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

5.0 General

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

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

5.1 Void

5.2 Void

5.3 RRC_CONNECTED state mobility

5.3.1 Void

5.3.2 RRC connection mobility control

5.3.2.1 Void

5.3.2.2 Random access

5.3.2.2.1 EN-DC FR2 contention based random access

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

- The settable window for first preamble uplink power and the uplink calibration process are FFS.
- The test requirement for absolute uplink power is FFS.
- The test requirement for relative uplink power is FFS.
- The uncertainty value and test requirement for PRACH timing are in []
- The results of the TT analysis are provisional until the corresponding MU values are agreed

5.3.2.2.1.1 Test purpose

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

5.3.2.2.1.2 Test applicability

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

5.3.2.2.1.3 Minimum conformance requirement

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

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

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

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

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

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

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

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

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

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

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

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

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

5.3.2.2.1.4 Test description

5.3.2.2.1.4.1 Initial conditions

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

Table 5.3.2.2.1.4.1-1: Supported test configurations

Test Case ID	Test Config Index	Description
5.3.2.2.1-1	1	LTE FDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
5.3.2.2.1-2	2	LTE TDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD

NOTE: The UE is only required to be tested in one of the supported test configurations.

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

With the UE configured to report SS-RSRP, the Δ_{DL} value is calculated as $(RSRP_{REP} - RSRP_{76})$, where $RSRP_{REP}$ is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value $RSRP_x$, x is treated as a positive integer value.

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

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

Table 5.3.2.2.1.4.1-2: Initial conditions

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

1. Message contents are defined in clause 5.3.2.2.1.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.1.5-1.
3. Downlink signals for NR cell are initially set up according to clause C.2.1.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.1.4.2 Test procedure

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

1. Ensure the UE is in state E-UTRA RRC_CONNECTED with generic procedure parameters *Connectivity E-UTRA/EPC* with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to Table 5.3.2.2.1.5-1.
3. The test system shall send a RRCReconfiguration message to the UE to add NR PSCell, then the UE shall trigger a random access procedure.
4. Test 1: Correct behaviour when transmitting Random Access Preamble

- 4.1. The UE shall send a preamble to the System Simulator. The System Simulator shall check that the Random Access Preamble belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured rsrp-ThresholdSSB .
5. Test 2: Correct behaviour when receiving Random Access Response
 - 5.1. Repeat steps 1-3.
 - 5.2. The UE shall send preambles to the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response containing Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.
 - 5.3. As the received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires.
 - 5.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator.
 - 5.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3.
 - 5.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.1.5. Measure the relative power and timing applied to additional preambles (last 4 preambles) and it shall not exceed the values specified in 5.3.2.2.1.5.
6. Test 3: Correct behaviour when not receiving Random Access Response
 - 6.1. Repeat steps 1-3.
 - 6.2. The UE shall send preambles to the System Simulator. The System Simulator shall not respond to the first 4 preambles.
 - 6.3. As no Random Access Response was received within the RA Response window, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the backoff time expires.
 - 6.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator.
 - 6.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3.
 - 6.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.1.5. Measure the relative power and timing applied to additional preambles (last 4 preambles) and it shall not exceed the values specified in 5.3.2.2.1.5.
7. Test 4: Correct behaviour when receiving an UL grant for msg3 retransmission
 - 7.1. Repeat steps 1-3.
 - 7.2. The UE shall send a preamble to the System Simulator. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble.
 - 7.3. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3 including C-RNTI MAC control element.
 - 7.4. The System Simulator shall send PDCCH addressed to the Temporary C-RNTI after receiving the msg3.
 - 7.5. The UE shall re-transmit the msg3 including C-RNTI MAC control element.

- 7.6. The System Simulator shall check if UE re-transmit the msg3.
8. Test 5: Correct behaviour when receiving a successful UE Contention Resolution
- 8.1. Repeat steps 1-3.
- 8.2. The UE shall send a preamble to the System Simulator. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble.
- 9.3. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3 including C-RNTI MAC control element.
- 9.4. The System Simulator shall send a PDCCH addressed to the C-RNTI.
- 9.5. The UE shall send PUSCH according to the received PDCCH addressed to the C-RNTI.
10. Test 7: Correct behaviour when contention Resolution timer expires
- 10.1. Repeat steps 1-3.
- 10.2. The UE shall send a preamble to the System Simulator. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble.
- 10.3. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE shall transmit the msg3.
- 10.4. The System Simulator shall not send a response.
- 10.5. As there was no response, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power when the Contention Resolution Timer expires and then after the backoff timer expires.
- 10.6. Measure the power and timing of the first preamble after the Contention Resolution Timer and backoff timer expire and it shall not exceed the values specified in 5.3.2.2.1.5.

5.3.2.2.1.4.3 Message contents

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

Table 5.3.2.2.1.4.3-0: Common Exception messages

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

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

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

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

Derivation Path: TS 38.508-1 [14], table 4.6.3-128			
Information Element	Value/remark	Comment	Condition
RACH-ConfigCommon ::= SEQUENCE {			
rach-ConfigGeneric	RACH-ConfigGeneric		
totalNumberOfRA-Preambles	48		
ssb-perRACH-OccasionAndCB-PreamblesPerSSB CHOICE {			
oneFourth	n48		FR2
}			
groupBconfigured SEQUENCE {			
numberOfRA-PreamblesGroupA	48		
}			
ra-ContentionResolutionTimer	sf48		
rsrp-ThresholdSSB	RSRP_69 + Δ_{DL}	Δ_{DL} is derived from the downlink calibration process	
prach-RootSequenceIndex CHOICE {			
l139	0		
}			
msg1-SubcarrierSpacing	kHz 120		
}			

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

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

Table 5.3.2.2.1.4.3-4: ServingCellConfigCommonSIB for Contention Based Random Access

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

5.3.2.2.1.5 Test requirement

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

Table 5.3.2.2.1.5-1: General test parameters

Parameter	Unit	Test-1	Comments
SSB Configuration	Config 1,2	SSB.1 FR2	As defined in A.3.2
CSI-RS for tracking	Config 1,2	TRS.2.1 TDD	
Duplex Mode for Cell 2	Config 1,2	TDD	
TDD Configuration	Config 1,2	TDDConf.3.1	As defined in A.1.5
BW _{channel}	Config 1,2	MHz	100: N _{RB,c} = 24
OCNG Pattern ^{Note 1}		OP.3	As defined in A.2.1
PDSCH Reference Channel ^{Note 2}	Config 1,2	SR.3.1 TDD	As defined in A.1.1
RMSI CORESET Reference Channel	Config 1,2	CR.3.1 TDD	As defined in A.1.2
RMC CORESET Reference Channel	Config 1,2	CCR.3.1 TDD	As defined in A.1.3
NR RF Channel Number		1	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH_DMRS to SSS	dB		
EPRE ratio of PBCH to PBCH_DMRS	dB		
EPRE ratio of PDCCH_DMRS to SSS	dB		
EPRE ratio of PDCCH to PDCCH_DMRS	dB		
EPRE ratio of PDSCH_DMRS to SSS	dB		
EPRE ratio of PDSCH to PDSCH_DMRS	dB		
ss-PBCH-BlockPower	dBm/ SCS	+20 + Δ_{UL}	As defined in TS 38.331 [13]. Δ_{UL} is derived from the uplink calibration process ^{Note 3}
Configured UE transmitted power ($P_{C_{MAX, f,c}}$)	dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 of TS 38.101-2 [3]
PRACH Configuration		PRACH.1 FR2	As defined in A.7.2, with exceptions as defined below
rsrp-ThresholdSSB	dBm	RSRP_69 + Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process ^{Note 4}
preambleReceivedTargetPower	dBm	-100	As defined in TS 38.331 [13]
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			
NOTE 3: The Δ_{UL} value is calculated as $-\text{ROUND}(\text{PPRACH}_0 - 1)$, where PPRACH ₀ is the measured first PRACH power with -80.6dBm/SCS applied, <i>preambleReceivedTargetPower</i> = -100dBm and <i>ss-PBCH-BlockPower</i> = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.			
NOTE 4: The Δ_{DL} value is calculated as $(\text{RSRP}_{\text{REP}} - \text{RSRP}_{76})$, where RSRP_{REP} is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP _x , x is treated as a positive integer value.			

Table 5.3.2.2.1.5-2: OTA-related test parameters

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.9.1
Assumption for UE beams ^{Note 2}			Rough	
SSB with index 0	E_s ^{Note 1}	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-80.6	
	$E_s/10_{\text{dB}}$	dB	21.09	
	I_0	dBm/95.04 MHz	-56.01	I_0 in symbols containing SSB index 0
SSB with index 1	E_s ^{Note 1}	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-95.0	
	$E_s/10_{\text{dB}}$	dB	6.69	
	I_0	dBm/95.04 MHz	-70.41	I_0 in symbols containing SSB index 1
Propagation Condition		-	AWGN	
NOTE 1: No artificial noise is applied in this test.				
NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation				

Test 1: Correct behaviour when transmitting Random Access Preamble

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

Test 2: Correct behaviour when receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.1.5-3.
- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.1.5-4.
- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.1.5-5.

Test 3: Correct behaviour when not receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.1.5-3.
- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.1.5-4.
- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.1.5-5.

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

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

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

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

Test 7: Correct behaviour when contention resolution timer expires

- The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the back off time expires if the contention resolution timer expires.
- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.1.5-3.
- The transmit timing of the PRACH transmission shall be within the accuracy specified in Table 5.3.2.2.1.5-5.

Table 5.3.2.2.1.5-3 Absolute power tolerance Test requirements

Conditions	Tolerance
Normal	\pm FFS dB

Table 5.3.2.2.1.5-4 Relative power tolerance Test requirements

Measured power	Power step ΔP (dB)	PRACH (dB)
Measured power of both PRACHs being compared > $(P_{\max}^{\text{Note1}} - 6\text{dB})$	$2 \leq \Delta P < 3$	$\pm (4+\text{FFS})$.
Measured power of either PRACHs being compared $\leq (P_{\max}^{\text{Note1}} - 6\text{dB})$		$\pm (6+\text{FFS})$
NOTE 1: P_{\max} is the Min peak EIRP defined in clause 6.2.1 of TS 38.101-2 [3], selected according to power class and operating band.		

Table 5.3.2.2.1.5-5: T_e Timing error Test requirements

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

5.3.2.2.2 EN-DC FR2 non-contention based random access

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

- The settable window for first preamble uplink power and the uplink calibration process are FFS.
- The test requirement for absolute uplink power is FFS.
- The test requirement for relative uplink power is FFS.
- The uncertainty value and test requirement for PRACH timing are in []
- The results of the TT analysis are provisional until the corresponding MU values are agreed

5.3.2.2.2.1 Test purpose

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

5.3.2.2.2.2 Test applicability

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

5.3.2.2.2.3 Minimum conformance requirement

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

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

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

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

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

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

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

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

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

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

5.3.2.2.2.4 Test description

5.3.2.2.2.4.1 Initial conditions

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

Table 5.3.2.2.2.4.1-1: Supported test configurations

Test Case ID	Test Config Index	Description
5.3.2.2.2-1	1	LTE FDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
5.3.2.2.2-2	2	LTE TDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
NOTE: The UE is only required to be tested in one of the supported test configurations		

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

With the UE configured to report SS-RSRP, the Δ_{DL} value is calculated as $(RSRP_{REP} - RSRP_{76})$, where $RSRP_{REP}$ is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value $RSRP_x$, x is treated as a positive integer value.

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

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

Table 5.3.2.2.2.4.1-2: Initial conditions

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

1. Message contents are defined in clause 5.3.2.2.2.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.2.5-1.
3. Downlink signals for NR cell are initially set up according to clause C.2.1.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.2.4.2 Test procedure

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

1. Ensure the UE is in state E-UTRA RRC_CONNECTED with generic procedure parameters *Connectivity E-UTRA/EPC* with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to Table 5.3.2.2.2.5-1.
3. SS sends a RRCReconfiguration to trigger a contention-free random access procedure according to Table 5.3.2.2.2.4.3-2.
4. Test 1: Correct behaviour when transmitting SSB-based Random Access Preamble
 - 4.1. The UE shall send a preamble to the System Simulator. The System Simulator shall check that the Random Access Preamble has the Preamble Index associated with the SSB with index 0, that it arrives on a PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and that the selected PRACH occasion belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.
5. Test 2: Correct behaviour when transmitting CSI-RS-based Random Access Preamble
 - 5.1. Set the parameters according to Table 5.3.2.2.2.5-1 Subtest 2.
 - 5.2. Repeat steps 1-3
 - 5.3. The UE shall send a preamble to the System Simulator. The System Simulator shall check that the Random Access Preamble has the Preamble Index associated with the CSI-RS configured, that it arrives on a PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and that the selected PRACH occasion belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.
6. Test 3: Correct behaviour when receiving Random Access Response
 - 6.1. Repeat steps 1-3

- 6.2. The UE shall send preambles to the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response containing Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.
- 6.3. As the received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power.
- 6.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator.
- 6.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE may stop monitoring for Random Access Response(s).
- 6.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.5. Measure the relative power and timing applied to additional preambles (last 2 preambles) and it shall not exceed the values specified in 5.3.2.2.5.
7. Test 4: Correct behaviour when not receiving Random Access Response
- 7.1. Repeat steps 1-3.
- 7.2. The UE shall send preambles to the System Simulator. The System Simulator shall not respond to the first 2 preambles.
- 7.3. As no Random Access Response was received within the RA Response window configured in *RACH-ConfigCommon*, the UE shall perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [12], and transmit with the calculated PRACH transmission power.
- 7.4. The System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier matching the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator.
- 7.5. As the received Random Access Response contains a Random Access Preamble identifier that matches the transmitted Random Access Preamble, the UE may stop monitoring for Random Access Response(s).
- 7.6. Measure the power and timing of the first preamble and it shall not exceed the values specified in 5.3.2.2.5. Measure the relative power and timing applied to additional preambles (last 2 preambles) and it shall not exceed the values specified in 5.3.2.2.5.

5.3.2.2.4.3 Message contents

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

Table 5.3.2.2.4.3-0: Common Exception messages

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

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

Derivation Path: TS 38.508-1 [14], table 4.6.3-128			
Information Element	Value/remark	Comment	Condition
RACH-ConfigCommon::= SEQUENCE {			
rach-ConfigGeneric	RACH-ConfigGeneric		
totalNumberOfRA-Preambles	48		
groupBconfigured SEQUENCE {			
numberOfRA-PreamblesGroupA	48		
}			
rsrp-ThresholdSSB	RSRP ₆₉ + Δ _{DL}	Δ _{DL} is derived from the downlink calibration process	Subtest 1
prach-RootSequenceIndex CHOICE {			
l139	0		
}			
msg1-SubcarrierSpacing	kHz 120		
}			

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

Derivation Path: TS 38.508-1 [14], table 4.6.3-129			
Information Element	Value/remark	Comment	Condition
RACH-ConfigDedicated::= SEQUENCE {			
cfra SEQUENCE {			
occasions SEQUENCE {			
ssb-perRACH-Occasion	oneFourth		
}			
resources CHOICE {			
ssb SEQUENCE {			
ssb-ResourceList SEQUENCE (SIZE(1..maxRA-SSB-Resources)) OF {	1 entry		
ssb[1]	0		
ra-PreambleIndex[1]	50		Subtest 1
}			
ra-ssb-OccasionMaskIndex	1		Subtest 1
}			
csirs SEQUENCE {			
csirs-ResourceList SEQUENCE (SIZE(1..maxRA-CSIRS-Resources)) OF {			
ra-OccasionList	1		Subtest 2
ra-PreambleIndex[1]	50		Subtest 2
}			
rsrp-ThresholdCSI-RS	RSRP ₆₉ + Δ _{DL}	Δ _{DL} is derived from the downlink calibration process	Subtest 2
}			
}			

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

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

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

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

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

Derivation Path: TS 38.508-1 [14], table 4.6.3-19			
Information Element	Value/remark	Comment	Condition
CellGroupConfig ::= SEQUENCE {			
spCellConfig SEQUENCE {			
servCellIndex	ServCellIndex		
reconfigurationWithSync SEQUENCE {			
newUE-Identity	1		
rach-ConfigDedicated CHOICE {			
uplink	RACH-ConfigDedicated		
}			
}			
}			

5.3.2.2.2.5 Test requirement

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

Table 5.3.2.2.2.5-1: General test parameters

Parameter	Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1,2	SSB.1 FR2	SSB.1 FR2	As defined in A.3.2
CSI-RS Configuration	Config 1,2	N/A	CSI-RS.3.1 TDD	As defined in A.1.4
Duplex Mode for Cell 2	Config 1,2	TDD	TDD	
TDD Configuration	Config 1,2	TDDConf.3.1	TDDConf.3.1	As defined in A.1.5
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c} = 24$	100: $N_{RB,c} = 24$
OCNG Pattern ^{Note 1}		OP.3	OP.3	As defined in A.2.1.
PDSCH Reference Channel ^{Note 2}	Config 1,2	SR3.1 TDD	SR3.1 TDD	As defined in A.1.1.
RMSI CORESET Reference Channel	Config 1,2	CR.3.1 TDD	CR.3.1 TDD	As defined in A.1.2
RMC CORESET Reference Channel	Config 1,2	CCR.3.1 TDD	CCR.3.1 TDD	As defined in A.1.3
NR RF Channel Number		1	1	
EPRE ratio of PSS to SSS	dB	0	0	
EPRE ratio of PBCH_DMRS to SSS	dB			
EPRE ratio of PBCH to PBCH_DMRS	dB			
EPRE ratio of PDCCH_DMRS to SSS	dB			
EPRE ratio of PDCCH to PDCCH_DMRS	dB			
EPRE ratio of PDSCH_DMRS to SSS	dB			
EPRE ratio of PDSCH to PDSCH_DMRS	dB			
ss-PBCH-BlockPower	dBm/ SCS	+20 + Δ_{UL}	+20 + Δ_{UL}	As defined in TS 38.331 [13]. Δ_{UL} is derived from the uplink calibration process ^{Note 3}
Configured UE transmitted power ($P_{CMAX, f,c}$)	dBm	maximum value configurable for certain power class	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [3]
PRACH Configuration		PRACH.2 FR2	PRACH.3 FR2	As defined in A.7.2, with exceptions as defined below.
rsrp-ThresholdSSB	dBm	RSRP_69 + Δ_{DL}	RSRP_69 + Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process ^{Note 4}
preambleReceivedTargetPower	dBm	-100	-100	As defined in TS 38.331 [13]
<p>NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.</p> <p>NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.</p> <p>NOTE 3: The Δ_{UL} value is calculated as $-\text{ROUND}(\text{PPRACH0} - 1)$, where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, $\text{preambleReceivedTargetPower} = -100\text{dBm}$ and $\text{ss-PBCH-BlockPower} = 20\text{dBm}$. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.</p> <p>NOTE 4: The Δ_{DL} value is calculated as $(\text{RSRP}_{\text{REP}} - \text{RSRP}_{76})$, where RSRP_{REP} is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.</p>				

Table 5.3.2.2.5-2: OTA-related test parameters

Parameter	Unit	Test-1	Test-2	Comments	
AoA setup		Setup 1	Setup 1	As defined in A.9.1	
Assumption for UE beams ^{Note 2}		Rough	Rough		
SSB with index 0	E_s ^{Note 1}	dBm/SCS	-80.6	-80.6	Power of SSB with index 0 is set to be above configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-80.6	-80.6	
	$E_s/10_{\text{dB}}$	dB	21.09	21.09	
	10	dBm/95.0 4 MHz	-56.01	-56.01	10 in symbols containing SSB index 0
SSB with index 1	E_s ^{Note 1}	dBm/SCS	-95.0	-95.0	Power of SSB with index 1 is set to be below configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-95.0	-95.0	
	$E_s/10_{\text{dB}}$	dB	6.69	6.69	
	10	dBm/95.0 4 MHz	-70.41	-70.41	10 in symbols containing SSB index 1
Propagation Condition	-	AWGN	AWGN		
NOTE 1: No artificial noise is applied in this test.					
NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation					

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

- The Random Access Preamble shall be one of the Random Access Preambles associated with SSB index 0.
- The Random Access Preamble shall arrive on a PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0.
- The selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

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

- The Random Access Preamble shall have the Preamble Index associated with the CSI-RS configured.
- The Random Access Preamble shall arrive on a PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured.
- The selected PRACH occasion belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.

Test 3: Correct behaviour when receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.5-3.
- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.5-4.
- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.5-5.

Test 4: Correct behaviour when not receiving Random Access Response

- The power of the first preamble shall be 0.6 dBm within the accuracy specified in Table 5.3.2.2.5-3.
- The relative power for preamble ramping step shall be 2 dB within the accuracy specified in Table 5.3.2.2.5-4.
- The transmit timing of all PRACH transmissions shall be within the accuracy specified in Table 5.3.2.2.5-5.

Table 5.3.2.2.5-3 Absolute power tolerance Test requirements

Conditions	Tolerance
Normal	\pm FFS dB

Table 5.3.2.2.2.5-4 Relative power tolerance Test requirements

Measured power	Power step ΔP (dB)	PRACH (dB)
Measured power of both PRACHs being compared $> (P_{\max}^{\text{Note1}} - 6\text{dB})$	$2 \leq \Delta P < 3$	$\pm (4+\text{FFS})$.
Measured power of either PRACHs being compared $\leq (P_{\max}^{\text{Note1}} - 6\text{dB})$		$\pm (6+\text{FFS})$
NOTE 1: P_{\max} is the Min peak EIRP defined in clause 6.2.1 of TS 38.101-2 [3], selected according to power class and operating band.		

Table 5.3.2.2.2.5-5: T_e Timing error Test requirements

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

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

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

- Message contents are not complete.
- TT analysis and test requirements are missing.
- Test procedure is FFS

5.3.2.2.3.1 Test purpose

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

5.3.2.2.3.2 Test applicability

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

5.3.2.2.3.3 Minimum conformance requirement

Same as in clause 4.3.2.2.3.3

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

5.3.2.2.3.4 Test description

5.3.2.2.3.4.1 Initial conditions

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

Table 5.3.2.2.3.4.1-1: Supported test configurations

Test Case ID	Test Config Index	Description
5.3.2.2.3-1	1	LTE FDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
5.3.2.2.3-2	2	LTE TDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
NOTE: The UE is only required to be tested in one of the supported test configurations		

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

With the UE configured to report SS-RSRP, the Δ_{DL} value is calculated as $(RSRP_{REP} - RSRP_{76})$, where $RSRP_{REP}$ is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value $RSRP_x$, x is treated as a positive integer value.

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

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

Table 5.3.2.2.3.4.1-2: Initial conditions

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

1. Message contents are defined in clause 5.3.2.2.3.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.3.5-1.
3. Downlink signals for NR cell are initially set up according to clause C.2.1.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.3.4.2 Test procedure

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

1. Ensure the UE is in state E-UTRA RRC_CONNECTED with generic procedure parameters *Connectivity E-UTRA/EPC* with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to Table 5.3.2.2.3.5-1.
3. The test system shall send a RRCReconfiguration message to the UE to add NR PSCell, then the UE shall trigger a random access procedure.

FFS

5.3.2.2.3.4.3 Message contents

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

Table 5.3.2.2.3.4.3-0: Common Exception messages

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

5.3.2.2.3.5 Test requirement

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

Table 5.3.2.2.3.5-1: General test parameters

Parameter	Unit	Test-1	Comments
SSB Configuration	Config 1,2	SSB.1 FR2	As defined in A.3.2
Duplex Mode for Cell 2	Config 1,2	TDD	
TDD Configuration	Config 1,2	TDDConf.3.1	As defined in A.1.5
BW _{channel}	Config 1,2	MHz	100: N _{RB,c} = 24
OCNG Pattern ^{Note 1}		OP.3	As defined in A.2.1
PDSCH Reference Channel ^{Note 2}	Config 1,2	SR.3.1 TDD	As defined in A.1.1
RMSI CORESET Reference Channel	Config 1,2	CR.3.1 TDD	As defined in A.1.2
RMC CORESET Reference Channel	Config 1,2	CCR.3.1 TDD	As defined in A.1.3
NR RF Channel Number		1	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH_DMRS to SSS	dB		
EPRE ratio of PBCH to PBCH_DMRS	dB		
EPRE ratio of PDCCH_DMRS to SSS	dB		
EPRE ratio of PDCCH to PDCCH_DMRS	dB		
EPRE ratio of PDSCH_DMRS to SSS	dB		
EPRE ratio of PDSCH to PDSCH_DMRS	dB		
<i>ss-PBCH-BlockPower</i>	dBm/ SCS	+20 + Δ_{UL}	As defined in TS 38.331 [13]. Δ_{UL} is derived from the uplink calibration process ^{Note 3}
Configured UE transmitted power ($P_{CMAX,f,c}$)	dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 of TS 38.101-2 [3]
MsgA Configuration		FR2 MsgA configuration 1	As defined in FFS, with exceptions as defined below
<i>msgA-RSRP-ThresholdSSB</i>	dBm	RSRP_69 + Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process ^{Note 4}
<i>msgA-PreambleReceivedTargetPower</i>	dBm	-100	As defined in TS 38.331 [13]
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			
NOTE 3: The Δ_{UL} value is calculated as $-\text{ROUND}(\text{PPRACH0} - 1)$, where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, <i>preambleReceivedTargetPower</i> = -100dBm and <i>ss-PBCH-BlockPower</i> = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.			
NOTE 4: The Δ_{DL} value is calculated as $(\text{RSRP}_{\text{REP}} - \text{RSRP}_{76})$, where RSRP _{REP} is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP _x , x is treated as a positive integer value.			

Table 5.3.2.2.3.5-2: OTA-related test parameters

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.9.1
Assumption for UE beams ^{Note 2}			Rough	
SSB with index 0	E_s ^{Note 1}	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-80.6	
	$E_s/10_{dB}$	dB	21.09	
	I_0	dBm/95.04 MHz	-56.01	I_0 in symbols containing SSB index 0
SSB with index 1	E_s ^{Note 1}	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-95.0	
	$E_s/10_{dB}$	dB	6.69	
	I_0	dBm/95.04 MHz	-70.41	I_0 in symbols containing SSB index 1
Propagation Condition		-	AWGN	
NOTE 1: No artificial noise is applied in this test.				
NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation				

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

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

- Message contents are not complete.
- TT analysis and test requirements are missing.
- Test procedure is FFS

5.3.2.2.4.1 Test purpose

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

5.3.2.2.4.2 Test applicability

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

5.3.2.2.4.3 Minimum conformance requirement

Same as in clause 4.3.2.2.4.3

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

5.3.2.2.4.4 Test description

5.3.2.2.4.4.1 Initial conditions

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

Table 5.3.2.2.4.4.1-1: Supported test configurations

Test Case ID	Test Config Index	Description
5.3.2.2.4-1	1	LTE FDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
5.3.2.2.4-2	2	LTE TDD, NR 120 kHz SSB SCS, 10MHz bandwidth, TDD
NOTE: The UE is only required to be tested in one of the supported test configurations		

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

With the UE configured to report SS-RSRP, the Δ_{DL} value is calculated as $(RSRP_{REP} - RSRP_{76})$, where $RSRP_{REP}$ is the SS-RSRP Reported value according to TS 38.133 [6] Table 10.1.6.1-1 with -80.6dBm/SCS applied at the Reference point. For a Reported value $RSRP_x$, x is treated as a positive integer value.

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

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

Table 5.3.2.2.4.4.1-2: Initial conditions

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

1. Message contents are defined in clause 5.3.2.2.4.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The E-UTRAN PCell power levels and settings are specified in Table A.6.1.1-1. Cell 2 is the NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, with downlink signal levels as per clause C.1.2. General Test parameters are defined in Table 5.3.2.2.4.5-1.
3. Downlink signals for NR cell are initially set up according to clause C.2.1.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.3.2.2.4.4.2 Test procedure

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

1. Ensure the UE is in state E-UTRA RRC_CONNECTED with generic procedure parameters *Connectivity E-UTRA/EPC* with Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to Table 5.3.2.2.4.5-1.
3. The test system shall send a RRCReconfiguration message to the UE to add NR PSCell, then the UE shall trigger a random access procedure.

FFS

5.3.2.2.4.4.3 Message contents

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

Table 5.3.2.2.4.4.3-0: Common Exception messages

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

5.3.2.2.4.5 Test requirement

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

Table 5.3.2.2.4.5-1: General test parameters

Parameter	Unit	Test-1	Comments
SSB Configuration	Config 1,2	SSB.1 FR2	As defined in A.3.2
Duplex Mode for Cell 2	Config 1,2	TDD	
TDD Configuration	Config 1,2	TDDConf.3.1	As defined in A.1.5
BW _{channel}	Config 1,2	MHz	100: N _{RB,c} = 24
OCNG Pattern ^{Note 1}		OP.3	As defined in A.2.1
PDSCH Reference Channel ^{Note 2}	Config 1,2	SR.3.1 TDD	As defined in A.1.1
RMSI CORESET Reference Channel	Config 1,2	CR.3.1 TDD	As defined in A.1.2
RMC CORESET Reference Channel	Config 1,2	CCR.3.1 TDD	As defined in A.1.3
NR RF Channel Number		1	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH_DMRS to SSS	dB		
EPRE ratio of PBCH to PBCH_DMRS	dB		
EPRE ratio of PDCCH_DMRS to SSS	dB		
EPRE ratio of PDCCH to PDCCH_DMRS	dB		
EPRE ratio of PDSCH_DMRS to SSS	dB		
EPRE ratio of PDSCH to PDSCH_DMRS	dB		
<i>ss-PBCH-BlockPower</i>	dBm/ SCS	+20 + Δ_{UL}	As defined in TS 38.331 [13]. Δ_{UL} is derived from the uplink calibration process ^{Note 3}
Configured UE transmitted power ($P_{CMAX,f,c}$)	dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 of TS 38.101-2 [3]
MsgA Configuration		FR2 MsgA configuration 2	As defined in FFS, with exceptions as defined below
<i>msgA-RSRP-ThresholdSSB</i>	dBm	RSRP_69 + Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process ^{Note 4}
<i>msgA-PreambleReceivedTargetPower</i>	dBm	-100	As defined in TS 38.331 [13]
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			
NOTE 3: The Δ_{UL} value is calculated as $-\text{ROUND}(\text{PPRACH0} - 1)$, where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, <i>preambleReceivedTargetPower</i> = -100dBm and <i>ss-PBCH-BlockPower</i> = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.			
NOTE 4: The Δ_{DL} value is calculated as $(\text{RSRP}_{\text{REP}} - \text{RSRP}_{76})$, where RSRP _{REP} is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP _x , x is treated as a positive integer value.			

Table 5.3.2.2.4.5-2: OTA-related test parameters

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.9.1
Assumption for UE beams ^{Note 2}			Rough	
SSB with index 0	E_s ^{Note 1}	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-80.6	
	$E_s/10_{\text{dB}}$	dB	21.09	
	I_0	dBm/95.04 MHz	-56.01	I_0 in symbols containing SSB index 0
SSB with index 1	E_s ^{Note 1}	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured <i>rsrp-ThresholdSSB</i>
	SSB_RP	dBm/SCS	-95.0	
	$E_s/10_{\text{dB}}$	dB	6.69	
	I_0	dBm/95.04 MHz	-70.41	I_0 in symbols containing SSB index 1
Propagation Condition		-	AWGN	
NOTE 1: No artificial noise is applied in this test.				
NOTE 2: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation				

5.3.2.3 Void

5.4 Timing

5.4.1 UE transmit timing

5.4.1.0 Minimum Conformance Requirements

5.4.1.0.1 Minimum conformance requirements for UE transmit timing accuracy

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

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

The UE shall meet the T_e 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 $(N_{TA} + N_{TA\text{ offset}}) \times T_c$. 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.

$(N_{TA} + N_{TA\text{ offset}}) \times T_c$ (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 TS 38.133 [6] clause 7.3 was applied. N_{TA} for other channels is not changed until next timing advance is received. The value of $N_{TA\text{ offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{TA\text{ offset}}$ is defined in Table 5.4.1.0.1-2.

Table 5.4.1.0.1-1: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (KHz)	SCS of uplink signals (KHz)	T_e
1	15	15	$12 \cdot 64 \cdot T_c$
		30	$10 \cdot 64 \cdot T_c$
		60	$10 \cdot 64 \cdot T_c$
	30	15	$8 \cdot 64 \cdot T_c$
		30	$8 \cdot 64 \cdot T_c$
		60	$7 \cdot 64 \cdot T_c$
2	120	60	$3.5 \cdot 64 \cdot T_c$
		120	$3.5 \cdot 64 \cdot T_c$
	240	60	$3 \cdot 64 \cdot T_c$
		120	$3 \cdot 64 \cdot T_c$

NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]

Table 5.4.1.0.1-2: The Value of $N_{TA\ offset}$

Frequency range and band of cell used for uplink transmission	$N_{TA\ offset}$ (Unit: T_c)
FR1 FDD band without LTE-NR coexistence case or FR1 TDD band without LTE-NR coexistence case	25600 (Note 1)
FR1 FDD band with LTE-NR coexistence case	0 (Note 1)
FR1 TDD band with LTE-NR coexistence case	39936 (Note 1)
FR2	13792

NOTE: The UE identifies $N_{TA\ offset}$ 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 clause 4.2 in [3] and the value 39936 of $N_{TA\ offset}$ can also be provided for a FDD serving cell. NOTE 2: Void

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

When the transmission timing error between the UE and the reference timing exceeds $\pm T_e$, the UE is required to adjust its timing to within $\pm T_e$. The reference timing shall be $(N_{TA} + N_{TA\ offset}) \cdot T_c$ 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 200ms.

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

Table 5.4.1.0.1-3: 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	$5.5 \cdot 64 \cdot T_c$	$5.5 \cdot 64 \cdot T_c$
	30	$5.5 \cdot 64 \cdot T_c$	$5.5 \cdot 64 \cdot T_c$
	60	$5.5 \cdot 64 \cdot T_c$	$5.5 \cdot 64 \cdot T_c$
2	60	$2.5 \cdot 64 \cdot T_c$	$2.5 \cdot 64 \cdot T_c$
	120	$2.5 \cdot 64 \cdot T_c$	$2.5 \cdot 64 \cdot T_c$

NOTE: 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.

5.4.1.1 EN-DC FR2 UE transmit timing accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.4.1.1.1 Test purpose

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

5.4.1.1.2 Test applicability

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

5.4.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.4.1.0.1.

