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 $\pm T_e$ where the timing error limit value T_e 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 $(N_{TA} + N_{TA\,offset}) \times T_c$. 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.

$(N_{TA} + N_{TA\,offset}) \times T_c$ (in T_c 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 of $N_{TA\,offset}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{TA\,offset}$ is defined in Table 6.4.1.0.1-2.

Table 6.4.1.0.1-1: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (KHz)	SCS of uplink signals s(KHz)	T_e
1	15	15	12*64*T_c
		30	10*64*T_c
		60	10*64*T_c
	30	15	8*64*T_c
		30	8*64*T_c
		60	7*64*T_c
2	120	60	3.5*64*T_c
		120	3.5*64*T_c
	240	60	3*64*T_c
		120	3*64*T_c
Note 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 6.4.1.0.1-2: The Value of $N_{TA\,offset}$

Frequency range and band of cell used for uplink transmission	$N_{TA\,offset}$ (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 $N_{TA\,offset}$ based on the information n-TimingAdvanceOffset according to [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N_{TA\,offset}$ 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 $N_{TA\,offset}$ 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 $\pm T_e$, the UE is required to adjust its timing to within $\pm T_e$. The reference timing shall be $(N_{TA} + N_{TA\ offset}) \times T_c$ 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 T_q.

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

3) The maximum aggregate adjustment rate shall be T_q per [200]ms.

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

Table 6.4.1.0.1-3: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (KHz)	T_q	T_p
1	15	$5.5*64*T_c$	$5.5*64*T_c$
	30	$5.5*64*T_c$	$5.5*64*T_c$
	60	$5.5*64*T_c$	$5.5*64*T_c$
2	60	$2.5*64*T_c$	$2.5*64*T_c$
	120	$2.5*64*T_c$	$2.5*64*T_c$
NOTE 1: T_c 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 transmisisons and verify that, for each received SRS, the timing of the NR cell is within (N_{TA} + N_{TA_offset}) $\times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 25600 for FR1

   b. The T_e 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 T_q 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 $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ 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	

		1	10: $N_{RB,c}$ = 52	
BW$_{channel}$	MHz	2	10: $N_{RB,c}$ = 52	
		3	40: $N_{RB,c}$ = 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.8[Note5]
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)				
N_{oc} [Note2]	dBm/15 kHz	1,2,3	-98	-98
N_{oc} [Note2]	dBm/SCS	1,2	-98	-98
		3	-95	-95
$\hat{E}_s / I_{ot}$		1,2,3	3.3	3.3
$\hat{E}_s / N_{oc}$		1,2,3	3.3	3.3
SS-RSRP[Note3]	dBm/SCS	1,2	-95	-95
		3	-92	-92
Io[Note3]	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.1[Note6]	SRSConf.3[Note6]
		2,3	SRSConf.1[Note6]	SRSConf.2[Note6]
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 N_{oc} 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 $N_{RB,c}$
	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: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (KHz)	SCS of uplink signals (KHz)	T_e
1	15	15	$13.75*64*T_c$
		30	$11.75*64*T_c$
		60	$11.75*64*T_c$
	30	15	$9.75*64*T_c$

		30	$9.75*64*T_c$
		60	$8.75*64*T_c$
Note 1:	T_c is the basic timing unit defined in TS 38.211 [6]		

Table 6.4.1.1.5-5: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (KHz)	T_q	T_p	Maximum Adjustement Rate
1	15	$6.0*64*T_c$	$1.9*64*T_c$	$6.6*64*T_c$
	30	$6.0*64*T_c$	$1.9*64*T_c$	$6.6*64*T_c$
	60	$6.0*64*T_c$	$1.9*64*T_c$	$6.6*64*T_c$
NOTE 1: T_c 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	$\pm256\ T_c$	$\pm256\ T_c$	$\pm128\ T_c$	$\pm32\ T_c$

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 (T_A) value during T1		31	$N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For SCS = 15kHz : $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ (based on equation in TS38.213 section 4.2) For SCS = 30kHz : $N_{TA\_new} = N_{TA\_old} + 4096*T_c$ (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

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1, Table 4.6.3-182			
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
BW$_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 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)			
N_{oc} Note2		dBm/15kHz	-98
N_{oc} Note2	Config 1,2	dBm/SCS	-98
	Config 3		-95
$\hat{E}_s / I_{ot}$		dB	3
$\hat{E}_s / N_{oc}$		dB	3
Io Note3	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 N_{oc} 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	$\pm344\ T_c$	$\pm344\ T_c$	$\pm216\ T_c$

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 Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell.

The threshold Q_{out} 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 ($BLER_{out}$) as defined in Table 6.5.1-1.

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

The out-of-sync block error rate ($BLER_{out}$) and in-sync block error rate ($BLER_{in}$) 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	BLER$_{out}$	BLER$_{in}$
0	10%	2%

UE shall be able to monitor up to X_{RLM-RS} RLM-RS resources of the same or different types in each corresponding carrier frequency range, where X_{RLM-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 X_{RLM-RS}

Maximum number of RLM-RS resources, X_{RLM-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.

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 $T_{Evaluate\_out\_SSB}$ [ms] period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate\_out\_SSB}$ [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.

$T_{Evaluate\_out\_SSB}$ is defined in Table 6.5.1.0.1-1 for FR1.

Table 6.5.1.0.1-1: Evaluation period $T_{Evaluate\_out}$ for FR1

Configuration	$T_{Evaluate\_out\_SSB}$ (ms)
no DRX	$max(200, ceil(10*P)*T_{SSB})$
DRX cycle≤320	$max(200, ceil(15*P)*max(T_{DRX}, T_{SSB}))$
DRX cycle>320	$ceil(10*P)*T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB configured for RLM.	

For FR1,

- $P=1/(1 - T_{SSB}/MGRP)$, 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, $T_{SMTCperiod}$ follows *smtc2*; otherwise $T_{SMTCperiod}$ 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 Q_{out}, 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 $T_{Indication\_interval}$.

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 $T_{Indication\_interval}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} 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 $T_{Evaluate\_in\_SSB}$ [ms] period becomes better than the threshold Q_{in_SSB} within $T_{Evaluate\_in\_SSB}$ [ms] evaluation period.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 6.5.1.0.2-1 for FR1.

For FR1,

- $P=1/(1 - T_{SSB}/MGRP)$, 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, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ 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 M_{out} and M_{in} used in Table 6.5.1.2.3-1 are defined as:

- $M_{out} = 20$ and $M_{in} = 10$, if the CSI-RS resource configured for RLM is transmitted with Density =3.

Table 6.5.1.0.2-1: Evaluation period $T_{Evaluate\_out}$ and $T_{Evaluate\_in}$ for FR1

Configuration	$T_{Evaluate\_out}$ (ms)	$T_{Evaluate\_in}$ (ms)
no DRX	max(200, ceil($M_{out} \times P$)×T_{CSI-RS})	max(100, ceil($M_{in} \times P$) × T_{CSI-RS})
DRX ≤ 320ms	max(200, ceil(1.5×$M_{out} \times P$)× max(T_{DRX}, T_{CSI-RS}))	max(100, ceil(1.5×$M_{in} \times P$)× max(T_{DRX}, T_{CSI-RS}))
DRX > 320ms	ceil($M_{out} \times P$) × T_{DRX}	ceil($M_{in} \times P$) × T_{DRX}
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource configured for RLM. T_{DRX} is the DRX cycle length.		

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Q_{in}, 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 $T_{Indication\_interval}$.

When DRX is not used $T_{Indication\_interval}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in section 8.1.2 of TS 38.133 [6] if the RLM-RS resource is SSB, or T_{CSI-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 $T_{Evaluate\_out\_CSI-RS}$ [ms] period becomes worse than the threshold Q_{out_CSI-RS} within $T_{Evaluate\_out\_CSI-RS}$ [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 $T_{Evaluate\_in\_CSI-RS}$ [ms] period becomes better than the threshold Q_{in_CSI-RS} within $T_{Evaluate\_in\_CSI-RS}$ [ms] evaluation period.

-   $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 8.1.3.2-1 for FR1.

For FR1,

-   $P = 1/(1 - T_{CSI-RS}/MGRP)$, 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, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ 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 M_{out} and M_{in} used in Table 8.1.3.2-1 are defined as:

-   $M_{out} = 20$ and $M_{in} = 10$, if the CSI-RS resource configured for RLM is transmitted with Density =3.

