements in this clause apply for a UE receives reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

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 TS 36.331 [29] clause 11.2 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 TS 38.331 [13] clause 12, 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].

The normative reference for this requirement is TS 38.133 [6] clause 8.13.1 and 8.13.2.

#### 6.5.8.1 UE specific CBW change on PCell in FR1 in non-DRX

6.5.8.1.1 Test purpose

To verify the UE specific CBW change delay requirement defined in 38.133 [6] clause 8.13.

6.5.8.1.2 Test applicability

This test applies to all types of NR UEs from Release 16 onwards.

6.5.8.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 6.5.8.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.6.5.8.1.

6.5.8.1.4 Test description

The test scenario comprises of one Cell, PCell (Cell 1), which has constant signal levels throughout the test. The test consists of 1 time period with duration of T1.

During T1 the TE sends an *RRCReconfiguration* message containing *SCS-SpecificCarrier* to reconfigure UE-specific CBW. The test equipment verifies the UE specific CBW switching delay in PCell 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.

6.5.8.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 6.5.8.1.4.1-1.

Table 6.5.8.1.4.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 6.5.8.1-1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.8.1-2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 6.5.8.1-3 | TDD duplex mode, 30 kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Configure the test equipment and the DUT according to the parameters in Table 6.5.8.1.4.1-2.

Table 6.5.8.1.4.1-2: 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, table E.4-1 and TS 38.508-1 [14] clause 4.3.1 and 4.4.2. | | |
| Channel bandwidth | As specified by the test configuration selected from Table 6.5.8.1.4.1-1. | | |
| Propagation conditions | AWGN | | As specified in Annex C.2.2. |
| Connection Diagram | TE Part | A.3.1.7.1 | As specified in TS 38.508-1 [14] Annex A. |
| DUT Part | A.3.2.3.4 |
| Exceptions to connection diagram | - Without LTE link | |  |

1. The general test parameter settings are set up according to Table 6.5.8.1.4.1-3.

2. Message contents are defined in clause 6.5.8.1.4.3.

3. There is one NR carrier and one NR cells specified in the test. Cell 1 is the NR cell used for connection setup with the power level set according to Annex C.1.2 and C.1.3 for this test.

Table 6.5.8.1.4.1-3: General test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active Cell |  | Cell 1 | Cell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| T1 | s | 0.2 |  |

6.5.8.1.4.2 Test procedure

1. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. UE has been configured with UE specific CBW (CBW-1), initial BWP (BWP-1) and *firstActiveDownlinkBWP-Id* indicating BWP-1 is the active BWP.

2. The SS starts sending PDCCHs indicating new transmissions continuously on Cell 1.

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 If the UE starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot , then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.

6. After the SS receives the ACK/NACK in step 5 or when T1 expires, the SS shall

- transmit *RRCRelease* message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources

or

- switch the UE off.

7. Depending on the choice in step 6, the SS shall,

- transmit in NR Cell 1 a *Paging* message including matched ng-5G-S-TMSI for the UE if an *RRCRelease* has been sent in step 6. If the paging fails, switches off and on the UE,

or

- switch on the UE if the UE is switched off in step 6.

8. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. UE has been configured with UE specific CBW (CBW-1), initial BWP (BWP-1) and *firstActiveDownlinkBWP-Id* indicating BWP-1 is the active BWP.

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

6.5.8.1.4.3 Message contents

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

Table 6.5.8.1.4.3-1:*ServingCellConfigCommon* (step 1, 3 and 8, test procedure)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon::= SEQUENCE { |  |  |  |
| downlinkConfigCommon SEQUENCE { |  |  |  |
| initialDownlinkBWP SEQUENCE { |  |  |  |
| genericParameters | Set according to DLBWP.0.2 |  |  |
| } |  |  |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { | BWP-UplinkCommon |  |  |
| genericParameters | Set according to ULBWP.0.2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.8.1.4.3-2: *ServingCellConfig* (step 1, 3 and 8, test procedure)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| uplinkChannelBW-PerSCS-List SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier { | 1 entry |  |  |
| SCS-SpecificCarrier[1] | SCS-SpecificCarrier-UL | Entry 1  Table 6.5.8.1.4.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| downlinkChannelBW-PerSCS-List SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier { | 1 entry |  |  |
| SCS-SpecificCarrier[1] | SCS-SpecificCarrier-DL | Entry 1  Table 6.5.8.1.4.3-3 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.8.1.4.3-3: *SCS-SpecificCarrier-DL* (Table 6.5.8.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14] Table 4.6.3-160 | | | |
| Information Element | Value/remark | Comment | Condition |
| SCS-SpecificCarrier ::= SEQUENCE { |  |  |  |
| offsetToCarrier | The offset between point A and the lowest PRB index to guarantee the CBW including SSB and CORESET#0 | CBW-1 (DLCBW.1.1) | step 1 or step 8 |
|  | The offset between Point A and the lowest usable subcarrier on this carrier, i.e. the offsetToCarrier given in 38.508-1[14] clause 4.3.1. | CBW-2 (DLCBW.1.2) | step 3 |
| } |  |  |  |