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

5.4.1.1.4 Test Description

5.4.1.1.4.1 Initial Conditions

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

Table 5.4.1.1.4.1-1: Supported test configurations for FR2 PSCell

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

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

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

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

1. Message contents are defined in clause 5.4.1.1.4.3.

2. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.6.1.1-1. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2.
3. Downlink signals for NR cell are initially set up according to clause C.1.2 and C.1.3.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.4.1.1.4.2 Test procedure

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

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

Following will be the test sequence for this test

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [6] clause 4.5.
2. Set up E-UTRA PCell according to parameters given in Table A.6.1.1-1 and setup NR PSCell according to parameters given in Table 5.4.1.1.4.1-1.
3. The SS shall transmit an RRCConnectionReconfiguration message configuring the UE with the message content defined in clause 5.4.1.1.4.3.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex I.1 - I.3. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.
6. After connection set up with the cell and during 2 seconds before DL timing adjustment, the test equipment shall monitor all SRS transmissions and verify that, for each received SRS, the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
 - a. The N_{TA} offset value (in T_c units) is 13792 for FR2
 - b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in Table 5.4.1.1.5-4.
7. The test system shall adjust the timing of the DL path by values given in Table 5.4.1.1.4.2-1

Table 5.4.1.1.4.2-1: Adjustment Value for DL Timing

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

8. The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Table 5.4.1.1.5-5. This will only be done for Test1. The test system samples the UE Transmit Timing once per SRS transmission (as per configured SRS periodicity). To check Rule 1, the SS shall check that the maximum time adjustment step size T_q between one SRS transmission to next consecutive SRS transmission of a valid UL slot is within Rule 1 as specified in clause 5.4.1.0.1 and Table 5.4.1.0.1-3. To check that the minimum adjustment rate is within Rule 2 as specified in clause 5.4.1.0.1 and Table 5.4.1.0.1-3, the SS shall measure the change in SRS transmission timing over a $1 + \text{offset}$ seconds sliding window (offset in ms to the next consecutive SRS transmission), with step size p (where p is the periodicity of SRS), as long as the resulting slot is a valid UL slot. To check that the maximum adjustment rate is within Rule 3 as specified in clause 5.4.1.0.1 and Table 5.4.1.0.1-3, the SS shall measure the change in SRS transmission timing over a 200ms – offset sliding window of previous SRS transmission, with step size p (where p is the periodicity of SRS), as

long as the resulting slot is a valid UL slot. The three rules apply until the UE transmit timing offset is within the limits specified in 5.4.1.0.1 and Table 5.4.1.0.1-3 with respect to the first detected path (in time) of the corresponding downlink frame of Cell 1. The test system will wait till evaluation interval of T seconds is met to ensure UE transmit timing is stable at the end of the step, where $T = \text{DL_timing_change}[\text{Ts}] / 5.5\text{Ts}$ and DL_timing_change is specified in Table 5.4.1.1.4.2-1.

9. After the UE transmit timing is within the limits specified in step 7, and during 2 seconds, the test system shall monitor all SRS transmissions and verify that, for each received SRS, the UE transmit timing offset stays within $(N_{\text{TA}} + N_{\text{TA_offset}}) \times T_c \pm T_e$ 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.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1 in TS 38.521-2 [3].

5.4.1.1.4.3 Message contents

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

Table 5.4.1.1.4.3-0: Common Exception messages

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

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

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

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

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

5.4.1.1.5 Test Requirements

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

The UE shall meet the T_e 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 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 5.4.1.1.5-5.

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

Parameter	Unit	Config	Test1	Test2	Band Group
SSB ARFCN		1,2	Freq1	Freq1	
Duplex Mode		1,2	TDD		
TDD configuration		1,2	TDDConf.3.1		
BW _{channel}	MHz	1,2	100: NRB.c = 66		
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1		
TRS Configuration		1,2	TRS.2.1 TDD		
PDSCH/PDCCH TCI State		1,2	TCI.State.2		
DRX Cycle	ms	1,2	N/A	DRX.8 ^{Note5}	
PDSCH Reference measurement channel		1,2	SR.3.3 TDD		
RMSI CORESET Reference Channel		1,2	CR.3.2 TDD		
Dedicated CORESET Reference Channel		1,2	CCR.3.7 TDD		
OCNG Patterns		1,2	OP.1		
SSB Configuration		1,2	SSB.4 FR2		
SMTc Configuration		1,2	SMTc.1		
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120		
EPRE ratio of PSS to SSS	dB	1,2	0	0	

EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNB DMRS to SSS(Note 1)					
EPRE ratio of OCNB to OCNB DMRS (Note 1)					
Propagation condition		1,2	AWGN		
SRS Config		1,2	Config1 ^{Note6}	Config2 ^{Note6}	
NOTE 1: OCNB shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Void					
NOTE 3: Void					
NOTE 4: Void					
NOTE 5: DRx related parameters are given in Table A.3.3.5-1 or Table A.5-1					
NOTE 6: SRS configs are given in Table A. 5.4.1.1.5-2					

Table 5.4.1.1.5-2: SRS Configuration for Timing Accuracy Test

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

Table 5.4.1.1.5-3: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 defined in A.9.1	
Assumption for UE beams ^{Note 6}		Fine	
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-112	
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-100	
\hat{E}_s/N_{oc}	dB	4	
SS-RSRP ^{Note2}	dBm/SCS ^{Note4}	-96	
\hat{E}_s/I_{ot}	dB	4	
I_0 ^{Note2}	dBm/95.04 MHz ^{Note4}	-68,5	
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SSB_RP and I_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: Void			
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone			
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone			
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table 5.4.1.1.5-4: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_e
2	120	60	N/A
		120	N/A
	240	60	N/A
		120	$3.75 \cdot 64 \cdot T_c$
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 5.4.1.1.5-5: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

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

Table 5.4.1.1.5-6: The Value of $N_{TA\ offset}$

Frequency range and band of cell used for uplink transmission	$N_{TA\ offset}$ (Unit: T_c)
FR2	13792
NOTE 1: The UE identifies $N_{TA\ offset}$ based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N_{TA\ offset}$ 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 clause 4.2 in TS 38.213 [3] and the value 39936 of $N_{TA\ offset}$ can also be provided for a FDD serving cell.	
NOTE 2: Void	

5.4.2 UE timer accuracy

FFS.

5.4.3 Timing advance

5.4.3.0 Minimum conformance requirements

5.4.3.0.1 Minimum conformance requirements for timing advance adjustment accuracy

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

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

Table 5.4.3.0.3-1: UE Timing Advance adjustment accuracy

Sub Carrier Spacing, SCS kHz	15	30	60	120
UE Timing Advance adjustment accuracy	$\pm 256 T_c$	$\pm 256 T_c$	$\pm 128 T_c$	$\pm 32 T_c$

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

5.4.3.1 EN-DC FR2 timing advance adjustment accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.4.3.1.1 Test purpose

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

5.4.3.1.2 Test applicability

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

5.4.3.1.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 5.4.3.0.1.

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

5.4.3.1.4 Test description

5.4.3.1.4.1 Initial conditions

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

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

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

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

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

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

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

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

Table 5.4.3.1.4.1-3: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		Cell 1: 1 Cell 2: 2	1 for E-UTRAN PCell 2 for NR PSCell
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1 of TS 38.133 [6]
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1 of TS 38.133 [6]
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1 of TS 38.133 [6]
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1 of TS 38.133 [6]
Timing Advance Command (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	$N_{TA_new} = N_{TA_old} + 1024 \cdot T_c$ (based on equation in TS 38.213 [3] clause 4.2)
T1	s	5	
T2	s	5	

1. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.1.
2. Downlink signals for NR cell are initially set up according to clause C.1.2, C.1.3.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.4.3.1.4.2 Test Procedure

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

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

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5. Message content are defined in clause 5.4.3.1.2.3.
2. Set the parameters according to values in Tables 5.4.3.1.4.1-3 and Table 5.4.3.1.5-1 as appropriate. Propagation conditions are set according to clause C.2.2.
3. SS shall transmit an RRCConnectionReconfiguration message.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in Clause 6.1.3.4 in TS 38.321. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.
6. During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value of 39 as specified in table 5.4.3.1.4.1-3.
7. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.
8. As specified in Clause 7.3.2.1 of TS 38.133 [6], the UE adjusts its uplink timing at slot $n+k+1$ for a timing advance command received in slot n . This delay shall be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.
9. The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.
10. The result from the SRS and adjustment of the timing advance in step 7) is used to measure that the UE adjusts the timing of its transmission with a relative accuracy better than or equal to value specified in Table 5.4.3.0.3-1 to the signalled timing advance value compared to the timing of preceding uplink transmission.
11. If the UE adjust the timing of its transmission within a relative accuracy greater than or equal to value specified in Table 5.4.3.0.3-1 to the signalled timing advance value compared to the timing of preceding uplink transmission then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.
12. The SS shall transmit RRCConnectionReconfiguration message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
13. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
14. If any of the above Reconfiguration in Step 12 or 13 fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
15. Repeat steps 3-14 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.4.3.1.4.3 Message Contents

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

Table 5.4.3.1.4.3-0: Common Exception messages

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

Table 5.4.3.1.4.3-1: srs-Config setup

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

5.4.3.1.5 Test Requirement

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

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

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

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

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

Parameter	Unit	Test1	
		T1	T2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
BW _{channel}	MHz	100: N _{RB,c} = 66	
BWP BW	MHz	100: N _{RB,c} = 66	
DRx Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR.3.1 TDD	
CORESET Reference Channel		CR.3.1 TDD	
TRS configuration		TRS.2.1 TDD	
PDSCH/PDCCH TCI state		TCI.State.2	
OCNG Patterns		OCNG pattern 1	
SMTc configuration		SMTc.1 FR2	
SSB configuration		SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	kHz	120 kHz	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

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

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1	
Assumption for UE beams ^{Note 6}		Fine	
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-112	
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-103	
\hat{E}_s / N_{oc}	dB	4	
SS-RSRP ^{Note2}	dBm/SCS ^{Note4}	-99	
\hat{E}_s / I_{ot}	dB	4	
I_o ^{Note2}	dBm/95.04 MHz ^{Note4}	-68.53	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone

NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone

NOTE 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation

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

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

NOTE: For further information see clause 6.3.2 in TS 38.331 [13].

Table 5.4.3.1.5-3: UE Timing Advance adjustment accuracy

UL Sub Carrier Spacing(kHz)	60	120
UE Timing Advance adjustment accuracy	$\pm 128 T_c$	$\pm 72 T_c$

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%.

5.5 Signaling characteristics

5.5.1 Radio link monitoring

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

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell.

5.5.1.0 Minimum conformance requirements

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

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

$T_{Evaluate_out_SSB}$ is defined in Table 5.5.1.0.1-1 for FR2.

Table 5.5.1.0.1-1: Evaluation period $T_{\text{Evaluate_out}}$ for FR2

Configuration	$T_{\text{Evaluate_out_SSB}}$ (ms)
no DRX	$\max(200, \text{ceil}(10 \cdot P \cdot N) \cdot T_{\text{SSB}})$
DRX cycle ≤ 320	$\max(200, \text{ceil}(15 \cdot P \cdot N) \cdot \max(T_{\text{DRX}}, T_{\text{SSB}}))$
DRX cycle > 320	$\text{ceil}(10 \cdot P \cdot N) \cdot T_{\text{DRX}}$
NOTE:	T_{SSB} is the periodicity of SSB configured for RLM. T_{DRX} is the DRX cycle length.

For FR2,

- $P = 1 / (1 - T_{\text{SSB}} / T_{\text{SMTCperiod}})$, when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$).
- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC period ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$).
- P is $1 / (1 - T_{\text{SSB}} / \text{MGRP} - T_{\text{SSB}} / T_{\text{SMTCperiod}})$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
- $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
- $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{SSB}} < 0.5 \cdot T_{\text{SMTCperiod}}$
- P is $1 / (1 - T_{\text{SSB}} / \text{MGRP}) \cdot 3$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{SSB}} = 0.5 \cdot T_{\text{SMTCperiod}}$
- P is $1 / \{1 - T_{\text{SSB}} / \min(T_{\text{SMTCperiod}}, \text{MGRP})\}$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap
- P is $1 / (1 - T_{\text{SSB}} / \text{MGRP}) \cdot 3$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)

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

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

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{\text{Evaluate_out_SSB}}$ [ms] period becomes worse than the threshold $Q_{\text{out_SSB}}$ within $T_{\text{Evaluate_out_SSB}}$ [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{\text{Evaluate_in_SSB}}$ [ms] period becomes better than the threshold $Q_{\text{in_SSB}}$ within $T_{\text{Evaluate_in_SSB}}$ [ms] evaluation period.

$T_{\text{Evaluate_out_SSB}}$ and $T_{\text{Evaluate_in_SSB}}$ are defined in Table 8.1.2.2-1 for FR1.

$T_{\text{Evaluate_out_SSB}}$ and $T_{\text{Evaluate_in_SSB}}$ are defined in Table 8.1.2.2-2 for FR2 with scaling factor $N=8$.

For FR2,

- $P = \frac{1}{1 - \frac{T_{\text{SSB}}}{T_{\text{SMTCperiod}}}}$, when RLM-RS is not overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$).
- P is $P_{\text{sharing factor}}$, when the RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC period ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$).

- $P = \frac{1}{1 - \frac{T_{SSB}}{MGRP} - \frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{SMTCperiod} \neq MGRP$ or
 - $T_{SMTCperiod} = MGRP$ and $T_{SSB} < 0.5 * T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1 - \frac{T_{SSB}}{MGRP}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{SSB} = 0.5 * T_{SMTCperiod}$
- $P = \frac{1}{1 - \frac{T_{SSB}}{\min(MGRP, T_{SMTCperiod})}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{sharing\ factor}}{1 - \frac{T_{SSB}}{MGRP}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)
- $P_{sharing\ factor} = 1$
 - if all of the reference signals configured for RLM outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
 - if all of the reference signal configured for RLM outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped by with the SSB symbols indicated by SSB-ToMeasure and 1 symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured;
- $P_{sharing\ factor} = 3$, otherwise.

If the high layer in TS 38.331 [2] signalling 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 previous conditions.

Table 5.5.1.0.2-1: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR2

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	$\text{Max}(200, \text{Ceil}(10 * P * N) * T_{SSB})$	$\text{Max}(100, \text{Ceil}(5 * P * N) * T_{SSB})$
DRX cycle ≤ 320	$\text{Max}(200, \text{Ceil}(15 * P * N) * \text{Max}(T_{DRX}, T_{SSB}))$	$\text{Max}(100, \text{Ceil}(7.5 * P * N) * \text{Max}(T_{DRX}, T_{SSB}))$
DRX cycle > 320	$\text{Ceil}(10 * P * N) * T_{DRX}$	$\text{Ceil}(5 * P * N) * T_{DRX}$

NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.

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

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

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

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

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

[TS38.133, clause 8.1.3.1]

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

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

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4dB
Bandwidth (MHz)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

[TS38.133, clause 8.1.3.2]

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{\text{Evaluate_out_CSI-RS}}$ [ms] period becomes worse than the threshold $Q_{\text{out_CSI-RS}}$ within $T_{\text{Evaluate_out_CSI-RS}}$ [ms] evaluation period.

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

For FR2,

- $P=1$, when RLM-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=1/(1 - T_{\text{CSI-RS}}/\text{MGRP})$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is not overlapped with SMTC occasion ($T_{\text{CSI-RS}} < \text{MGRP}$)
- $P=1/(1 - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$).
- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$).
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP} - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} < 0.5 * T_{\text{SMTCperiod}}$
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * 3$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} = 0.5 * T_{\text{SMTCperiod}}$
- P is $1/\{1 - T_{\text{CSI-RS}}/\min(T_{\text{SMTCperiod}}, \text{MGRP})\}$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap

- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * 3$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)

If the high layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{\text{SMTCperiod}}$ follows *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ 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 previous conditions.

The value of M_{out} used in Table 5.5.1.0.3-2 is defined as:

- $M_{\text{out}} = 20$ if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* set to 3 and over the bandwidth ≥ 24 PRBs.

Table 5.5.1.0.3-2: Evaluation period $T_{\text{Evaluate_out_CSI-RS}}$ for FR2

Configuration	$T_{\text{Evaluate_out_CSI-RS}}$ (ms)
no DRX	$\max(200, \text{ceil}(M_{\text{out}} \times P \times N) \times T_{\text{CSI-RS}})$
$\text{DRX} \leq 320\text{ms}$	$\max(200, \text{ceil}(1.5 \times M_{\text{out}} \times P \times N) \times \max(T_{\text{DRX}}, T_{\text{CSI-RS}}))$
$\text{DRX} > 320\text{ms}$	$\text{ceil}(M_{\text{out}} \times P \times N) \times T_{\text{DRX}}$
NOTE: $T_{\text{CSI-RS}}$ is the periodicity of CSI-RS resource configured for RLM. The requirements in this table apply for $T_{\text{CSI-RS}}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.	

[TS38.133, clause 8.1.3.3]

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

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

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

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

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.
 - The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or
 - The other CSI-RS is configured in q_1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

[TS38.133, clause 8.1.4 and 8.1.5]

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

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

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

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

[TS38.133, clause 8.1.6]

When the downlink radio link quality on all the configured RLM-RS resources is worse than 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.

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

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

In case DRX is used, $T_{Indication_interval}$ is $\max(10\text{ms}, 1.5 \cdot \text{DRX_cycle_length}, 1.5 \cdot T_{RLM-RS,M})$ 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.

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

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

[TS38.133, clause 8.1.3.1]

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

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

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

[TS38.133, clause 8.1.3.2]

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{\text{Evaluate_in_CSI-RS}}$ [ms] period becomes better than the threshold $Q_{\text{in_CSI-RS}}$ within $T_{\text{Evaluate_in_CSI-RS}}$ [ms] evaluation period.

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

For FR2,

- $P=1$, when RLM-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=1/(1 - T_{\text{CSI-RS}}/\text{MGRP})$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is not overlapped with SMTC occasion ($T_{\text{CSI-RS}} < \text{MGRP}$)
- $P=1/(1 - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$).
- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$).
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP} - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} < 0.5 * T_{\text{SMTCperiod}}$
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * 3$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} = 0.5 * T_{\text{SMTCperiod}}$
- P is $1/[1 - T_{\text{CSI-RS}}/\min(T_{\text{SMTCperiod}}, \text{MGRP})]$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * 3$, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)

If the high layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{\text{SMTCperiod}}$ follows *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ 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 previous conditions.

The values of M_{in} used in Table 5.5.1.0.4-2 are defined as:

- $M_{\text{in}} = 10$, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* set to 3 and over the bandwidth ≥ 24 PRBs.

Table 5.5.1.0.4-2: Evaluation period $T_{\text{Evaluate_in_CSI-RS}}$ for FR2

Configuration	$T_{\text{Evaluate_in_CSI-RS}}$ (ms)
no DRX	$\max(100, \text{ceil}(M_{\text{in}} \times P \times N) \times T_{\text{CSI-RS}})$
$\text{DRX} \leq 320\text{ms}$	$\max(100, \text{ceil}(1.5 \times M_{\text{in}} \times P \times N) \times \max(T_{\text{DRX}}, T_{\text{CSI-RS}}))$
$\text{DRX} > 320\text{ms}$	$\text{ceil}(M_{\text{in}} \times P \times N) \times T_{\text{DRX}}$
NOTE:	$T_{\text{CSI-RS}}$ is the periodicity of CSI-RS resource configured for RLM. The requirements in this table apply for $T_{\text{CSI-RS}}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.

[TS38.133, clause 8.1.3.3]

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

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

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

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

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.
 - The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or
 - The other CSI-RS is configured in q_1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

[TS38.133, clause 8.1.4 and 8.1.5]

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

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

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

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

[TS38.133, clause 8.1.6]

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Q_m , 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 $T_{\text{Indication_interval}}$.

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

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

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

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

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

- If the RLM-RS is CSI-RS which is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON,
 - There are no scheduling restrictions due to radio link monitoring based on the CSI-RS.
- Otherwise
 - The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.

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

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

For FR2, if following conditions are met,

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

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

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

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

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.5.1.1.1 Test purpose

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

5.5.1.1.2 Test applicability

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

5.5.1.1.3 Minimum conformance requirement

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

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

5.5.1.1.4 Test description

There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1 as defined in 38.133 [6]. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.1.4-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states and Figure 5.5.1.1.4-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

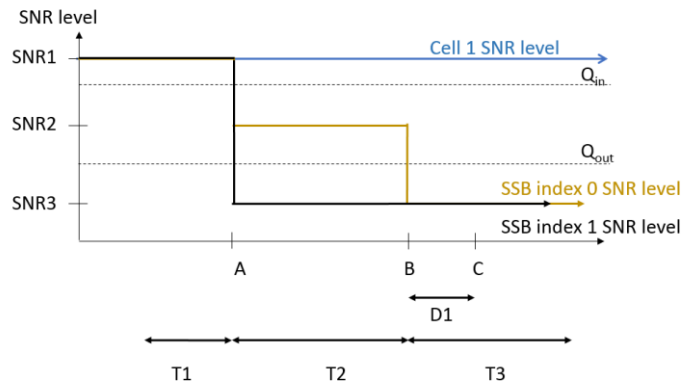


Figure 5.5.1.1.4-1: SNR variation for out-of-sync testing

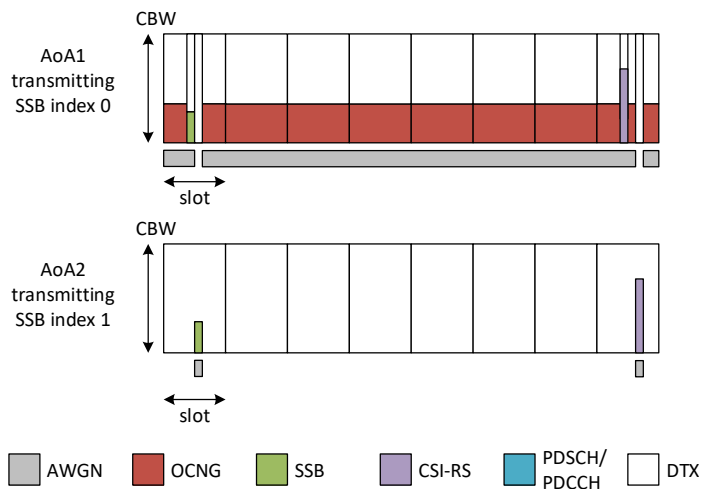


Figure 5.5.1.1.4-2: Time multiplexed downlink transmissions

5.5.1.1.4.1 Initial conditions

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

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

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

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

Configuration	Description
5.5.1.1-1	FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.1.1-2	TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

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

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

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

PDCCH transmission parameters are given in Table 5.5.1.1.4.1-4

Table 5.5.1.1.4.1-3: Void

1. Message contents are defined in clause 5.5.1.1.4.3.
2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2
3. The test parameters are given in Table 5.5.1.1.4.1-4 below.
4. Downlink signals for NR cell are initially set up according to Annex [C.x].

Table 5.5.1.1.4.1-4: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD
$BW_{channel}$	Config 1, 2		100: $N_{RB,c} = 66$
Data RBs allocated	Config 1, 2		24
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.3.4 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTTC Configuration	Config 1, 2		SMTTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		PRACH.4 FR2
SSB index assigned as RLM RS	Config 1, 2		0,1
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	9.68
T3		s	9.68
D1		s	9.64
Note 1: All configurations are assigned to the UE prior to the start of time period T1.			
Note 2: UE-specific PDCCH is not transmitted after T1 starts.			
Note 3: E-UTRAN is in non-DRX mode under test.			

5.5.1.1.4.2 Test Procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 1] with a reporting periodicity as mentioned in the above table 5.5.1.1.4.1-4.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 5.5.
2. Set the parameters according to T1 in Table 5.5.1.1.4.4-1 for subtest 1 and 2. Propagation conditions are set according to Annex C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.1.4.4-1 for subtests 1 and 2. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.1.4.4-1 for subtests 1 and 2. T3 starts.
5. If the SS:
 - a) detects uplink power in each subframe configured for CQI transmission (according to configured CQI periodicity on PUCCH [format 1]) during the period from time point A to time point B

and

- b) does not detect any uplink power from time point C (240 ms after the start of T3) until T3 expires, the number of successful tests is increased by one.

6. Otherwise the number of failed tests is increased by one and proceed to Step 10.
7. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.1.4.4-1.
8. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.
9. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].
11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.1.4.3 Message Contents

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

Table 5.5.1.1.4.3-0: Common Exception messages

	Default Message Contents
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED Table H.3.1-3 with Condition INTER-FREQ MO (where <i>ssbFrequency</i> is set to the ARFCN value of carrier center of Adjacent range) Table H.3.1-4 with <i>A3-offset</i> = 0 Table H.3.4-1 Table H.3.4-1a Table H.3.4-4 with condition <i>gapUE</i> Table H.3.4-5 with condition BFD Table H.3.5-4 Table H.3.5-9 with Condition SSB RLM

Table 5.5.1.1.4.3-1: PDCCH Search Space

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
Duration	2		
monitoringSymbolsWithinSlot	11000000000000	Symbols 0 and 1	
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n0		
aggregationLevel8	n1	AL8	
aggregationLevel16	n0		
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0	
}			
}			
}			

Table 5.5.1.1.4.3-2: UE-TimersAndConstants

Derivation Path: TS 38.508-1 [14], Table 4.6.3-200			
Information Element	Value/remark	Comment	Condition
UE-TimersAndConstants ::= SEQUENCE {			
t310	ms0		
n310	n1		
t311	ms1000		
n311	n1		
}			

Table 5.5.1.1.4.3-3: CSI-FrequencyOccupation

Derivation Path: TS 38.508-1 [14], Table 4.6.3-33			
Information Element	Value/remark	Comment	Condition
CSI-FrequencyOccupation ::= SEQUENCE {			
startingRB	0		
nrofRBs	66	100 MHz (120 KHz SCS)	
}			

5.5.1.1.5 Test Requirement

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

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

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

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

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

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

Parameter	Unit	Test 1								
		T1	T2	T3	T1	T2	T3			
AoA setup		Setup 3 defined in A.9.3								
		AoA1			AoA2					
Assumption for UE beams ^{Note 5}		Rough			Rough					
EPRE ratio of PDCCH DMRS to SSS	dB	4								
EPRE ratio of PDCCH to PDCCH DMRS	dB	0								
EPRE ratio of PBCH DMRS to SSS	dB									
EPRE ratio of PBCH to PBCH DMRS	dB									
EPRE ratio of PSS to SSS	dB									
EPRE ratio of PDSCH DMRS to SSS	dB									
EPRE ratio of PDSCH to PDSCH DMRS	dB									
EPRE ratio of OCNG DMRS to SSS	dB									
EPRE ratio of OCNG to OCNG DMRS	dB									
ssb-Index 0 SNR	Config 1, 2	dB	4.1 ^{Note 6}	-3.9 ^{Note 6}	-15	Not sent				
ssb-Index 1 SNR	Config 1, 2		Not sent					4.1 ^{Note 6}	-15	-15
N_{oc}	Config 1, 2	dBm/15kHz	-94.8					-94.8		
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure 5.5.1.1.4-2							
Propagation condition			TDL-A 30ns 75Hz					TDL-A 30ns 75Hz		
Note 1:	OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.									
Note 2:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.									
Note 3:	SNR levels correspond to the signal to noise ratio over the SSS REs.									
Note 4:	The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is 38.133 [6] A.3.6.									
Note 5:	Information about types of UE beam is given in 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation									
Note 6:	This value allows up to 1dB degradation from applied SNR to UE baseband									

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

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.5.1.2.1 Test Purpose

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 PSCell radio link monitoring requirements in clause 8.1 of TS 38.133 [3].

5.5.1.2.2 Test Applicability

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

5.5.1.2.3 Minimum Conformance Requirements

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

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

5.5.1.2.4 Test Description

There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.1.2.4-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states and Figure 5.5.1.2.4-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms.

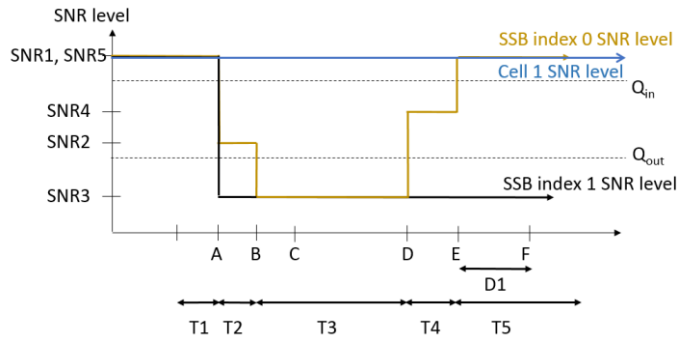


Figure 5.5.1.2.4-1: SNR variation for in-sync testing

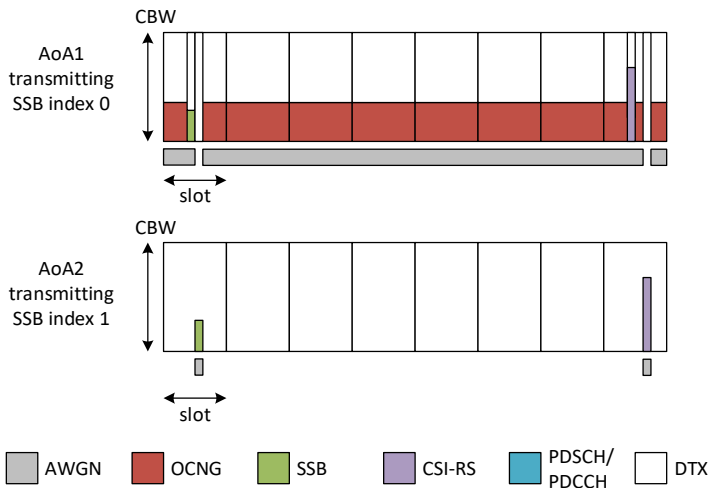


Figure 5.5.1.2.4-2: Time multiplexed downlink transmissions

5.5.1.2.4.1 Initial conditions

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

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

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

Table 5.5.1.2.4.1-1: Supported test configurations for FR2 PSCell

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

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

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

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

PDCCH transmission parameters are given in Table 5.5.1.2.4.1-4.

Table 5.5.1.2.4.1-3: Void

1. Message contents are defined in clause 5.5.1.2.4.3.
2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2
3. The general test parameters are given in Table 5.5.1.2.5-4 below.
4. Downlink signals for NR cell are initially set up according to clause C.1.

Table 5.5.1.2.4.1-4: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter	Unit	Value
		Test 1
Active E-UTRA PCell		Cell 1
E-UTRA RF Channel Number		1
Active PSCell		Cell 2
RF Channel Number		2
Duplex mode	Config 1, 2	TDD
BW _{channel}	Config 1, 2	100: N _{RB,c} = 66

Parameter		Unit	Value
			Test 1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.3.1 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTc Configuration	Config 1, 2		SMTc.3
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		PRACH.4 FR2
SSB index assigned as RLM RS	Config 1, 2		0.1
OCNG parameters			OP.2
CP length			Normal
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.2
T3		s	1.88
T4		s	0.2
T5		s	3.84
D1		s	3.8
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.			
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			
NOTE 3: E-UTRAN is in non-DRX mode under test.			

5.5.1.2.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 1] with a reporting periodicity as mentioned in the above table 5.5.1.2.4.1-4.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 4.5.
2. Set the parameters according to T1 in Table 5.5.1.2.4-1 for subtest 1 and 2. Propagation conditions are set according to Annex C.2.3. T1 starts.
3. When T1 expires, the SS shall change the SNR value to T2 as specified in Table 5.5.1.2.5-1. T2 starts.
4. When T2 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.2.5-1. T3 starts.
5. When T3 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.2.5-1. T4 starts.
6. When T4 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.2.5-1. T5 starts.
7. If the SS detects uplink power in the On-duration part of every DRX cycle in the subframe according the configured CQI reporting mode (PUCCH 1-0) during the period from time point A to time point F (1120 ms after the start of time duration T5) the number of successful tests is increased by one.
Otherwise the number of failed tests is increased by one.
8. Repeat steps 2-7 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.2.4.3 Message Contents

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

Table 5.5.1.2.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.4-1 Table H.3.5-4 Table H.3.5-9 with Condition SSB RLM

Table 5.5.1.2.4.3-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
duration	2		
monitoringSymbolsWithinSlot	11000000000000	Symbols 0 and 1	
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n0		
aggregationLevel8	n1	AL8	
aggregationLevel16	n0		
}			
searchSpaceType CHOICE {			
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0	
}			
}			
}			

Table 5.5.1.2.4.3-3: RLF-TimersAndConstant

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

Table 5.5.1.2.4.3-4: CSI-FrequencyOccupation

Derivation Path: TS 38.508-1 [14], Table 4.6.3-33			
Information Element	Value/remark	Comment	Condition
CSI-FrequencyOccupation ::= SEQUENCE {			
startingRB	0		
nrofRBs	66	100 MHz (120 KHz SCS)	
}			

5.5.1.2.5 Test Requirements

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

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

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

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

Parameter	Unit	Test 1										
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	
AoA setup		Setup 3 defined in A.9.3										
		AoA1					AoA2					
Assumption for UE beams ^{Note 5}		Rough					Rough					
EPRE ratio of PDCCH DMRS to SSS	dB	0					Not sent					
EPRE ratio of PDCCH to PDCCH DMRS	dB	0										
EPRE ratio of PBCH DMRS to SSS	dB											
EPRE ratio of PBCH to PBCH DMRS	dB											
EPRE ratio of PSS to SSS	dB											
EPRE ratio of PDSCH DMRS to SSS	dB											
EPRE ratio of PDSCH to PDSCH DMRS	dB											
EPRE ratio of OCNG DMRS to SSS	dB											
EPRE ratio of OCNG to OCNG DMRS	dB											
ssb-Index 0 SNR	Config 1, 2	dB	4.1 Note 6	- 3.9 Note 6	-15	-4.5	4.1 Note 6					
ssb-Index 1 SNR	Config 1, 2		Not sent					4.1 Note 6	-15	-15	-15	-15
N_{oc}	Config 1, 2	dBm/ 15kHz	-94.8					-94.8				
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure 5.5.1.2.4-2									
Propagation condition			TDL-A 30ns 75Hz					TDL-A 30ns 75Hz				
<p>Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.</p> <p>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.</p> <p>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.</p> <p>Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is 38.133 [6] A.3.6.</p> <p>Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p> <p>Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband</p>												

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

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.5.1.3.1 Test purpose

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

5.5.1.3.2 Test applicability

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

5.5.1.3.3 Minimum conformance requirement

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

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

5.5.1.3.4 Test description

There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2 as defined in 38.133 [6]. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure 5.5.1.3.4-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

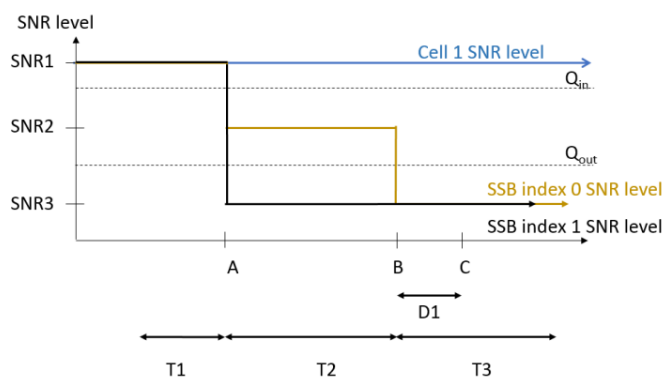


Figure 5.5.1.3.4-1: SNR variation for out-of-sync testing

5.5.1.3.4.1 Initial conditions

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

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

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

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

Configuration	Description
5.5.1.3-1	FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.1.3-2	TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

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

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

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

PDCCH transmission parameters are given in Table 5.5.1.3.4.1-4

Table 5.5.1.3.4.1-3: Void

1. Message contents are defined in clause 5.5.1.3.4.3.
2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2
3. The test parameters are given in Table 5.5.1.3.4.1-4 below.
4. Downlink signals for NR cell are initially set up according to Annex [C.x].