Table 6.5.1.0.3-1: Evaluation period $T_{Evaluate\_out}$ and $T_{Evaluate\_in}$ for FR1

Configuration	$T_{Evaluate\_out}$ (ms)	$T_{Evaluate\_in}$ (ms)
no DRX	$max(200, ceil(M_{out} \times P) \times T_{CSI-RS})$	$max(100, ceil(M_{in} \times P) \times T_{CSI-RS})$
DRX ≤ 320ms	$max(200, ceil(1.5 \times M_{out} \times P) \times max(T_{DRX}, T_{CSI-RS}))$	$max(100, ceil(1.5 \times M_{in} \times P) \times max(T_{DRX}, T_{CSI-RS}))$
DRX > 320ms	$ceil(M_{out} \times P) \times T_{DRX}$	$ceil(M_{in} \times P) \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource configured for RLM. T_{DRX} 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 Q_{out}, 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 Q_{in}, 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 $T_{Indication\_interval}$.

When DRX is not used $T_{Indication\_interval}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in section 8.1.2 if the RLM-RS resource is SSB, or T_{CSI-RS} specified in section 8.1.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, $T_{Indication\_interval}$ is max(10ms, 1.5*DRX_cycle_length, 1.5*$T_{RLM-RS,M}$) if DRX cycle_length is less than or equal to 320ms, and $T_{Indication\_interval}$ 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.

6.5.1.1 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.
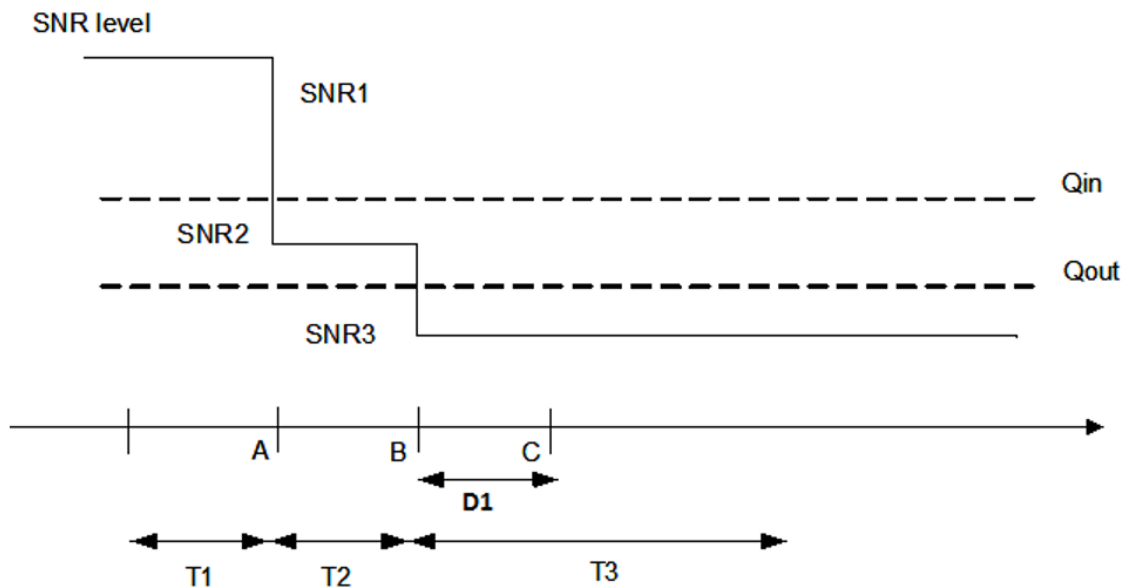
Figure 6.5.1.1.4-1: SNR variation for out-of-sync testing

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
BW$_{channel}$	Config 1	MHz	10: N$_{RB,c}$ = 52
	Config 2		10: N$_{RB,c}$ = 52
	Config 3		40: N$_{RB,c}$ = 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 1] 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 1]) 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
N_{oc}	Config 1	dBm/ 15kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	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 forwarded

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
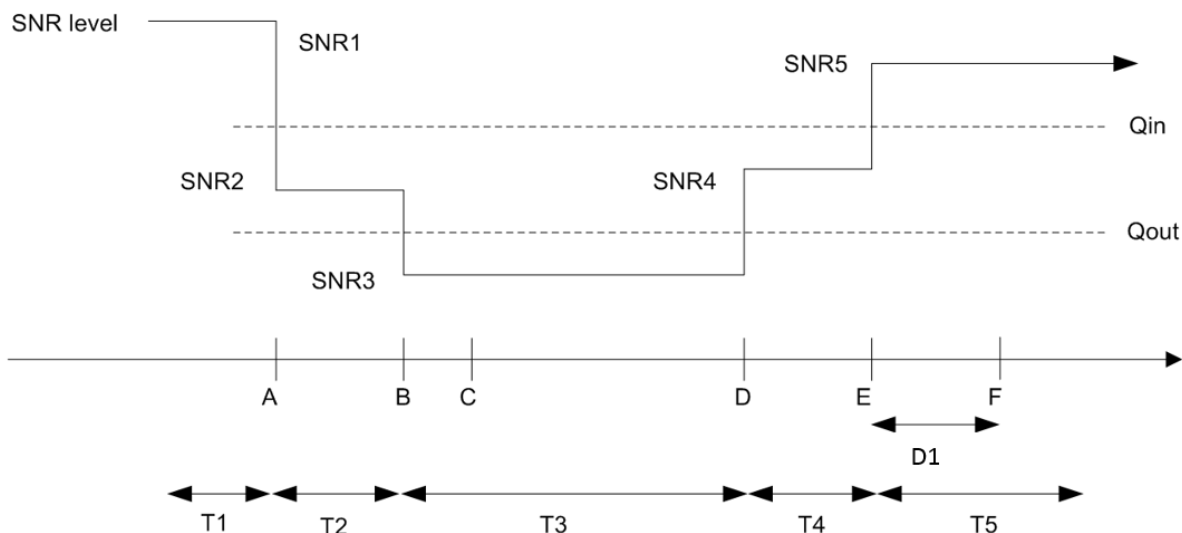
6.5.1.2.4 Test Requirements

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
BW$_{channel}$	Config 1	MHz	10: N$_{RB,c}$ = 52
	Config 2		10: N$_{RB,c}$ = 52
	Config 3		40: N$_{RB,c}$ = 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 1] 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 1-0) 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
N_{oc}	Config 1	dBm/ 15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	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.
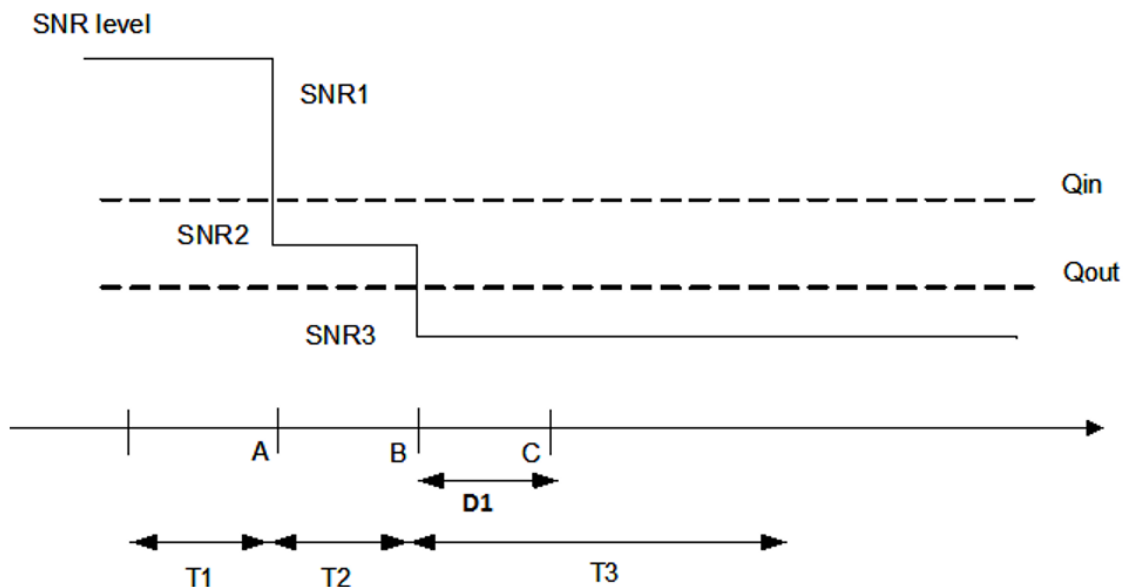
Figure 6.5.1.3.4-1: SNR variation for out-of-sync testing

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
BW$_{channel}$	Config 1	MHz	10: N$_{RB,c}$ = 52
	Config 2		10: N$_{RB,c}$ = 52
	Config 3		40: N$_{RB,c}$ = 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
	Config 1, 2		15 KHz