Table 6.5.8.1.4.3-4: *SCS-SpecificCarrier-UL* (Table 6.5.8.1.4.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [14] Table 4.6.3-160 | | | |
| Information Element | Value/remark | Comment | Condition |
| SCS-SpecificCarrier ::= SEQUENCE { |  |  |  |
| offsetToCarrier | The offset between point A and the lowest PRB index to guarantee the CBW including SSB and CORESET#0 | CBW-1 (ULCBW.1.1) | step 1 or step 8 |
|  | The offset between Point A and the lowest usable subcarrier on this carrier, i.e. the offsetToCarrier given in 38.508-1[14] clause 4.3.1. | CBW-2 (ULCBW.1.2) | step 3 |
| } |  |  |  |

6.5.8.1.5 Test requirement

Tables 6.5.8.1.4.1-3 and 6.5.8.1.5-1 define the primary level settings including test tolerances.

Table 6.5.8.1.5-1: NR Cell specific test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Cell 1 |
| Frequency Range | | | |  | FR1 |
| Duplex mode | | Config 1 | |  | FDD |
| Config 2,3 | | TDD |
| TDD configuration | | Config 1 | |  | Not Applicable |
| Config 2 | | TDDConf.1.1 |
| Config 3 | | TDDConf.2.1 |
| BWchannel | | Config 1 | |  | 10 MHz: NRB,c = 52 |
| Config 2 | | 10 MHz: NRB,c = 52 |
| Config 3 | | 40 MHz: NRB,c = 106 |
| Active DL BWP ID | | Config 1,2, 3 | |  | 0 |
| Initial DL BWP Configuration (BWP-1) | | Config 1,2, 3 | |  | DLBWP.0.2 |
| Initial UL BWP Configuration (BWP-1) | | Config 1,2, 3 | |  | ULBWP.0.2 |
| Initial Condition | Active DL CBW Configureation  (CBW-1) | Config 1, 2, 3 | |  | DLCBW.1.1 |
|  | Active UL  CBW  Configuration  (CBW-1) | Config 1, 2, 3 | |  | ULCBW.1.1 |
| Final Condition | Active DL CBW Configureation  (CBW-2) | Config 1, 2, 3 | |  | DLCBW.1.2 |
|  | Active UL  CBW  Configuration  (CBW-2) | Config 1, 2, 3 | |  | ULCBW.1.2 |
| PDSCH Reference measurement channel | | Config 1 | |  | SR.1.1 FDD |
| Config 2 | | SR.1.1 TDD |
| Config 3 | | SR2.1 TDD |
| RMSI CORESET parameters | | Config 1 | |  | CR.1.1 FDD |
| Config 2 | | CR.1.1 TDD |
| Config 3 | | CR2.1 TDD |
| Dedicated CORESET parameters | | Config 1 | |  | CCR.1.1 FDD |
| Config 2 | | CCR.1.1 TDD |
| Config 3 | | CCR.2.1 TDD |
| OCNG Patterns | | | |  | OP.1 |
| SSB Configuration | | Config 1,2 | |  | SSB.1 FR1 |
| Config 3 | | SSB.2 FR1 |
| SMTC Configuration | | | |  | SMTC.1 |
| TRS Configuration | | | Config 1 |  | TRS.1.1 FDD |
| Config 2 |  | TRS.1.1 TDD |
| Config 3 |  | TRS.1.2 TDD |
| Antenna Configuration | | | |  | 1x2 Low |
| 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) | | | |
| NocNote 2 | | Config 1,2 | | dBm/SCS | -104 |
| Config 3 | | -101 |
| SS-RSRP Note 3 | | Config 1,2 | | dBm/SCS | -87 |
| Config 3 | | -84 |
| Ês/Iot | | | | dB | 17 |
| Ês/Noc | | | | dB | 17 |
| IoNote3 | | Config 1,2 | | dBm/  9.36MHz | -58.96 |
| Config 3 | | dBm/  38.16MHz | -52.86 |
| 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.0.1 is linked with ULBWP.0.1; DLBWP.1.1 is linked with ULBWP.1.1; as defined in clause 12 of TS 38.213 [3]. | | | | | |

During T1, the UE shall be ready for the reception of uplink grant for the PCell from the first DL slot that occurs right after the beginning of slot and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.213.

All of the above test requirements shall be fulfilled in order for the observed UE specific CBW change delay on the PCell to be counted as correct.

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