Table 5.5.1.3.4.1-4: General test parameters for FR2 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode		Config 1, 2	TDD
BW _{channel}		Config 1, 2	100: N _{RB,c} = 66
Data RBs allocated		Config 1, 2	66
DL initial BWP configuration		Config 1, 2	DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2	DLBWP.1.1
UL initial BWP configuration		Config 1, 2	ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2	ULBWP.1.1
TDD Configuration		Config 1, 2	TDDConf.3.1
CORESET Reference Channel		Config 1, 2	CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2	CCR.3.4 TDD
SSB Configuration		Config 1, 2	SSB.1 FR2
SMTC Configuration		Config 1, 2	SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2	120 KHz
PRACH Configuration		Config 1, 2	PRACH.4 FR2
SSB index assigned as RLM RS		Config 1, 2	0,1
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
REG bundle size			6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting		Config 1, 2	CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking		Config 1, 2	TRS.2.1 TDD
T1		s	0.2
T2		s	14.48
T3		s	14.48
D1		s	14.44
Note 1: All configurations are assigned to the UE prior to the start of time period T1.			
Note 2: UE-specific PDCCH is not transmitted after T1 starts.			
Note 3: E-UTRAN is in non-DRX mode under test.			

5.5.1.3.4.2 Test Procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 1] with a reporting periodicity as mentioned in the above table 5.5.1.3.4.1-4.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 5.5.
2. Set the parameters according to T1 in Table 5.5.1.3.5-1 for subtest 1 and 2. Propagation conditions are set according to Annex C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.3.5-1 for subtests 1 and 2. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.3.5-1 for subtests 1 and 2. T3 starts.
5. If the SS:
 - a) detects uplink power in each subframe configured for CQI transmission (according to configured CQI periodicity on PUCCH [format 1]) during the period from time point A to time point B
 and
 - b) does not detect any uplink power from time point C (240 ms after the start of T3) until T3 expires,

the number of successful tests is increased by one.
6. Otherwise the number of failed tests is increased by one and proceed to Step 10.
7. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.3.4.4-1.
8. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.
9. The SS then shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].
11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.3.4.3 Message Contents

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

Table 5.5.1.3.4.3-0: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.4-1 Table H.3.5-4 Table H.3.5-9 with Condition SSB RLM Table H.3.7-1 with condition DRX.3

Table 5.5.1.3.4.3-1: PDCCH Search Space

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
Duration	2		
monitoringSymbolsWithinSlot	11000000000000	Symbols 0 and 1	
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n0		
aggregationLevel8	n1	AL8	
aggregationLevel16	n0		
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0	
}			
}			
}			

Table 5.5.1.3.4.3-2: UE-TimersAndConstants

Derivation Path: TS 38.508-1 [14], Table 4.6.3-200			
Information Element	Value/remark	Comment	Condition
UE-TimersAndConstants ::= SEQUENCE {			
t310	ms0		
n310	n1		
t311	ms1000		
n311	n1		
}			

Table 5.5.1.3.4.3-3: CSI-FrequencyOccupation

Derivation Path: TS 38.508-1 [14], Table 4.6.3-33			
Information Element	Value/remark	Comment	Condition
CSI-FrequencyOccupation ::= SEQUENCE {			
startingRB	0		
nrofRBs	66	100 MHz (120 KHz SCS)	
}			

5.5.1.3.5 Test Requirement

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

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

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

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

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

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

Parameter	Unit	Test 1			
		T1	T2	T3	
AoA setup		Setup 1 defined in A.9.1			
Assumption for UE beams ^{Note 5}		Rough			
EPRE ratio of PDCCH DMRS to SSS	dB	4			
EPRE ratio of PDCCH to PDCCH DMRS	dB	0			
EPRE ratio of PBCH DMRS to SSS	dB	0			
EPRE ratio of PBCH to PBCH DMRS	dB				
EPRE ratio of PSS to SSS	dB				
EPRE ratio of PDSCH DMRS to SSS	dB				
EPRE ratio of PDSCH to PDSCH DMRS	dB				
EPRE ratio of OCNG DMRS to SSS	dB				
EPRE ratio of OCNG to OCNG DMRS	dB				
ssb-index 0 SNR	Config 1, 2	dB	3.32 ^{Note 6}	-4.76 ^{Note 6}	-15.4
ssb-index 1 SNR	Config 1, 2		3.32 ^{Note 6}	-15.4	-15.4
N_{oc}	Config 1, 2	dBm/15K Hz	-104.7dBm		
Propagation condition			TDL-A 30ns 75Hz		
<p>Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.</p> <p>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.</p> <p>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.</p> <p>Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is TS 38.133 [6] A.3.6.</p> <p>Note 5: Information about types of UE beam is given in TS 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation</p> <p>Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband</p>					

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

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.5.1.4.1 Test Purpose

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell with DRX configured. This test will partly verify the FR2 PSCell radio link monitoring requirements in clause 8.1.

5.5.1.4.2 Test Applicability

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

5.5.1.4.3 Minimum Conformance Requirements

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

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

5.5.1.4.4 Test Description

5.5.1.4.4 Test Description

There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

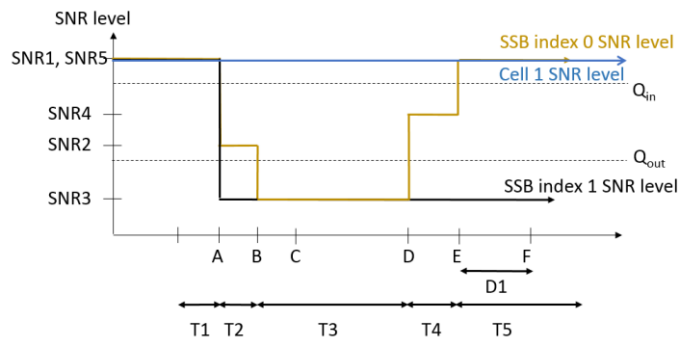


Figure 5.5.1.4.4-1: SNR variation for in-sync testing

5.5.1.4.4.1 Initial conditions

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

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

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

Table 5.5.1.4.4.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
5.5.1.4-1	FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.1.4-2	TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

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

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

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

PDCCH transmission parameters are given in Table 5.5.1.4.4.1-4.

Table 5.5.1.4.4.1-3: Void

1. Message contents are defined in clause 5.5.1.4.4.3.
2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2
3. The general test parameters are given in Table 5.5.1.4.5-4 below.
4. Downlink signals for NR cell are initially set up according to clause C.1.

Table 5.5.1.4.4.1-4: General test parameters for FR2 in-sync testing in DRX mode

Parameter		Unit	Value
Active E-UTRA PCeell			Cell 1
E-UTRA RF Channel Number			1
Active PSCeell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD
BW _{channel}	Config 1, 2		100: N _{RB,c} = 66
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.3.1 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.3
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		PRACH.4 FR2
SSB index assigned as RLM RS	Config 1, 2		0,1
OCNG parameters			OP.1
CP length			Normal
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.11
Gap pattern ID			N.A.
Layer 3 filtering			<i>Enabled</i>
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	2.8
T4		s	0.2
T5		s	3.88
D1		s	3.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.			
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			
NOTE 3: E-UTRAN is in non-DRX mode under test.			

5.5.1.4.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (Pcell), and a single NR cell (PSCell). Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CQI reporting in PUCCH [format 1] with a reporting periodicity as mentioned in the above table 5.5.1.4.4.1-4.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 4.5.
2. Set the parameters according to T1 in Table 5.5.1.4.4-1 for subtest 1 and 2. Propagation conditions are set according to Annex C.2.3. T1 starts.
3. When T1 expires, the SS shall change the SNR value to T2 as specified in Table 5.5.1.4.5-1. T2 starts.
4. When T2 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.4.5-1. T3 starts.
5. When T3 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.4.5-1. T4 starts.
6. When T4 expires, the SS shall change the SNR value to T3 as specified in Table 5.5.1.4.5-1. T5 starts.
7. If the SS detects uplink power in the On-duration part of every DRX cycle in the subframe according the configured CQI reporting mode (PUCCH 1-0) during the period from time point A to time point F (1120 ms after the start of time duration T5) the number of successful tests is increased by one.

Otherwise the number of failed tests is increased by one.

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

5.5.1.4.4.3 Message Contents

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

Table 5.5.1.4.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.4-1 Table H.3.5-4 Table H.3.5-9 with Condition SSB RLM Table H.3.7-1 with condition DRX.3

Table 5.5.1.4.4.3-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
monitoringSlotPeriodicityAndOffset CHOICE {			
s1	NULL		
}			
duration	2		
monitoringSymbolsWithinSlot	11000000000000	Symbols 0 and 1	
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n0		
aggregationLevel8	n1	AL8	
aggregationLevel16	n0		
}			
searchSpaceType CHOICE {			
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0	
}			
}			
}			

Table 5.5.1.4.4.3-3: RLF-TimersAndConstant

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

Table 5.5.1.4.4.3-4: CSI-FrequencyOccupation

Derivation Path: TS 38.508-1 [14], Table 4.6.3-33			
Information Element	Value/remark	Comment	Condition
CSI-FrequencyOccupation ::= SEQUENCE {			
startingRB	0		
nrofRBs	66	100 MHz (120 KHz SCS)	
}			

5.5.1.4.5 Test Requirements

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

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

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

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

Parameter	Unit	Test 1					
		T1	T2	T3	T4	T5	
AoA setup		Setup 1 defined in A.9.1					
Assumption for UE beams ^{Note 5}		Rough					
EPRE ratio of PDCCH DMRS to SSS	dB	0					
EPRE ratio of PDCCH to PDCCH DMRS	dB	0					
EPRE ratio of PBCH DMRS to SSS	dB	0					
EPRE ratio of PBCH to PBCH DMRS	dB						
EPRE ratio of PSS to SSS	dB						
EPRE ratio of PDSCH DMRS to SSS	dB						
EPRE ratio of PDSCH to PDSCH DMRS	dB						
EPRE ratio of OCNG DMRS to SSS	dB						
EPRE ratio of OCNG to OCNG DMRS	dB						
ssb-Index 0 SNR	Config 1, 2	dB	3.3 2 ^{Note 6}	-4.7 6 ^{Note 6}	-15.4	-4.95	3.32 Note 6
ssb-Index 1 SNR	Config 1, 2		3.3 2 ^{Note 6}	-15.4	-15.4	-15.4	-15.4
N_{oc}	Config 1, 2	dBm/15 KHz	-104.7dBm				
Propagation condition			TDL-A 30ns 75Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.3							
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is TS 38.133 [6] A.3.6.							
Note 5: Information about types of UE beam is given in 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation							
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband							

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

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

- TT analysis is made at Test frequency $f \leq 40.8$ GHz
- Connection diagram is TBD
- Test Procedure and message contents will need further editing and review

5.5.1.5.1 Test purpose

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

5.5.1.5.2 Test applicability

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

5.5.1.5.3 Minimum conformance requirements

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

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

5.5.1.5.4 Test description

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

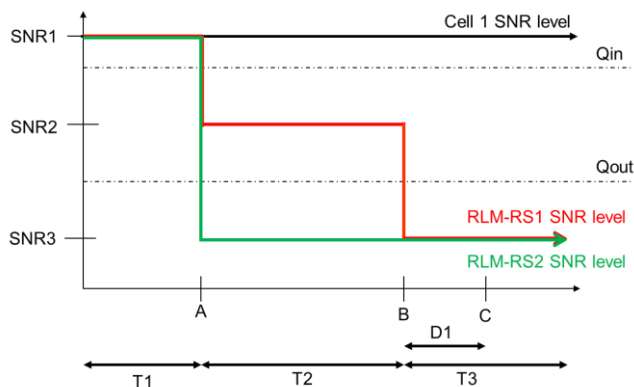


Figure 5.5.1.5.4-1: SNR variation for out-of-sync testing

5.5.1.5.4.1 Initial conditions

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

Table 5.5.1.5.4.1-1: Supported test configurations for FR2 PSCell

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

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

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

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

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

Exceptions to connection diagram	N/A	
----------------------------------	-----	--

1. The test parameters are given in Table 5.5.1.5.4.1-3 below.
2. Message contents are defined in clause 5.5.1.5.4.3.
3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to TS 38.133 [6] Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.5.4.1-3: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
Active E-UTRA PCell			Test 1
E-UTRA RF Channel Number			Cell 1
Active PSCell			1
RF Channel Number			Cell 2
Duplex Mode			2
BW _{channel}			TDD
Data RBs allocated		Config 1, 2	
BW _{occupied}		Config 1, 2	
BW _{channel}		Config 1, 2	
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.4
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CR.3.1 TDD
	Config 2		CCR.3.4 TDD CCR.3.6 TDD
SSB Configuration	Config 1		CCR.3.4 TDD CCR.3.6 TDD
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SSB.1 FR2
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		SMTC.1
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		120 KHz
			Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
TRS configuration			TRS.2.1 TDD
			TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	0.35
T3		s	0.35
D1		s	0.31
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			
NOTE 2: E-UTRAN is in non-DRX mode under test.			

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

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

5.5.1.5.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms).

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.5.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.5.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.5.5-1. T3 starts.
5. If the SS:
 - a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B

and

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

Otherwise the number of failed tests is increased by one.

6. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.5.5-1.
7. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.
8. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
9. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].
10. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.5.4.3 Message contents

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

Table 5.5.1.5.4.3-1: Common Exception messages

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

Table 5.5.1.5.4.3-2: MeasConfig for E-UTRAN PCell

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

5.5.1.5.5 Test requirement

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

Table 5.5.1.5-1: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1								
		T1	T2	T3	T1	T2	T3			
AoA setup		Setup 3 defined in A.9.3								
		AoA1			AoA2					
Assumption for UE beams ^{Note 10}		Rough			Rough					
EPRE ratio of PDCCH DMRS to SSS	dB	0								
EPRE ratio of PDCCH to PDCCH DMRS	dB									
EPRE ratio of PBCH DMRS to SSS	dB									
EPRE ratio of PBCH to PBCH DMRS	dB									
EPRE ratio of PSS to SSS	dB									
EPRE ratio of PDSCH DMRS to SSS	dB									
EPRE ratio of PDSCH to PDSCH DMRS	dB									
EPRE ratio of OCNG DMRS to SSS	dB									
EPRE ratio of OCNG to OCNG DMRS	dB									
SNR on RLM-RS1	Config 1, 2	dB	4.1 ^{Note 11}	3.9 ^{Note 11}	-15	Not sent				
SNR on RLM-RS2	Config 1, 2		Not sent					4.1 ^{Note 11}	-14	-15
N_{oc}	Config 1, 2	dBm/ 15kHz	-94.8					-94.8		
Propagation condition			TDL-A 30ns 75Hz					TDL-A 30ns 75Hz		
Note 1:	OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.									
Note 2:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.									
Note 3:	NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.									
Note 4:	Measurement gap configuration is assigned to the UE prior to the start of time period T1.									
Note 5:	The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.									
Note 6:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.									
Note 7:	SNR levels correspond to the signal to noise ratio over the SSS REs.									
Note 8:	The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.1.5.4-1.									
Note 9:	The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is TS 38.133 [6] A.3.6.									
Note 10:	Information about types of UE beam is given in TS 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation									
Note 11:	This value allows up to 1dB degradation from applied SNR to UE baseband									

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

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according the configured periodic CSI reporting for Cell 2.

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

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

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

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

- TT analysis is made at Test frequency $f \leq 40.8$ GHz- Connection diagram is TBD.

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

5.5.1.6.1 Test purpose

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

5.5.1.6.2 Test applicability

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

5.5.1.6.3 Minimum conformance requirements

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

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

5.5.1.6.4 Test description

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

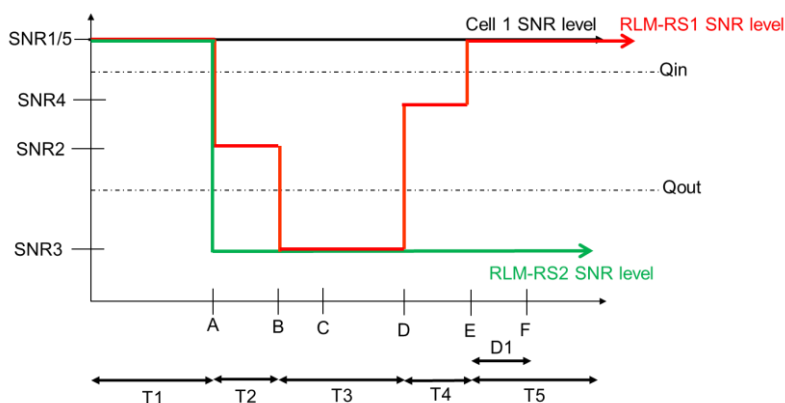


Figure 5.5.1.6.4-1: SNR variation for in-sync testing

5.5.1.6.4.1 Initial conditions

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

Table 5.5.1.6.4.1-1: Supported test configurations for FR2 PSCell

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

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

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

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

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

1. The test parameters are given in Table 5.5.1.6.4.1-3 below.
2. Message contents are defined in clause 5.5.1.6.4.3.
3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to TS 38.133 [6] Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.6.4.1-3: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter	Unit	Value
		Test 1
Active E-UTRA PCell		Cell 1
E-UTRA RF Channel Number		1
Active PSCell		Cell 2
RF Channel Number		2
Duplex Mode		TDD
BW _{channel}	Config 1, 2	100: N _{RB,c} = 66
Data RBs allocated	Config 1, 2	24
BW _{occupied}	Config 1, 2	24
TDD Configuration	Config 1	TDDConf.3.1
	Config 2	TDDConf.3.1
DL initial BWP configuration	Config 1, 2	DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2	DLBWP.1.4
UL initial BWP configuration	Config 1, 2	ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2	ULBWP.1.4
RMSI CORESET Reference Channel	Config 1	CR.3.1 TDD
	Config 2	CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1	CCR.3.1 TDD
	Config 2	CCR.3.3 TDD
SSB Configuration	Config 1	SSB.1 FR2
	Config 2	SSB.1 FR2
SMTC Configuration	Config 1	SMTC.1
	Config 2	SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1	120 KHz
	Config 2	120 KHz
CSI-RS for RLM	Config 1, 2	Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
OCNG parameters		OP.5
TRS configuration		TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH		TCI.State.2

Parameter		Unit	Value
			Test 1
TCI configuration for PDCCH#2			TCI.State.3
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average 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 for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
T1		s	0.2
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			
NOTE 2: E-UTRAN is in non-DRX mode under test.			

5.5.1.6.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled.

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

2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.6.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.6.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.6.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.1.6.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.1.6.5-1. T5 starts.
7. If the SS detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point F (T6 ms after the start of time duration T5) the number of successful tests is increased by one.
Otherwise the number of failed tests is increased by one.
8. If the UE has not re-established the connection in at least 1s, the SS shall ensure PSCell is released.
9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5].
11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.6.4.3 Message contents

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

Table 5.5.1.6.4.3-1: Common Exception messages

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

5.5.1.6.5 Test requirement

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

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

Parameter	Unit	Test 1															
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5						
AoA setup		Setup 3 defined in A.9.3															
		AoA1					AoA2										
Assumption for UE beams ^{Note 10}		Rough					Rough										
EPRE ratio of PDCCH DMRS to SSS	dB	0					Not sent										
EPRE ratio of PDCCH to PDCCH DMRS	dB	0															
EPRE ratio of PBCH DMRS to SSS	dB																
EPRE ratio of PBCH to PBCH DMRS	dB																
EPRE ratio of PSS to SSS	dB																
EPRE ratio of PDSCH DMRS to SSS	dB																
EPRE ratio of PDSCH to PDSCH DMRS	dB																
EPRE ratio of OCNG DMRS to SSS	dB																
EPRE ratio of OCNG to OCNG DMRS	dB																
SNR on RLM-RS1	Config 1, 2											dB	4.1 ^{Note 11}	3.9 ^{Note 11}	-15	-4.5	4.1 ^{Note 11}
SNR on RLM-RS2	Config 1, 2							Not sent					4.1 ^{Note 11}	-14	-15	-15	-14
N_{oc}	Config 1, 2	dBm/15KHz	-94.8					-94.8									
Propagation condition		TDL-A 30ns 75Hz					TDL-A 30ns 75Hz										
<p>Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.</p> <p>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.</p> <p>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.</p> <p>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.</p> <p>Note 7: SNR levels correspond to the signal to noise ratio over the SSS RES.</p> <p>Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure 5.5.1.6.4-1.</p> <p>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is TS 38.133 [6] A.3.6.</p> <p>Note 10: Information about types of UE beam is given in TS 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation</p> <p>Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband</p>																	

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

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

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

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

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

- TT analysis is made at Test frequency $f \leq 40.8$ GHz

- Connection Diagrams are TBD

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

5.5.1.7.1 Test purpose

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

5.5.1.7.2 Test applicability

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

5.5.1.7.3 Minimum conformance requirements

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

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

5.5.1.7.4 Test description

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

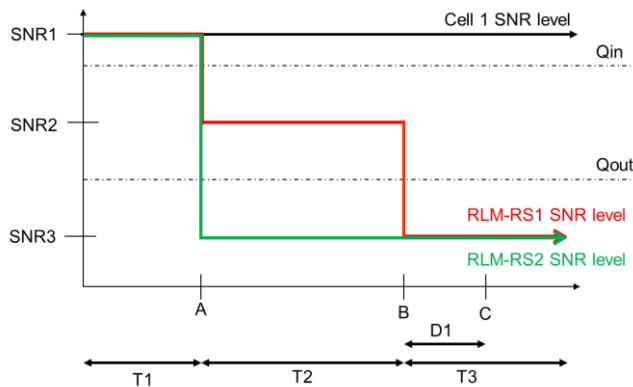


Figure 5.5.1.7.4-1: SNR variation for out-of-sync testing

5.5.1.7.4.1 Initial conditions

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

Table 5.5.1.7.4.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
5.5.1.7-1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.5.1.7-2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

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

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

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.1.7.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	TBD	
Exceptions to connection diagram	N/A		

1. The test parameters are given in Table 5.5.1.7.4.1-3 below.
2. Message contents are defined in clause 5.5.1.7.4.3.
3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.7.4.1-3: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR. 3.1 TDD
	Config 2		CR. 3.1 TDD
RMC CORESET Reference Channel	Config 1		CCR. 3.4 TDD
	Config 2		CCR.3.6 TDD
			CCR.3.4 TDD
			CCR.3.6 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD
			Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD
			TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1

Parameter		Unit	Value
			Test 1
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 for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			
NOTE 2: E-UTRAN is in non-DRX mode under test.			

5.5.1.7.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.7.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.7.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.7.5-1. T3 starts.
5. If the SS:
 - a) detects uplink power on NR carrier in the On-duration part of every DRX cycle in the slots configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B
and

- b) does not detect any uplink power on NR carrier from time point C (D1 after the start of T3) until T3 expires, the number of successful tests is increased by one.
- Otherwise the number of failed tests is increased by one.
6. When T3 expires the SS shall change the SNR value to T1 as specified in Table 5.5.1.7.5-1.
 7. If the UE has not re-established the connection in at least 1s, the UE is switched off and then on. Ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to TS 38.508-1 [14] clause 4.5.
 8. Repeat steps 2-7 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.7.4.3 Message contents

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

Table 5.5.1.7.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-2 with Condition INTRA-FREQ, L3 FILTERING NEEDED; Table H.3.1-3 with Condition INTRA-FREQ MO, SSB.1 FR2, SMTC.1 and RLM Table H.3.1-8 with Condition CSI RLM Table H.3.1-9 Table H.3.7-1 with condition DRX.7

5.5.1.7.5 Test requirement

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

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

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.9.3		
Assumption for UE beams ^{Note 10}			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS1	Config 1, 2	dB	3.3 ^{Note}	-4.7 ^{Note}	-15.4
SNR on RLM-RS2	Config 1, 2		3.3 ^{Note}	-14.4	-15.4
N_{oc}	Config 1	dBm/15KHz	-104.7		
	Config 2		-104.7		
Propagation condition			TDL-A 30ns 75Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.					
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.					
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.					
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.					
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.					
Note 7: SNR levels correspond to the signal to noise ratio over the SSS RES.					
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.1.7.4-1.					
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is TS 38.133 [6] A.3.6.					
Note 10: Information about types of UE beam is given in TS 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation					
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband					

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

During the period from time point A to time point B the UE shall transmit uplink signal at least once every DRX cycle, in the On-duration part of the cycle in the slots configured for CSI transmission according the configured periodic CSI reporting for Cell 2.

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

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

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

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

- TT analysis is made at Test frequency $f \leq 40.8$ GHz
- Connection Diagram is TBD.
- Test Procedure and message contents will need further editing and review

5.5.1.8.1 Test purpose

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

5.5.1.8.2 Test applicability

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

5.5.1.8.3 Minimum conformance requirements

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

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

5.5.1.8.4 Test description

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

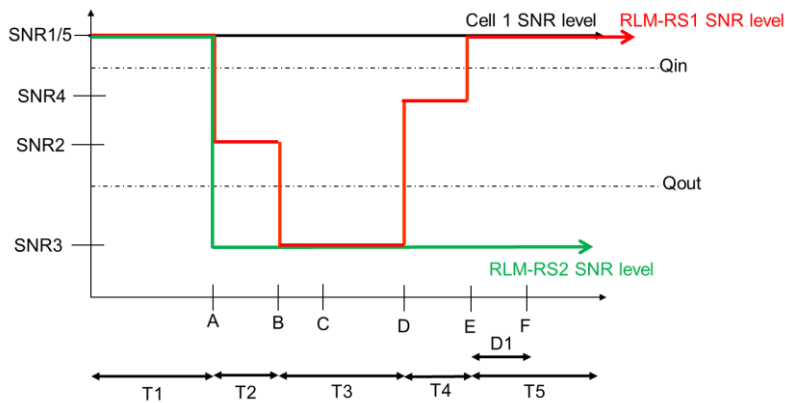


Figure 5.5.1.8.4-1: SNR variation for In-sync testing

5.5.1.8.4.1 Initial conditions

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

Table 5.5.1.8.4.1-1: Supported test configurations for FR2 PSCell

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

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

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

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

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.1.8.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part DUT Part	TBD TBD
Exceptions to connection diagram	N/A	

1. The test parameters are given in Table 5.5.1.8.4.1-2 below.
2. Message contents are defined in clause 5.5.1.8.4.3.
3. There are two cells in the test, where Cell 1 is the E-UTRAN PCell on the E-UTRA carrier, and Cell 2 is the NR PSCell on the NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.1.8.4.1-3: General test parameters for FR2 PSCell for CSI-RS In-sync testing in DRX mode

Parameter	Unit	Value
		Test 1
Active E-UTRA PCell		Cell 1
E-UTRA RF Channel Number		1
Active PSCell		Cell 2
RF Channel Number		2
Duplex Mode		TDD
TDD Configuration	Config 1	TDDConf.3.1
	Config 2	TDDConf.3.1
DL initial BWP configuration	Config 1, 2	DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2	DLBWP.1.1
UL initial BWP configuration	Config 1, 2	ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2	ULBWP.1.1
RMSI CORESET Reference Channel	Config 1	CR.3.1 TDD
	Config 2	CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1	CCR.3.1 TDD
		CCR.3.3 TDD
	Config 2	CCR.3.1 TDD
		CCR.3.3 TDD
SSB Configuration	Config 1	SSB.1 FR2
	Config 2	SSB.1 FR2
SMTC Configuration	Config 1	SMTC.1
	Config 2	SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1	120 KHz
	Config 2	120 KHz
CSI-RS for RLM	Config 1, 2	Resource #4 in TRS.2.1 TDD

Parameter		Unit	Value
			Test 1
			Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync 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			<i>gp0</i>
Layer 3 filtering			<i>Enabled</i>
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.2
T3		s	1.64
T4		s	0.2
T5		s	1.88

Parameter	Unit	Value
		Test 1
D1	s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.		
NOTE 2: E-UTRAN is in non-DRX mode under test.		

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

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

5.5.1.8.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms).

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of Cell 2 according to T1 in Table 5.5.1.8.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.1.8.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.1.8.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.1.8.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.1.8.5-1. T5 starts.
7. If the SS detects uplink power on NR carrier in the On-duration part of every DRX cycle in the configured slots for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point F (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 SS shall ensure PSCell is released.
9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition *MCG_and_SCG* according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
10. If the Reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].
11. Repeat steps 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.8.4.3 Message contents

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

Table 5.5.1.8.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-2 with Condition INTER-FREQ, L3 FILTERING NEEDED; Table H.3.1-3 with Condition INTER-FREQ MO, SSB.1 FR2, SMTTC.1 and RLM Table H.3.1-4 with a3-offset = -6dB; Table H.3.1-8 with Condition CSI RLM Table H.3.1-9 Table H.3.7-1 with condition DRX.3 and Gap

Table 5.5.1.8.4.3-2: MeasConfig for E-UTRAN PCell

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

5.5.1.8.5 Test requirement

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

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

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.9.3				
Assumption for UE beams ^{Note 10}			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS1	Config 1, 2	dB	3.3 ^{Note}	-4.7 ^{Note 11}	-15.4	-4.9	3.3 ^{Note 11}
SNR on RLM-RS2	Config 1, 2	dB	3.3 ^{Note}	-14.4	-15.4	-15.4	-14.4
N_{oc}	Config 1, 2	dBm/15KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				
<p>Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.</p> <p>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.</p> <p>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.</p> <p>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.</p> <p>Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.</p> <p>Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure 5.5.1.8.4-1.</p> <p>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is TS 38.133 [6] A.3.6.</p> <p>Note 10: Information about types of UE beam is given in TS 38.133 [6] B.2.1.3, and does not limit UE implementation or test system implementation</p> <p>Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband</p>							

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

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

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

5.5.1.9 EN-DC FR2 radio link monitoring UE scheduling restrictions

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

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

-Message content is TBD

5.5.1.9.1 Test purpose

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

5.5.1.9.2 Test applicability

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

This test is only applicable to UE which supports *pdch-MonitoringAnyOccasions* or *pdch-MonitoringAnyOccasionsWithSpanGap*.

5.5.1.9.3 Minimum conformance requirement

The minimum conformance requirements are specified in clause 5.5.1.0.5.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.1.9.

5.5.1.9.4 Test description

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and NR FR2 PSCell (Cell 2). The test parameters for NR PSCell are given in table 5.5.1.9.4.1-1, table 5.5.1.9.4.1-3 and table 5.5.1.9.5-1 below and the parameters and applicability for the E-UTRAN cell are defined in A.6.1.2. The test consists of one time period with time duration of T1. Figure 5.5.1.9.4-1 shows the Time multiplexed downlink transmissions from each Angle of Arrival. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.

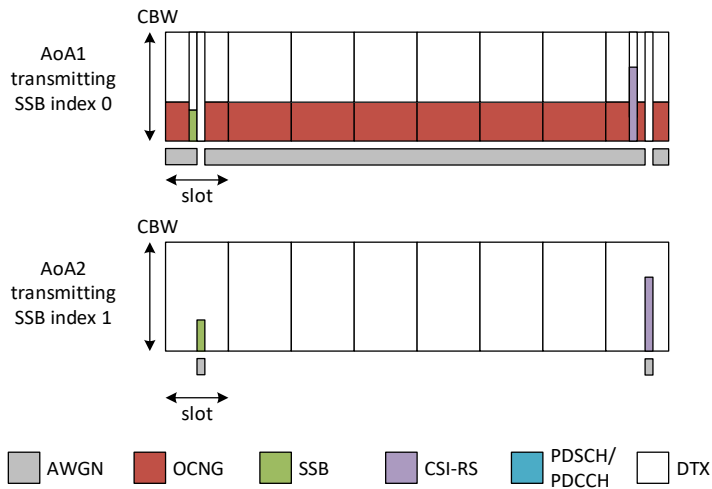


Figure 5.5.1.9.4-1: Time multiplexed downlink transmissions

5.5.1.9.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.1.9.4.1-1.

Table 5.5.1.9.4.1-1: Supported test configurations for EN-DC FR2 radio link monitoring UE scheduling restrictions

Configuration	Description
5.5.1.9-1	FDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode
5.5.1.9-2	TDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Configure the test equipment and the DUT according to the parameters in Table 5.5.1.9.4.1-2

Table 5.5.1.9.4.1-2: Initial conditions for EN-DC FR2 radio link monitoring UE scheduling restrictions

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E.1.2, Table E.4-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.1.9.4.1-1	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part	TBD
	DUT Part	TBD
Exceptions to connection diagram	N/A	

1. The test parameters for PSCell are given in Table 5.5.1.9.4.1-3
2. Message contents are defined in clause 5.5.1.9.4.3.
3. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in clause C.1.3, and the downlink signal levels as per clause C.1.2

Table 5.5.1.9.4.1-3: General test parameters for EN-DC FR2 radio link monitoring UE scheduling restrictions

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1, 2	1 and 2	1 for NR PSCell and 2 for LTE PCell
SSB configuration		1, 2	SSB.1 FR2	
SMTC configuration		1, 2	SMTC pattern 1	
DRX cycle length	s	1, 2	OFF	
T1	s	1, 2	5	During T1 the UE is required to correctly transmit ACK/NACK

5.5.1.9.4.2 Test Procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

1. Set the parameters according to T1 in Table 5.5.1.9.4.1. Propagation conditions are set according to clause C.2.2. T1 starts.
2. If the SS receives ACK/NACK from Cell 2 on each UL transmission occasion scheduled by PDCCH which are not overlapped with SSBs configured for radio link monitoring during T1, the number of successful tests is increased by one. otherwise the number of failed tests is increased by one.
3. The UE is switched off and then on. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* according to TS 38.508-1 [10] clause 4.5.
4. Repeat steps 1-3 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.1.9.4.3 Message Contents

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

Table 5.5.1.9.4.3-1: Common Exception messages for EN-DC FR2 radio link monitoring UE scheduling restrictions

Default Message Contents	
Common contents of system information blocks exceptions	TBD
Default RRC messages and information elements contents exceptions	TBD

5.5.1.9.5 Test Requirement

Table 5.5.1.9.4.1-3 and 5.5.1.9.5-1 define the primary level settings including test tolerances for EN-DC FR2 radio link monitoring UE scheduling restrictions.

Table 5.5.1.9.5-1: Cell specific test parameters for EN-DC FR2 radio link monitoring UE scheduling restrictions

Parameter	Unit	Test configuration	Cell 2	
			AoA1	AoA2
AoA setup		1, 2	Setup 3 defined in A.9.3	
Assumption for UE beams ^{Note 1}			Rough	Rough
TDD configuration		1, 2	TDDConf.3.1	
BW _{channel}	MHz	1, 2	100: N _{RB,c} = 66	
Data RBs allocated		1, 2	24	
PDSCH Reference measurement channel		1, 2	SR.3.2 TDD	Not sent
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD	Not sent
Dedicated CORESET RMC configuration		1, 2	CCR.3.2 TDD	Not sent
TRS configuration		1, 2	TRS.2.1 TDD	TRS.2.2 TDD
PDCCH/PDSCH TCI state		1, 2	TCI.State.2	Not sent
OCNG Pattern		1, 2	OP.5	Not sent
Initial DL BWP configuration		1, 2	DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1	
RLM-RS		1, 2	SSB with index 0	SSB with index 1
N_{oc}	dBm/15kHz	1, 2	-92.1	-92.1
N_{oc} ^{Note2}	dBm/SCS	1, 2	-83.1	-83.1
\hat{E}_s/N_{oc}	dB	1, 2	2	2
\hat{E}_s/I_{ot_BB} ^{Note 4}	dB	1, 2	1	1
SSB_RP ^{Note3}	dBm/SCS	1, 2	-81.1	-81.1
Io	dBm/95.04 MHz	1, 2	-54.35	-54.35
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in Figure 5.5.1.9.4-1	
Propagation Condition		1, 2	AWGN	AWGN
Note 1:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N _{oc} to be fulfilled.			
Note 3:	Es/I _{ot} , SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
Note 4:	Calculation of Es/I _{ot_{BB}} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔM _{Bs} from TS 38.101-2 [3] Table 6.2.1.3-4.			