PDSCH/PDCCH subcarrier spacing	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 1] 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 1]) 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
N_{oc}	Config 1	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	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
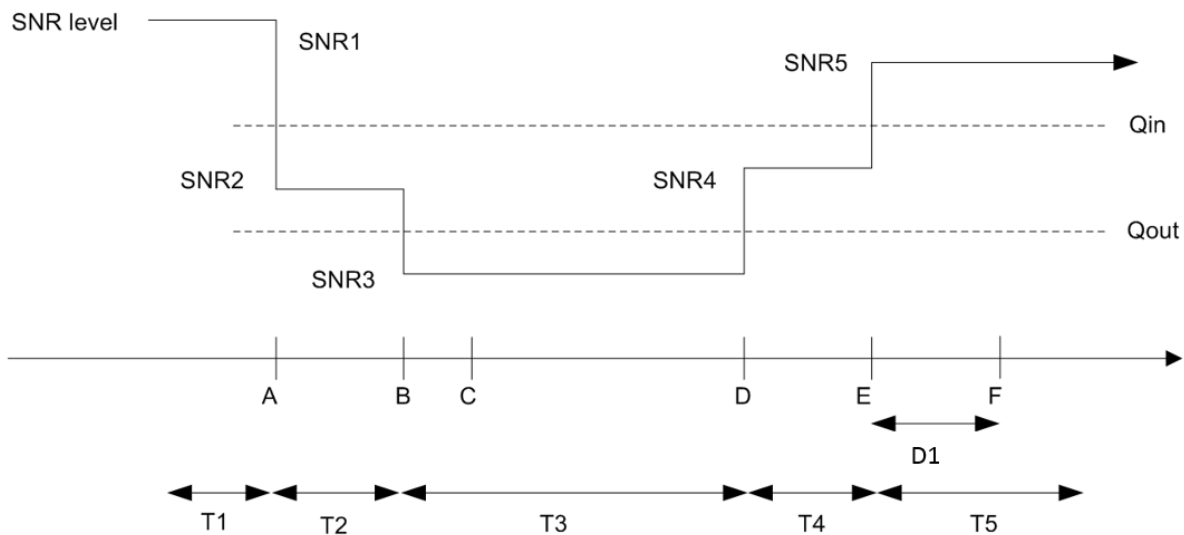
6.5.1.4.4.1   Initial Conditions

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
BW$_{channel}$	Config 1		MHz	10: N$_{RB,c}$ = 52
	Config 2			10: N$_{RB,c}$ = 52
	Config 3			40: N$_{RB,c}$ = 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 1] 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 1-0) 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
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	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.
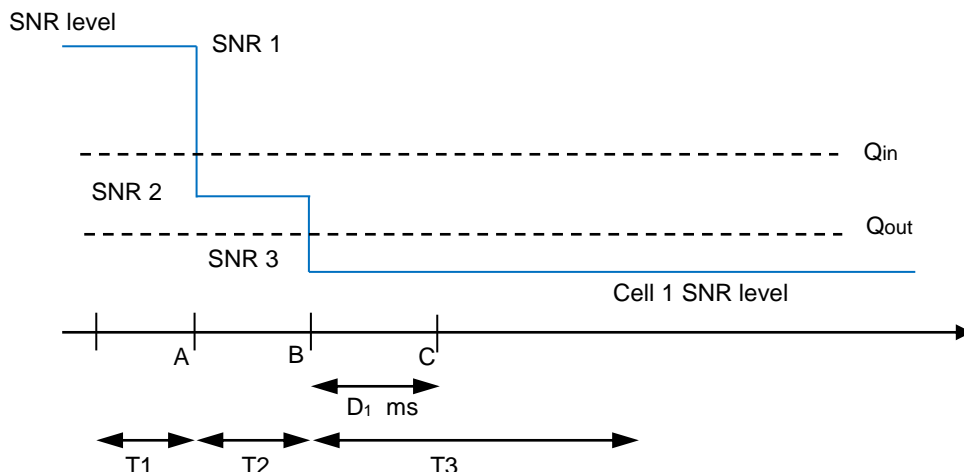
Figure 6.5.1.5.4-1: SNR variation for out-of-sync testing

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
N_{oc}	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 (D_1 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.
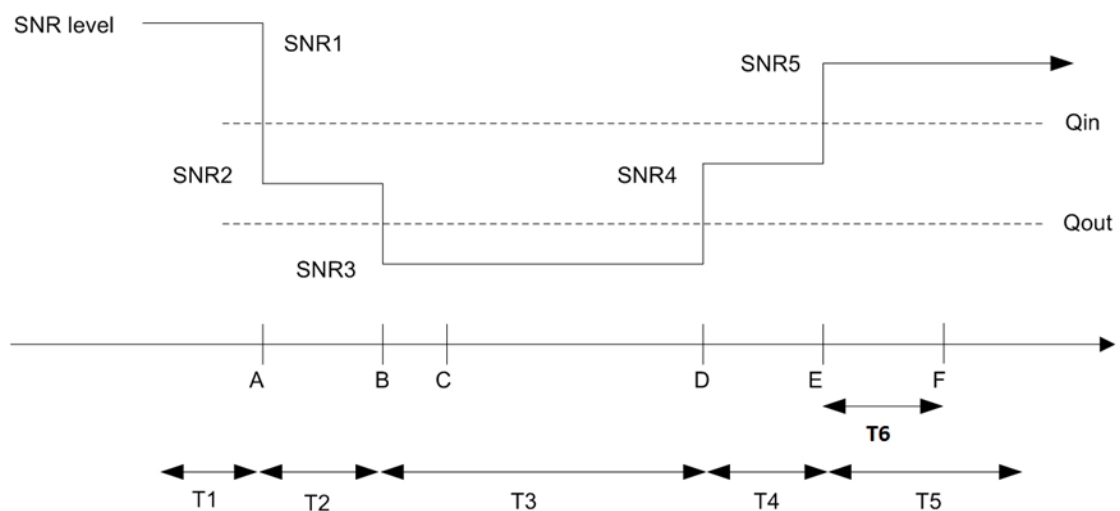
Figure 6.5.1.6.4-1: SNR variation for In-sync testing

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
N_{oc}	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.
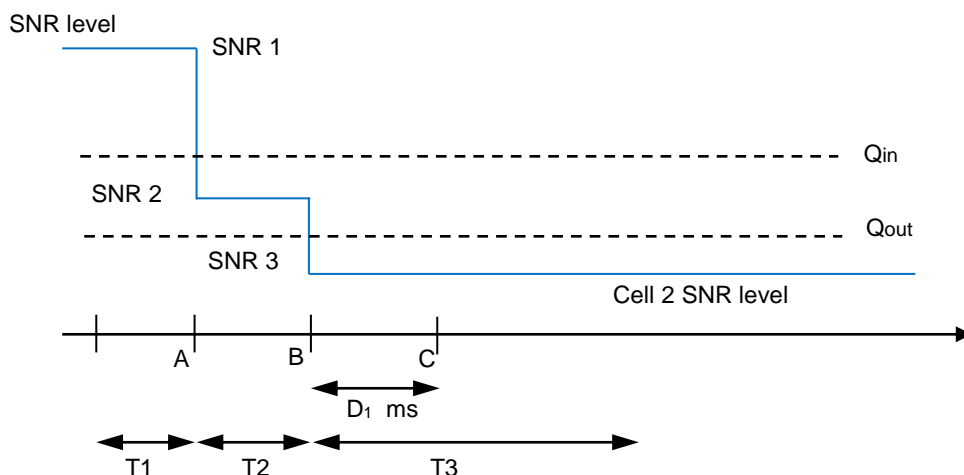
Figure 6.5.1.7.4-1: SNR variation for out-of-sync testing

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
N_{oc}	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 (D_1 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.
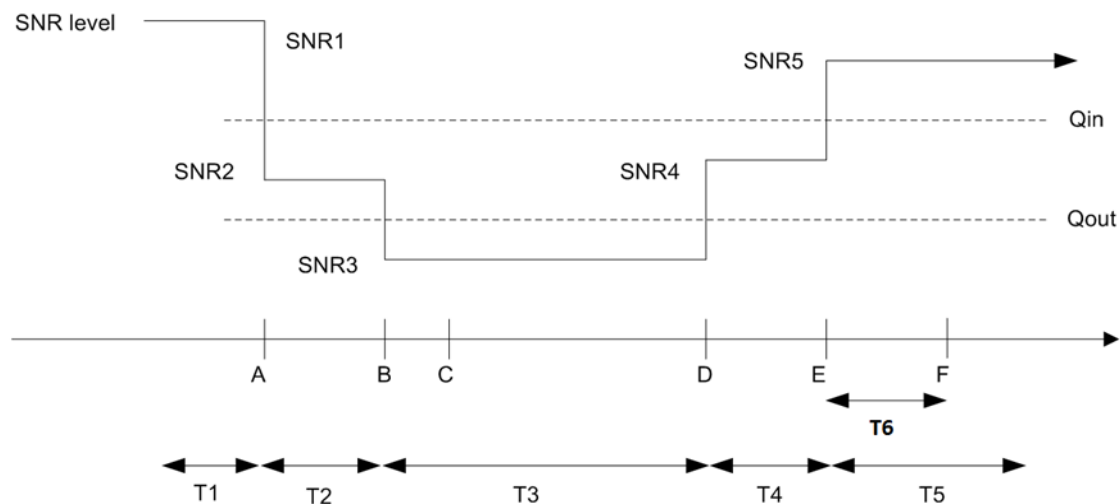
Figure 6.5.1.8.4-1: SNR variation for In-sync testing

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
N_{oc}	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%.