The UE behaviour during time duration T1 follows the requirements defined in TS 38.133 [6] clause 8.1.7.3:

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

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

5.5.2 Interruption

5.5.2.0 Minimum conformance requirements

5.5.2.0.1 Minimum conformance requirements for interruptions at transitions between active and non-active during DRX

[TS38.133, clause 8.2.1.2.1]

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions between active and non-active during DRX when PSCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 5.5.2.0.1-1.

Each interruption shall not exceed X slot as defined in table 5.5.2.0.1-1.

Table 5.5.2.0.1-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	

When both E-UTRA PCell and PSCell are in DRX, no interruption is allowed.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.1.

5.5.2.0.2 Minimum conformance requirements for interruptions during measurements on deactivated NR SCC

[TS38.133, clause 8.2.1.2.5.1]

Interruption on PSCell and other active NR SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with PSCell.

[TS38.133, clause 8.2.2.2.3]

Interruptions on PCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 5.5.2.0.2-1 if the PCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 5.5.2.0.2-2 if the PCell is in the same band as the deactivated SCell.

Interruptions on active SCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 5.5.2.0.2-1 if the active SCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 5.5.2.0.2-2 if the active SCell is in the same band as the deactivated SCell.

[TS38.133, clause 8.2.2.2.2]

Table 5.5.2.0.2-1: Interruption duration for SCell activation/deactivation for inter-band CA

μ	NR Slot length (ms)	Interruption length
0	1	1
1	0.5	1
2	0.25	2
3	0.125	4

Table 5.5.2.0.2-2: Interruption duration for SCell activation/deactivation for intra-band CA

μ	NR Slot length (ms)	Interruption length
0	1	1 + $T_{\text{SMTC_duration}}$
1	0.5	1 + $T_{\text{SMTC_duration}}$
2	0.25	2 + $T_{\text{SMTC_duration}}$
3	0.125	4 + $T_{\text{SMTC_duration}}$

NOTE: $T_{\text{SMTC_duration}}$ IS

- the longest SMTC duration among all above activated serving cells and the SCell being activated when one SCell is activated;
- the longest SMTC duration among all activated serving cells in the same band when one SCell is deactivated.

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.5.1.

5.5.2.0.3 Minimum conformance requirements for interruptions during measurements on deactivated E-UTRAN SCC

[TS38.133 clause 8.2.1.2.5.2]

When one E-UTRA SCell in MCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [2] for the deactivated E-UTRA SCells is 640 ms or longer.
- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2] for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [2].

Each interruption shall not exceed

- X3 slot, if the PSCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or
- Y3 slot + SMTC duration, if the PSCell or activated SCell is in the same band as the E-UTRA deactivated SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

Table 5.5.2.0.3-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X3 slot	Interruption length Y3 slot
0	1	1	1
1	0.5	1	1
2	0.25	2	2
3	0.125	4	4

The normative reference for this requirement is TS 38.133 [6] clause 8.2.1.2.5.1.

5.5.2.1 EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.5.2.1.1 Test purpose

The purpose of this test is:

- To verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits.
- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.1.2 Test applicability

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

5.5.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.1.

5.5.2.1.4 Test description

5.5.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.2.1.4.1-1.

Table 5.5.2.1.4.1-1: Supported test configurations for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Configuration	Description
5.5.2.1-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.2.1-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.1.4.1-2.

Table 5.5.2.1.4.1-2: Initial conditions for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.2.1.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.1.
Connection Diagram	TE Part A.3.3.3.1-1 DUT Part A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.

Exceptions to connection diagram	N/A	
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1. The general test parameter settings are set up according to Table 5.5.2.1.4.1-3.
2. Message contents are defined in clause 5.5.2.1.4.3.
3. There are one E-UTRAN carrier and one NR carrier and two cells in the test. Cell 1 is PCell on the E-UTRAN carrier, Cell 2 is PSCell on the NR carrier, Cell 1 is the cell used for connection setup with the power levels set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.2.1.4.1-3: General test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1 and cell 2
DRX		DRX.4	DRX related parameters are defined in TS 38.133 Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	6.25	

5.5.2.1.4.2 Test procedure

The test consists of two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1 and Cell2. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.
3. The SS shall transmit an *RRCCConnectionReconfiguration* message to configure PCell (Cell1) and PSCell (Cell2) on the MCG and SCG as per TS 36.508 [7] clause 4.6 with the message content exceptions defined in clause 5.5.2.1.4.3.
4. The UE shall transmit *RRCCConnectionReconfigurationComplete* message.
5. The SS would ensure continuous transmission on PSCell, while not scheduling on PCell at least for 200 ms to ensure inactivity timer is expired on the UE for LTE PCell.
6. Set the parameters according to T1 in Table 5.5.2.1.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
7. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.
8. If more than 99% of uplink transmissions are received by SS then count a success for the event "ACK/NACK". Otherwise count a fail for the event "ACK/NACK".
9. If no two consecutive missing PUCCH transmissions are observed by the SS, then count a success for the event "DTX". Otherwise count a fail for the event "DTX".
10. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),

or

- switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

11. Repeat step 3-10 until a test verdict has been achieved

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict. If all events pass, the test passes. If one event fails, the test fails.

5.5.2.1.4.3 Message contents

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

Table 5.5.2.1.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.7-2 with Condition DRX.4

5.5.2.1.5 Test requirement

Table 5.5.2.1.4.1-1, 5.5.2.1.5-1 and 5.5.2.1.5-2 define the NR cell specific primary level settings including test tolerances for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC test.

Table 5.5.2.1.5-1: NR cell specific test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,C} = 66$
Data RBs allocated	Config 1,2		66
Initial DL BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET parameters	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.3 FR2
SMTTC Configuration	Config 1,2		SMTTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
\bar{E}_s/N_{oc}			
Propagation Condition			AWGN
Time offset to cell1 ^{Note 2}		μ s	3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table 5.5.2.1.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.9.1
Assumption for UE beams ^{Note 6}		Fine
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-112
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-102.97
\hat{E}_s/N_{oc}	dB	17
SSB_RP ^{Note2}	dBm/SCS ^{Note4}	-85.97
\hat{E}_s/I_{ot}	dB	17
I_o ^{Note2}	dBm/95.04 MHz ^{Note4}	-56.90
<p>NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>NOTE 2: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone</p> <p>NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone</p> <p>NOTE 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133[6], and does not limit UE implementation or test system implementation</p>		

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in clause TS 38.133 clause 8.2.1.

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

5.5.2.2 EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.5.2.2.1 Test purpose

The purpose of this test is:

- To verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits.
- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.2.2 Test applicability

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

5.5.2.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.2.

5.5.2.2.4 Test description

5.5.2.2.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 5.5.2.2.4.1-1.

Table 5.5.2.2.4.1-1: Supported test configurations for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Configuration	Description
5.5.2.2-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.2.2-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.2.4.1-2.

Table 5.5.2.2.4.1-2: Initial conditions for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.2.2.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.1.
Connection Diagram	TE Part	A.3.3.3.1-1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.2.2.4.1-3.
2. Message contents are defined in clause 5.5.2.2.4.3.
3. There are one E-UTRAN carrier and one NR carrier and two cells in the test. Cell 1 is PCell on the E-UTRAN carrier, Cell 2 is PSCell on the NR carrier, Cell 1 is the cell used for connection setup with the power levels set according to Table A.6.1.1-1 for this test. Cell 2 is configured according to clause C.1.1 and C.1.2.

Table 5.5.2.2.4.1-3: General test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1 and cell 2
DRX		DRX.4	DRX related parameters are defined in TS 38.133 Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	6.25	

5.5.2.2.4.2 Test procedure

The test consists of two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1 and Cell2. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.
3. The SS shall transmit an *RRCConnectionReconfiguration* message to configure PCell (Cell1) and PSCell (Cell2) on the MCG and SCG as per TS 36.508 [7] clause 4.6 with the message content exceptions defined in clause 5.5.2.2.4.3.
4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.
5. The SS would ensure continuous transmission on PSCell, while not scheduling on PCell at least for 200 ms to ensure inactivity timer is expired on the UE for LTE PCell.
6. Set the parameters according to T1 in Table 5.5.2.2.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
7. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.
8. If more than 99% of uplink transmissions are received by SS then count a success for the event "ACK/NACK". Otherwise count a fail for the event "ACK/NACK".
9. If no two consecutive missing PUCCH transmissions are observed by the SS, then count a success for the event "DTX". Otherwise count a fail for the event "DTX".
10. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),or
 - switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
11. Repeat step 3-10 until a test verdict has been achieved

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict. If all events pass, the test passes. If one event fails, the test fails.

5.5.2.2.4.3 Message contents

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

Table 5.5.2.2.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.7-2 with Condition DRX.4

5.5.2.2.5 Test requirement

Table 5.5.2.2.4.1-1, 5.5.2.2.5-1 and 5.5.2.2.5-2 define the NR cell specific primary level settings including test tolerances for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC test.

Table 5.5.2.2.5-1: NR cell specific test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
BW _{channel}		MHz	100: N _{RB,c} = 66
Data RBs allocated			66
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
TRS configuration			TRS.2.1 TDD
TCI state			TCI.State.0
PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
PDCCH CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.3 FR2
SMTc Configuration			SMTc.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
E _s /N _{oc}		dB	17
Propagation Condition			AWGN
Time offset to cell1 ^{Note 2}		μs	62.5
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table 5.5.2.2.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.9.1
Assumption for UE beams ^{Note 6}		Fine
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-112
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-102.97
\hat{E}_s/N_{oc}	dB	17
SSB_RP ^{Note2}	dBm/SCS ^{Note4}	-85.97
\hat{E}_s/I_{ot}	dB	17
I_o ^{Note2}	dBm/95.04 MHz ^{Note4}	-56.90
<p>NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>NOTE 2: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone</p> <p>NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone</p> <p>NOTE 6: Information about types of UE beam is given in B.2.1.3 of TS 38.133[6], and does not limit UE implementation or test system implementation</p>		

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in TS 38.133 clause 8.2.1.

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

5.5.2.3 EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Editor's note:

- Connection diagram is TBD.
- Test tolerance is missing.
- Test procedure may be further modified.

5.5.2.3.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits.
- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.3.2 Test applicability

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

5.5.2.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.3.

5.5.2.3.4 Test description

5.5.2.3.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 5.5.2.3.4.1-1.

Table 5.5.2.3.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Configuration	Description
5.5.2.3-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.2.3-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.3.4.1-2.

Table 5.5.2.3.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.2.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.1.
Connection Diagram	TE Part	A.3.TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.TBD	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.2.3.4.1-3.
2. Message contents are defined in clause 5.5.2.3.4.3.
3. There are one E-UTRAN carrier and two NR carriers and three cells specified in the test. Cell 1 is the PCell on E-UTRAN carrier, Cell 2 is the PSCell on one NR carrier and Cell 3 is the SCell on the other NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.3.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other two are NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1, cell 2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

5.5.2.3.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 is E-UTRAN PCell, Cell2 is NR PSCell and Cell3 is deactivated NR SCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1, Cell2 and Cell3. Cell1 shall be configured as E-UTRAN PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as NR deactivated SCell. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell and NR PSCell.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
 2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.
 3. The SS shall transmit an *RRCReconfiguration* message including *measCycleSCell* for the deactivated NR SCell.
 4. The UE shall transmit *RRCReconfigurationComplete* message.
 5. Set the parameters according to T1 in Table 5.5.2.3.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
 6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.
 7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event "ACK/NACK". Otherwise count a fail for the event "ACK/NACK".
 8. If no longer than X consecutive DTXs are observed by the SS, then count a success for the event "DTX". Otherwise count a fail for the event "DTX". Where,
 - X = 6 if the NR PSCell is not in the same band as the deactivated SCell, otherwise X = 16.
 9. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),
- or
- switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 3-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.3.4.3 Message contents

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

Table 5.5.2.3.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1; Table H.3.1-2 with Condition Deactivated SCell; Table H.3.1-3 with Condition Deactivated SCell, SSB.1 FR2 and SMTC.1 for configuration 5.5.2.3-1; Table H.3.1-3 with Condition Deactivated SCell, SSB.2 FR2 and SMTC.1 for configuration 5.5.2.3-3; Table H.3.1-4 with A3-offset = -6dB; Table H.3.1-7 with Condition Deactivated SCell;

5.5.2.3.5 Test requirement

Table 5.5.2.3.5-1 and Table 5.5.2.3.5-2 define the primary level settings including test tolerances for FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC test configurations.

Table 5.5.2.3.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode	Config 1		FDD	FDD
	Config 2		TDD	TDD
TDD configuration	Config 1		N.A	N.A
	Config 2		TBD	TBD
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c} = 66$	100: $N_{RB,c} = 66$
Initial BWP Configuration	Config 1,2		TBD	TBD
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	-
RMSI CORESET parameters	Config 1,2		CR.3.1 TDD	CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		TBD	TBD
OCNG Patterns			OP.1	OP.1
SMTC Configuration	Config 1,2		SMTC.1 FR2	SMTC.1 FR2
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)				
E_s/N_{oc}		dB	TBD	TBD
Propagation Condition			AWGN	AWGN
Time offset to cell1 ^{Note 2}		μ s	3	3+ Time offset to cell2
Time offset to cell2 ^{Note 3}		μ s	-	3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells				
NOTE 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells				

Table 5.5.2.3.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3	
UE orientation around TBD axis and TBD axis			TBD	
Relative difference in angle of arrival of cell 2 and cell 3 relative to cell 1	degrees		TBD	
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/15kHz ^{Note4}	TBD+TT	TBD+TT
	NR_TDD_FR2_B			
	NR_TDD_FR2_C			
	NR_TDD_FR2_D			
	NR_TDD_FR2_E			
	NR_TDD_FR2_F			
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/SCS ^{Note3}	TBD+TT	TBD+TT
	NR_TDD_FR2_B			
	NR_TDD_FR2_C			
	NR_TDD_FR2_D			
	NR_TDD_FR2_E			
	NR_TDD_FR2_F			
SS-RSRP ^{Note2}	NR_TDD_FR2_A	dBm/SCS ^{Note4}	TBD+TT	TBD+TT
	NR_TDD_FR2_B			
	NR_TDD_FR2_C			
	NR_TDD_FR2_D			
	NR_TDD_FR2_E			
	NR_TDD_FR2_F			
\hat{E}_s/I_{ot}	dB	TBD+TT	TBD+TT	
I_o ^{Note2}	NR_TDD_FR2_A	dBm/95.04 MHz ^{Note4}	TBD+TT	TBD+TT
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone				
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone				

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

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.3.5-3.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PSCell no earlier than 4 slot before an SMTC and no later than 4 slot after the SMTC. the interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.3.5-4.

Table 5.5.2.3.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table 5.5.2.3.5-4: Interruption duration if the NR PSCell is in the same band as the deactivated SCCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	8 + SMTc duration

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

5.5.2.4 EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Editor's note:

- Connection diagram is TBD.
- Test tolerance is missing.
- Test procedure may be further modified.

5.5.2.4.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits.
- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.4.2 Test applicability

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

5.5.2.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.4.

5.5.2.4.4 Test description

5.5.2.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.2.4.4.1-1.

Table 5.5.2.4.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Configuration	Description
5.5.2.4-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.2.4-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.4.4.1-2.

Table 5.5.2.4.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.2.4.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.1.
Connection Diagram	TE Part	A.3.TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.TBD	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.2.4.4.1-3.
2. Message contents are defined in clause 5.5.2.4.4.3.
3. There are one E-UTRAN carrier and two NR carriers and three cells specified in the test. Cell 1 is the PCell on E-UTRAN carrier, Cell 2 is the PSCell on one NR carrier and Cell 3 is the SCell on the other NR carrier. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.4.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other two are NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1, cell 2 and cell3
AoA number		1	Applicable to cell2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

5.5.2.4.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 is E-UTRAN PCell, Cell2 is NR PSCell and Cell3 is deactivated NR SCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1, Cell2 and Cell3. Cell1 shall be configured as E-UTRAN PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as NR deactivated SCell. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell and NR PSCell.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.
3. The SS shall transmit an *RRCReconfiguration* message including *measCycleSCell* for the deactivated NR SCell.
4. The UE shall transmit *RRCReconfigurationComplete* message.

5. Set the parameters according to T1 in Table 5.5.2.4.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.
7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event "ACK/NACK". Otherwise count a fail for the event "ACK/NACK".
8. If no longer than X consecutive DTX is observed by the SS, then count a success for the event "DTX". Otherwise count a fail for the event "DTX". Where,
 - X = 6 if the NR PSCell is not in the same band as the deactivated SCell, otherwise X = 16.
9. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),
 - or
 - switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 3-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.4.4.3 Message contents

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

Table 5.5.2.4.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1; Table H.3.1-2 with Condition Deactivated SCell; Table H.3.1-3 with Condition Deactivated SCell, SSB.1 FR2 and SMTC.1 for configuration 5.5.2.4-1; Table H.3.1-3 with Condition Deactivated SCell, SSB.2 FR2 and SMTC.1 for configuration 5.5.2.4-3; Table H.3.1-4 with A3-offset = -6dB; Table H.3.1-7 with Condition Deactivated SCell;

5.5.2.4.5 Test requirement

Table 5.5.2.4.5-1 and Table 5.5.2.4.5-2 define the primary level settings including test tolerances for FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC test configurations.

Table 5.5.2.4.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode	Config 1		FDD	FDD
	Config 2		TDD	TDD
TDD configuration	Config 1		N.A	N.A
	Config 2		TBD	TBD
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c} = 66$	100: $N_{RB,c} = 66$
Initial BWP Configuration	Config 1,2		TBD	TBD
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	-
RMSI CORESET parameters	Config 1,2		CR.3.1 TDD	CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		TBD	TBD
OCNG Patterns			OP.1	OP.1
SMTTC Configuration	Config 1,2		SMTTC.1 FR2	SMTTC.1 FR2
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)				
E_s/N_{oc}		dB	TBD	TBD
Propagation Condition			AWGN	AWGN
Time offset to cell1 ^{Note 2}		μ s	62.5	62.5+ Time offset to cell2
Time offset to cell2 ^{Note 3}		μ s	-	3

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells.

NOTE 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells

Table 5.5.2.4.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
UE orientation around TBD axis and TBD axis			TBD	
Relative difference in angle of arrival of cell 2 and cell 3 relative to cell 1		degrees	TBD	
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/15kHz ^{Note4}	TBD+TT	TBD+TT
	NR_TDD_FR2_B			
	NR_TDD_FR2_C			
	NR_TDD_FR2_D			
	NR_TDD_FR2_E			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/SCS ^{Note3}	TBD+TT	TBD+TT
	NR_TDD_FR2_B			
	NR_TDD_FR2_C			
	NR_TDD_FR2_D			
	NR_TDD_FR2_E			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			

Parameter		Unit	Cell 2	Cell 3
SS-RSRP ^{Note2}	NR_TDD_FR2_A	dBm/SCS ^{Note4}	TBD+TT	TBD+TT
	NR_TDD_FR2_B			
	NR_TDD_FR2_C			
	NR_TDD_FR2_D			
	NR_TDD_FR2_E			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
\hat{E}_s / I_{ot}		dB	TBD+TT	TBD+TT
I_o ^{Note2}	NR_TDD_FR2_A	dBm/95.04 MHz ^{Note4}	TBD+TT	TBD+TT
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone				

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

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PSCell immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.4.5-3.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PSCell no earlier than 4 slot before an SMTC and no later than 4 slot after the SMTC. the interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.4.2-4.

Table 5.5.2.4.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table 5.5.2.4.2-4: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	8 + SMTC duration

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

5.5.2.5 EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Editor's note:

- Connection diagram is TBD.
- Test tolerance is missing.
- Test procedure may be further modified.

5.5.2.5.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits.
- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.5.2 Test applicability

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

5.5.2.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.5.

5.5.2.5.4 Test description

5.5.2.5.4.1 Initial conditions

This test shall be run in one of the configurations defined in Table 5.5.2.5.4.1-1.

Table 5.5.2.5.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Configuration	Description
5.5.2.5-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.2.5-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.5.4.1-2.

Table 5.5.2.5.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.2.5.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.1.
Connection Diagram	TE Part	A.3.TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.TBD	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.2.5.4.1-3.
2. Message contents are defined in clause 5.5.2.5.4.3.
3. There are two E-UTRAN carriers and one NR carrier and three cells specified in the test. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.5.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other two are NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1, cell 2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

5.5.2.5.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1, Cell2 and Cell3. Cell1 shall be configured as E-UTRAN PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as E-UTRAN deactivated SCell. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the E-UTRAN SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell and NR PSCell.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
 2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.
 3. The SS shall transmit an *RRCConnectionReconfiguration* message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCell to perform measurements on the deactivated SCC.
 4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.
 5. Set the parameters according to T1 in Table 5.5.2.5.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
 6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.
 7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event "ACK/NACK". Otherwise count a fail for the event "ACK/NACK".
 8. If no longer than 8 consecutive DTX is observed by the SS, then count a success for the event "DTX". Otherwise count a fail for the event "DTX".
 9. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),
- or
- switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

10. Repeat step 3-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.5.4.3 Message contents

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

Table 5.5.2.5.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	

Table 5.5.2.5.4.3-2: MeasObjectEUTRA for E-UTRAN deactivated SCell

Derivation Path: 36.508 Table 4.6.6-2			
Information Element	Value/remark	Comment	Condition
MeasObjectEUTRA ::= SEQUENCE {			
carrierFreq	Downlink EARFCN for E-UTRAN SCell		
measCycleSCell-r10	sf640		
}			

5.5.2.5.5 Test requirement

Table 5.5.2.5.5-1 and Table 5.5.2.5.5-2 defines the primary level settings including test tolerances for E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC test configurations.

Table 5.5.2.5.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TBD
BW _{channel}	Config 1,2	MHz	100: N _{RB,c} = 66
Initial BWP Configuration	Config 1,2		TBD
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET parameters	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		TBD
OCNG Patterns			OP.1
SMTc Configuration	Config 1,2		SMTc.1 FR2
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
\bar{E}_s/N_{oc}		dB	TBD+TT
Propagation Condition			AWGN
Time offset to cell1 ^{Note 2}		μ s	3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table 5.5.2.5.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter		Unit	Cell 2
UE orientation around TBD axis and TBD axis			TBD
Relative difference in angle of arrival of cell 2 relative to cell 1		degrees	TBD
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/15kHz ^{Note4}	TBD+TT
	NR_TDD_FR2_B		
	NR_TDD_FR2_C		
	NR_TDD_FR2_D		
	NR_TDD_FR2_E		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/SCS ^{Note3}	TBD+TT
	NR_TDD_FR2_B		
	NR_TDD_FR2_C		
	NR_TDD_FR2_D		
	NR_TDD_FR2_E		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
SS-RSRP ^{Note2}	NR_TDD_FR2_A	dBm/SCS ^{Note4}	TBD+TT
	NR_TDD_FR2_B		
	NR_TDD_FR2_C		
	NR_TDD_FR2_D		
	NR_TDD_FR2_E		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		

Parameter	Unit	Cell 2
\hat{E}_s/I_{ot}	dB	TBD+TT
I_{o}^{Note2} NR_TDD_FR2_A	dBm/95.04 MHz ^{Note4}	TBD+TT
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone		
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone		

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.5.5-3.

Table 5.5.2.5.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	5

Table 5.5.2.5.5-4: Void

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

5.5.2.6 EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Editor's note:

- Connection diagram is TBD.
- Test tolerance is missing.
- Test procedure may be further modified.

5.5.2.6.1 Test purpose

The purpose of this test is:

- To verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits.
- To verify the missed ACK/NACK rate for NR PSCell in EN-DC.

5.5.2.6.2 Test applicability

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

5.5.2.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.2.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.2.6.

5.5.2.6.4 Test description

5.5.2.6.4.1 Initial conditions

Test 5.5.2.6 can be run in one of the configurations defined in Table 5.5.2.6.4.1-1.

Table 5.5.2.6.4.1-1: Supported test configurations for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Configuration	Description
5.5.2.6-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.2.6-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

Configure the test equipment and the DUT according to the parameters in Table 5.5.2.6.4.1-2.

Table 5.5.2.6.4.1-2: Initial conditions for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.2.6.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.1.
Connection Diagram	TE Part	A.3.TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.TBD	
Exceptions to connection diagram	N/A		

- The general test parameter settings are set up according to Table 5.5.2.6.4.1-3.
- Message contents are defined in clause 5.5.2.6.4.3.
- There are two E-UTRAN carriers and one NR carrier and three cells specified in the test. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. Cell 1 is the cell used for connection setup with the power level set according to Table A.6.1.1-1. Cell 2 and Cell 3 shall be configured according to clause C.1.1 and C.1.2.

Table 5.5.2.6.4.1-3: General test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other two are NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1, cell 2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

5.5.2.6.4.2 Test procedure

The test consists of three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1, Cell2 and Cell3. Cell1 shall be configured as E-UTRAN

PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as E-UTRAN deactivated SCell. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the E-UTRAN SCell is received by the UE, defines the start of time period T1. During T1 the UE shall be continuously scheduled on E-UTRAN PCell and NR PSCell.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
 2. Configure MCG according to TS 36.521-3 [26] clause C.0, C.1 and SCG according to clause C.1.1 and C.1.2 for all downlink physical channels.
 3. The SS shall transmit an *RRCConnectionReconfiguration* message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCell to perform measurements on the deactivated SCC.
 4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.
 5. Set the parameters according to T1 in Table 5.5.2.6.5-1. Propagation conditions are set according to clause C.2.1. T1 starts.
 6. SS schedules on PSCell continuously and UE shall start sending ACK/NACK reports. The SS shall monitor ACK/NACK/DTX on PSCell.
 7. If more than 99.5% of uplink transmissions are received by SS then count a success for the event "ACK/NACK". Otherwise count a fail for the event "ACK/NACK".
 8. If no longer than 8 consecutive DTX is observed by the SS, then count a success for the event "DTX". Otherwise count a fail for the event "DTX".
 9. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with UE-Identity) for the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5),
- or
- switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG_and_SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 3-9 until a test verdict has been achieved.

Each of the events "ACK/NACK" and "DTX" is evaluated independently for the statistic, resulting in an event verdict: pass or fail. Each event is evaluated only until the confidence level according to Table G.2.3-1 in Annex G.2 is achieved. Different events may require different times for a verdict.

If all events pass, the test passes. If one event fails, the test fails.

5.5.2.6.4.3 Message contents

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

Table 5.5.2.6.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	

Table 5.5.2.6.4.3-2: MeasObjectEUTRA for EUTRAN deactivated SCell

Derivation Path: 36.508 Table 4.6.6-2			
Information Element	Value/remark	Comment	Condition
MeasObjectEUTRA ::= SEQUENCE { carrierFreq	Downlink EARFCN for E-UTRAN SCell		
measCycleSCell-r10	sf640		
}			

5.5.2.6.5 Test requirement

Table 5.5.2.6.5-1 and Table 5.5.2.6.5-2 defines the primary level settings including test tolerances for E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC test configurations.

Table 5.5.2.6.5-1: NR cell specific test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TBD
BW _{channel}	Config 1,2	MHz	100: N _{RB,c} = 66
Initial BWP Configuration	Config 1,2		TBD
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET parameters	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		TBD
OCNG Patterns			OP.1
SMTc Configuration	Config 1,2		SMTc.1 FR2
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
\bar{E}_s/N_{oc}			
Propagation Condition			AWGN
Time offset to cell1 ^{Note 2}		μ s	62.5
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table 5.5.2.6.5-2: NR cell specific OTA related test parameters for EN-DC FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter		Unit	Cell 2
UE orientation around TBD axis and TBD axis			TBD
Relative difference in angle of arrival of cell 2 relative to cell 1		degrees	TBD
N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/15kHz ^{Note4}	TBD
	NR_TDD_FR2_B		
	NR_TDD_FR2_C		
	NR_TDD_FR2_D		
	NR_TDD_FR2_E		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		

N_{oc} ^{Note1}	NR_TDD_FR2_A	dBm/SCS ^{Note3}	TBD
	NR_TDD_FR2_B		
	NR_TDD_FR2_C		
	NR_TDD_FR2_D		
	NR_TDD_FR2_E		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
SS-RSRP ^{Note2}	NR_TDD_FR2_A	dBm/SCS ^{Note4}	TBD
	NR_TDD_FR2_B		
	NR_TDD_FR2_C		
	NR_TDD_FR2_D		
	NR_TDD_FR2_E		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
\hat{E}_s/I_{ot}		dB	TBD
I_o ^{Note2}	NR_TDD_FR2_A	dBm/95.04 MHz ^{Note4}	TBD
<p>NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>NOTE 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone</p> <p>NOTE 5: As observed with 0dBi gain antenna at the center of the quiet zone</p>			

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table 5.5.2.6.5-3.

Table 5.5.2.6.5-3: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
3	0.125	5

Table 5.5.2.6.5-4: Void

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

5.5.3 SCell activation and deactivation delay

5.5.3.1 EN-DC FR2 SCell activation and deactivation intra-band in non-DRX

Editor's notes: This clause is incomplete, the following items are TBD

- *The core requirements in TS 38.133 are between [.] or TBD;*
- *Test tolerance analysis is missing;*
- *Test procedure and Message content are TBD;*
- *Cell mapping and Connection diagram is TBD;*
- *Test applicability Table in TS38.522 need to be updated.*

5.5.3.1.1 Test purpose

This test is to verify that the SCell activation and deactivation times are within the requirements, when the SCell in FR2 intra-band is known by the UE at the time of activation.

5.5.3.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards and supporting 2DL CA.

5.5.3.1.3 Minimum conformance requirements

Same minimum conformance requirements as described in clause 4.5.3.1.3.

The normative reference for this requirement is TS 38.133 [6] clause 8.3 and A.5.5.3.1.

5.5.3.1.4 Test description

5.5.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.3.1.4.1-1.

Table 5.5.3.1.4.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

Test Case ID	Description
5.5.3.1-1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.3.1-2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations.	

Configure the test equipment and the DUT according to the parameters in Table 5.5.3.1.4.1-2 and Table 5.5.3.1.4.1-3.

Table 5.5.3.1.4.1-2: Initial conditions for known FR2 SCell activation case with FR2 PSCell

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.1-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 4.7.1.1.2-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	TBD	
Exceptions to connection diagram	N/A		

Table 5.5.3.1.4.1-3: General test parameters for FR2 SCell activation case with FR2 PSCell

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2 of TS38.133 [6]
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell3 timing offset to cell2	μs	0	
Time alignment error between cell3 and cell2	μs	≤ Time alignment error as specified in TS 38.104 [28] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T _{HARQ}	ms	$k_1 \cdot \text{NR slot length}$	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]
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 38.331 [13].
k	ms	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe}, \mu} + 1$	As specified in clause 4.3 of TS38.213 [8]

1. Message contents are defined in clause 5.5.3.1.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in the same frequency. Cell 2 is the PSCell and Cell 3 is the deactivated SCell.

5.5.3.1.4.2 Test procedure

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG according to TS 38.508-1 [14] clause 4.5.
2. TBD.

5.5.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [14] clause 7.3.

5.5.3.1.5 Test requirement

Table 5.5.3.1.5-1 will replace the values of corresponding parameters in Table 4.5.3.1.5-1 and Table 5.5.3.1.5-2 defines OTA related test parameters.

Table 5.5.3.1.5-1: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

Parameter ^{Note 5}	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
SSB ARFCN		freq1			freq2		
Duplex mode		TDD			TDD		
TDD configuration		TDDConf.3.1			TDDConf.3.1		
BW _{channel}	MHz	100: N _{RB,c} = 66			100: N _{RB,c} = 66		
PDSCH Reference measurement channel		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel		CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel		CCR.3.1 TDD			CCR.3.1 TDD		
DL initial BWP configuration					DLBWP.0.1		
DL dedicated BWP configuration					DLBWP.1.1		
UL initial BWP configuration					ULBWP.0.1		
UL dedicated BWP configuration					ULBWP.1.1		
OCNG Patterns					OP.1		
SMTc configuration					SMTc.1		
SSB configuration					SSB.1 FR2		
CSI-RS configuration for CSI reporting					CSI-RS.3.1 TDD		
reportQuantity		cri-RI-CQI			N/A		
CSI reporting periodicity	slot	40			N/A		
CSI reporting offset	slot	4			N/A		
PDSCH/PDCCH subcarrier spacing	kHz	120					
TCI state					TCI.State.0		
TRS configuration					TRS.2.1 TDD		
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS ^{note 1}							
EPRE ratio of OCNG to OCNG DMRS ^{note 1}							
Propagation conditions					AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for 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: All parameters apply for configuration 1 and 2.							

Table 5.5.3.1.5-2: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

Parameter ^{Note 6}	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.9.1					
Assumption for UE beams ^{Note 7}		Rough			Rough		
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-112			-112		
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-102.97			-102.97		
\hat{E}_s / N_{oc}	dB	14			14		
SS-RSRP ^{Note2}	dBm/SCS ^{Note4}	-88.97			-88.97		
\hat{E}_s / I_{ot}	dB	14			14		
I_o ^{Note2}	dBm/95.04 MHz ^{Note4}	-88.80			-88.80		
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone							
NOTE 6: All parameters apply for configuration 1 and 2							
NOTE 7: Information about types of UE beam is given in TS 38.133 [6] clause B.2.1.3, and does not limit UE implementation or test system implementation							

The test requirements defined in clause 4.5.3.1.5 shall apply to this test case.

5.5.4 UE UL carrier RRC reconfiguration delay

5.5.5 Link recovery procedures

5.5.5.0 Minimum conformance requirements

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

[TS38.133, clause 8.5.2.1]

The requirements in this clause apply for each SSB resource in the set \bar{q}_0 configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in TS 38.133 [6] clause 8.5.2.2. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band.

Table 5.5.5.0.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

[TS38.133, clause 8.5.2.2]

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set \bar{q}_0 estimated over the last $T_{\text{Evaluate_BFD_SSB}}$ ms period becomes worse than the threshold $Q_{\text{out_LR_SSB}}$ within $T_{\text{Evaluate_BFD_SSB}}$ ms period.

The value of $T_{\text{Evaluate_BFD_SSB}}$ is defined in Table 5.5.5.0.1-2 for FR2 with scaling factor $N=8$.

For FR2,

- $P=1/(1-T_{\text{SSB}}/T_{\text{SMTCperiod}})$, when BFD-RS is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$).
- $P = P_{\text{sharing factor}}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$).
- $P=1/(1-T_{\text{SSB}}/MGRP-T_{\text{SSB}}/T_{\text{SMTCperiod}})$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq MGRP$ or
 - $T_{\text{SMTCperiod}} = MGRP$ and $T_{\text{SSB}} < 0.5 * T_{\text{SMTCperiod}}$
- $P = P_{\text{sharing factor}} / (1 - T_{\text{SSB}} / MGRP)$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = MGRP$ and $T_{\text{SSB}} = 0.5 * T_{\text{SMTCperiod}}$
- $P=1/(1-T_{\text{SSB}}/T_{\text{SMTCperiod}})$, when the BFD-RS resource is partially overlapped with measurement gap ($T_{\text{SSB}} < MGRP$) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = P_{\text{sharing factor}} / (1 - T_{\text{SSB}} / MGRP)$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < MGRP$)
- $P_{\text{sharing factor}} = 1$, if the BFD-RS resource outside measurement gap is
 - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
 - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol

before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{\text{sharing factor}} = 3$, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{\text{SMTCPeiod}}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{\text{SMTCPeiod}}$ corresponds to the value of higher layer parameter *smtc1*. $T_{\text{SMTCPeiod}}$ is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

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

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{\text{Identify_CGI}}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{\text{Identify_CGI-E-UTRAN}}$ when the UE is requested to decode an LTE CGI.

Table 5.5.5.0.1-2: Evaluation period $T_{\text{Evaluate_BFD_SSB}}$ for FR2

Configuration	$T_{\text{Evaluate_BFD_SSB}}$ (ms)
no DRX	$\text{Max}(\{50\}, \text{Cceil}(5 \cdot P \cdot N) \cdot T_{\text{SSB}})$
DRX cycle ≤ 320 ms	$\text{Mmax}(\{50\}, \text{Cceil}(7.5 \cdot P \cdot N) \cdot \text{Mmax}(T_{\text{DRX}}, T_{\text{SSB}}))$
DRX cycle > 320 ms	$\text{Cceil}(5 \cdot P \cdot N) \cdot T_{\text{DRX}}$

NOTE: T_{SSB} is the periodicity of SSB in the set \bar{q}_0 . T_{DRX} is the DRX cycle length.

[TS38.133, clause 8.5.2.3]

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

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

[TS38.133, clause 8.5.4]

When the radio link quality on all the RS resources in set \bar{q}_0 is worse than $Q_{\text{out_LR}}$, Layer 1 of the UE shall send a beam failure instance indication to the higher layers.

The beam failure instance evaluation for the RS resources in set \bar{q}_0 shall be performed as specified in clause 6 in TS 38.213. Two successive indications from Layer 1 shall be separated by at least $T_{\text{Indication_interval_BFD}}$.

When DRX is not used, $T_{\text{Indication_interval_BFD}}$ is $\text{max}(2\text{ms}, T_{\text{SSB-RS,M}})$ or $\text{max}(2\text{ms}, T_{\text{CSI-RS,M}})$, where $T_{\text{SSB-RS,M}}$ and $T_{\text{CSI-RS,M}}$ is the shortest periodicity of all 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, for SSB based link quality measurement,

- $T_{\text{Indication_interval_BFD}} = \text{Max}(1.5 \times \text{DRX_cycle_length}, 1.5 \times T_{\text{SSB-RS,M}})$, if $\text{DRX_cycle_length} \leq 320$ ms,
- $T_{\text{Indication_interval_BFD}} = \text{DRX_cycle_length}$, if $\text{DRX_cycle_length} > 320$ ms.

[TS38.133, clause 8.5.5.1]

The requirements in this clause apply for each SSB resource in the set \bar{q}_1 configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in TS 38.133 [6] clause 8.5.5.2. The requirements in this clause could not be applicable if UE is required to perform candidate beam detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

[TS38.133, clause 8.5.5.2]

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set \bar{q}_1 estimated over the last $T_{\text{Evaluate_CBD_SSB}}$ ms period becomes better than the threshold $Q_{\text{in_LR}}$ provided SSB_RP and SSB \bar{E}_s/tot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 5.5.5.0.1-3 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{\text{Evaluate_CBD_SSB}}$ is defined in Table 5.5.5.0.1-3 for FR2 with scaling factor $N=8$.

Where,

For FR2,

- $P=1/(1-T_{\text{SSB}}/T_{\text{SMTCperiod}})$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$).
- P is $P_{\text{sharing factor}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$).
- $P=1/(1-T_{\text{SSB}}/\text{MGRP}-T_{\text{SSB}}/T_{\text{SMTCperiod}})$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{SSB}} < 0.5 * T_{\text{SMTCperiod}}$
- $P = P_{\text{sharing factor}} / (1 - T_{\text{SSB}} / \text{MGRP})$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{SSB}} = 0.5 * T_{\text{SMTCperiod}}$
- $P=1/(1-T_{\text{SSB}}/T_{\text{SMTCperiod}})$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{SSB}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = P_{\text{sharing factor}} / (1 - T_{\text{SSB}} / \text{MGRP})$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{\text{SSB}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)
- $P_{\text{sharing factor}} = 1$, if the candidate beam detection RS outside measurement gap is
 - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
 - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured - $P_{\text{sharing factor}} = 3$, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{\text{SMTCperiod}}$ follows *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ follows *smtc1*. $T_{\text{SMTCperiod}}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

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

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{\text{identify_CGI}}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{\text{identify_CGI-E-UTRAN}}$ when the UE is requested to decode an LTE CGI.

The values of P_{CBD} used in Table 5.5.5.0.1-3 are defined as

For each SSB resource in the set \bar{q}_1 configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- $P_{\text{CBD}} = 1$.

For each SSB resource in the set \bar{q}_1 configured for PSCell in NR-DC

- $P_{\text{CBD}} = 2$ if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each SSB resource in the set \bar{q}_1 configured for a SCell

- $P_{\text{CBD}} = Z$ in EN-DC or NE-DC or SA.
- $P_{\text{CBD}} = 2 * Z$ in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell Table 5.5.5.0.1-3: Evaluation period $T_{\text{Evaluate_CBD_SSB}}$ for FR2

Configuration	$T_{\text{Evaluate_CBD_SSB}}$ (ms)
non-DRX, DRX cycle \leq 320ms	$\text{Max}(25, \text{Ceil}(3 \times P \times N \times P_{\text{CBD}}) \times T_{\text{SSB}})$
DRX cycle > 320ms	$\text{Ceil}(3 \times P \times N \times P_{\text{CBD}}) \times T_{\text{DRX}}$
NOTE: T_{SSB} is the periodicity of SSB in the set \bar{q}_1 . T_{DRX} is the DRX cycle length.	

[TS38.133, clause 8.5.5.3]

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

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.2.1, 8.5.2.2, 8.5.2.3, 8.5.4, 8.5.5.1, 8.5.5.2 and 8.5.5.3.

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

[TS38.133, clause 8.5.3.1]

The requirements in this clause apply for each CSI-RS resource in the set \bar{q}_0 of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set \bar{q}_0 for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in TS 38.133 clause 8.5.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured as BFD-RS if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

Table 5.5.5.0.2-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

[TS38.133, clause 8.5.3.2]

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set \bar{q}_0 estimated over the last $T_{\text{Evaluate_BFD_CSI-RS}}$ ms period becomes worse than the threshold $Q_{\text{out_LR_CSI-RS}}$ within $T_{\text{Evaluate_BFD_CSI-RS}}$ ms period.

The value of $T_{\text{Evaluate_BFD_CSI-RS}}$ is defined in Table 5.5.5.0.2-2 for FR2 with $N=1$. The requirements of $T_{\text{Evaluate_BFD_CSI-RS}}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR2,

- $P=1$, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=1/(1 - T_{\text{CSI-RS}}/\text{MGRP})$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion ($T_{\text{CSI-RS}} < \text{MGRP}$)
- $P=1/(1 - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$).
- P is $P_{\text{sharing factor}}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$).
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP} - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} < 0.5 * T_{\text{SMTCperiod}}$
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * P_{\text{sharing factor}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} = 0.5 * T_{\text{SMTCperiod}}$
- P is $1/\{1 - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}}\}$, when the BFD-RS resource is partially overlapped with measurement gap ($T_{\text{CSI-RS}} < \text{MGRP}$) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * P_{\text{sharing factor}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)

- $P_{\text{sharing factor}} = 1$, if the BFD-RS resource outside measurement gap is
 - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
 - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,
- $P_{\text{sharing factor}}$ is 3, otherwise.

where,

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{\text{SMTCperiod}}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ corresponds to the value of higher layer parameter *smtc1*. $T_{\text{SMTCperiod}}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

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

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{\text{identify_CGI}}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{\text{identify_CGI-E-UTRAN}}$ when the UE is requested to decode an LTE CGI.

The values of M_{BFD} used in Table 5.5.5.0.2-2 are defined as

- $M_{\text{BFD}} = 10$, if the CSI-RS resource(s) in set \bar{q}_0 used for BFD is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of P_{BFD} used in Table 5.5.5.0.2-2 are defined as

For each CSI-RS resource in the set \bar{q}_0 configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- $P_{\text{BFD}} = 1$.

For each CSI-RS resource in the set \bar{q}_0 configured for PSCell in NR-DC

$P_{\text{BFD}} = 2$ if UE is configured for beam failure detection on SCell, 1 otherwise.

For each CSI-RS resource in the set \bar{q}_0 configured for a SCell

- $P_{\text{BFD}} = Z$ in EN-DC or NE-DC or SA.
- $P_{\text{BFD}} = 2 * Z$ in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

Table 5.5.5.0.2-2: Evaluation period $T_{\text{Evaluate_BFD_CSI-RS}}$ for FR2

Configuration	$T_{\text{Evaluate_BFD_CSI-RS}}$ (ms)
no DRX	$\text{Max}(50, \text{Ceil}(M_{\text{BFD}} \times P \times N \times P_{\text{BFD}}) \times T_{\text{CSI-RS}})$
DRX cycle ≤ 320 ms	$\text{Max}(50, \text{Ceil}(1.5 \times M_{\text{BFD}} \times P \times N \times P_{\text{BFD}}) \times \text{Max}(T_{\text{DRX}}, T_{\text{CSI-RS}}))$
DRX cycle > 320 ms	$\text{Ceil}(M_{\text{BFD}} \times P \times N \times P_{\text{BFD}}) \times T_{\text{DRX}}$
NOTE: $T_{\text{CSI-RS}}$ is the periodicity of CSI-RS resource in the set \bar{q}_0 . T_{DRX} is the DRX cycle length.	

[TS38.133, clause 8.5.3.3]

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

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

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

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for BFD measurement and the other CSI-RS. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.
 - The CSI-RS for BFD measurement or the other CSI-RS in a resource set configured with repetition ON, or
 - The other CSI-RS is configured in set \bar{q}_1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
 - Otherwise, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

[TS38.133, clause 8.5.4]

When the radio link quality on all the RS resources in set \bar{q}_0 is worse than $Q_{\text{out_LR}}$, Layer 1 of the UE shall send a beam failure instance indication to the higher layers.

The beam failure instance evaluation for the RS resources in set \bar{q}_0 shall be performed as specified in clause 6 in TS 38.213. Two successive indications from Layer 1 shall be separated by at least $T_{\text{Indication_interval_BFD}}$.

When DRX is not used, $T_{\text{Indication_interval_BFD}}$ is $\text{max}(2\text{ms}, T_{\text{SSB-RS,M}})$ or $\text{max}(2\text{ms}, T_{\text{CSI-RS,M}})$, where $T_{\text{SSB-RS,M}}$ and $T_{\text{CSI-RS,M}}$ is the shortest periodicity of all 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, for CSI-RS based link quality measurement,

- $T_{\text{Indication_interval_BFD}} = \text{Max}(1.5 \times \text{DRX_cycle_length}, 1.5 \times T_{\text{CSI-RS,M}})$, if $\text{DRX_cycle_length} \leq 320$ ms,
- $T_{\text{Indication_interval_BFD}} = \text{DRX_cycle_length}$, if $\text{DRX_cycle_length} > 320$ ms.

[TS38.133, clause 8.5.6.1]

The requirements in this clause apply for each CSI-RS resource in the set \bar{q}_1 configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in TS 38.133 clause 8.5.6.2. The requirements in this clause could not be

applicable if UE is required to perform candidate beam detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

[TS38.133, clause 8.5.6.2]

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set \bar{q}_i estimated over the last $T_{\text{Evaluate_CBD_CSI-RS}}$ [ms] period becomes better than the threshold $Q_{\text{in_LR}}$ within $T_{\text{Evaluate_CBD_CSI-RS}}$ [ms] period provided CSI-RS \hat{E}_s/Tot is according to TS 38.133 Annex Table B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in Table 5.5.5.0.2-3 corresponding to the non-DRX mode, if the configured DRX cycle $\leq 320\text{ms}$.

The value of $T_{\text{Evaluate_CBD_CSI-RS}}$ is defined in Table 5.5.5.0.2-3 for FR2 with scaling factor $N=8$.

For FR2,

- $P=1$, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=1/(1 - T_{\text{CSI-RS}}/\text{MGRP})$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion ($T_{\text{CSI-RS}} < \text{MGRP}$)
- $P=1/(1 - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$).
- $P = P_{\text{sharing factor}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$).
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP} - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}})$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} < 0.5 * T_{\text{SMTCperiod}}$
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * P_{\text{sharing factor}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} = 0.5 * T_{\text{SMTCperiod}}$
- P is $1/\{1 - T_{\text{CSI-RS}}/T_{\text{SMTCperiod}}\}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap
- P is $1/(1 - T_{\text{CSI-RS}}/\text{MGRP}) * 3$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)- $P_{\text{sharing factor}} = 1$, if the candidate beam detection RS outside measurement gap is
 - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
 - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.
- $P_{\text{sharing factor}} = 3$, otherwise.

where,

If the high layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{\text{SMTCperiod}}$ follows *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ follows *smtc1*. $T_{\text{SMTCperiod}}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

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

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in TS 38.133 clause 8.5.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{\text{identify_CGI}}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{\text{identify_CGI-LTE-UTRAN}}$ when the UE is requested to decode an LTE CGI.

The values of M_{CBD} used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- $M_{\text{CBD}} = 3$, if the CSI-RS resource configured in the set \bar{q}_1 is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of P_{CBD} used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

For each CSI-RS resource in the set \bar{q}_1 configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- $P_{\text{CBD}} = 1$.

For each CSI-RS resource in the set \bar{q}_1 configured for PSCell in NR-DC

- $P_{\text{CBD}} = 2$ if UE configured for candidate beam detection on SCell, 1 otherwise.

For each CSI-RS resource in the set \bar{q}_1 configured for a SCell

- $P_{\text{CBD}} = Z$ in EN-DC or NE-DC or SA.
- $P_{\text{CBD}} = 2^* Z$ in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

Table 5.5.0.2-3: Evaluation period $T_{\text{Evaluate_CBD_CSI-RS}}$ for FR2

Configuration	$T_{\text{Evaluate_CBD_CSI-RS}}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$\text{Max}(25, \text{Ceil}(M_{\text{CBD}} \times P \times N \times P_{\text{CBD}}) \times T_{\text{CSI-RS}})$
DRX cycle > 320 ms	$\text{Ceil}(M_{\text{CBD}} \times P \times N \times P_{\text{CBD}}) \times T_{\text{DRX}}$
NOTE:	$T_{\text{CSI-RS}}$ is the periodicity of CSI-RS resource in the set \bar{q}_1 . T_{DRX} is the DRX cycle length.

[TS38.133, clause 8.5.6.3]

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

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

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and the other CSI-RS. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.3.1, 8.5.3.2, 8.5.3.3, 8.5.4, 8.5.6.1, 8.5.6.2 and 8.5.6.3.

5.5.5.0.3 Scheduling availability of UE during beam failure detection and candidate beam detection

[TS38.133, clause 8.5.7.3]

The following scheduling restriction applies due to beam failure detection.

- For the case where no RSs are provided for BFD, or when CSI-RS is configured for BFD is explicitly configured and is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON
 - There are no scheduling restrictions due to beam failure detection performed based on the CSI-RS.
- Otherwise
 - The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on BFD-RS resource symbols to be measured for beam failure detection.

For FR2, if following conditions are met,

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

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

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

[TS38.133, clause 8.5.8.3]

The following scheduling restriction applies due to candidate beam detection

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

For FR2, if following conditions are met,

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

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

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

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.7.4, 8.5.8.3.

5.5.5.0.4 Requirements for Beam Failure Recovery in SCell

[TS 38.133, clause 8.5.9.1]

For the UE provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of SCells, the UE shall transmit SR for UL resource, followed by MAC CE providing one index for at least one corresponding SCell with radio link quality is worse than $Q_{out,LR}$, and the index q_{new} for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS38.321 [7], if any, for a corresponding SCell.

For the UE not provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of SCells, the UE shall transmit preamble for UL-SCH resource application, followed by MAC CE providing one index for at least one corresponding SCell with radio link quality is worse than $Q_{out,LR}$, and the index q_{new} for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS38.321 [7], if any, for a corresponding SCell.

[TS 38.133, clause 8.5.9.2]

Provided that UE is configured by *schedulingRequestIDForBFR* a configuration for LRR in a PUCCH transmission, after BFR is triggered on any of SCells as described in clause 5.17 of TS38.321 [7], UE shall be capable of transmit PUCCH with a LRR within a period of T, where

- $T = T_1 \times \text{Ceil}((T_2+D)/T_1)$ in which T_1 , T_2 and D are defined as
- T_1 is equal to the periodicity of PUCCH configured with *schedulingRequestIDForBFR*.
- $T_2 = T_{\text{Evaluate_CBD}}$ is the evaluation period specified in TS 38.133 clause 8.5.5 or 8.5.6 for SSB or CSI-RS based candidate beam detection, that is $T_{\text{Evaluate_CBD_SSB}}$ or $T_{\text{Evaluate_CBD_CSI-RS}}$, depending on the applicable reference signal configured for candidate beam detection.
- $D = 2\text{ms}$ is the UE Processing time.

References: The conformance requirements covered in the current TC are specified in: TS 38.133 [6], clauses 8.5.9.1, 8.5.9.2.

5.5.5.1 EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Editor's Note: This test case is complete for the following configurations:

- Test frequency $f \leq 40.8$ GHz
- UE PC3

This test case is incomplete for Test frequency $f > 40.8$ GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.1.1 Test purpose

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell 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 of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in TS 38.133 [6] clause 8.5.

5.5.5.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 onwards.

5.5.5.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.1.

5.5.5.1.4 Test description

There are two cell configured in this test: E-UTRAN PCell and NR PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.1.4-1 shows the five different time durations and the corresponding variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PCell to emulate SSB based beam failure. Figure 5.5.5.1.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery.

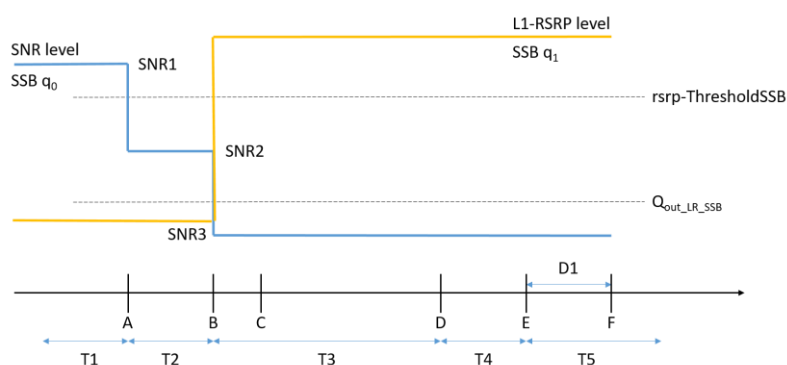


Figure 5.5.5.1.4-1: SNR and L1-RSRP for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

5.5.5.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.1.4.1-1.

Table 5.5.5.1.4.1-1: Supported test configurations for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Configuration	Description
5.5.5.1-1	LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.1-2	LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.1-3	LTE FDD, NR TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
5.5.5.1-4	LTE TDD, NR TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.1.4.1-2.

Table 5.5.5.1.4.1-2: Initial conditions for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.5.1.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.1.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.5.1.4.1-3.
2. Message contents are defined in clause 5.5.5.1.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.1.4.1-3: General test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active E-UTRA PCell	1-4		Cell 1	
E-UTRA RF Channel Number	1-4		1	
Active PCell	1-4		Cell 2	
RF Channel Number	1-4		2	
Duplex mode	1-4		TDD	
TDD Configuration	1-4		TDDConf.3.1	Table A.1.5-3
BW_{channel}	1-4	MHz	$100: N_{RB,c} = 66$	
Data RBs allocated	1-4		66	
PDSCH/PDCCH subcarrier spacing	1-4	kHz	120	
DL initial BWP configuration	1-4		DLBWP.0.1	Table A.8.1-1
DL dedicated BWP configuration	1-4		DLBWP.1.1	Table A.8.1-2
UL initial BWP configuration	1-4		ULBWP.0.1	Table A.8.2-1
UL dedicated BWP configuration	1-4		ULBWP.1.1	Table A.8.2-2
PDSCH Reference Channel	1-2		SR.3.2 TDD	Table A.1.1.2-3
	3-4		SR.3.3 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	Table A.1.2.2-3
	3-4		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	Table A.1.3.2-3
	3-4		CCR.3.7 TDD	
OCNG parameters	1-4		OP.1	Table A.2.1-1
CP length	1-4		Normal	
PDSCH/PDCCH TCI state	1-4		TCI.State.0	Table A.10.2-1
CSI-RS for tracking	1-4		TRS.2.1 TDD	Table A.1.4A.2.1-1
SSB Configuration	1-2		SSB.1 FR2	Table A.3.2-1
	3-4		SSB.2 FR2	
SMTC Configuration	1-4		SMTC.3	Table A.4-1
PRACH Configuration	1-4		PRACH.2 FR2	Table A.7.2-1
DRX configuration	1-4		OFF	
SSB index assigned as BFD RS (q_0)	1-4		0	
SSB index assigned as CBD RS (q_1)	1-4		1	
SSB index assigned as RLM RS	1-4		0,1	
Beam failure detection transmission parameters	DCI format	1-4	1-0	
	Number of Control OFDM symbols	1-4	2	
	Aggregation level	1-4	CCE	8

	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0	
	DMRS precoder granularity	1-4		REG bundle size	
	REG bundle size	1-4		6	
Gap pattern ID	gapOffset	1-4	ms	gp0	
	rimInSyncOutOfSyncThreshold	1-4		absent	Value 0 is applied. (38.133 [6] Table 8.1.1-1).
	rsrp-ThresholdSSB	1-2	dBm/SCS	-109 ^{Note 3}	Threshold used for $Q_{in_LR_SSB}$
		3-4		-106 ^{Note 3}	
	powerControlOffsetSS	1-4		db0	Used for deriving rsrp-ThresholdCSI-RS
	beamFailureInstanceMaxCount	1-4		n1	see TS 38.321 [12], clause 5.17
	beamFailureDetectionTimer	1-4		pbfd4	see TS 38.321 [12], clause 5.17
	CSI-RS configuration for CSI reporting	1-4		CSI-RS.3.1 TDD	Table A.1.4.2-3
	reportConfigType	1-4		periodic	
	reportQuantity	1-4		cri-RI-PMI-CQI	
	CSI reporting periodicity	1-4	slot	40	
	CSI reporting offset	1-4	slot	4	
	T310	1-4	ms	1000	
	N310	1-4		2	
	T1	1-4	s	1	The UE shall be fully synchronized to cell 1 during T1
	T2	1-4	s	2.61	
	T3	1-4	s	1.64	
	T4	1-4	s	0	
	T5	1-4	s	1.01	
	D1	1-4	s	0.97	
Note 1: All configurations are assigned to the UE prior to the start of time period T1.					
Note 2: UE-specific PDCCH is not transmitted after T1 starts.					
Note 3: Including test tolerance given in Annex F.1.3.2.					

5.5.5.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA Cell 1 and NR Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) given in table 5.5.5.1.5-2.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.1.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.1.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.1.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.1.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.1.5-1. T5 starts.
7. If the SS:

- a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B; and
- b) does not detect preamble on a beam associated with candidate beam set q_i before time point B; and
- c) detects preamble on a beam associated with candidate beam set q_i before time point F (D1 after the start of T5),

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

8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.1.5-1.
9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.
10. Switch the UE on and off. Ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.1.4.3 Message contents

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

Table 5.5.5.1.4.3-1: Common Exception messages for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with condition INTER-FREQ and GAP_NEEDED Table H.3.1-3 with condition INTER-FREQ MO (where ssbFrequency is set to the ARFCN value of carrier centre of High range) Table H.3.1-4 with A3-offset = 0 Table H.3.1-8 with condition SSB BFD Table H.3.1-10 with condition SSB Table H.3.1-10A Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition BFD

Table 5.5.5.1.4.3-2: PDCCH Search Space for BFR

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	3	BFR	
controlResourceSetId	2	BFR	
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
monitoringSymbolsWithinSlot	10000000000000	Symbols 0 and 1	
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n0		
aggregationLevel8	n1	AL8	
aggregationLevel16	n0		
}			
searchSpaceType CHOICE {			
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0	
}			

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
}			
}			

Table 5.5.5.1.4.3-3: RLF-TimersAndConstants

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

Table 5.5.5.1.4.3-4: PDCCH-Config

Derivation Path: TS 38.501-1 [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 5.5.5.1.4.3-5: 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		
	1		Test Configuration 3 & 4
cce-REG-MappingType CHOICE {			
interleaved ::= SEQUENCE {			
reg-BundleSize	n6		
interleaverSize	n2		
shiftIndex	0		
}			
tci-StatesPDCCH-ToAddList	Not present		
}			

5.5.5.1.5 Test requirement

Tables 5.5.5.1.4.1-3 and 5.5.5.1.5-1 define the primary level settings including test tolerances for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX.

Table 5.5.5.1.5-1: NR Cell specific test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in non-DRX

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.9				
Assumption for UE beams ^{Note 10}		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNB DMRS to SSS	dB					
EPRE ratio of OCNB to OCNB DMRS	dB					
SNR_SSB of set q_0	Config 1-4 dB	13.7 ^{Note 11,12}	5.7 ^{Note 11,12}	-12	-12	-12
SNR_SSB of set q_1	Config 1-4 dB	0.2	0.2	20 ^{Note 12}	20 ^{Note 12}	20 ^{Note 12}
SSB_RP of set q_1	Config 1-2	-104.5	-104.5	-84.7	-84.7	-84.7
	Config 3-4	-101.5	-101.5	-101.5	-81.7	-81.7
	SCS					
N_{oc}	Config 1-4 dBm/120 KHz	-104.7				
Propagation condition		TDL-A 30ns 75Hz				
NOTE 1: OCNB 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 OCNB.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.1.4-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.						
NOTE 10: Information about types of UE beam is given in TS 38.133 clause B.2.1.3, and does not limit UE implementation or test system implementation						
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband						
Note 12: Including test tolerance given in Annex F.1.3.2						

Table 5.5.5.1.5-2: Void

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

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

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

During T3 the shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1 .

No later than time point F occurring no later than $D1 = 960 + 10$ ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set 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%.

5.5.5.2 EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Editor's Note: This test case is complete for the following configurations:

- Test frequency $f \leq 40.8$ GHz
- UE PC3

This test case is incomplete for Test frequency $f > 40.8$ GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.2.1 Test purpose

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PCell 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 of the PCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in TS 38.133 [6] clause 8.5.

5.5.5.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 onwards and supporting long DRX cycle.

5.5.5.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.2.

5.5.5.2.4 Test description

There is one E-UTRAN PCell and one NR PCell configured in this test. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.2.4-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PCell to emulate SSB based beam failure. Figure 5.5.5.2.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery

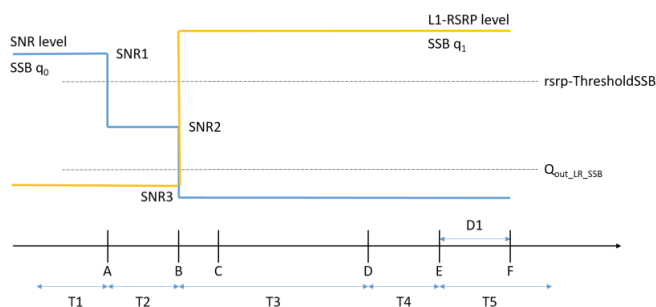


Figure 5.5.5.2.4-1: SNR and L1-RSRP variation for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

5.5.5.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.2.4.1-1.

Table 5.5.5.2.4.1-1: Supported test configurations for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Configuration	Description
5.5.5.2-1	LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.2-2	LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.2-3	LTE FDD, NR TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
5.5.5.2-4	LTE TDD, NR TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.2.4.1-2.

Table 5.5.5.2.4.1-2: Initial conditions for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 6.5.5.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.1.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.5.2.4.1-3. The DRX configuration for is according to Table 5.5.5.2.4.1-3. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.
2. Message contents are defined in clause 5.5.5.2.4.3.
3. There is one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.2.4.1-3: General test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active E-UTRA PCell	1-4		Cell 1	
E-UTRA RF Channel Number	1-4		1	
Active PCell	1-4		Cell 2	
RF Channel Number	1-4		2	
Duplex mode	1-4		TDD	Table A.1.5-3
TDD Configuration	1-4		TDDConf.3.1	
BW _{channel}	1-4	MHz	100: N _{RB,c} = 66	
Data RBs allocated	1-4		66	
PDSCH/PDCCH subcarrier spacing	1-4	kHz	120	
DL initial BWP configuration	1-4		DLBWP.0.1	Table A.8.1-1
DL dedicated BWP configuration	1-4		DLBWP.1.1	Table A.8.1-2
UL initial BWP configuration	1-4		ULBWP.0.1	Table A.8.2-1
UL dedicated BWP configuration	1-4		ULBWP.1.1	Table A.8.2-2
PDSCH Reference Channel	1-2		SR.3.2 TDD	Table A.1.1.2-3
	3-4		SR.3.3 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	Table A.1.2.2-3
	3-4		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	Table A.1.3.2-3
	3-4		CCR.3.7 TDD	

OCNG parameters	1-4		OP.1	Table A.2.1-1
CP length	1-4		Normal	
PDSCH/PDCCH TCI state	1-4		TCI.State.0	Table A.10.2-1
CSI-RS for tracking	1-4		TRS.2.1 TDD	Table A.1.4A.2.1-1
SSB Configuration	1-2		SSB.1 FR2	Table A.3.2-1
	3-4		SSB.2 FR2	
SMT-C Configuration	1-4		SMT-C.3	Table A.4-1
PRACH Configuration	1-4		PRACH.2 FR2	Table A.7.2-1
DRX configuration	1-4		DRX.3	Table A.5-1
SSB index assigned as BFD RS (q_0)	1-4		0	
SSB index assigned as CBD RS (q_1)	1-4		1	
SSB index assigned as RLM RS	1-4		0,1	
Beam failure detection transmission parameters	DCI format	1-4		1-0
	Number of Control OFDM symbols	1-4		2
	Aggregation level	1-4	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0
	DMRS precoder granularity	1-4		REG bundle size
REG bundle size	1-4		6	
Gap pattern ID	1-4		N/A	
rimInSyncOutOfSyncThreshold	1-4		absent	Value 0 is applied. (TS 38.133 [6] Table 8.1.1-1).
rsrp-ThresholdSSB	1-2	dBm/SCS	-109 ^{Note 2}	Threshold used for $Q_{in_LR_SSB}$
	3-4		-106 ^{Note 2}	
powerControlOffsetSS	1-4		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1-4		n1	see TS 38.321 [12], clause 5.17
beamFailureDetectionTimer	1-4		pbfd4	see TS 38.321 [12], clause 5.17
CSI-RS configuration for CSI reporting	1-4		CSI-RS.3.1 TDD	Table A.1.4.2-3
reportConfigType	1-4		periodic	
reportQuantity	1-4		cri-RI-PMI-CQI	
CSI reporting periodicity	1-4	slot	40	
CSI reporting offset	1-4	slot	4	
T310	1-4	ms	1000	
N310	1-4		2	
T1	1-4	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1-4	s	3.37	
T3	1-4	s	2.8	
T4	1-4	s	0	
T5	1-4	s	0.61	
D1	1-4	s	0.57	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				
Note 2: Including test tolerance given in Annex F.1.3.2				

5.5.5.2.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCSEll and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI

during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.2.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.2.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.2.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.2.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.2.5-1. T5 starts.
7. If the SS:
 - a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B; and
 - b) does not detect preamble on a beam associated with the candidate beam set 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. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.2.5-1.
9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.
10. Switch the UE on and off. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.2.4.3 Message contents

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

Table 5.5.5.2.4.3-1: Common Exception messages for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-8 with condition SSB BFD Table H.3.1-10 with condition SSB Table H.3.1-10A Table H.3.7-1 with condition DRX.3

Table 5.5.5.2.4.3-2: PDCCH Search Space for BFR

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	3	BFR	
controlResourceSetId	2	BFR	
monitoringSlotPeriodicityAndOffset CHOICE {			
s1	NULL		

}			
monitoringSymbolsWithinSlot	10000000000000	Symbols 0 and 1	
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n0		
aggregationLevel8	n1	AL8	
aggregationLevel16	n0		
}			
searchSpaceType CHOICE {			
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0	
}			
}			
}			

Table 5.5.5.2.4.3-3: RLF-TimersAndConstants

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

Table 5.5.5.2.4.3-4: PDCCH-Config

Derivation Path: TS 38.501-1 [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 5.5.5.2.4.3-5: 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		
}			
}			Test Configuration 3 & 4
tci-StatesPDCCH-ToAddList	Not present		

--	--	--	--

5.5.5.2.5 Test requirement

Tables 5.5.5.2.4.1-3 and 5.5.5.2.5-1 define the primary level settings including test tolerances for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX.

Table 5.5.5.2.5-1: NR Cell specific test parameters for EN-DC FR2 SSB-based beam failure detection and link recovery in DRX

Parameter	Unit	Test 1					
		T1	T2	T3	T4	T5	
AoA setup		Setup 1 defined in A.9					
Assumption for UE beams ^{Note 10}		Rough					
EPRE ratio of PDCCH DMRS to SSS	dB	0					
EPRE ratio of PDCCH to PDCCH DMRS	dB						
EPRE ratio of PBCH DMRS to SSS	dB						
EPRE ratio of PBCH to PBCH DMRS	dB						
EPRE ratio of PSS to SSS	dB						
EPRE ratio of PDSCH DMRS to SSS	dB						
EPRE ratio of PDSCH to PDSCH DMRS	dB						
EPRE ratio of OCNG DMRS to SSS	dB						
EPRE ratio of OCNG to OCNG DMRS	dB						
SNR_SSB of set q_0	Config 1-4 dB						13.7 ^{Note 11,12}
SNR_SSB of set q_1	Config 1-4 dB	0.2	0.2	20 ^{Note 12}	20 ^{Note 12}	20 ^{Note 12}	
SSB_RP of set q_1	Config 1-2	dBm/	-104.5	-104.5	-84.7	-84.7	-84.7
	Config 3-4	SCS kHz	-101.5	-101.5	-81.7	-81.7	-81.7
N_{oc}	Config 1-4 dBm/12 0 KHz	-104.7					
Propagation condition		TDL-A 30ns 75Hz					
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.2.4-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.							
NOTE 10: Information about types of UE beam is given in TS 38.133 clause B.2.1.3, and does not limit UE implementation or test system implementation							
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband							
Note 12: Including test tolerance given in Annex F.1.3.2							

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

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

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

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1 .

No later than time point F occurring no later than $D1 = 560 + 10$ ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set 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%.

5.5.5.3 EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Editor's Note: This test case is complete for the following configurations:

- Test frequency $f \leq 40.8$ GHz
- UE PC3

This test case is incomplete for Test frequency $f > 40.8$ GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.3.1 Test purpose

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set 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 . The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in TS 38.133 [6] clause 8.5.

5.5.5.3.2 Test applicability

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

5.5.5.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.3.

5.5.5.3.4 Test description

There are two cell configured in this test: E-UTRAN PCell and NR PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.3.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate CSI-RS based beam failure. Figure 5.5.5.3.4-1 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.

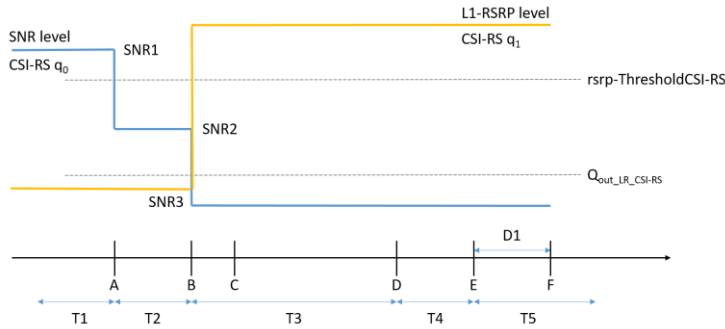


Figure 5.5.5.3.4-1: SNR and L1-RSRP variation for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

5.5.5.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.3.4.1-1.