6.5.2 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 $T_{SMTC\_duration}$ and no later than X slots after $T_{SMTC\_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC\_duration}$ 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 $T_{SMTC\_duration}$ and no later than X slots after $T_{SMTC\_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC\_duration}$ 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

μ	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

μ	NR Slot length (ms)	Interruption length (slots)
0	1	$1 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
1	0.5	$1 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
2	0.25	$2 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
3	0.125	$4 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$

NOTE 1: $T_{SMTC\_duration}$ 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 $T_{SMTC\ duration}$ for the SCell being activated is [x]ms. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, $T_{SMTC\ duration}$ 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: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [7].

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

6.5.2.1 NR SA FR1 interruptions during measurements on deactivated NR SCC

Editor's Note: TT analysis for test configuration with SpCC SCS = 15kHz + SCC SCS = 30kHz or SpCC SCS = 30kHz + SCC SCS = 15kHz are still missing.

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 ($BW_{channel}$) defined in each test configuration,

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

Config$_{SCell}$	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 ($BW_{channel}$) 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 test configuration 6.5.2.1-1 and 6.5.2.1-4,

     - X = interruption length+k_1 if $k_1 \leq$ interruption length

     - X = interruption length if $k_1 >$ interruption length

   Note: UE expects that the SS won't use $k_1 = 3$ for test configuration 4.5.2.3-1 and 4.5.2.3-4.

   - For test configuration 6.5.2.1-2, 6.5.2.1-3 and 6.5.2.1-5,

     - 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 Test Configuration 6.5.2.1-1, 6.5.2.1-2, 6.5.2.1-3 and 6.5.2.1-4	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 Test Configuration 6.5.2.1-5	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)

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition MEAS			
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
	Config 3		TDDConf.2.1
$BW_{channel}$			Note 9
$BW_{occupied}$	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.1 Note 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			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17

N_{oc} [Note 2]	Config 1,2	dBm/SCS	-104
	Config 3		-101
Io [Note 3]	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 N_{oc} to be fulfilled within $BW_{occupied}$.			
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 $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
Note 8: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
Note 9: $N_{RB,c}$ is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.			

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	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$			Note 9
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 [Note 7]
	$Config_{SCell}$ 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	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.2 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
CSI-RS for tracking	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 [Note 7]
	$Config_{SCell}$ 3		OP.1 [Note 8]
SMTC Configuration			SMTC.4
SSB Configuration	$Config_{SCell}$ 1,2		SSB.5 FR1
	$Config_{SCell}$ 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]			
N_{oc} [Note 2]		dBm/15 kHz	-104
SS-RSRP [Note 3]		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
N_{oc} [Note 2]	Config$_{SCell}$ 1,2	dBm/SCS	-104
	Config$_{SCell}$ 3		-101
I_o [Note3]	Config$_{SCell}$ 1,2	dBm/9.36MHz	-58.96
	Config$_{SCell}$ 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 N_{oc} to be fulfilled within BW$_{occupied}$.			
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 BW$_{occupied}$ (i.e. 10 MHz, 52 RBs) from F$_{C,low}$, and Io is independent of the BW$_{channel}$ configured.			
Note 8: All UL/DL transmission shall be confined within BW$_{occupied}$ (i.e. 40 MHz, 106 RBs) from F$_{C,low}$, and Io is independent of the BW$_{channel}$ configured.			
Note 9: N$_{RB,c}$ is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BW$_{channel}$.			

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

μ	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

μ	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%.

6.5.3   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

Editor's Note: TT analysis for test configuration with SpCC SCS = 15kHz + SCC SCS = 30kHz or SpCC SCS = 30kHz + SCC SCS = 15kHz are still missing.

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 ($BW_{channel}$) defined in each test configuration.

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

Config$_{SCell}$	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 ($BW_{channel}$) 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	$\leq$ 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.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	$k_1 \times$NR slot length k_1 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.
$T_{CSI\_Reporting}$	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 $n + \frac{T_{\text{HARQ}} + T_{\text{activation\_time}} + T_{\text{CSI\_Reporting}}}{\text{NR slot length}}$, 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 $n + \frac{T_{\text{HARQ}} + 3\text{ms}}{\text{NR slot length}}$ 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 $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}} + 3\text{ms} + T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in TS 38.133 [6] clause 8.3, where $N_{\text{interruption}}$ 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 $m + \frac{T_{\text{HARQ}} + 3ms}{NR\ slot\ length}$, 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 $m + 1 + \frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{\text{HARQ}} + 3ms}{NR\ slot\ length}$, 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 $n + 1 + \frac{T_{\text{HARQ}} + 3\text{ms} + T_{\text{CSI\_Reporting}}}{NR\ slot\ length}$,

     - or slot $n + 1 + \frac{T_{\text{HARQ}} + 3ms + T_{\text{CSI\_Reporting}} + T_X}{NR\ slot\ length} + N_{interruption} + 1$ if the slot $n + 1 + \frac{T_{\text{HARQ}} + 3\text{ms} + T_{\text{CSI\_Reporting}}}{NR\ slot\ length}$ was subject to interruption,

   - and CSI report with non-zero CQI index is received by the SS earlier than or equal to slot $n + \frac{T_{\text{HARQ}} + T_{\text{activation\_time}} + T_{\text{CSI\_Reporting}}}{\text{NR slot length}}$,

     - or the next available uplink resource if there are no uplink resources for reporting the valid CSI in a slot $n + \frac{T_{\text{HARQ}} + T_{\text{activation\_time}} + T_{\text{CSI\_Reporting}}}{\text{NR slot length}}$

   - and DTX is not observed by the SS outside the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}} + 3ms + T_X}{NR\ slot\ length} + N_{interruption} + \frac{T_{\text{HARQ}}}{NR\ slot\ length}$ 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 $m + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$

    - and DTX is not observed by the SS outside the slot $m + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{HARQ}+3ms}{NR\ slot\ length} + N_{interruption} + \frac{T_{HARQ}}{NR\ slot\ length}$ 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 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**

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.1-13 with condition NR_MEAS and SCell_add			
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)

Information Element	Value/Remark	Comment	Condition
Derivation path: Table H.3.1-2 with condition Deactivated SCell			
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