Table 5.5.5.3.4.1-1: Supported test configurations for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Configuration	Description
5.5.5.3-1	LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.3-2	LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.3.4.1-2.

Table 5.5.5.3.4.1-2: Initial conditions for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.5.3.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.1.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.5.5.3.4.1-3. The NZP-CSI-RS configuration is according to Table 5.5.5.3.4.1-3.
2. Message contents are defined in clause 5.5.5.3.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.3.4.1-3: General test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Parameter	Test Config.	Unit	Value	Comment
			Test 1	

Active E-UTRA PCell	1-2		Cell 1	
E-UTRA RF Channel Number	1-2		1	
Active PCell	1-2		Cell 2	
RF Channel Number	1-2		2	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	Table A.1.5-3
$BW_{channel}$	1-2	MHz	100: $N_{RB,c} = 66$	
Data RBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	Table A.8.1-1
DL dedicated BWP configuration	1-2		DLBWP.1.1	Table A.8.1-2
UL initial BWP configuration	1-2		ULBWP.0.1	Table A.8.2-1
UL dedicated BWP configuration	1-2		ULBWP.1.1	Table A.8.2-2
PDSCH Reference Channel	1-2		SR.3.2 TDD	Table A.1.1.2-3
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	Table A.1.2.2-3
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	Table A.1.3.2-3
OCNG parameters	1-2		OP.1	Table A.2.1-1
CP length	1-2		Normal	
PDSCH/PDCCH TCI state	1-2		TCI.State.0	Table A.10.2-1
CSI-RS for tracking	1-2		TRS.2.1 TDD	Table A.1.4A.2.1-1
SSB Configuration	1-2		SSB.1 FR2	Table A.3.2-1
SMTC Configuration	1-2		SMTC.3	Table A.4-1
PRACH Configuration	1-2		PRACH.4 FR2	Table A.7.2-1
DRX configuration	1-2		OFF	
CSI-RS configuration for BFD/CBD/RLM	1-2		CSI-RS.3.2 TDD	Table A.1.4.2-3
CSI-RS index assigned as BFD RS (q_0)	1-2		0	
CSI-RS index assigned as CBD RS (q_1)	1-2		1	
CSI-RS index assigned as RLM RS	1-2		0,1	
Beam failure detection transmission parameters	DCI format	1-2	1-0	
	Number of Control OFDM symbols	1-2	2	
	Aggregation level	1-2	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0
	DMRS precoder granularity	1-2		REG bundle size
REG bundle size	1-2		6	

Gap pattern ID	1-2			N/A	
rlmInSyncOutOfSyncThreshold	1-2			absent	Value 0 is applied. (TS 38.133 [6] Table 8.1.1-1).
rsrp-ThresholdSSB	1-2	dBm/SCS		-109 ^{Note 2}	Threshold used for $Q_{in, LR, SSB}$
powerControlOffsetSS	1-2			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1-2			n1	see TS 38.321 [12], clause 5.17
beamFailureDetectionTimer	1-2			pbfd4	see TS 38.321 [12], clause 5.17
CSI-RS configuration for CSI reporting	1-2			CSI-RS.3.1 TDD	Table A.1.4.2-3
reportConfigType	1-2			periodic	
reportQuantity	1-2			cri-RI-PMI-CQI	
CSI reporting periodicity	1-2	slot		40	
CSI reporting offset	1-2	slot		4	
T310	1-2	ms		1000	
N310	1-2			2	
T1	1-2	s		1	The UE shall be fully synchronized to cell 1 during T1
T2	1-2	s		1.17	
T3	1-2	s		0.9	
T4	1-2	s		0	
T5	1-2	s		0.31	
D1	1-2	s		0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.					
Note 2: Including test tolerance given in Annex F.1.3.2.					

5.5.5.3.4.2 Test procedure

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

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.3.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.3.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.3.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.3.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.3.5-1. T5 starts.
7. If the SS:
 - a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B;
and
 - b) does not detect preamble on a beam associated with the candidate beam set 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. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.3.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.
10. Switch the UE on and off. Ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.3.4.3 Message contents

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

Table 5.5.5.3.4.3-1: Common Exception messages for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-8 with condition CSI-RS BFD Table H.3.1-10 with condition CSI-RS Table H.3.1-10A

Table 5.5.5.3.4.3-2: PDCCH Search Space for BFR

Derivation Path: TS 38.508-1 [14], Table 4.6.3-162				
Information Element	Value/remark	Comment	Condition	
SearchSpace ::= SEQUENCE {				
searchSpaceId	4	BFR		
controlResourceSetId	2	BFR		
monitoringSlotPeriodicityAndOffset CHOICE {				
s1	NULL			
}				
monitoringSymbolsWithinSlot	10000000000000	Symbols 0 and 1		
nrofCandidates SEQUENCE {				
aggregationLevel1	n0			
aggregationLevel2	n0			
aggregationLevel4	n0			
aggregationLevel8	n1	AL8		
aggregationLevel16	n0			
}				
searchSpaceType CHOICE {				
ue-Specific SEQUENCE {				USS
dci-Formats	formats0-0-And-1-0	DCI Format 1_0		
}				
}				
}				

Table 5.5.5.3.4.3-3: RLF-TimersAndConstants

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

Table 5.5.5.3.4.3-4: NZP-CSI-RS-Resource

Derivation Path: TS 38.508-1 [14], Table 4.6.3-85				
Information Element	Value/remark	Comment	Condition	
NZP-CSI-RS-Resource ::= SEQUENCE {				
powerControlOffsetSS	db0			
}				

Table 5.5.5.3.4.3-5: PDCCH-Config

Derivation Path: TS 38.501-1 [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 5.5.5.3.4.3-6: 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		
	1		Test Configuration 2
cce-REG-MappingType CHOICE {			
interleaved ::= SEQUENCE {			
reg-BundleSize	n6		
interleaverSize	n2		
shiftIndex	0		
}			
tci-StatesPDCCH-ToAddList	Not present		
}			

5.5.5.3.5 Test requirement

Tables 5.5.5.3.4.1-3 and 5.5.5.3.5-1 define the primary level settings including test tolerances for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX.

Table 5.5.5.3.5-1: NR Cell specific test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in non-DRX

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.9				
Assumption for UE beams ^{Note 10}		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					
SNR_CSI-RS of set q_0	Config 1-2 dB	13.7 ^{Note 11,12}	5.7 ^{Note 11,12}	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1-2 dB	0.2	0.2	20 ^{Note 12}	20 ^{Note 12}	20 ^{Note 12}
CSI-RS_RP of set q_1	Config 1-2 dBm/SCS	-104.5	-104.5	-84.7	-84.7	-84.7
N_{oc}	Config 1-2 dBm/120 KHz	TBD				
Propagation condition		TDL-A 30ns 75Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.3.4-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.						
NOTE 10: Information about types of UE beam is given in TS 38.133 clause B.2.1.3, and does not limit UE implementation or test system implementation						
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband						
Note 12: Including test tolerance given in Annex F.1.3.2						

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

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

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

During T3 the shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1 .

No later than time point F occurring no later than $D1 = 260+10$ ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set 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%.

5.5.5.4 EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Editor's Note: This test case is complete for the following configurations:

- Test frequency $f \leq 40.8$ GHz

- UE PC3

This test case is incomplete for Test frequency $f > 40.8$ GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.4.1 Test purpose

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set 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 . The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in TS 38.133 [6] clause 8.5.

5.5.5.4.2 Test applicability

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

5.5.5.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.4.

5.5.5.4.4 Test description

There is one E-UTRAN PCeell and one NR PSCeell configured in this test. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.4.4-1 shows the five different time durations and the corresponding variation of the downlink SNR in the active cell to emulate CSI-RS based beam failure. Figure 5.5.5.4.4-1-1 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.

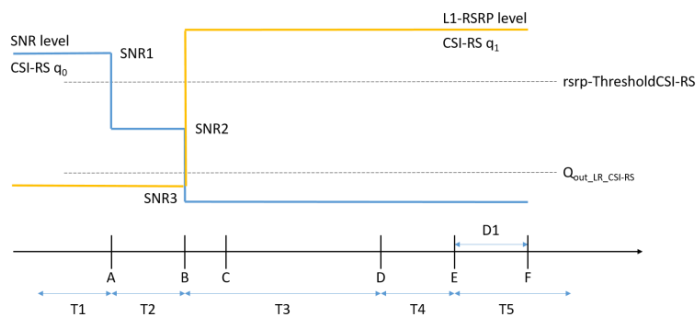


Figure 5.5.5.4.4-1: SNR and L1-RSRP variation for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

5.5.5.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.4.4.1-1.

Table 5.5.5.4.4.1-1: Supported test configurations for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Configuration	Description
5.5.5.4-1	LTE FDD, NR TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth
5.5.5.4-2	LTE TDD, NR TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.4.4.1-2.

Table 5.5.5.4.4.1-2: Initial conditions for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 6.5.5.3.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.1.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.5.5.4.4.1-3. The NZP-CSI-RS configuration is according to Table 5.5.5.4.4.1-3. The DRX configuration for is according to Table 5.5.5.4.4.1-3. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.
2. Message contents are defined in clause 5.5.5.4.4.3.
3. There is one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.4.4.1-3: General test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Parameter	Test Config.	Unit	Value	Comment
			Test 1	

Active E-UTRA PCell	1-2		Cell 1	
E-UTRA RF Channel Number	1-2		1	
Active PCell	1-2		Cell 2	
RF Channel Number	1-2		2	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	Table A.1.5-3
$BW_{channel}$	1-2	MHz	100: $N_{RB,c} = 66$	
Data RBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	Table A.8.1-1
DL dedicated BWP configuration	1-2		DLBWP.1.1	Table A.8.1-2
UL initial BWP configuration	1-2		ULBWP.0.1	Table A.8.2-1
UL dedicated BWP configuration	1-2		ULBWP.1.1	Table A.8.2-2
PDSCH Reference Channel	1-2		SR.3.2 TDD	Table A.1.1.2-3
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	Table A.1.2.2-3
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	Table A.1.3.2-3
OCNG parameters	1-2		OP.1	Table A.2.1-1
CP length	1-2		Normal	
PDSCH/PDCCH TCI state	1-2		TCI.State.0	Table A.10.2-1
CSI-RS for tracking	1-2		TRS.2.1 TDD	Table A.1.4A.2.1-1
SSB Configuration	1-2		SSB.1 FR2	Table A.3.2-1
SMTC Configuration	1-2		SMTC.3	Table A.4-1
PRACH Configuration	1-2		PRACH.4 FR2	Table A.7.2-1
DRX configuration	1-2		DRX.3	Table A.5-1
CSI-RS configuration for BFD/CBD/RLM	1-2		CSI-RS.3.2 TDD	Table A.1.4.2-3
CSI-RS index assigned as BFD RS (q_0)	1-2		0	
CSI-RS index assigned as CBD RS (q_1)	1-2		1	
CSI-RS index assigned as RLM RS	1-2		0,1	
Beam failure detection transmission parameters	DCI format	1-2	1-0	
	Number of Control OFDM symbols	1-2	2	
	Aggregation level	1-2	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0
	DMRS precoder granularity	1-2		REG bundle size
REG bundle size	1-2		6	

Gap pattern ID	1-2			N/A	
rlmInSyncOutOfSyncThreshold	1-2			absent	Value 0 is applied. (TS 38.133 [6] Table 8.1.1-1).
rsrp-ThresholdSSB	1-2	dBm/SCS		-109 ^{Note 2}	Threshold used for $Q_{in, LR, SSB}$
powerControlOffsetSS	1-2			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1-2			n1	see TS 38.321 [12], clause 5.17
beamFailureDetectionTimer	1-2			pbfd4	see TS 38.321 [12], clause 5.17
CSI-RS configuration for CSI reporting	1-2			CSI-RS.3.1 TDD	Table A.1.4.2-3
reportConfigType	1-2			periodic	
reportQuantity	1-2			cri-RI-PMI-CQI	
CSI reporting periodicity	1-2	slot		40	
CSI reporting offset	1-2	slot		4	
T310	1-2	ms		1000	
N310	1-2			2	
T1	1-2	s		1	The UE shall be fully synchronized to cell 1 during T1
T2	1-2	s		5.43	
T3	1-2	s		5.16	
T4	1-2	s		0	
T5	1-2	s		0.31	
D1	1-2	s		0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.					
Note 2: Including test tolerance given in Annex F.1.3.2.					

Table 5.5.5.4.4.1-4: Void

5.5.5.4.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to NR Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.4.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.4.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.4.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.4.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.4.5-1. T5 starts.
7. If the SS:
 - a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point A to time point B; and
 - b) does not detect preamble on a beam associated with the candidate beam set 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. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.4.5-1.

9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.
10. Switch the UE on and off. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.4.4.3 Message contents

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

Table 5.5.5.4.4.3-1: Common Exception messages for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-8 with condition CSI-RS BFD Table H.3.1-10 with condition CSI-RS Table H.3.1-10A Table H.3.7-1 with condition DRX.3

5.5.5.4.5 Test requirement

Tables 5.5.5.4.4.1-3 and 5.5.5.4.5-1 define the primary level settings including test tolerances for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX.

Table 5.5.5.4.5-1: NR Cell specific test parameters for EN-DC FR2 CSI-RS-based beam failure detection and link recovery in DRX

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.9				
Assumption for UE beams ^{Note 10}		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					
SNR_CSI-RS of set q_0	Config 1-2 dB	13.7 ^{Note 11,12}	5.7 ^{Note 11,12}	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1-2 dB	0.2	0.2	20 ^{Note 12}	20 ^{Note 12}	20 ^{Note 12}
CSI-RS_RP of set q_1	Config 1-2 dBm/SCS	-104.5	-104.5	-84.7	-84.7	-84.7
N_{ac}	Config 1-2 dBm/120 KHz	-104.7				
Propagation condition		TDL-A 30ns 75Hz				

NOTE 1:	OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3:	NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4:	Void
NOTE 5:	The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7:	SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8:	The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.4.4-1.
NOTE 9:	The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.
NOTE 10:	Information about types of UE beam is given in TS 38.133 clause B.2.1.3, and does not limit UE implementation or test system implementation
Note 11:	This value allows up to 1dB degradation from applied SNR to UE baseband
Note 12:	Including test tolerance given in Annex F.1.3.2.

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

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

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

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1 .

No later than time point F occurring no later than $D1 = 260 + 10$ ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set 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%.

5.5.5.5 EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Editor's Note: This test case is complete for the following configurations:

- Test frequency $f \leq 40.8$ GHz
- UE PC3

This test case is incomplete for Test frequency $f > 40.8$ GHz

This test case is incomplete for UE power class other than PC3.

5.5.5.5.1 Test purpose

The purpose of this test is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used, and to verify the scheduling availability restriction requirements for SSB based beam failure detection and link recovery for an FR2 serving cell in TS 38.133 [6] clause 8.5.7 and 8.5.8.

5.5.5.5.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 15 onwards.

5.5.5.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.5.

5.5.5.5.4 Test description

There are two cells configured in this test. Cell 1 is the E-UTRAN PCell and Cell 2 is the PSCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.5.4-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure 5.5.5.5.4-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery.

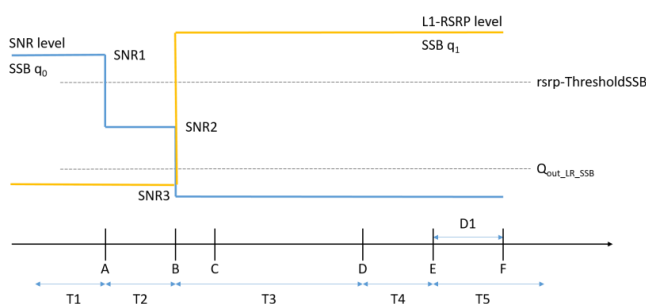


Figure 5.5.5.5.4-1: SNR and L1-RSRP variation for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

5.5.5.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.5.4.1-1.

Table 5.5.5.5.4.1-1: Supported test configurations for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Configuration	Description
5.5.5.5-1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.5.5-2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.5.5-3	LTE FDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.5.5.5-4	LTE TDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.5.4.1-2.

Table 5.5.5.5.4.1-2: Initial conditions for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.5.5.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part A.3.3.1.1 DUT Part A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.5.5.5.4.1-3.
2. Message contents are defined in clause 5.5.5.5.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.5.5.4.1-3: General test parameters for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Parameter	Test Config.	Unit	Value	Comment	
			Test 1		
Active E-UTRA PCell	1-4		Cell 1		
E-UTRA RF Channel Number	1-4		1		
Active PCell	1-4		Cell 2		
RF Channel Number	1-4		2		
Duplex mode	1-4		TDD		
TDD Configuration	1-4		TDDConf.3.1	Table A.1.5-3	
BW _{channel}	1-4	MHz	100: N _{RB,c} = 66		
Data RBs allocated	1-4		66		
PDSCH/PDCCH subcarrier spacing	1-4	kHz	120		
DL initial BWP configuration	1-4		DLBWP.0.1	Table A.8.1-1	
DL dedicated BWP configuration	1-4		DLBWP.1.1	Table A.8.1-2	
UL initial BWP configuration	1-4		ULBWP.0.1	Table A.8.2-1	
UL dedicated BWP configuration	1-4		ULBWP.1.1	Table A.8.2-2	
PDSCH Reference Channel	1-2		SR.3.2 TDD	Table A.1.1.2-3	
	3-4		SR.3.3 TDD		
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	Table A.1.2.2-3	
	3-4		CR.3.2 TDD		
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	Table A.1.3.2-3	
	3-4		CCR.3.7 TDD		
OCNG parameters	1-4		OP.1	Table A.2.1-1	
CP length	1-4		Normal		
PDSCH/PDCCH TCI state	1-4		TCI.State.0	Table A.10.2-1	
CSI-RS for tracking	1-4		TRS.2.1 TDD	Table A.1.4A.2.1-1	
SSB Configuration	1-2		SSB.1 FR2	Table A.3.2-1	
	3-4		SSB.2 FR2		
SMTc Configuration	1-4		SMTc.1	Table A.4-1	
PRACH Configuration	1-4		PRACH.2 FR2	Table A.7.2-1	
DRX configuration	1-4		OFF		
SSB index assigned as BFD RS (q ₀)	1-4		0		
SSB index assigned as CBD RS (q ₁)	1-4		1		
Beam failure detection transmission parameters	DCI format	1-4	1-0		
	Number of Control OFDM symbols	1-4	2		
	Aggregation level	1-4	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0	
	DMRS precoder granularity	1-4		REG bundle size	
	REG bundle size	1-4		6	
Gap pattern ID	1-4		N/A	No measurement gap is configured	
rlmInSyncOutOfSyncThreshold	1-4		absent	Value 0 is applied. (TS 38.133 [6] Table 8.1.1-1).	
rsrp-ThresholdSSB	1-2	dBm/SCS	-109 ^{Note 3}	Threshold used for Q _{in_LR_SSB}	
	3-4		-106 ^{Note 3}		

powerControlOffsetSS	1-4		db0	Used for deriving $rsrp$ -ThresholdCSI-RS
beamFailureInstanceMaxCount	1-4		n1	see TS 38.321 [12], clause 5.17
beamFailureDetectionTimer	1-4		pbfd4	see TS 38.321 [12], clause 5.17
CSI-RS configuration for CSI reporting	1-4		CSI-RS.3.1 TDD	Table A.1.4.2-3
reportConfigType	1-4		periodic	
reportQuantity	1-4		cri-RI-PMI-CQI	
CSI reporting periodicity	1-4	slot	40	
CSI reporting offset	1-4	slot	4	
T310	1-4	ms	1000	
N310	1-4		2	
T1	1-4	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1-4	s	2.6	
T3	1-4	s	1.64	
T4	1-4	s	0	
T5	1-4	s	1.01	
D1	1-4	s	0.97	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: Including test tolerance given in Annex F.1.3.2				

5.5.5.5.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. This test will focus on the scheduling availability during beam failure detection and candidate beam detection. In the test, DRX configuration is not enabled. During the test the UE is scheduled to transmit continuously in UL.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.5.5.5-1. Propagation conditions are set according to clause C.2.3. T1 starts.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.5.5-1. T2 starts.
4. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.5.5-1. T3 starts.
5. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.5.5-1. T4 starts.
6. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.5.5-1. T5 starts.
7. If the SS:
 - a) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) which are not overlapped with SSBs configured for beam failure detection during the period from time point B to time point D; and
 - b) detects uplink power on NR carrier in each slot configured for CQI transmission (according CQI reporting on PUCCH) during the period from time point D until T5 expires,
 the number of successful tests is increased by one.
 Otherwise the number of failed tests is increased by one.
8. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.5.5-1.
9. Wait 1s for the UE to re-establish the connection or continue directly to step 10. If the UE re-establishes the connection within 1s continue to step 11. Otherwise continue to step 10.

10. Switch the UE on and off. Ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.
11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.4.3 Message contents

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

Table 5.5.5.4.3-1: Common Exception messages for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-8 with condition SSB BFD Table H.3.1-10 with condition SSB Table H.3.1-10A

5.5.5.5 Test requirement

Tables 5.5.5.4.1-3 and 5.5.5.5-1 define the primary level settings including test tolerances for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX.

Table 5.5.5.5-1: NR Cell specific test parameters for EN-DC FR2 scheduling available restriction during SSB-based beam failure detection and link recovery in non-DRX

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A. 9.1				
Assumption for UE beams ^{Note 10}		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					
SNR_SSB of set q_0	Config 1-4 dB	13.7 ^{Note 11,12}	5.7 ^{Note 11,12}	-12	-12	-12
SNR_SSB of set q_1	Config 1-4 dB	0.2	0.2	20 ^{Note 12}	20 ^{Note 12}	20 ^{Note 12}
SSB_RP of set q_1	Config 1-2 dBm/SCS	-104.5	-104.5	-84.7	-84.7	-84.7
	Config 3-4 dBm/SCS	-101.5	-101.5	-81.7	-81.7	-81.7
N_{oc}	Config 1-4 dBm/120K Hz	-104.7				
Propagation condition		TDL-A 30ns 75Hz				

NOTE 1:	OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3:	NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4:	Void
NOTE 5:	The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7:	SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8:	The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.4-1.
NOTE 9:	The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.
NOTE 10:	Information about types of UE beam is given in TS 38.133 clause B.2.1.3, and does not limit UE implementation or test system implementation
Note 11:	This value allows up to 1dB degradation from applied SNR to UE baseband
Note 12:	Including test tolerance given in Annex F.1.3.2.

The UE behaviour during time duration T3 follows the requirements defined in TS 38.133 [6] clause 8.5.7.3:

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

The UE behaviour during time durations T4 and T5 follows the requirements defined in TS 38.133 [6] clause 8.5.8.3:

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

5.5.5.6 EN-DC FR2 CSI-RS-based BFD and LR for SCell in non-DRX

Editor's Note:

- This test case is incomplete for Test frequency $f > 40.8$ GHz
- This test case is incomplete for UE power class other than PC3.

5.5.5.6.1 Test purpose

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for an active SCell and that the UE performs correct CSI-RS-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 of the SCell with *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 SCell requirements in TS 38.133 [6] clause 8.5.

5.5.5.6.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 16 onwards supporting SCell BFR.

5.5.5.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2 and 5.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.6.

5.5.5.6.4 Test description

There are three cells configured in this test. Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell and Cell 3 is the SCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.6.4-1 shows the variation of the downlink SNR of the active SCell and the SNR of the CSI-RS in set q_0 in the

active SCell to emulate CSI-RS based beam failure. Figure 5.5.5.6.4-1 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.

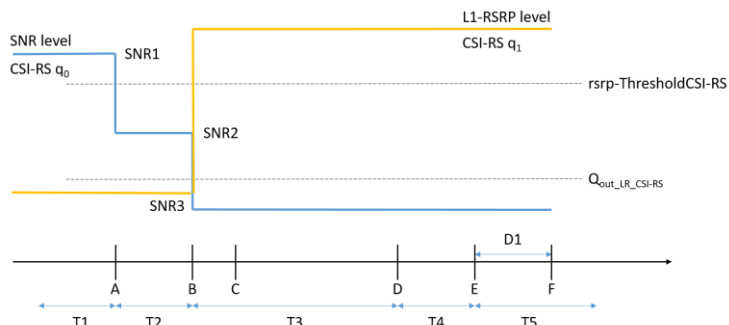


Figure 5.5.5.6.4-1: SNR and L1-RSRP variation for CSI-RS based beam failure detection and link recovery testing for SCell in non-DRX mode

5.5.5.6.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.6.4.1-1.

Table 5.5.5.6.4.1-1: Supported test configurations for EN-DC FR2 SCell beam failure detection and link recovery testing in non-DRX

Configuration	Description
5.5.5.6-1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.6-2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
Note: The UE is only required to be tested in one of the supported test configurations	

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.6.4.1-2.

Table 5.5.5.6.4.1-2: Initial conditions for EN-DC FR2 SCell beam failure detection and link recovery testing in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.5.6.4.1-1.	
Propagation conditions	AWGN	As specified in Annex C.2.2.
Connection Diagram	TE Part	A.3.3.3.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.5.5.6.4.1-3.
2. Message contents are defined in clause 5.5.5.6.4.3.
3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.5.6.4.1-3: General test parameters for FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment	
			Test 1		
Active E-UTRA PCell	1-2		Cell 1		
E-UTRA RF Channel Number	1-2		1		
Active PCell	1-2		Cell 2		
RF Channel Number for PSCell	1-2		2		
Active SCell	1-2		Cell 3		
RF Channel Number for SCell	1-2		3		
Duplex mode	1-2		TDD		
TDD Configuration	1-2		TDDConf.3.1		
$BW_{channel}$	1-2	MHz	100: $N_{RB,c} = 66$		
Data RBs allocated	1-2		66		
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120		
DL initial BWP configuration	1-2		DLBWP.0.1		
DL dedicated BWP configuration	1-2		DLBWP.1.1		
UL initial BWP configuration	1-2		ULBWP.0.1		
UL dedicated BWP configuration	1-2		ULBWP.1.1		
PDSCH Reference Channel	1-2		SR.3.2 TDD		
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	A.1.2.2	
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD		
OCNG parameters	1-2		OP.1	A.2.1	
CP length	1-2		Normal		
PDSCH/PDCCH TCI state	1-2		TCI.State.0		
CSI-RS for tracking	1-2		TRS.2.1 TDD		
SSB Configuration	1-2		SSB.3 FR2	A.3	
SMTTC Configuration	1-2		SMTTC.3	A.4	
PRACH Configuration	1-2		FR2 PRACH configuration 4	Table A.7.2-1	
DRX configuration	1-2		OFF		
CSI-RS configuration for BFD/CBD in activated SCell	1-2		CSI-RS.3.2 TDD	A.1.4.2	
CSI-RS index assigned as BFD RS (q_0) in activated SCell	1-2		0		
CSI-RS index assigned as CBD RS (q_1) in activated SCell	1-2		1		
CSI-RS configuration for RLM in PSCell	1-2		CSI-RS.3.2 TDD	A.1.4.2	
Beam failure detection transmission parameters	DCI format	1-2	1-0		
	Number of Control OFDM symbols	1-2	2		
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
REG bundle size	1-2		6		

Gap pattern ID	1-2		N/A	
schedulingRequestID-BFR-SCell-r16	1-2		Configured	
Periodicity of PUCCH for SR configuration for BFR on SCell	1-2	slot	40	5ms
Offset of PUCCH for SR configuration for BFR on SCell	1-2	slot	4	
PUCCH parameters for SR configuration for BFR on SCell	1-2		Table 8.3.3.1.2-1 in [28]	
rimInSyncOutOfSyncThreshold	1-2		absent	Value 0 is applied. (Table 8.1.1-1 in TS 38.133 [6]).
rsrp-ThresholdSSB	1-2	dBm/SCS	-109 ^{Note 2}	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS	1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer	1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	1-2		CSI-RS.3.1 TDD	A.1.4.2
reportConfigType	1-2		periodic	
reportQuantity	1-2		cri-RI-PMI-CQI	
CSI reporting periodicity	1-2	slot	40	
CSI reporting offset	1-2	slot	4	
T310	1-2	ms	1000	
N310	1-2		2	
T1	1-2	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1-2	s	1.17	
T3	1-2	s	0.9	
T4	1-2	s	0	
T5	1-2	s	0.31	
D1	1-2	s	0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				
Note 2: Including test tolerance given in Annex F.1.3.2				

5.5.5.6.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1, Cell 2 and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. During the test the UE is scheduled to transmit continuously in UL.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.
2. The SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.5.6.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.
3. The SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.10).
4. Set the parameters of NR Cell 2 and Cell 3 according to T1 in Table 5.5.5.6.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.
5. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.6.5-1. T2 starts.
6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.6.5-1. T3 starts.
7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.6.5-1. T4 starts.
8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.6.5-1. T5 starts.

9. If the SS:

- a) detects uplink power on NR in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point B; and
- b) does not detect PUCCH with LRR before time point B, and
- c) detects PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set 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. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.6.5-1.

11. If the iteration fails, the SS shall first attempt to release and add the FR2 SCell. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration, and ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.

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

5.5.5.6.4.3 Message contents

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

Table 5.5.5.6.4.3-1: Common Exception messages for EN-DC FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-8 with Condition CSI-RS BFD Table H.3.1-12 on Cell 3 Table H.3.1-13 on Cell 3

Table 5.5.5.6.4.3-2: MAC-CellGroupConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-68			
Information Element	Value/remark	Comment	Condition
MAC-CellGroupConfig ::= SEQUENCE {			
schedulingRequestID-BFR-SCell-r16	SchedulingRequestId		
}			

Table 5.5.5.6.4.3-3: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
sl40	4		
}			
}			

5.5.5.6.5 Test requirement

Tables 5.5.5.6.4.1-3 and 5.5.5.6.5-1 define the primary level settings including test tolerances for EN-DC FR2 SCell for beam failure detection and link recovery testing in non-DRX.

Table 5.5.6.5-1: NR Cell specific test parameters for EN-DC FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Cell2 T1 to T5	Cell3 Test 1					
			T1	T2	T3	T4	T5	
AoA setup		Setup 1 defined in A.9.1	Setup 1 defined in A.9.1					
Assumption for UE beams ^{Note 10}		Rough	Rough					
EPRE ratio of PDCCH DMRS to SSS	dB	0	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
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	0.2	20	20	20
CSI-RS_RP of set q_1	Config 1	dBm/5 CS kHz	-104.5	-104.5	-104.5	-84.7	-84.7	-84.7
N_{oc}	Config 1	dBm/120 kHz	-104.7	-104.7				
Propagation condition		TDL-A 30ns 75Hz	TDL-A 30ns 75Hz					
<p>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.</p> <p>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 4: Void</p> <p>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.</p> <p>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.</p> <p>Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.</p> <p>Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.6.4-1.</p> <p>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.</p> <p>Note 10: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation</p>								

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

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates beam candidate from beam candidate set q_1 .

No later than time point F occurring no later than $D1 = 260+10$ ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_1 . The UE shall not transmit PUCCH with an LRR 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%.

5.5.5.7 EN-DC FR2 SCell CSI-RS-based beam failure detection and link recovery in DRX

Editor's Note: This test case is incomplete for Test frequency $f > 40.8$ GHz

- This test case is incomplete for UE power class other than PC3.

5.5.5.7.1 Test purpose

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for an active SCell and that the UE performs correct CSI-RS-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 of the SCell with *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 SCell requirements in TS 38.133 [6] clause 8.5.

5.5.5.7.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from release 16 onwards supporting SCell BFR.

5.5.5.7.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.5.0.2 and 5.5.5.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.5.7.

5.5.5.7.4 Test description

There are three cells configured in this test. Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell and Cell 3 is the SCell. This test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure 5.5.5.7.4-1 shows the variation of the downlink SNR of the active SCell and the SNR of the CSI-RS in set q_0 in the active SCell to emulate CSI-RS based beam failure. Figure 5.5.5.7.4-1 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.

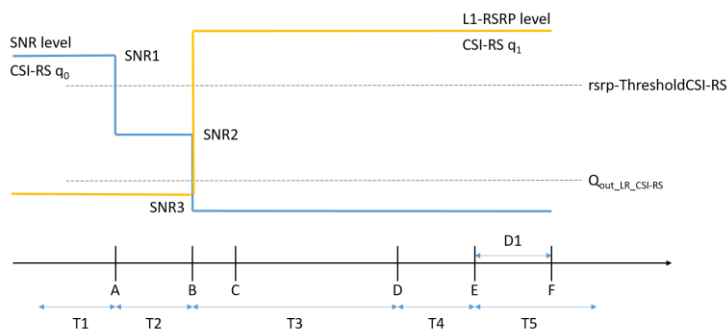


Figure 5.5.5.7.4-1: SNR and L1-RSRP variation for CSI-RS based beam failure detection and link recovery testing for SCell in DRX mode

5.5.5.7.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.5.7.4.1-1.

Table 5.5.5.7.4.1-1: Supported test configurations for EN-DC FR2 SCell beam failure detection and link recovery testing in DRX

Configuration	Description
5.5.5.7-1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
5.5.5.7-2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
Note:	The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.5.5.7.4.1-2.

Table 5.5.5.7.4.1-2: Initial conditions for EN-DC FR2 SCell beam failure detection and link recovery testing in DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.5.7.4.1-1.	
Propagation conditions	AWGN	As specified in Annex C.2.2.
Connection Diagram	TE Part	A.3.3.3.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.5.5.7.4.1-3.
2. Message contents are defined in clause 5.5.5.7.4.3.
3. There are one E-UTRAN cell and two NR cells specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to Annex C.1.1 and C.1.2 for this test.