Information Element	Value/remark	Comment	Condition
Derivation Path: Table H.3.1-3 with condition Deactivated SCell and Synchronous cells			
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		
BW$_{channel}$		MHz	Note 7		
BW$_{occupied}$	Config 1,2	RB	52 $^{Note 5}$		
	Config 3		106 $^{Note 6}$		
Initial BWP configuration			DLBWP.0.2		
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.1$^{Note 5}$		
	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 $^{Note 1}$					
N$_{oc}$^{Note2}	Config 1,2	dBm/SCS	-104		
	Config 3		-101		
$\hat{E}_s/I_{ot}$		dB	17		
$\hat{E}_s/N_{oc}$		dB	17		
SS-RSRP^{Note3}	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		
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 N_{oc} to be fulfilled within $BW_{occupied}$.
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 $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
Note 6:	All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
Note 7:	$N_{RB,c}$ is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.
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	Configs$_{SCell}$ 1		FDD		
	Configs$_{SCell}$ 2,3		TDD		
TDD configuration	Configs$_{SCell}$ 1		Not applicable		
	Configs$_{SCell}$ 2		TDDConf.1.1		
	Configs$_{SCell}$ 3		TDDConf.2.1		
BW$_{channel}$		MHz	Note 7		
BW$_{occupied}$	Configs$_{SCell}$ 1,2	RB	52 [Note 5]		
	Configs$_{SCell}$ 3		106 [Note 6]		
Initial BWP configuration			DLBWP.0.2		
TCI state			TCI.State.0		
TRS Configuration	Configs$_{SCell}$ 1		TRS.1.1 FDD		
	Configs$_{SCell}$ 2		TRS.1.1 TDD		
	Configs$_{SCell}$ 3		TRS.1.2 TDD		
PDSCH Reference measurement channel	Configs$_{SCell}$ 1		N/A		
	Configs$_{SCell}$ 2		N/A		
	Configs$_{SCell}$ 3		N/A		
Dedicated CORESET parameters	Configs$_{SCell}$ 1		N/A		
	Configs$_{SCell}$ 2		N/A		
	Configs$_{SCell}$ 3		N/A		
RMSI CORESET parameters	Configs$_{SCell}$ 1		N/A		
	Configs$_{SCell}$ 2		N/A		
	Configs$_{SCell}$ 3		N/A		
OCNG Patterns	Configs$_{SCell}$ 1,2		OP.1 [Note 5]		
	Configs$_{SCell}$ 3,		OP.1 [Note 6]		
SSB Configuration	Configs$_{SCell}$ 1,2		SSB.1 FR1		
	Configs$_{SCell}$ 3		SSB.2 FR1		
CSI-RS configuration for CSI reporting [Note 8]	Configs$_{SCell}$ 1		CSI-RS.1.1 FDD		
	Configs$_{SCell}$ 2		CSI-RS.1.1 TDD		
	Configs$_{SCell}$ 3		CSI-RS.2.1 TDD		
SMTC configuration			SMTC.1		
reportConfigType			N/A		
reportQuantity			N/A		
CSI reporting periodicity	Configs$_{SCell}$ 1,2	slot	N/A		
	Configs$_{SCell}$ 3		N/A		
CSI reporting offset	Configs$_{SCell}$ 1,2	slot	N/A		
	Configs$_{SCell}$ 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]					
N$_{oc}$ [Note2]	Configs$_{SCell}$ 1,2	dBm/SCS	-104		
	Configs$_{SCell}$ 3		-101		
$\hat{E}_s/I_{ot}$		dB	17		
$\hat{E}_s/N_{oc}$		dB	17		
SS-RSRP [Note3]	Configs$_{SCell}$ 1,2	dBm/SCS	-87		
	Configs$_{SCell}$ 3		-84		
SCH_RP [Note 3]		dBm/15 kHz	-87		
Io [Note3]	Configs$_{SCell}$ 1,2	dBm/ 9.36MHz	-58.96		
	Configs$_{SCell}$ 3	dBm/ 38.16MHz	-52.87		
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 N_{oc} to be fulfilled within BW$_{occupied}$.
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 BW$_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the BW$_{channel}$ configured.
Note 6:	All UL/DL transmission shall be confined within BW$_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the BW$_{channel}$ configured.
Note 7:	N$_{RB,c}$ is derived from Table 5.3.2-1 in TS38.101-1[2] with configured BW$_{channel}$.
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 $n + 1 + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$ 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 $n + 1 + \frac{T_{HARQ}+3ms+T_{CSI\_Reporting}}{NR\ slot\ length}$ was interrupted or not is checked by monitoring ACK/NACK sent in PCell in slot $n + 1 + \frac{T_{HARQ}+3ms+T_{CSI\_Reporting}}{NR\ slot\ length}$.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion\_time}+T_{CSI\_Reporting}}{NR\ slot\ length}$, $T_{activation\_time} = T_{FirstSSB} + 5ms$, 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 $n + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $n + 1 + \frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length} + N_{interruption}$, 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.
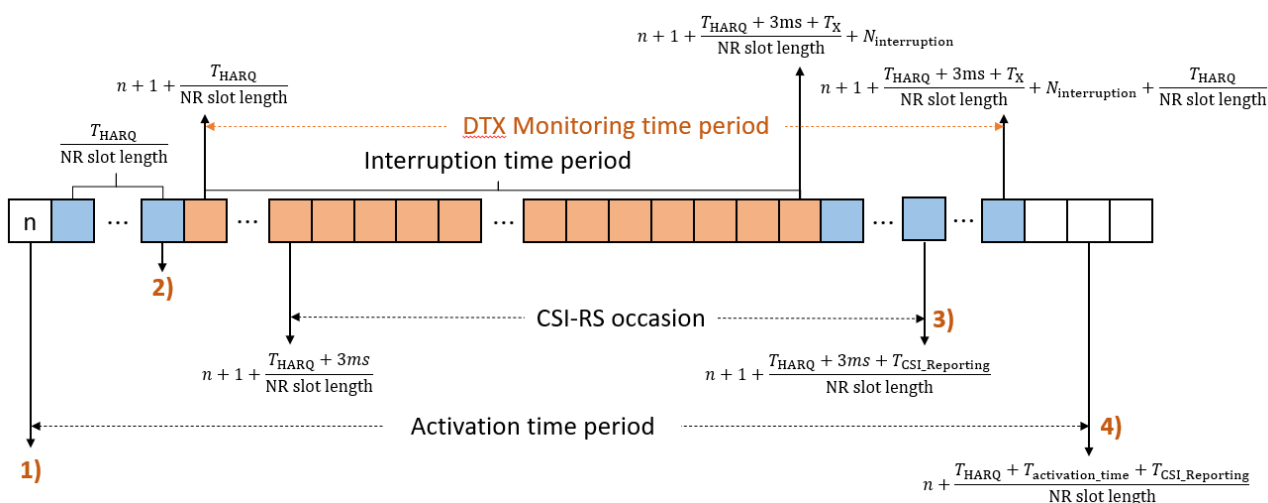
Figure 6.5.3.1.5-1: Procedure derivation for Activation

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 $m + \frac{T_{HARQ} + 3ms}{NR\ slot\ length}$, as defined in TS 38.133 [6] section 8.3.

During T3 interruption of PCell during SCell deactivation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{HARQ} + 3ms}{NR\ slot\ length}$, 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.
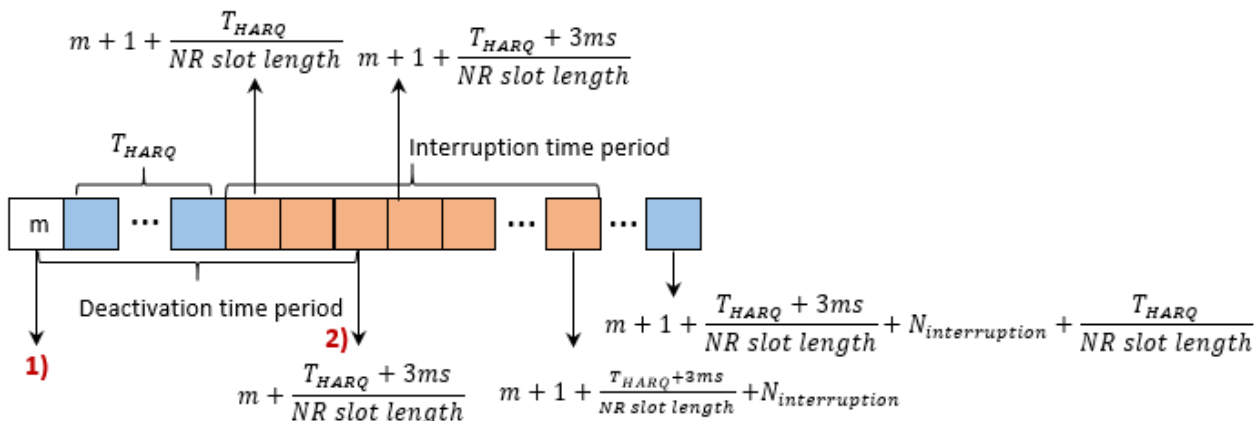
Figure 6.5.3.1.5-2: Procedure derivation for Deactivation

    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 $n + \frac{T_{HARQ} + T_{activtion\_time} + T_{CSI\_Reporting}}{NR\ slot\ length}$ 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 $T_{activation\_time}$ will be replaced with the value $T_{FirstSSB\_MAX}$ + T_{rs} + 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 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)

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-19 with condition SCell_add			
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)

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-167			
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)

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-167 with condition No_UL			
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 $T_{activation\_time}$ will be replaced with the value $T_{FirstSSB\_MAX} + T_{SMTC\_MAX} + 2*T_{rs} + 5ms$

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 $T_{UL\_carrier\_config}$ from the end of the last slot containing the RRC command.

$T_{UL\_carrier\_config}$ 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 $T_{UL\_carrier\_deconfig}$ from the end of the last slot containing the RRC command.

$T_{UL\_carrier\_deconfig}$ 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 ($BW_{channel}$) 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		
BW$_{channel}$	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		
BW$_{occupied}$	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		
		Conf 1, 2, 3	CR.1.1 FDD			CR.1.1 FDD		
		Conf 4, 5, 6	CR.1.1 TDD			CR.1.1 TDD		

RMSI CORESET reference measurement channel as defined in A.3.1.2		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								
N_{oc} 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		
$\hat{E}_s / N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
$\hat{E}_s / I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16

			Test 1			Test 2		
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/ 38.16 MHz	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 N_{oc} to be fulfilled within $BW_{occupied}$.								
NOTE 3: $\hat{E}_s/I_{ot}$, 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 $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.								
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.								
NOTE 6: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.								