Table 5.5.5.7.4.1-3: General test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	

Active E-UTRA PCell	1-2		Cell 1	
E-UTRA RF Channel Number	1-2		1	
Active PCell	1-2		Cell 2	
RF Channel Number for PSCell	1-2		2	
Active SCell	1-2		Cell 3	
RF Channel Number for SCell	1-2		3	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2	MHz	100: $N_{RB,c} = 66$	
Data RBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	
UL initial BWP configuration	1-2		ULBWP.0.1	
UL dedicated BWP configuration	1-2		ULBWP.1.1	
PDSCH Reference Channel	1-2		SR.3.2 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	A.1.2.2
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	
OCNG parameters	1-2		OP.1	A.2.1
CP length	1-2		Normal	
PDSCH/PDCCH TCI state	1-2		TCI.State.0	
CSI-RS for tracking	1-2		TRS.2.1 TDD	
SSB Configuration	1-2		SSB.3 FR2	A.3
SMTc Configuration	1-2		SMTc.3	A.4
PRACH Configuration	1-2		FR2 PRACH configuration 4	Table A.7.2-1
DRX configuration	1-2		DRX.3	A.5
CSI-RS configuration for BFD/CBD in activated SCell	1-2		CSI-RS.3.2 TDD	A.1.4.2
CSI-RS index assigned as BFD RS (q_0) in activated SCell	1-2		0	
CSI-RS index assigned as CBD RS (q_1) in activated SCell	1-2		1	
CSI-RS configuration for RLM in PSCell	1-2		CSI-RS.3.2 TDD	A.1.4.2
Beam failure detection transmission parameters	DCI format	1-2	1-0	
	Number of Control OFDM symbols	1-2	2	
	Aggregation level	1-2	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0
	DMRS precoder granularity	1-2		REG bundle size
REG bundle size	1-2		6	

Gap pattern ID	1-2		N/A	
schedulingRequestID-BFR-SCell-r16	1-2		Configured	
Periodicity of PUCCH for SR configuration for BFR on SCell	1-2	slot	40	5ms
Offset of PUCCH for SR configuration for BFR on SCell	1-2	slot	4	
PUCCH parameters for SR configuration for BFR on SCell	1-2		Table 8.3.3.1.2-1 in [28]	
rimInSyncOutOfSyncThreshold	1-2		absent	Value 0 is applied. (Table 8.1.1-1 in TS 38.133 [6]).
rsrp-ThresholdSSB	1-2	dBm/SCS	-109 ^{Note 2}	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS	1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1-2		n1	see TS 38.321 [12], clause 5.17
beamFailureDetectionTimer	1-2		pbfd4	see TS 38.321 [12], clause 5.17
CSI-RS configuration for CSI reporting	1-2		CSI-RS.3.1 TDD	A.1.4.2
reportConfigType	1-2		periodic	
reportQuantity	1-2		cri-RI-PMI-CQI	
CSI reporting periodicity	1-2	slot	40	
CSI reporting offset	1-2	slot	4	
T310	1-2	ms	1000	
N310	1-2		2	
T1	1-2	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1-2	s	5.43	
T3	1-2	s	5.16	
T4	1-2	s	0	
T5	1-2	s	0.31	
D1	1-2	s	0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				
Note 2: Including test tolerance given in Annex F.1.3.2				

5.5.5.7.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1, Cell 2 and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. During the test the UE is scheduled to transmit continuously in UL.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.
2. The SS shall configure SCell (Cell 3) on the SCC as per TS 38.508-1 [14] clause 7.5.2, with the message content exceptions defined in clause 5.5.5.7.4.3. NR RRCReconfiguration message is contained in RRCConnectionReconfiguration and NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.
3. The SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [12], clauses 5.9, 6.1.3.10).
4. Set the parameters of NR Cell 2 and Cell 3 according to T1 in Table 5.5.5.7.5-1. Propagation conditions are set according to Annex C.2.3. T1 starts.
5. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.5.7.5-1. T2 starts.
6. When T2 expires the SS shall change the SNR value to T3 as specified in Table 5.5.5.7.5-1. T3 starts.

7. When T3 expires the SS shall change the SNR value to T4 as specified in Table 5.5.5.7.5-1. T4 starts.
8. When T4 expires the SS shall change the SNR value to T5 as specified in Table 5.5.5.7.5-1. T5 starts.
9. If the SS:
 - a) detects uplink power on NR carrier in each slot configured for CSI transmission (according CSI reporting on PUCCH) during the period from time point A to time point B; and
 - b) does not detect PUCCH with LRR before time point B, and
 - c) detects PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_i before time point F (D1 after the start of T5),
 the number of successful tests is increased by one.
 Otherwise the number of failed tests is increased by one.
10. When T5 expires the SS shall change the SNR value to T1 as specified in Table 5.5.5.7.5-1.
11. If the iteration fails, the SS shall first attempt to release and add the FR2 SCell. If that also fails, then the UE is switched OFF/ON to proceed with the next iteration, and ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.4.
12. Repeat steps 2-11 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.5.7.4.3 Message contents

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

Table 5.5.5.7.4.3-1: Common Exception messages for EN-DC FR2 SCell for beam failure detection and link recovery testing in DRX mode

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-8 with Condition CSI-RS BFD Table H.3.1-12 on Cell 3 Table H.3.1-13 on Cell 3 Table H.3.7-1 with condition DRX.3

Table 5.5.5.7.4.3-2: MAC-CellGroupConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-68			
Information Element	Value/remark	Comment	Condition
MAC-CellGroupConfig ::= SEQUENCE {			
schedulingRequestID-BFR-SCell-r16	SchedulingRequestId		
}			

Table 5.5.5.7.4.3-3: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
sl40	4		
}			
}			

5.5.5.7.5 Test requirement

Tables 5.5.5.7.4.1-3 and 5.5.5.7.5-1 define the primary level settings including test tolerances for EN-DC FR2 SCell for beam failure detection and link recovery testing in DRX.

Table 5.5.5.7.5-1: NR Cell specific test parameters for EN-DC FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Cell2 T1 to T5	Cell3 Test 1				
				T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.9.1	Setup 1 defined in A.9.1				
Assumption for UE beams ^{Note 10}			Rough	Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0	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	13.7	5.7	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	0.2	20	20	20
CSI-RS_RP of set q_1	Config 1	dBm/S CS kHz	-104.5	-104.5	-104.5	-84.7	-84.7	-84.7
N_{oc}	Config 1	dBm/12 0kHz	-104.7	-104.7				
Propagation condition			TDL-A 30ns 75Hz	TDL-A 30ns 75Hz				
<p>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.</p> <p>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.</p> <p>Note 4: Void</p> <p>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.</p> <p>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.</p> <p>Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.</p> <p>Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure 5.5.5.7.4-1.</p> <p>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause D.4.</p> <p>Note 10: Information about types of UE beam is given in B.2.1.3 in TS 38.133 [6], and does not limit UE implementation or test system implementation</p>								

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

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates beam candidate from beam candidate set q_1 .

No later than time point F occurring no later than $D1 = 260+10$ ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_1 . The UE shall not transmit PUCCH with an LRR 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%.

5.5.6 Active BWP switch delay

5.5.6.1 DCI-based and time-based active BWP switch

5.5.6.1.0 Minimum conformance requirements

FFS

5.5.6.1.1 EN-DC FR2 DCI-based DL active BWP switch in non-DRX in synchronous EN-DC

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

- Test tolerance analysis is missing

- Message contents are TBD

- Cell mapping is TBD

- Test procedure is TBD

- Test applicability needs to be added to TS 38.522

5.5.6.1.1.1 Test purpose

FFS

5.5.6.1.1.2 Test applicability

FFS

5.5.6.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.1.1.

5.5.6.1.1.4 Test description

5.5.6.1.1.4.1 Initial conditions

FFS

5.5.6.1.1.4.2 Test procedure

FFS

5.5.6.1.1.4.3 Message contents

FFS

5.5.6.1.1.5 Test requirements

FFS

5.5.6.1.2 EN-DC FR2 DCI-based DL active BWP switch with SCell in non-DRX in synchronous EN-DC

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

- Test tolerance analysis is missing

- Message contents are TBD

- Cell mapping is TBD

- Test procedure is TBD

- Test applicability needs to be added to TS 38.522

5.5.6.1.2.1 Test purpose

FFS

5.5.6.1.2.2 Test applicability

FFS

5.5.6.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.6.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.1.2.

5.5.6.1.2.4 Test description

5.5.6.1.2.4.1 Initial conditions

FFS

5.5.6.1.2.4.2 Test procedure

FFS

5.5.6.1.2.4.3 Message contents

FFS

5.5.6.1.2.5 Test requirements

FFS

5.5.6.2 RRC-based active BWP switch

The requirements in this clause apply for a UE configured with more than one BWP on PSCell or any activated SCell in SCG in EN-DC. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

5.5.6.2.0 Minimum conformance requirements

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured, with

- Active BWP switch or parameter change of its active BWPs for SpCell
- Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* for SCell

For RRC-based BWP switch, after the UE receives BWP switching request, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after the beginning of DL slot $n + \frac{T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

NR Slot length is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in millisecond as defined in clause 11.2 in TS 36.331 [29] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [2], and

$T_{BWPswitchDelayRRC} = 6ms$ 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. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [8].

5.5.6.2.1 EN-DC FR2 RRC-based DL active BWP switch in non-DRX in synchronous EN-DC

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

- *Test tolerance analysis is missing*
- *Message contents are TBD*
- *Cell mapping is TBD*
- *Test applicability needs to be added to TS 38.522*

5.5.6.2.1.1 Test purpose

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 5.5.6.2.0.1. Supported test configurations are shown in Table 5.5.6.2.1.4.1-1.

5.5.6.2.1.2 Test applicability

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

5.5.6.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.6.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.6.2.1.

5.5.6.2.1.4 Test description

5.5.6.2.1.4.1 Initial conditions

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

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

This test shall be tested using any of the test configurations in Table 5.5.6.2.1.4.1-1.

Table 5.5.6.2.1.4.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.5.6.2.1.4.1-2

Table 5.5.6.2.1.4.1-2: Initial conditions for EN-DC FR2 RRC-based DL active BWP switch in non-DRX in synchronous EN-DC

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

1. Message contents are defined in clause 5.5.6.2.1.4.3.
2. The power levels and settings for Cell 1 are set according to Annex A.6, Table A.6.1.1-1. Cell 2 is NR FR2 PSCell. The connection setup is done according to the settings in Annex [C.x], and the downlink signal levels as per Annex [C.x]
3. The test parameters are given in Table 5.5.6.2.1.4.1-3 below.
4. Downlink signals for NR cell are initially set up according to Annex [C.x].

Table 5.5.6.2.1.4.1-3: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	μs	3	Synchronous EN-DC
T1	s	[0.2]	

5.5.6.2.1.4.2 Test procedure

The test consists of two cells, a single E-UTRA cell (PCell), and a single NR cell (PSCell). Prior to the start of the test, the UE shall be fully synchronized to PSCell. The UE shall be configured for parameters as mentioned in the Table 5.5.6.2.1.4.1-3.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [6] clause 5.5.
2. PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.
3. The SS shall send an *RRCConnectionReconfiguration* message releasing the dedicated configuration of the *initialDownlinkBWP* and the *initialUplinkBWP*. This message also configures another UE-specific bandwidth part, BWP-1, and indicates BWP-1 as the active DL BWP using *firstActiveDownlinkBWP-Id*, according to the initial condition of Active BWP-1 in Table 5.5.6.2.1.5-1.
4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.
5. Before the test starts UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
6. Before the test starts UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell).
7. Before the test starts UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
8. Ensure all cells have constant signal levels throughout the test.
9. The test consists of 1 time period, with duration of T1.
10. Time period T1 starts when a *RRCConnectionReconfiguration* with bandwidth part configuration BWP-2, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
11. If the UE starts to report valid ACK/NACK for PSCell from the first UL slot that occurs after the beginning of DL slot $i+208+k_1$ then the number of successful tests is increased by one. Otherwise, the number of failure tests is increased by one.
12. After the SS receives the ACK/NACK in step 9) or when T1 expires, the SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
13. The SS shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message. If either of the reconfiguration in step 10 or step 11 fails, switch off and on the UE and go to step 1.
14. Repeat steps 2-13 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.6.2.1.4.3 Message contents

FFS

5.5.6.2.1.5 Test requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in a slot $i + \frac{T_{\text{RRCprocessingDelay}} + T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$, and starts to report valid ACK/NACK for the PSCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{\text{RRCprocessingDelay}} + T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}} + k_1$, where,

$T_{\text{RRCprocessingDelay}} = 20$ ms, is the RRC procedure delay in ms as defined in clause 11.2 in TS 36.331 [29];

$T_{\text{BWPswitchDelayRRC}} = 6$ ms, is the time used by the UE to perform BWP switch;

NR slot length = 0.125 ms for SCS = 120 kHz.

k_1 is the timing between DL data receiving and acknowledgement as specified in [12].

Which gives $\frac{T_{\text{RRCprocessingDelay}} + T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}} = 208$ slots.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

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

Table 5.5.6.2.1.5-1: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2		
Frequency Range		FR2		
Duplex mode		TDD		
TDD configuration		TDDConf.3.1		
BW _{channel}		100 MHz: N _{RB,c} = 66		
Active BWP ID		1, 2		
Initial DL BWP Configuration		DLBWP.0.2		
Active DL BWP-1 Configuration		DLBWP.1.3		
Active DL BWP-2 Configuration		DLBWP.1.1		
Initial UL BWP Configuration		ULBWP.0.2		
Active UL BWP-1 Configuration		ULBWP.1.3		
Active UL BWP-2 Configuration		ULBWP.1.1		
PDSCH Reference measurement channel		SR.3.1 TDD		
RMSI CORESET parameters		CR.3.1 TDD		
Dedicated CORESET parameters		CCR.3.1 TDD		
OCNG Patterns		OP.1		
SSB Configuration		SSB.1 FR2		
SMTTC Configuration		SMTTC.1		
TCI State		TCI.State.0		
TRS Configuration		TRS.2.1 TDD		
Antenna Configuration		1x2		
Propagation Condition		AWGN		
EPRE ratio of PSS to SSS	dB	0		
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N _{oc} to be fulfilled.				
NOTE 3: SS-RSRP and I _o 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].				

Table 5.5.6.2.1.5-2: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 2
Angle of arrival configuration		According to table A.3.15
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz
	NR_TDD_FR2_B	
	NR_TDD_FR2_F	
	NR_TDD_FR2_G	
	NR_TDD_FR2_T	
	NR_TDD_FR2_Y	
NR_TDD_FR2_A	dBm/SCS	TBD

Parameter		Unit	Cell 2
N_{oc} ^{Note1}	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP ^{Note2}	NR_TDD_FR2_A	dBm/SCS ^{Note3}	TBD
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
\hat{E}_s/I_{ot}		dB	TBD
I_o ^{Note2}	NR_TDD_FR2_A	dBm/95.04 MHz ^{Note4}	TBD
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
<p>NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone</p>			

5.5.7 Void

5.5.8 Active TCI state switch delay

5.5.8.0 Minimum conformance requirements

5.5.8.0.1 Minimum conformance requirements for MAC-CE based active TCI state switch

[TS38.133, clause 8.10.2]

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state
 - TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
 - The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command
 - The TCI state remain detectable during the TCI state switching period
 - The SSB associated with the TCI state remain detectable during the TCI switching period
 - SNR of the TCI state \geq -3dB

Otherwise, the TCI state is unknown.

[TS38.133, clause 8.10.3]

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n , UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot $n + T_{\text{HARQ}} + (3\text{ms} + T_{0k} * (T_{\text{first-SSB}} + T_{\text{SSB-proc}})) / NR \text{ slot length}$. The UE shall be able to receive PDCCH with the old TCI state until slot $n + T_{\text{HARQ}} + (3\text{ms} + T_{0k} * (T_{\text{first-SSB}})) / NR \text{ slot length}$.

Where,

T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.321 [7];

$T_{\text{first-SSB}}$ is time to first SSB transmission after MAC CE command is decoded by the UE;

$T_{\text{SSB-proc}} = 2\text{ms}$;

$T_{0k} = 1$ if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n , UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot $n + T_{\text{HARQ}} + (3 \text{ ms} + T_{\text{L1-RSRP}} + T_{0k} * (T_{\text{first-SSB}} + T_{\text{SSB-proc}})) / NR \text{ slot length}$. The UE shall be able to receive PDCCH with the old TCI state until slot $n + T_{\text{HARQ}} + (3 \text{ ms} + T_{\text{L1-RSRP}} + T_{0k} * (T_{\text{first-SSB}})) / NR \text{ slot length}$.

Where

$T_{\text{L1-RSRP}}$ is the time for L1-RSRP measurement for Rx beam refinement, defined as

- $T_{\text{L1-RSRP_Measurement_Period_SSB}}$ for SSB as specified in clause 9.5.4.1,
 - with the assumption of $M=1$
 - with $T_{\text{Report}} = 0$
- $T_{\text{L1-RSRP_Measurement_Period_CSI-RS}}$ for CSI-RS as specified in clause 9.5.4.2
 - with the assumption of $M=1$ for periodic CSI-RS
 - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
 - with $T_{\text{Report}} = 0$
- $T_{\text{L1-RSRP_Measurement_Period_SSB}} = 0$ for SSB in FR2 and $T_{\text{L1-RSRP_Measurement_Period_CSI-RS}} = 0$ for CSI-RS in FR2, provided that the TCI state switching involves QCL-TypeA, QCL-TypeB or QCL-TypeC only.

$T_{0k} = 1$ for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD

$T_{0k} = 1$ when TCI state switching involves other QCL types

$T_{\text{first-SSB}}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;

$T_{\text{first-SSB}}$ is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;

The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

During MAC-CE based TCI state switch the UE is allowed an interruption due to one shot timing adjustment on the serving or any activated serving cells as defined in clause 8.2.

5.5.8.0.2 Minimum conformance requirements for RRC based active TCI state switch

[TS38.133, clause 8.10.2]

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state

- TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
- The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command
- The TCI state remain detectable during the TCI state switching period
- The SSB associated with the TCI state remain detectable during the TCI switching period
 - SNR of the TCI state ≥ -3 dB

Otherwise, the TCI state is unknown.

[TS38.133, clause 8.10.5]

If the target TCI state is known, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot $n + T_{\text{RRC_processing}} + T_{\text{Ok}} * (T_{\text{first-SSB}} + T_{\text{SSB-proc}}) / NR \text{ slot length}$. The UE is not required to receive PDCCH/PDSCH or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{\text{RRC_processing}}$ is the RRC processing delay defined in Clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in Clause 12 of TS 38.331 [2].
- $T_{\text{first-SSB}}$ is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{\text{SSB-proc}}$ and T_{Ok} are defined in clause 8.10.3.

If the target TCI state is unknown, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs no later than at slot $n + T_{\text{RRC_processing}} + T_{\text{L1-RSRP}} + T_{\text{Ok}} * (T_{\text{first-SSB}} + T_{\text{SSB-proc}}) / NR \text{ slot length}$. The UE is not required to receive PDCCH/PDSCH or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{\text{RRC_processing}}$ is the RRC processing delay defined in Clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in Clause 12 of TS 38.331 [2].
- $T_{\text{first-SSB}}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{\text{first-SSB}}$ is time to first SSB transmission after RRC processing time at the UE for other QCL types;
 - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{\text{L1-RSRP}}$, T_{Ok} and $T_{\text{SSB-proc}}$ are defined in 38.133 clause 8.10.3.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{\text{HARQ}} > T_{\text{RRC_processing}}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [8].

5.5.8.1 EN-DC FR2 MAC-CE based active TCI state switch

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

- Message contents are not complete.
- Connection diagram is TBD.

- TT analysis is missing.

- RAN4 dependency: Test parameters have brackets and TBDs.

5.5.8.1.1 Test purpose

The purpose of this test is to verify the active TCI state switch delay requirement defined in TS 38.133 [6] clause 8.10.3.

5.5.8.1.2 Test applicability

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

5.5.8.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.8.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.8.1.

5.5.8.1.4 Test description

There are two cell configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.8.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.8.1.4.1-1.

Table 5.5.8.1.4.1-1: Supported test configurations for EN-DC FR2 MAC-CE based active TCI state switch

Config	Description
5.5.8.1-1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.5.8.1-2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Configure the test equipment and the DUT according to the parameters in Table 5.5.8.1.4.1-2.

Table 5.5.8.1.4.1-2: Initial conditions for EN-DC FR2 MAC-CE based active TCI state switch

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the test configuration selected from Table 5.5.8.1.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.TBD
	DUT Part	A.3.TBD
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.5.8.1.4.1-3.
2. Message contents are defined in clause 5.5.8.1.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.8.1.4.1-3: General test parameters for EN-DC FR2 MAC-CE based active TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	μs	3	Synchronous EN-DC
T1	s	[0.2]	
T2	s	[0.2]	

5.5.8.1.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and PSCell. The UE shall be configured with 2 different TCI states for PSCell: PDCCH TCI-state 0 (QCL'd to SSB0) and TCI-state 1 (QCL'd to SSB1), in Cell 2 before starting the test. TCI state-0 is indicated as the active PDCCH TCI-state

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.8.1.5-1. Propagation conditions are set according to clause C.2.3. T1 starts. During T1 only SSB to which PDCCH TCI-state 0 is QCL'd is transmitted.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.8.1.5-1. T2 starts. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting.
4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.
5. The UE transmits an *RRCReconfigurationComplete* message.
6. The SS sends a MAC-CE to indicate switch to TCI-state 1 in slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.
7. If the SS:
 - a) Receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 0 until slot $n+T_{\text{HARQ}}+24+8 \times T_{\text{first-SSB}}$, and
 - b) Receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 1 after slot $n+T_{\text{HARQ}}+40+8 \times T_{\text{first-SSB}}$
 the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.
8. When T2 expires the SS shall send a MAC-CE to indicate switch to TCI-state 0.
9. Wait 1s for the UE to switch TCI-state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 0 continue to step 11. Otherwise continue to step 10.
10. Switch the UE on and off. Ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
11. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.8.1.4.3 Message contents

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

Table 5.5.8.1.4.3-1: Common Exception messages for EN-DC FR2 MAC-CE based active TCI state switch

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	FFS

5.5.8.1.5 Test requirement

Tables 5.5.8.1.4.1-3, 5.5.8.1.5-1 and 5.5.8.1.5-2 define the primary level settings including test tolerances for EN-DC FR2 MAC-CE based active TCI state switch.

Table 5.5.8.1.5-1: NR Cell specific test parameters for EN-DC FR2 MAC-CE based active TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
BW _{channel}		100 MHz: N _{RB,c} = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTc Configuration		SMTc.1
TCI State 0		TC.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table 5.5.8.1.5-2: OTA related test parameter for EN-DC FR2 MAC-CE based active TCI state switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3			
N _{oc} ^{Note 1}	dBm/15 kHz	[-92.1]			
N _{oc} ^{Note 1}	dBm/SCS	[-83.1]			
\bar{E}_s/N_{oc}	dB	1	1	-Infinity	1
SS-RSRP ^{Note 2}	dBm/120 kHz ^{Note 3}	-82.1	-82.1	-Infinity	-82.1

I_{o} ^{Note2, Note6}	dBm/95.04 MHz ^{Note4}	-54.94	-54.94	-54.94	-54.94
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0dBi gain antenna at the center of the quiet zone.					

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n , UE shall be able to continue to receive on TCI state 0 until $n+T_{HARQ}+(3ms+T_{first-SSB})$ / NR slot length, where

- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [8];
- $T_{first-SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE;
- NR slot length = 0.125ms for 120kHz SSB SCS;

So UE shall be able to continue to receive PDCCH on TCI state 0 until $n+T_{HARQ}+24+8 \times T_{first-SSB}$

After receiving MAC-CE command in slot n , UE shall be able to receive PDCCH with TCI state 1 no later than at slot $n+T_{HARQ}+(3ms+T_{first-SSB} + T_{SSB-proc})$ / NR slot length., where

- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [8];
- $T_{first-SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE;
- $T_{SSB-proc} = 2$ ms;
- NR slot length = 0.125ms for 120kHz SSB SCS;

So UE shall be able to continue to receive PDCCH on TCI state 1 no later than $n+T_{HARQ}+40+8 \times T_{first-SSB}$

5.5.8.2 EN-DC FR2 RRC based active TCI state switch

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

- Message contents are not complete.
- Connection diagram is TBD.
- TT analysis is missing.
- RAN4 dependency: Test parameters have brackets and TBDs.

5.5.8.2.1 Test purpose

The purpose of this test is to verify the active TCI state switch delay requirement defined in TS 38.133 [6] clause 8.10.3.

5.5.8.2.2 Test applicability

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

5.5.8.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.5.8.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.5.8.2.

5.5.8.2.4 Test description

There are two cell configured in this test: E-UTRAN PCell (Cell 1) and NR PSCell (Cell 2). This test consists of two successive time periods, with time duration of T1 and T2 respectively.

5.5.8.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.5.8.2.4.1-1.

Table 5.5.8.2.4.1-1: Supported test configurations for EN-DC FR2 RRC based active TCI state switch

Config	Description
5.5.8.2-1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.5.8.2-2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Configure the test equipment and the DUT according to the parameters in Table 5.5.8.2.4.1-2.

Table 5.5.8.2.4.1-2: Initial conditions for EN-DC FR2 RRC based active TCI state switch

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, table E.5-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.		
Channel bandwidth	As specified by the test configuration selected from Table 5.5.8.2.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.TBD	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.TBD	
Exceptions to connection diagram	N/A		

1. The general test parameter settings are set up according to Table 5.5.8.2.4.1-3.
2. Message contents are defined in clause 5.5.8.2.4.3.
3. There are one E-UTRAN cell and one NR cell specified in the test. E-UTRAN Cell 1 is the cell used for connection setup with the power level set according to clause C.1.1 and C.1.2 for this test.

Table 5.5.8.2.4.1-3: General test parameters for EN-DC FR2 RRC based active TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	μs	3	Synchronous EN-DC
T1	s	[0,2]	
T2	s	[0,2]	

5.5.8.2.4.2 Test procedure

During the test PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Prior to the start of the time duration T1, the UE shall be fully synchronized to E-UTRA PCell and PSCell. The UE shall be configured with 2 different TCI states for PSCell: PDCCH TCI-state 0 (QCL'd to SSB0) and TCI-state 1 (QCL'd to SSB1), in Cell 2 before starting the test. TCI state-0 is indicated as the active PDCCH TCI-state

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
2. Set the parameters of NR Cell 1 according to T1 in Table 5.5.8.2.5-1. Propagation conditions are set according to clause C.2.3. T1 starts. During T1 only SSB to which PDCCH TCI-state 0 is QCL'd is transmitted.
3. When T1 expires the SS shall change the SNR value to T2 as specified in Table 5.5.8.2.5-1. T2 starts. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting.
4. The SS transmits an *RRCReconfiguration* message to configure periodic L1-RSRP reporting.
5. The UE transmits an *RRCReconfigurationComplete* message.
6. The SS sends an *RRCReconfiguration* message to indicate switch to TCI-state 1 in slot *n* which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1.
7. The UE transmits an *RRCReconfigurationComplete* message.
8. If the SS receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 1 after slot $n+176+8 \times T_{\text{first-SSB}}$ the number of successful tests is increased by one, otherwise the number of failed tests is increased by one.
9. When T2 expires the SS sends an *RRCReconfiguration* message to indicate switch to TCI-state 0.
10. The UE transmits an *RRCReconfigurationComplete* message.
11. Wait 1s for the UE to switch TCI-state 0. If the SS receives ACK/NACK on each UL transmission occasion scheduled on TCI-state 0 continue to step 13. Otherwise continue to step 12.
12. Switch the UE on and off. Ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity *EN-DC*, DC bearer *MCG* and *SCG*, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.4.
13. Repeat steps 2-10 for all subtests until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.5.8.2.4.3 Message contents

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

Table 5.5.8.2.4.3-1: Common Exception messages for EN-DC FR2 RRC based active TCI state switch

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	FFS

5.5.8.2.5 Test requirement

Tables 5.5.8.2.4.1-3, 5.5.8.2.5-1 and 5.5.8.2.5-2 define the primary level settings including test tolerances for EN-DC FR2 RRC based active TCI state switch.

Table 5.5.8.2.5-1: NR Cell specific test parameters for EN-DC FR2 RRC based active TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
BW _{channel}		100 MHz: N _{RB,c} = 66

Parameter	Unit	Cell 2
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTTC Configuration		SMTTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		
NOTE: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table 5.5.8.2.5-2: OTA related test parameter for EN-DC FR2 RRC based active TCI state switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3			
N_{oc} ^{Note 1}	dBm/15 kHz	[-92.1]			
N_{oc} ^{Note 1}	dBm/SCS	[-83.1]			
\bar{E}_s/N_{oc}	dB	1	1	-Infinity	1
SS-RSRP ^{Note 2}	dBm/120 kHz ^{Note 3}	-82.1	-82.1	-Infinity	-82.1
I_o ^{Note 2, Note 6}	dBm/95.04 MHz ^{Note 4}	-54.94	-54.94	-54.94	-54.94
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0dBi gain antenna at the center of the quiet zone.					

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to receive PDCCH with TCI state 1 no later than at slot n+ ($T_{RRC_processing} + T_{first-SSB} + T_{SSB-proc}$) / NR slot length, where

- $T_{RRC_processing}$ =20 ms is the RRC processing delay as specified in TS 38.331 [13];
- $T_{first-SSB}$ is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to TCI state 1;
- $T_{SSB-proc}$ = 2 ms;

- NR slot length = 0.125ms for 120kHz SSB SCS;

So UE shall be able to continue to receive PDCCH on TCI state 1 no later than slot $n+176+8 \times T_{\text{first-SSB}}$.

5.6 Measurement procedures

5.6.1 Intra-frequency measurements

5.6.1.0 Minimum conformance requirements

5.6.1.0.1 Minimum conformance requirements for event-triggered measurement without gap

[TS38.133, clause 9.2.2]

The requirements in Section 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in Sections 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in Sections 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_{RP} and SSB_{Ês}/I_{ot} according to Annex B.2.2 for a corresponding Band.

[TS38.133, clause 9.2.4.3]

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{\text{DCCH}}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{identify intra with index}}$ or $T_{\text{identify intra without index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{\text{identify intra without index}}$ or $T_{\text{identify intra with index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2. If a cell which has been detectable at least for the time period $T_{\text{identify intra without index}}$ or $T_{\text{identify intra with index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than $T_{\text{SSB_measurement_period_intra}}$ provided the timing to that cell has not changed more than $\pm 3200 T_c$ while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

[TS38.133-f60, clause 9.2.5.1]

The UE shall be able to identify a new detectable intra frequency cell within $T_{\text{identify_intra_without_index}}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index ($reportQuantityRsIndexes$ or $maxNrofRSIndexesToReport$ is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell ($deriveSSB-IndexFromCell$ is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{\text{identify_intra_with_index}}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{\text{identify_intra_without_index}}$. It is assumed that $deriveSSB-IndexFromCell$ is always enabled for FR1 TDD and FR2.

$$T_{\text{identify_intra_without_index}} = (T_{\text{PSS/SSS_sync_intra}} + T_{\text{SSB_measurement_period_intra}}) \text{ ms}$$

Where:

$T_{\text{PSS/SSS_sync_intra}}$: it is the time period used in PSS/SSS detection given in table 5.6.1.0.1-1

$T_{\text{SSB_measurement_period_intra}}$: equal to a measurement period of SSB based measurement given in table 5.6.1.0.1-2

$\text{CSSF}_{\text{intra}}$: it is a carrier specific scaling factor and is determined

-according to $\text{CSSF}_{\text{outside_gap},i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $\text{CSSF}_{\text{within_gap},i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra frequency SMTC is fully overlapping with measurement gaps.

-if the high layer in TS 38.331 [2] signalling of $smtc2$ is configured, the assumed periodicity of intra frequency SMTC occasions corresponds to the value of higher layer parameter $smtc2$; Otherwise the assumed periodicity of intra frequency SMTC occasions corresponds to the value of higher layer parameter $smtc1$.

$M_{\text{pss/sss_sync_w/o_gaps}}$: For a UE supporting FR2 power class 1, $M_{\text{pss/sss_sync}}=40$. For a UE supporting power class 2, $M_{\text{pss/sss_sync_w/o_gaps}}=24$. For a UE supporting FR2 power class 3, $M_{\text{pss/sss_sync_w/o_gaps}}=24$. For a UE supporting FR2 power class 4, $M_{\text{pss/sss_sync_w/o_gaps}}=24$

$M_{\text{meas_period_w/o_gaps}}$: For a UE supporting power class 1, $M_{\text{meas_period_w/o_gaps}}=40$. For a UE supporting FR2 power class 2, $M_{\text{meas_period_w/o_gaps}}=24$. For a UE supporting power class 3, $M_{\text{meas_period_w/o_gaps}}=24$. For a UE supporting power class 4, $M_{\text{meas_period_w/o_gaps}}=24$.

When intra frequency SMTC is fully non overlapping with measurement gaps or intra frequency SMTC is fully overlapping with MGs, $K_p=1$

When intra frequency SMTC is partially overlapping with measurement gaps, $K_p = 1/(1 - (\text{SMTC period} / \text{MGRP}))$, where $\text{SMTC period} < \text{MGRP}$

If the higher layer signalling in TS38.331 [2] signalling of $smtc2$ is present and $smtc1$ is fully overlapping with measurement gaps and $smtc2$ is partially overlapping with measurement gaps, requirements are not specified for $T_{\text{identify_intra_without_index}}$ or $T_{\text{identify_intra_with_index}}$

For FR2, if $SSB-ToMeasure$ is configured, when all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap is fully non-overlapping with the SSB symbols indicated by $SSB-ToMeasure$ and 1 symbol before each consecutive SSB symbols indicated by $SSB-ToMeasure$ and 1 symbol after each consecutive SSB symbols indicated by $SSB-ToMeasure$, $K_{\text{layer1_measurement}}=1$, otherwise $K_{\text{layer1_measurement}}=1.5$. If $SSB-ToMeasure$ is not configured, when any of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap is fully overlapping with intra-frequency SMTC, $K_{\text{layer1_measurement}}=1.5$, otherwise $K_{\text{layer1_measurement}}=1$.

If SCG DRX is in use, intra frequency cell identification requirements specified in Table 5.6.1.0.1-1 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.1-1: Time period for PSS/SSS detection, (Frequency range FR2)

DRX cycle	$T_{\text{PSS/SSS_sync_intra}}$
No DRX	$\max(600\text{ms}, \text{ceil}(M_{\text{pss/sss_sync_w/o_gaps}} \times K_p \times K_{\text{layer1_measurement}}) \times \text{SMTC period})^{\text{Note 1}} \times \text{CSSF}_{\text{intra}}$
DRX cycle \leq 320ms	$\max(600\text{ms}, \text{ceil}(1.5 \times M_{\text{pss/sss_sync_w/o_gaps}} \times K_p \times K_{\text{layer1_measurement}}) \times \max(\text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{\text{intra}}$
DRX cycle $>$ 320ms	$\text{ceil}(M_{\text{pss/sss_sync_w/o_gaps}} \times K_p \times K_{\text{layer1_measurement}}) \times \text{DRX cycle} \times \text{CSSF}_{\text{intra}}$
NOTE:	If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified

[TS38.133, clause 9.2.5.2]

The measurement period for intra frequency measurements without gaps is as shown in table 5.6.1.0.1-2. If the higher layer signalling in TS38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{\text{SSB_measurement_period_intra}}$

If SCG DRX is in use, intra frequency measurement period requirements specified in Table 5.6.1.0.1-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.1-2: Measurement period for intrafrequency measurements without gaps(Frequency FR2)

DRX cycle	$T_{\text{SSB_measurement_period_intra}}$
No DRX	$\max(400\text{ms}, \text{ceil}(M_{\text{meas_period_w/o_gaps}} \times K_p \times K_{\text{layer1_measurement}}) \times \text{SMTC period})^{\text{Note 1}} \times \text{CSSF}_{\text{intra}}$
DRX cycle \leq 320ms	$\max(400\text{ms}, \text{ceil}(1.5 \times M_{\text{meas_period_w/o_gaps}} \times K_p \times K_{\text{layer1_measurement}}) \times \max(\text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{\text{intra}}$
DRX cycle $>$ 320ms	$\text{ceil}(M_{\text{meas_period_w/o_gaps}} \times K_p \times K_{\text{layer1_measurement}}) \times \text{DRX cycle} \times \text{CSSF}_{\text{intra}}$
NOTE:	If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified

The normative reference for this requirement is TS 38.133 [6] clause 9.2.2, 9.2.4.3, 9.2.5.1, 9.2.5.2.

5.6.1.0.2 Minimum conformance requirements for event-triggered measurement with gap

[TS38.133, clause 9.2.2]

The requirements in Section 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in Sections 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in Sections 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_{RP} and SSB_{Es/Iot} according to Annex B.2.2 for a corresponding Band.