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		
BW$_{channel}$	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		
BW$_{occupied}$	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		
		Conf 1, 4, 7	CCR.1.1 FDD			CCR.1.1 FDD		
		Conf 2, 5, 8	CCR.1.1 TDD			CCR.1.1 TDD		

RMC CORESET reference measurement channel as defined in A.3.1.3		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								
N_{oc} [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		
$\hat{E}_s/N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
$\hat{E}_s/I_{ot}$ [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/ 38.16 MHz	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 N_{oc} to be fulfilled within $BW_{occupied}$.								
NOTE 3: $\hat{E}_s/I_{ot}$, 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 $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.								
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.								
NOTE 6: $N_{RB,c}$ is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.								

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 $\bar{q}_0$ estimated over the last $T_{Evaluate\_BFD\_CSI-RS}$ [ms] period becomes worse than the threshold $Q_{out\_LR\_CSI-RS}$ within $T_{Evaluate\_BFD\_CSI-RS}$ [ms] period.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-1 for FR1.

For FR1,

- P=1/(1 – T_{CSI-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 M_{BFD} used in Table 6.5.5.0.2-1 is defined as

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

Table 6.5.5.0.2-1: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR1

Configuration	$T_{Evaluate\_BFD\_CSI-RS}$ (ms)
no DRX	max([50], [M_{BFD} *P] * T_{CSI-RS})
DRX cycle ≤ 320ms	max([50], [1.5×M_{BFD} *P]*max(T_{DRX}, T_{CSI-RS}))
DRX cycle > 320ms	[M_{BFD}*P] * T_{DRX}
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

When the radio link quality on all the configured RS resources in set $\bar{q}_0$ is worse than Q_{out_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 $\bar{q}_0$ 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 $T_{Indication\_interval\_BFD}$.

When DRX is not used, $T_{Indication\_interval\_BFD}$ is max(2ms, $T_{BFD-RS,M}$), where $T_{BFD-RS,M}$ is the shortest periodicity of all configured RS resources in set $\bar{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\bar{q}_0$ or CSI-RS resource in the set $\bar{q}_0$.

When DRX is used, $T_{Indication\_interval\_BFD}$ is max(1.5*DRX_cycle_length, 1.5*$T_{BFD-RS,M}$) if DRX cycle_length is less than or equal to 320ms, and $T_{Indication\_interval}$ 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 $\bar{q}_1$ estimated over the last $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period becomes better than the threshold Q_{in_LR} within $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period provided CSI-RS Ês/Iot is according to Annex Table B.2.4.2 for a corresponding band.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 6.5.5.0.2-2 for FR1.

For FR1,

- P=1/(1 – T_{CSI-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 M_{CBD} used in Table 6.5.5.0.2-2 is defined as

- M_{CBD} = 3, if the CSI-RS resource configured in the set $\bar{q}_1$ is transmitted with Density = 3.

Table 6.5.5.0.2-2: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR1

Configuration	$T_{Evaluate\_CBD\_CSI-RS}$ (ms)
non-DRX	$\max([25], \lceil M_{CBD} * P \rceil * T_{CSI-RS})$
DRX cycle ≤ 320ms	$\lceil M_{CBD} * P * N \rceil * \max(T_{DRX}, T_{CSI-RS})$
DRX cycle > 320ms	$\lceil M_{CBD} * P \rceil * T_{DRX}$
Note:	T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} 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 q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. 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
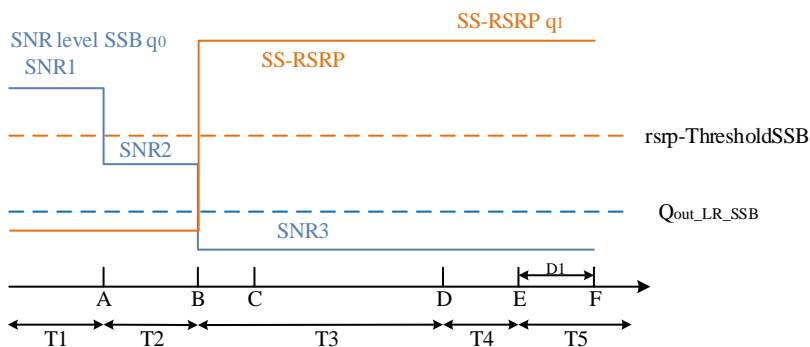
Figure 6.5.5.1.4-1: SNR and L1-RSRP variation for NR SA FR1 SSB-based beam failure detection and link recovery in non-DRX mode

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 (q_0)			0	
SSB Index assigned as CBD RS (q_1)			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 $Q_{in\_LR\_SSB}$
	Config 3	dBm/ SCS kHz	-95	Threshold used for $Q_{in\_LR\_SSB}$
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 q_1 before time point B

and

c) detects preamble on a beam associated with the candidate beam set q_1 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

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.501-1 [14],Table 7.3.1-15			
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 q_0	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 q_1	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
N_{oc}	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 q_1.

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 q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 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 q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. 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 q_1 of the candidate beam used for link recovery.
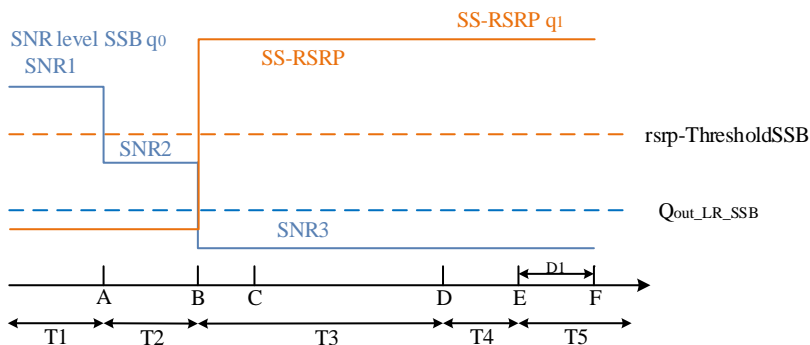
Figure 6.5.5.2.4-1: SNR and L1-RSRP variation for NR SA FR1 SSB-based beam failure detection and link recovery in DRX

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 (q_0)			0	
SSB Index assigned as CBD RS (q_1)			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 $Q_{in\_LR\_SSB}$
	Config 3	dBm/ SCS kHz	-95	Threshold used for $Q_{in\_LR\_SSB}$
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 q_1 before time point B

and

c) detects preamble on a beam associated with the candidate beam set q_1 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					
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB			0			
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 q_0	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 q_1	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
N_{oc}	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 q_1.

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 q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 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 q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. 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.
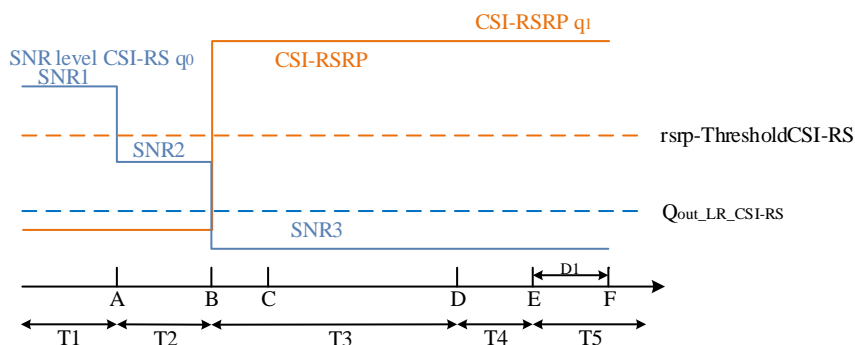
Figure 6.5.5.3.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and link recovery in non-DRX

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 q_0			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 q_1			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 $Q_{in\_LR\_SSB}$
	Config 3	dBm/SCS kHz	-95	Threshold used for $Q_{in\_LR\_SSB}$
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 q_0 and q_1	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
	Config 1		CSI-RS.1.1 FDD	

CSI-RS configuration for CSI reporting	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 q_1 before time point B

   and

   c) detects preamble on a beam associated with the candidate beam set q_1 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.3.1-11 with Condition CSI-RS 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 q_0	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		-108.2	-108.2	−87.8	−87.8	−87.8

	Config 2	dBm/S	-108.2	-108.2	−87.8	−87.8	−87.8
	Config 3	CS kHz	-105.2	-105.2	−84.8	−84.8	−84.8
N_{oc}	Config 1	dBm/15	-98				
	Config 2	kHz	-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 q_0 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 q_1.

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 q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 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 q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. 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 q_1 of the candidate beam used for link recovery.
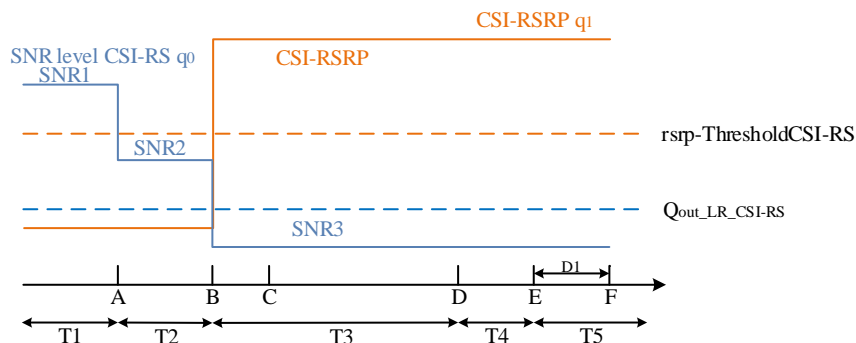
Figure 6.5.5.4.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and link recovery in DRX

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 q_0			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 q_1			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 $Q_{in\_LR\_SSB}$
	Config 3	dBm/SCS kHz	-95	Threshold used for $Q_{in\_LR\_SSB}$
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 q_0 and q_1	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
	Config 1		CSI-RS.1.1 FDD	

CSI-RS configuration for CSI reporting	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 q_1 before time point B

    and

    c) detects preamble on a beam associated with the candidate beam set q_1 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.3.1-11 with Condition CSI-RS 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					
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB			0		
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 q_0	Config 1		5.8	-2.2	-12.8	-12.8	-12.8
	Config 2	dB	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 q_1	Config 1		-10.2	-10.2	10.2	10.2	10.2
	Config 2	dB	-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 q_1	Config 1		-108.2	-108.2	−87.8	−87.8	−87.8

	Config 2	dBm/S	-108.2	-108.2	−87.8	−87.8	−87.8
	Config 3	CS kHz	-105.2	-105.2	−84.8	−84.8	−84.8
N_{oc}	Config 1	dBm/15	-98				
	Config 2	kHz	-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 q_1.

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 q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 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 q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. 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 q_0 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 q_1 of the candidate beam used for link recovery.
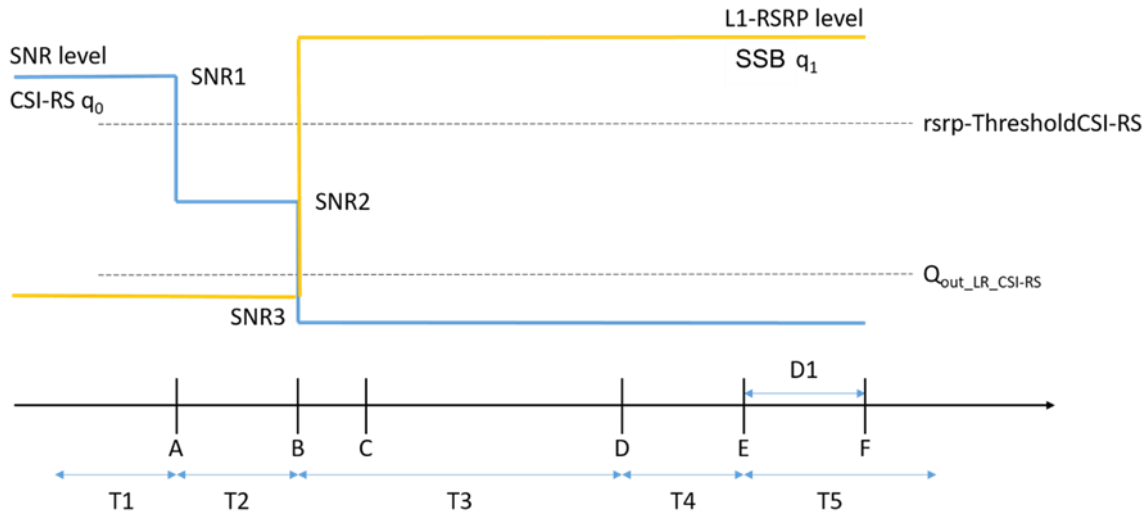
Figure 6.5.5.5.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery in non-DRX

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 q_0 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 $Q_{in\_LR\_SSB}$
	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 q_0 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*

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-150			
RLF-TimersAndConstants ::= SEQUENCE {			
n310	n2		
}			

Table 6.5.5.5.4.3-4: *PDCCH-Config*

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.501-1 [14],Table 4.6.3-95			
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

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.501-1 [14],Table 7.3.1-15			
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						
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB	0	0				
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	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 q_1	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 q_1	Config 1	dBm/ SCS kHz	-108	-108.2	-108.2	-87.8	-87.8	-87.8
	Config 2		-108	-108.2	-108.2	-87.8	-87.8	-87.8
	Config 3		-105	-105.2	-105.2	-84.8	-84.8	-84.8
N_{oc}	Config 1	dBm/ 15kHz	-98	-98				
	Config 2		-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 q_1.

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 q_1. 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 q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. 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 q_0 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 q_1 of the candidate beam used for link recovery.
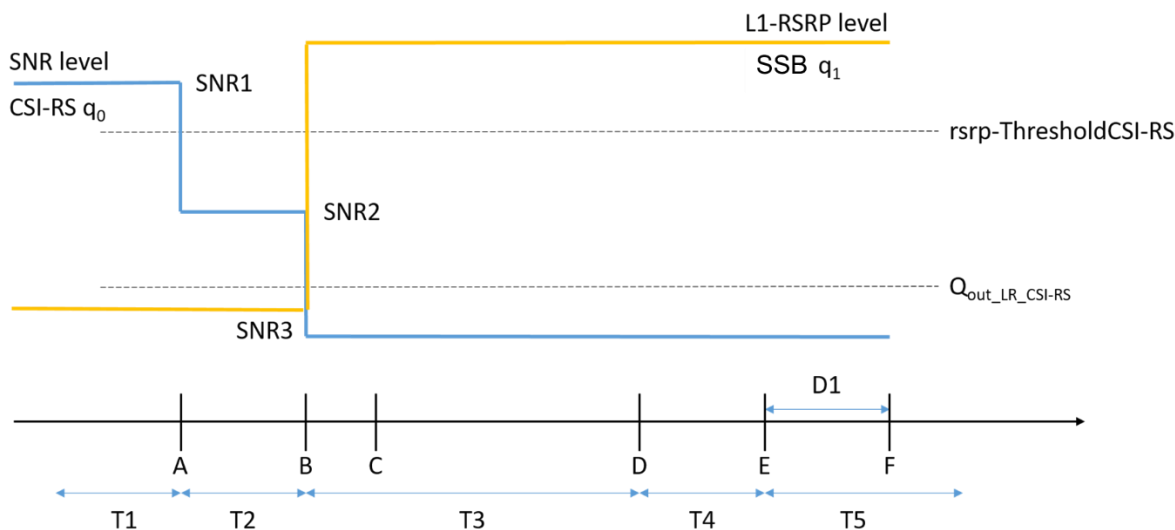

Figure 6.5.5.6.4-1: SNR and L1-RSRP variation for NR SA FR1 CSI-RS-based beam failure detection and SSB-based link recovery for SCell in DRX

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 q_0 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 $Q_{in\_LR\_SSB}$
	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 q_0 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

Parameter	Config	Units						
EPRE ratio of PDCCH DMRS to SSS		dB						
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB	0			0		
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	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 q_1	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 q_1	Config 1	dBm/ SCS kHz	-110	-108.2	-108.2	−87.8	−87.8	−87.8
	Config 2		-110	-108.2	-108.2	−87.8	−87.8	−87.8
	Config 3		-107	-105.2	-105.2	−84.8	−84.8	−84.8
N_{oc}	Config 1	dBm/15 kHz	-98	-98				
	Config 2		-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 q_0 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 q_1.

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 q_1. 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%.

6.5.6 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 $T_{BWPswitchDelay}$ 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 $T_{BWPswitchDelay}$ 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 $T_{BWPswitchDelay}$ 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 $T_{BWPswitchDelay}$ 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 $T_{BWPswitchDelay}$ defined in Table 6.5.6.1.0.1-1.

Table 6.5.6.1.0.1-1: BWP switch delay

μ	NR Slot length (ms)	BWP switch delay $T_{BWPswitchDelay}$ (slots)	
		Type 1[Note 1]	Type 2[Note 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

- $T_{BWPswitchDelay}$, 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

- $T_{BWPswitchDelay} + 1$, 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 $T_{BWPswitchDelay}$ 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 $T_{BWPswitchDelay}$ 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

μ	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

Editor's Note: TT analysis for test configuration with SpCC SCS = 15kHz + SCC SCS = 30kHz or SpCC SCS = 30kHz + SCC SCS = 15kHz are still missing.

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 (BW$_{channel}$) 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

Config$_{SCell}$	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 (BW$_{channel}$) 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.

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.

Before the test starts,

- 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.

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 and indicates BWP-1 as the active DL BWP using *firstActiveDownlinkBWP-Id*, according to Table 6.5.6.1.1.4.3-2.

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+T$_{BWPswitchDelay}$+k$_1$)

    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+T$_{BWPswitchDelay}$+ Interruption length + k$_1$)

    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+T$_{BWPswitchDelay}$+k$_1$)

    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+T$_{BWPswitchDelay}$+ Interruption length + k$_1$)

    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)**

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-167			
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)**

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-9			
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
}			
}			

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*

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	$T_{BWPswitchDelay}$	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

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
BW$_{channel}$			Note 7
BW$_{occupied}$	Config 1,2	RB	52 [Note 5]
	Config 3		106 [Note 6]
Active BWP ID			0
Initial DL BWP Configuration			DLBWP.0.2[Note4]
Initial UL BWP Configuration			ULBWP.0.2[Note4]
Active DL BWP-0 Configuration			DLBWP.0.2[Note4]
Active DL BWP-1 Configuration			N.A.
Active DL BWP-2 Configuration			N.A.
Active UL BWP-0 Configuration			ULBWP.0.2[Note4]
Active UL BWP-1 Configuration			N.A.
Active UL BWP-2 Configuration			N.A.
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
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)			
N$_{oc}$[Note 2]	Config 1,2	dBm/SCS	-104
	Config 3		-101
N$_{oc}$[Note 2]		dBm/15KHz	-104
SS-RSRP [Note 3]	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io[Note3]	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 N_{oc} to be fulfilled within $BW_{occupied}$.
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 $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
Note 6:	All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
Note 7:	$N_{RB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.

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	Config$_{SCell}$ 1		FDD
	Config$_{SCell}$ 2,3		TDD
TDD configuration	Config$_{SCell}$ 1		Not Applicable
	Config$_{SCell}$ 2		TDDConf.1.1
	Config$_{SCell}$ 3		TDDConf.1.2
BW$_{channel}$			Note 7
BW$_{occupied}$	Config$_{SCell}$ 1,2	RB	52 [Note 5]
	Config$_{SCell}$ 3		106 [Note 6]
Active BWP ID			1, 2
Initial DL BWP Configuration			DLBWP.0.2[Note4]
Initial UL BWP Configuration			N.A.
Active DL BWP-0 Configuration			N.A.
Active DL BWP-1 Configuration			DLBWP.1.1[Note4]
Active DL BWP-2 Configuration			DLBWP.1.3[Note4]
Active UL BWP-0 Configuration			N.A.
Active UL BWP-1 Configuration			N.A.
Active UL BWP-2 Configuration			N.A.
PDSCH Reference measurement channel	Config$_{SCell}$ 1		SR.1.1 FDD
	Config$_{SCell}$ 2		SR.1.1 TDD
	Config$_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters	Config$_{SCell}$ 1		CR.1.1 FDD
	Config$_{SCell}$ 2		CR.1.1 TDD
	Config$_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	Config$_{SCell}$ 1		CCR.1.2 FDD
	Config$_{SCell}$ 2		CCR.1.2 TDD
	Config$_{SCell}$ 3		CCR.2.4 TDD
TRS Configuration	Config$_{SCell}$ 1		TRS.1.1 FDD
	Config$_{SCell}$ 2		TRS.1.1 TDD
	Config$_{SCell}$ 3		TRS.1.2 TDD
OCNG Patterns	Config$_{SCell}$ 1,2		OP.1 [Note 5]
	Config$_{SCell}$ 3		OP.1 [Note 6]
SSB Configuration	Config$_{SCell}$ 1,2		SSB.1 FR1
	Config$_{SCell}$ 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]			
N$_{oc}$[Note 2]	Config$_{SCell}$ 1,2	dBm/SCS	-104
	Config$_{SCell}$ 3		-101
N$_{oc}$[Note 2]		dBm/15KHz	-104
SS-RSRP [Note 3]	Config$_{SCell}$ 1,2	dBm/SCS	-87
	Config$_{SCell}$ 3		-84
Ê$_s$/I$_{ot}$		dB	17
Ê$_s$/N$_{oc}$		dB	17
Io[Note3]	Config$_{SCell}$ 1,2	dBm/ 9.36MHz	-58.96
	Config$_{SCell}$ 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 N_{oc} to be fulfilled within $BW_{occupied}$.	
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 $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.	
Note 6:	All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.	
Note 7:	$N_{RB,c}$ is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.	

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 ($i+T_{BWPswitchDelay}+k_1$).

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 ($j+T_{BWPswitchDelay}+k_1$).

Where, k_1 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 $T_{BWPswitchDelay}$ 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 ($i+ T_{BWPswitchDelay}+k_1$), ($j+ T_{BWPswitchDelay}+k_1$), 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.

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.

Before the test starts,

-    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.

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 and indicates BWP-1 as the active DL BWP using *firstActiveDownlinkBWP-Id*, according to Table 6.5.6.1.2.4.3-2.

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 ($i+T_{BWPswitchDelay}+k_1$). 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 ($j+T_{BWPswitchDelay}+k_1$). 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)**

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-167			
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
}			
}			

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*

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-103			
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	$T_{BWPswitchDelay}$	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	
}			
}			

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
BW$_{channel}$	Config 1		10 MHz: $N_{RB,c}$ = 52
	Config 2		10 MHz: $N_{RB,c}$ = 52
	Config 3		40 MHz: $N_{RB,c}$ = 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)			
N_{oc} [Note 2]	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc} [Note 2]		dBm/15kHz	-104
SS-RSRP [Note 3]	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
I_o [Note3]	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 $(i+T_{BWPswitchDelay}+k_1)$.

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 $(j+T_{BWPswitchDelay}+k_1)$.

Where, k_1 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 $T_{BWPswitchDelay}$ 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 $(i+ T_{BWPswitchDelay}+k_1)$, $(j+ T_{BWPswitchDelay}+k_1)$, 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 $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [13], and

$T_{BWPswitchDelayRRC} = 6ms$ 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 $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ 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.

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.

Before the test starts,

- 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 1.

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 $i + \frac{T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}}{NR\,Slot\,length} + k1$ then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.

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
BW$_{channel}$	Config 1		10 MHz: N$_{RB,c}$ = 52
	Config 2		10 MHz: N$_{RB,c}$ = 52
	Config 3		40 MHz: N$_{RB,c}$ = 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]			
N$_{oc}$[Note 2]	Config 1,2	dBm/SCS	-104
	Config 3		-101
SS-RSRP [Note 3]	Config 1,2	dBm/SCS	-87
	Config 3		-84
Ê$_s$/I$_{ot}$		dB	17
Ê$_s$/N$_{oc}$		dB	17

Io[Note3]				
	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 N_{oc} 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 $i + \frac{T_{\text{RRCprocessingDelay}} + T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{\text{RRCprocessingDelay}} + T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}} + k1$.

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

μ	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*

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], , Table 4.6.3-19			
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

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 7.3.1-1 with condition TDDConf.2.1			
TDD-UL-DL-ConfigCommon ::= SEQUENCE {			
pattern1 SEQUENCE {			
nrofDownlinkSymbols	11		
nrofUplinkSymbols	2		
}			
}			

6.5.7.1.4.3-5: SRS-Config

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-182			
SRS-Config ::= SEQUENCE {			
srs-ResourceSetToAddModList SEQUENCE (SIZE(0..maxNrofSRS-ResourceSets)) OF SEQUENCE {	3GPP		
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*

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-39			
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*
BW$_{channel}$	Config 1		10 MHz: N$_{RB,c}$ = 52	40 MHz: N$_{RB,c}$ = 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)				
N$_{oc}$[Note 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
Ê$_s$/I$_{ot}$		dB	17	17
Ê$_s$/N$_{oc}$		dB	17	17
N$_{oc}$[Note 2]	Config 1	dBm/SCS	105.1	-102.1
Io[Note3] on symbols without CSI-RS	Config 1	dBm/9.36 MHz	60.06	-
		dBm/ 38.16MHz	-	-53. 96
Io[Note6] 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 N_{oc} 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

μ	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*

Information Element	Value/remark	Comment	Condition
Derivation Path: TS 38.508-1 [14], Table 4.6.3-38			
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
BW$_{channel}$	Config 1		40 MHz: N$_{RB,c}$ = 106	40 MHz: N$_{RB,c}$ = 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)				
N$_{oc}$ Note 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
Ê$_s$/I$_{ot}$		dB	17	17
Ê$_s$/N$_{oc}$		dB	17	17
N$_{oc}$ Note 2	Config 1	dBm/SCS	-102.1	-102.1
Io Note3 on symbols without CSI-RS	Config 1	dBm/ 38.16MHz	-53.96	-53.96
Io Note6 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 N$_{oc}$ 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

μ	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%.