[TS38.133, clause 9.2.4.3]

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{identify_intra_with_index}}$ or $T_{\text{identify_intra_without_index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{\text{identify_intra_without_index}}$ or $T_{\text{identify_intra_with_index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2. If a cell which has been detectable at least for the time period $T_{\text{identify_intra_without_index}}$ or $T_{\text{identify_intra_with_index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_intra}$ provided the timing to that cell has not changed more than $\pm 3200 T_c$ while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

[TS38.133, clause 9.2.6.2]

The UE shall be able to identify a new detectable intra frequency cell within $T_{\text{identify_intra_without_index}}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRSIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{\text{identify_intra_with_index}}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{\text{identify_intra_without_index}}$. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{\text{identify_intra_without_index}} = (T_{\text{PSS/SSS_sync_intra}} + T_{\text{SSB_measurement_period_intra}}) \text{ ms}$$

Where:

$T_{\text{PSS/SSS_sync_intra}}$: it is the time period used in PSS/SSS detection given in table 5.6.1.0.2-1

$T_{\text{SSB_measurement_period_intra}}$: equal to a measurement period of SSB based measurement given in table 5.6.1.0.2-2

$CSSF_{\text{intra}}$: it is a carrier specific scaling factor and is determined according to $CSSF_{\text{within_gap},i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

$M_{\text{pss/sss_sync_with_gaps}}$: For a UE supporting FR2 power class 1, $M_{\text{pss/sss_sync_with_gaps}}=40$. For a UE supporting FR2 power class 2, $M_{\text{pss/sss_sync_with_gaps}}=24$. For a UE supporting FR2 power class 3, $M_{\text{pss/sss_sync_with_gaps}}=24$. For a UE supporting power class 4, $M_{\text{pss/sss_sync_with_gaps}}=24$

$M_{\text{meas_period_with_gaps}}$: For a UE supporting power class 1, $M_{\text{meas_period_with_gaps}}=40$. For a UE supporting power class 2, $M_{\text{meas_period_with_gaps}}=24$. For a UE supporting power class 3, $M_{\text{meas_period_with_gaps}}=24$. For a UE supporting power class 4, $M_{\text{meas_period_with_gaps}}=24$.

If the higher layer signalling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{\text{identify_intra_without_index}}$ or $T_{\text{identify_intra_with_index}}$.

If SCG DRX is in use, intrafrequency cell identification requirements specified in Table 5.6.1.0.2-1 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.2-1: Time period for PSS/SSS detection (Frequency range FR2)

DRX cycle	$T_{\text{PSS/SSS_sync_intra}}$
No DRX	$\max(600\text{ms}, M_{\text{pss/sss_sync_with_gaps}} \times \max(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{\text{intra}}$
DRX cycle \leq 320ms	$\max(600\text{ms}, \text{ceil}(1.5 \times M_{\text{pss/sss_sync_with_gaps}})) \times \max(\text{MGRP}, \text{SMTC period}, \text{DRX cycle}) \times \text{CSSF}_{\text{intra}}$
DRX cycle $>$ 320ms	$M_{\text{pss/sss_sync_with_gaps}} \times \max(\text{MGRP}, \text{DRX cycle}) \times \text{CSSF}_{\text{intra}}$

[TS38.133, clause 9.2.6.3]

The measurement period for FR2 intra frequency measurements with gaps is as shown in table 5.6.1.0.2-2.

If SCG DRX is in use, intrafrequency measurement period requirements specified in Table 5.6.1.0.2-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 5.6.1.0.2-2: Measurement period for intrafrequency measurements with gaps(Frequency Range FR2)

DRX cycle	$T_{\text{SSB_measurement_period_intra}}$
No DRX	$\max(400\text{ms}, M_{\text{meas_period_with_gaps}} \times \max(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{\text{intra}}$
DRX cycle \leq 320ms	$\max(400\text{ms}, \text{ceil}(1.5 \times M_{\text{meas_period_with_gaps}})) \times \max(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})^{\text{Note 1}} \times \text{CSSF}_{\text{intra}}$
DRX cycle $>$ 320ms	$M_{\text{meas_period_with_gaps}} \times \max(\text{MGRP}, \text{DRX cycle}) \times \text{CSSF}_{\text{intra}}$

The normative reference for this requirement is TS 38.133 [6] clause 9.2.2, 9.2.4.3, 9.2.6.2, 9.2.6.3.

5.6.1.1 EN-DC FR2 event-triggered reporting without gap in non-DRX

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

-Test frequency $f \leq 40.8$ GHz

-UE PC3

This test case is incomplete for UE power classes other than PC3

This test case is incomplete for test frequencies > 40.8 GHz

5.6.1.1.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search without gap under non-DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.1.2 Test applicability

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

5.6.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.1.

5.6.1.1.4 Test description

5.6.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.1.4.1-1.

Table 5.6.1.1.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting without gap under non-DRX

Configuration	Description
5.6.1.1-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.1-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.1-3	LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.1-4	LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations.

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.1.4.1-2.

Table 5.6.1.1.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting without gap under non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.1.1.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2
Connection Diagram	TE Part A.3.3.1.1 DUT Part A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	TBD	

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.1.4.1-3 below.
2. Message contents are defined in clause 5.6.1.1.4.3.
3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.1.4.1-3: General test parameters for EN-DC FR2 intra-frequency event triggered reporting tests without gap under non-DRX

Parameter	Unit	Config	Value	Comment
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTTC configuration		1~4	SMTTC.1	
A3-Offset	dB	1~4	-11	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μ s	Synchronous EN-DC

Parameter	Unit	Config	Value	Comment
Time offset between Cell 2 and Cell 3		1~4	3 μ s	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

5.6.1.1.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

1. Ensure the UE is in state `RRC_CONNECTED` with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.1.1.5-1.
3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.
4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.1.5-1. T2 starts.
6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 1442 ms, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit *RRCConnectionReconfiguration* message with condition `EN-DC_PSCell_Rel` according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.
9. The SS shall transmit *RRCConnectionReconfiguration* message with condition `MCG_and_SCG` according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state `RRC_CONNECTED` with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.1.1.4.3 Message contents

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

Table 5.6.1.1.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests without gap under non-DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 Table H.3.1-4 with A3-offset = -11dB Table H.3.1-7 with Condition INTRA-FREQ Table H.3.4-1 Table H.3.4-2

Table 5.6.1.1.4.3-2: MeasObjectNR (Step 3, test procedure)

Derivation Path: Table H.3.1-3 with condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
ssbSubcarrierSpacing	SubcarrierSpacing specified in 38.508-1 [14] Table 7.3.1-3a with condition SSB.3 FR2		5.6.1.1-1, 5.6.1.1-2
	SubcarrierSpacing specified in 38.508-1 [14] Table 7.3.1-3a with condition SSB.4 FR2		5.6.1.1-3, 5.6.1.1-4
smtc1	SSB-MTC specified in 38.508-1 [14] Table 7.3.1-3 with condition SMTC.1		
cellsToAddModList SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CellsToAddMod {	1 entry		
CellsToAddMod[1] SEQUENCE {		entry 1	
physCellId	PhysCellId of Cell 3		
cellIndividualOffset SEQUENCE {			
rsrpOffsetSSB	dB16		
rsrqOffsetSSB	Not present		
sinrOffsetSSB	Not present		
rsrpOffsetCSI-RS	Not present		
rsrqOffsetCSI-RS	Not present		
sinrOffsetCSI-RS	Not present		
}			
}			
}			

5.6.1.1.5 Test requirement

Tables 5.6.1.1.4.1-3, 5.6.1.1.5-1 and 5.6.1.1.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test without gap under non-DRX.

Table 5.6.1.1.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap under non-DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
BW _{channel}	MHz	1~4	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		1,2	24		24	
		3,4	48		48	
Initial BWP configuration		1~4	DLBWP.0.1		DLBWP.0.1	
			ULBWP.0.1		ULBWP.0.1	

Active DL BWP configuration		1~4	DLBWP.1.1	DLBWP.1.1
Active UL BWP configuration		1~4	ULBWP.1.1	ULBWP.1.1
RLM-RS		1~4	SSB	SSB
PDSCH RMC configuration		1,2	SR.3.2 TDD	N/A
		3,4	SR.3.3 TDD	
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD	CR.3.1 TDD
		3,4	CR.3.2 TDD	CR.3.2 TDD
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD	CCR.3.1 TDD
		3,4	CCR.3.7 TDD	CCR.3.7 TDD
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120	120
OCNG Patterns		1~4	OP.5	N/A
TRS configuration		1~4	TRS.2.1 TDD	N/A
PDSCH/PDCCH TCI state		1~4	TCI.State.2	N/A
cellIndividualOffset	dB	1~4	N/A	16
SSB configuration		1, 2	SSB.3 FR2	SSB.7 FR2
		3, 4	SSB.4 FR2	SSB.8 FR2
Propagation Condition		1~4	AWGN	

Table 5.6.1.1.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap under non-DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.9.3			
Assumption for UE beams ^{Note 4}		1~4	AoA1 Rough		AoA2 Rough	
E_s	dBm/SCS	1, 2	-89		-89	
		3, 4	-86		-86	
\hat{E}_s / I_{otBB} ^{Note 5}	dB	1~4	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
I_o	dBm/95.04MHz	1,2	-64.41	-64.41	-Infinity	-64.41
		3,4	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA	1~4	Defined in Figure 5.6.1.1.5-1	Time multiplexing of the downlink transmissions from each AoA		1~4	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						
NOTE 5: Calculation of E_s/I_{otBB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1440 ms from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCCH.

The overall delays measured shall be less than a total of 1442 ms in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

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

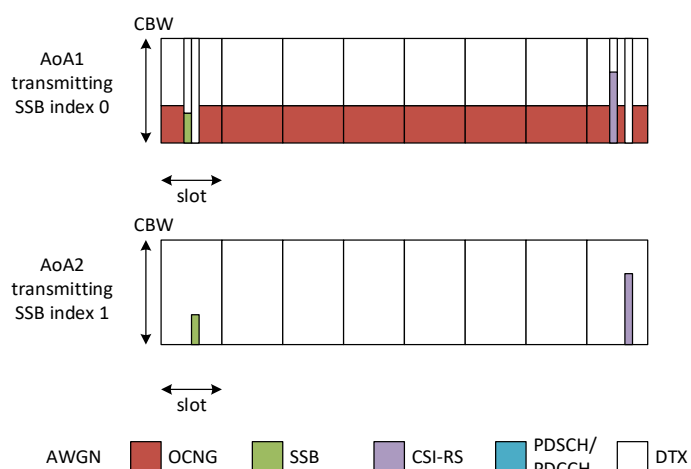


Figure 5.6.1.1.5-1: Time multiplexed downlink transmissions (Config 1,2 example)

5.6.1.2 EN-DC FR2 event-triggered reporting without gap in DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for test frequencies > 40.8 GHz

5.6.1.2.1 Test purpose
To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search without gap in DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.2.2 Test applicability

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

5.6.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.2.

5.6.1.2.4 Test description

5.6.1.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.2.4.1-1.

Table 5.6.1.2.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting without gap in DRX

Configuration	Description
5.6.1.2-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.2-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.2-3	LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.2-4	LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations.

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.2.4.1-2.

Table 5.6.1.2.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting without gap in DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.1.2.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2
Connection Diagram	TE Part	A.3.3.3.1-1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.3	
Exceptions to connection diagram	TBD		

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.2.4.1-3 below.
2. Message contents are defined in clause 5.6.1.2.4.3.
3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.2.4.1-3: General test parameters for EN-DC FR2 intra-frequency event triggered reporting tests without gap in DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)		
Neighbour cell		1~4	Cell 3		Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3		One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1~4	SMTC.1		
A3-Offset	dB	1~4	-7 (Note1)		
CP length		1~4	Normal		
Hysteresis	dB	1~4	0		
Time To Trigger	s	1~4	0		

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Filter coefficient		1~4	0		L3 filtering is not used
DRX		1~4	DRX.1	DRX. 7	DRX related parameters are defined in Table 5.6.1.2.5-2
Time offset between Cell 1 and Cell 2		1~4	3 μ s		Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μ s		Synchronous cells
T1	s	1~4	5		
T2	s	1~4	10	52	

NOTE: Test tolerance of -1dB applied

5.6.1.2.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

1. Ensure the UE is in state `RRC_CONNECTED` with generic procedure parameters Connectivity DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.1.2.5-1.
3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.
4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.2.5-1. T2 starts.
6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 4322 ms for Test 1 and 30722 ms for Test 2, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit *RRCConnectionReconfiguration* message with condition `EN-DC_PSCell_Rel` according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.
9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition `MCG_and_SCG` according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
10. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in `RRC_CONNECTED` with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5).
11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
12. Repeat step 1-11 for each sub-test in Table 5.6.1.2.4.1-3 as appropriate.

5.6.1.2.4.3 Message contents

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

Table 5.6.1.2.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests without gap in DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 Table H.3.1-3 with Condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR Table H.3.1-4 with A3-offset = -7dB Table H.3.1-7 with Condition INTRA-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.7-1 with Condition DRX.1 for Test 1 Table H.3.7-1 with Condition DRX. 7 for Test 2 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1
Specific message contents exceptions for Test Configuration 5.6.1.2-1 and 5.6.1.2-2	Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.3 FR2
Specific message contents exceptions for Test Configuration 5.6.1.2-3 and 5.6.1.2-4	Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.4 FR2

5.6.1.2.5 Test requirement

Tables 5.6.1.2.4.1-3, 5.6.1.2.5-1 and 5.6.1.2.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test without gap in DRX.

Table 5.6.1.2.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap in DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
BW _{channel}	MHz	1~4	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		1~4	66		66	
Initial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1~4	SSB		SSB	
PDSCH RMC configuration		1,2	SR.3.2 TDD		N/A	
		3,4	SR.3.3 TDD		N/A	
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD		N/A	
		3,4	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD		N/A	
		3,4	CCR.3.7 TDD		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
CSI-RS for tracking		1~4	TRS.2.1 TDD		N/A	
SSB configuration		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1~4	AWGN		AWGN	

Table 5.6.1.2.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap in DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 1 defined in A.9.1			
\hat{E}_s/I_{ot} BB Note 5	dB	1~4	3.77	-1.52	-Infinity	-1.52
N_{oc} Note 2	dBm/15 KHz	1~4	-101.5			
N_{oc} Note 2	dBm/SCS	1, 2	-92.5			
		3, 4	-89.5			
SSB_RP	dBm/SCS	1, 2	-88.47	-88.47	-Infinity	-88.47
		3, 4	-85.46	-85.46	-Infinity	-85.46
\hat{E}_s/N_{oc}	dB	1~4	4	4	-Infinity	4
I_o	dBm/95.04MHz	1~4	-58.03	-55.68	See Cell 2 columns	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: E_s/I_{ot} , SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						
NOTE 5: Calculation of $E_s/I_{ot_{dB}}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 4.32s from the beginning of time period T2.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 30.72s from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

The overall delays measured shall be less than a total of 4322 ms for Test 1 and 30722 ms for Test 2 in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

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

5.6.1.3 EN-DC FR2 event-triggered reporting with gap in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3

This test case is incomplete for UE power classes other than PC3

This test case is incomplete for test frequencies > 40.8 GHz

5.6.1.3.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search with gap in non-DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 forward, supporting EN-DC. This test applies to UE that support CSI-RS based RLM and BWP operation without bandwidth restriction.

5.6.1.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.3.

5.6.1.3.4 Test description

5.6.1.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.3.4.1-1.

Table 5.6.1.3.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting with gap in non-DRX

Configuration	Description
5.6.1.3-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.3-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.3-3	LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.3-4	LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations.

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.3.4.1-2.

Table 5.6.1.3.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting with gap in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.1.3.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2
Connection Diagram	TE Part	A.3.3.1.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	TBD	

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.3.4.1-3 below.
2. Message contents are defined in clause 5.6.1.3.4.3.
3. There are three cells in the test, E-UTRAN PCcell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.3.4.1-3: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
-----------	------	--------	-------	---------

Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
Gap type		1~4	Per-UE gaps	
Measurement gap repetition periodicity	ms	1~4	40	
Measurement gap length	ms	1~4	6	
Measurement gap offset	ms	1~4	39	
SMTC configuration		1~4	SMTC.1	
CSI-RS parameters		1~4	CSI-RS.3.2 TDD resource #0	
A3-Offset	dB	1~4	-11	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μ s	Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μ s	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

5.6.1.3.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

1. Ensure the UE is in state `RRC_CONNECTED` with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.1.3.5-1.
3. SS shall transmit an `RRCConnectionReconfiguration` message with event A3 configured.
4. The UE shall transmit `RRCConnectionReconfigurationComplete` message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.3.5-1. T2 starts.
6. UE shall transmit a `MeasurementReport` message triggered by Event A3 embedded in E-UTRA RRC message `ULInformationTransferMRDC`. If the overall delays measured from the beginning of time period T2 is less than 1922 ms, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receive the `MeasurementReport` message in step 6 or when T2 expires, the SS shall transmit `RRCConnectionReconfiguration` message with condition `EN-DC_PSCell_Rel` according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit `RRCConnectionReconfigurationComplete` message.

8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.
9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release O_n according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.1.3.4.3 Message contents

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

Table 5.6.1.3.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests with gap in non-DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTRA-FREQ and GAP NEEDED Table H.3.1-4 with A3-offset =-11dB Table H.3.1-7 with Condition INTRA-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition Pattern #0

PDSCH/PDCCH TCI state		1~4	TCI.State.2	N/A
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120	120
OCNG Patterns		1~4	OP.5	N/A
cellIndividualOffset	dB	1~4	N/A	16
SSB		1, 2	SSB.3 FR2	SSB.7 FR2
		3, 4	SSB.4 FR2	SSB.8 FR2
Propagation Condition		1~4	AWGN	

Table 5.6.1.3.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.3.9.3			
Assumption for UE beams ^{Note 4}		1~4	AoA1		AoA2	
			Rough		Rough	
E_s	dBm/SCS	1,2	-89		-89	
		3,4	-86		-86	
$\hat{E}_s / I_{ot} BB$ ^{Note 5}	dB	1~4	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
I_o	dBm/95.04MHz	1,2	-64.41	-64.41	-Infinity	-64.41
		3,4	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA	1~4	Defined in Figure 5.6.1.3.5-1	Time multiplexing of the downlink transmissions from each AoA		Time multiplexing of the downlink transmissions from each AoA	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						
NOTE 5: Calculation of $E_s/I_{ot} BB$ includes the effect of UE internal noise up to the value assumed for the associated R_{eSens} requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1.92s from the beginning of time period T2

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

The overall delays measured shall be less than a total of 1922 ms in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

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

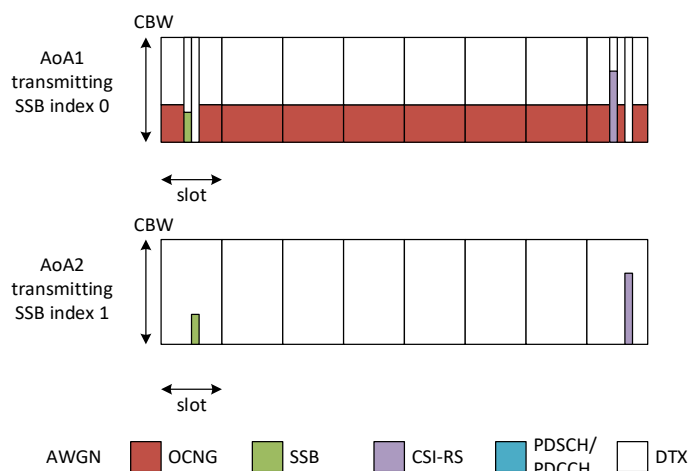


Figure 5.6.1.3.5-1: Time multiplexed downlink transmissions (Config 1,2 example)

5.6.1.4 EN-DC FR2 event-triggered reporting with gap in DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.1.4.1 Test purpose

To verify the UE's ability to make a correct reporting of an event within intra-frequency cell search with gap in DRX. This test will partly verify the TDD intra-frequency cell search requirements in TS 38.133 [6] clause 9.2.5.1 and 9.2.5.2

5.6.1.4.2 Test applicability

This test applies to all types of E-UTRA UE release 15 forward, supporting EN-DC. This test applies to UE that support CSI-RS based RLM, BWP operation without bandwidth restriction and long DRX cycle.

5.6.1.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.1.4.

5.6.1.4.4 Test description

5.6.1.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.1.4.4.1-1.

Table 5.6.1.4.4.1-1: Supported test configurations for EN-DC FR2 event-triggered reporting with gap in DRX

Configuration	Description
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5.6.1.4-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.4-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.4-3	LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.1.4-4	LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Configure the test requirement and the DUT according to the parameters in Table 5.6.1.4.4.1-2.

Table 5.6.1.4.4.1-2: Initial conditions for EN-DC FR2 event-triggered reporting with gap in DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.1.4.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2
Connection Diagram	TE Part	A.3.3.3.1-2	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	TBD		

1. The test parameters for PSCell and neighbour cell are given in Table 5.6.1.4.4.1-3 below.
2. Message contents are defined in clause 5.6.1.4.4.3.
3. There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.1 and C.1.2.

Table 5.6.1.4.4.1-3: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)		
Neighbour cell		1~4	Cell 3		Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3		One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
Gap type		1~4	Per-UE gaps		
Measurement gap repetition periodicity	ms	1~4	40		
Measurement gap length	ms	1~4	6		
Measurement gap offset	ms	1~4	39		
SMTC configuration		1~4	SMTC.1		
CSI-RS parameters		1~4	CSI-RS.3.2 TDD resource #0		
A3-Offset	dB	1~4	-7(Note1)		
CP length		1~4	Normal		
Hysteresis	dB	1~4	0		
Time To Trigger	s	1~4	0		
Filter coefficient		1~4	0		L3 filtering is not used
DRX		1~4	DRX.1	DRX.7	DRX related parameters are defined in Table 5.6.1.4.5-2
Time offset between Cell 1 and Cell 2		1~4	3µs		Synchronous EN-DC

Time offset between Cell 2 and Cell 3		1~4	3μs	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	10	52
Note1 : Test tolerance of -1dB applied				

5.6.1.4.4.2 Test procedure

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

1. Ensure the UE is in state `RRC_CONNECTED` with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.1.4.5-1.
3. SS shall transmit an *RRCConnectionReconfiguration* message with event A3 configured.
4. The UE shall transmit *RRCConnectionReconfigurationComplete* message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.1.4.5-1. T2 starts.
6. UE shall transmit a *MeasurementReport* message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delays measured from the beginning of time period T2 is less than 4322 ms for Test 1 and 30722 ms for Test 2, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receive the *MeasurementReport* message in step 6 or when T2 expires, the SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
8. Set Cell 3 physical cell identity = ((current cell 3 physical cell identity + 1) mod 1008) for next iteration of the test procedure loop.
9. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
10. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in `RRC_CONNECTED` with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5].
11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
12. Repeat step 1-11 for each sub-test in Table 5.6.1.2.4.1-3 as appropriate.

5.6.1.4.4.3 Message contents

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

Table 5.6.1.4.4.3-1: Common Exception messages EN-DC FR2 intra frequency event triggered reporting tests with gap in DRX

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTRA-FREQ and GAP NEEDED Table H.3.1-3 with Condition INTRA-FREQ MO, Synchronous cells and NOT SS-SINR Table H.3.1-4 with A3-offset = -7dB Table H.3.1-7 with Condition INTRA-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition Pattern #0 Table H.3.7-1 with Condition DRX.1 and Gap for test 1 Table H.3.7-1 with Condition DRX. 7 and Gap for test 2 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1
Specific message contents exceptions for Test Configuration 5.6.1.4-1 and 5.6.1.4-2	Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.3 FR2
Specific message contents exceptions for Test Configuration 5.6.1.4-3 and 5.6.1.4-4	Table 7.3.1-3a in TS 38.508-1 [14] with condition SSB.4 FR2

5.6.1.4.5 Test requirement

Tables 5.6.1.4.4.1-3, 5.6.1.4.5-1 and 5.6.1.4.5-2 define the primary level settings including test tolerances for EN-DC FR2 event triggered reporting test with gap in DRX.

Table 5.6.1.4.5-1: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{RB,C} = 66$		100: $N_{RB,C} = 66$	
Data RBs allocated		1~4	66		66	
Initial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1~4	CSI-RS		SSB	
PDSCH RMC configuration		1,2	SR.3.2 TDD		N/A	
		3,4	SR.3.3 TDD			
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD		CR.3.1 TDD	
		3,4	CR.3.2 TDD		CR.3.2 TDD	
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD		CCR.3.1 TDD	
		3,4	CCR.3.7 TDD		CCR.3.7 TDD	
TRS configuration		1~4	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
SSB		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	

Propagation Condition		1~4	AWGN	AWGN
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Table 5.6.1.4.5-2: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 1 defined in A.3.9.1			
\hat{E}_s/I_{ot} ^{BB Note 5}	dB	1~4	3.77	-1.52	-Infinity	-1.52
N_{oc} ^{Note 2}	dBm/15 KHz	1~4	-101.5			
N_{oc} ^{Note 2}	dBm/SCS	1, 2	-92.5			
		3, 4	-89.5			
SSB_RP	dBm/SCS	1, 2	-88.47	-88.47	-Infinity	-88.47
		3, 4	-85.46	-85.46	-Infinity	-85.46
\hat{E}_s/N_{oc}	dB	1~4	4	4	-Infinity	4
I_o	dBm/95.04MHz	1, 2	-58.03	-55.68	See Cell 2 columns	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: E_s/I_{ot} , SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						
NOTE 5: Calculation of $E_s/I_{ot_{dB}}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_{ref} from TS 38.101-2 [3] Table 6.2.1.3-4.						

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 4.32s from the beginning of time period T2

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 30.72s from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCCH.

The overall delays measured shall be less than a total of 4322 ms for Test 1 and 30722 ms for Test 2 in this test case (note: this gives a total measurement reporting delay plus 2 ms for TTI insertion uncertainty).

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

5.6.2 Inter-frequency measurements

5.6.2.0 Minimum conformance requirements for Inter-frequency measurements

The requirements in Section 9.3 apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in Sections 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in Sections 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_RP and SSB \hat{E}_s/Tot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter frequency cell within $T_{\text{identify_inter_without_index}}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRSIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{\text{identify_inter_with_index}}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{\text{identify_inter_without_index}}$.

$$T_{\text{identify_inter_without_index}} = (T_{\text{PSS/SSS_sync_inter}} + T_{\text{SSB_measurement_period_inter}}) \text{ ms}$$

$$T_{\text{identify_inter_with_index}} = (T_{\text{PSS/SSS_sync_inter}} + T_{\text{SSB_measurement_period_inter}} + T_{\text{SSB_time_index_inter}}) \text{ ms}$$

Where:

$T_{\text{PSS/SSS_sync_inter}}$: it is the time period used in PSS/SSS detection given in table 9.3.4-1 and table 9.3.4-2.

$T_{\text{SSB_time_index_inter}}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3 and table 9.3.4-4.

$T_{\text{SSB_measurement_period_inter}}$: equal to a measurement period of SSB based measurement given in table 9.3.5-1 and table 9.3.5-2.

$M_{\text{pss/sss_sync_inter}}$: For a UE supporting FR2 power class 1, $M_{\text{pss/sss_sync_inter}} = 64$ samples. For a UE supporting FR2 power class 2, $M_{\text{pss/sss_sync_inter}} = 40$ samples. For a UE supporting FR2 power class 3, $M_{\text{pss/sss_sync_inter}} = 40$ samples. For a UE supporting FR2 power class 4, $M_{\text{pss/sss_sync_inter}} = 40$ samples.

$M_{\text{SSB_index_inter}}$: For a UE supporting power FR2 class 1, $M_{\text{SSB_index_inter}} = 40$ samples. For a vehicle mounted UE supporting power class 2, $M_{\text{SSB_index_inter}} = 24$ samples. For a UE supporting power class 3, $M_{\text{SSB_index_inter}} = 24$ samples. For a UE supporting power class 4, $M_{\text{meas_period_inter}} = 24$ samples.

$M_{\text{meas_period_inter}}$: For a UE supporting FR2 power class 1, $M_{\text{meas_period_inter}} = 64$ samples. For a UE supporting FR2 power class 2, $M_{\text{meas_period_inter}} = 40$ samples. For a UE supporting FR2 power class 3, $M_{\text{meas_period_inter}} = 40$ samples. For a UE supporting FR2 power class 4, $M_{\text{meas_period_inter}} = 40$ samples.

$\text{CSSF}_{\text{inter}}$: it is a carrier specific scaling factor and is determined according to $\text{CSSF}_{\text{within_gap},i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

Table 9.3.4-2: Time period for PSS/SSS detection, (Frequency range FR2)

Condition ^{NOTE1,2}	$T_{\text{PSS/SSS_sync_inter}}$
No DRX	$\text{Max}(600\text{ms}, M_{\text{pss/sss_sync_inter}} \times \text{Max}(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{\text{inter}}$
DRX cycle $\leq 320\text{ms}$	$\text{Max}(600\text{ms}, (1.5 \times M_{\text{pss/sss_sync_inter}}) \times \text{Max}(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{\text{inter}}$
DRX cycle $> 320\text{ms}$	$M_{\text{pss/sss_sync_inter}} \times \text{DRX cycle} \times \text{CSSF}_{\text{inter}}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.4-4: Time period for time index detection (Frequency range FR2)

Condition ^{NOTE1,2}	$T_{\text{SSB_time_index_inter}}$
No DRX	$\text{Max}(200\text{ms}, M_{\text{SSB_index_inter}} \times \text{Max}(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{\text{inter}}$
DRX cycle $\leq 320\text{ms}$	$\text{Max}(200\text{ms}, (1.5 \times M_{\text{SSB_index_inter}}) \times \text{Max}(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{\text{inter}}$

DRX cycle > 320ms	$M_{SSB_index_inter} \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2:

Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (Frequency FR2)

Condition ^{NOTE1,2}	$T_{SSB_measurement_period_inter}$
No DRX	$\text{Max}(400\text{ms}, M_{meas_period_inter} \times \text{Max}(\text{MGRP, SMTC period})) \times CSSF_{inter}$
DRX cycle \leq 320ms	$\text{Max}(400\text{ms}, (1.5 \times M_{meas_period_inter}) \times \text{Max}(\text{MGRP, SMTC period, DRX cycle})) \times CSSF_{inter}$
DRX cycle > 320ms	$M_{meas_period_inter} \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{identify_inter_with_index}$. Both $T_{identify_inter_without_index}$ and $T_{identify_inter_with_index}$ are defined in clause 9.3.4. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4 and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_inter}$ defined in clause 9.3.5 provided the timing to that cell has not changed more than $\pm 3200 T_c$ while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used an additional delay can be expected.

The normative reference for this requirement is TS 38.133 [6] clause 9.3.2, 9.3.4, 9.3.5, 9.3.6.3.

5.6.2.1 EN-DC FR2-FR2 event-triggered reporting in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.1.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.1.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 1 is applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.1.

5.6.2.1.4 Test description

5.6.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.1.4.1-1.

Table 5.6.2.1.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in non-DRX supported test configurations

Test Case ID	Description
5.6.2.1-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.1-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table 5.6.2.1.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in TS 38.133 [6] clause 9.1.2-1.
Measurement gap offset		Config 1,2	39		
SMTC-SSB parameters		Config 1,2	SSB.3 FR2		As specified in clause A.3.2
offsetMO	dB	Config 1,2	16		Applied to NR Cell 3 measurement object
A3-Offset	dB	Config 1,2	-11		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	OFF		DRX is not used
Time offset between PCell and PScell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	5.2 for PC1; 3.5 for other PC	5.2 for PC1; 3.5 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.1.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.2.1.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part DUT Part	A.3.3.3.1 A.3.4.1.1
Exceptions to connection diagram		

1. Message contents are defined in clause 5.6.2.1.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 are set according to clause C.1.2 and clause C.1.3. Cell 3 is switched off during the initial connection setup.
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.
4. The AoA setup for this test is Setup 3 as defined in clause A.9. The UE RX spherical coverage direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.2.1.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration #0 as defined in Table 5.6.2.1.4.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.1.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release O_n according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.1.4.1-2. The TE shall ensure that the NR FR2 cells are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [3] and relative angular offset between active probes are according to Table A.9.3-1. T1 starts.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.1.4.1-2. T2 starts.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 5122 ms for UE supporting power class 1, or 3202 ms for UE supporting other power class for Test 1 and Test 2 then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
8. Set Cell 3 physical cell identity = [(current cell 3 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]
9. TE shall change the active probes in such way that relative angular offset between active probes differs in the following iteration.
10. The SS shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 10 fails, SS switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5..
11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
12. Repeat step 1-11 for each sub-test in Table 5.6.2.1.4.1-2 as appropriate.

5.6.2.1.4.3 Message contents

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

Table 5.6.2.1.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests in non-DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ for Test 1. For Test 2, additionally with condition GAP NEEDED Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells Table H.3.1-4 with A3-offset = -11dB Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 2 Table H.3.4-4 with Condition gapUE Test 1 Table H.3.4-5 with Condition Pattern #0 for Test 1 Table H.3.1-7 with Condition INTER-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

Table 5.6.2.1.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR2-FR2 measurement object configuration

Derivation Path: Table H.3.1-3			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
offsetMO SEQUENCE {			
rsrpOffsetSSB	dB16		
}			

5.6.2.1.5 Test requirement

Table 5.6.2.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.1.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 3 as specified in clause A.9			
			AoA1		AoA2	
Assumption for UE beams ^{Note 7}		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
BW_{channel}	MHz	Config 1,2	100: $N_{RB,c} = 66$		100: $N_{RB,c} = 66$	
Data RBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: $N_{RB,c} = 66$		100: $N_{RB,c} = 66$	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns		Config 1,2	OP.1		OP.1	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
RMSI CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
Dedicated CORESET Reference Channel		Config 1,2	CCR.3.1 TDD		-	
SMTTC configuration		Config 1,2	SMTTC.1		SMTTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
\hat{E}_s	dBm/SCS	Config 1,2	-87	-87	-Infinity	-87
SSB-RP ^{Note 3}	dBm/SCS ^{Note 5}	Config 1,2	-87	-87	-Infinity	-87
$\hat{E}_s / I_{\text{ot,BS}}$ ^{Note 8}	dB	Config 1,2	1.89	1.89	-Infinity	1.89
I_{o} ^{Note 3}	dBm/95.04 MHz ^{Note 5}	Config 1,2	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1,2	AWGN		AWGN	

NOTE 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2:	Void
NOTE 3:	SSB-RP, Es/lot and lo levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4:	Void
NOTE 5:	Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
NOTE 6:	As observed with 0dBi gain antenna at the centre of the quiet zone
NOTE 7:	Information about types of UE beam is given in TS 38.133 [6] Annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8:	Calculation of Es/lot _{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_s from TS 38.101-2 [3] Table 6.2.1.3-4.

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTIDCCH = 1$ ms; $2 \times TTIDCCH = 2$ ms

The overall delays measured shall be less than a total of 5122 ms in this test for power class UE and 3202 ms for other power classes.

5.6.2.2 EN-DC FR2-FR2 event-triggered reporting in DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.2.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.2.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Tests 1 and 2 are applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Tests 3 and 4 are applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.2.

5.6.2.2.4 Test description

5.6.2.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.2.4.1-1.

Table 5.6.2.2.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in DRX supported test configurations

Test Case ID	Description
5.6.2.2-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.2-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table 5.6.2.2.4-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2	1				One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2	1, 2				Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13			As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2	39				
SMTC-SSB parameters		Config 1,2	SSB.3 FR2				As specified in clause A.3
A3-Offset	dB	Config 1,2	-12				Value modified by TT
Hysteresis	dB	Config 1,2	0				
CP length		Config 1,2	Normal				
TimeToTrigger	s	Config 1,2	0				
Filter coefficient		Config 1,2	0				L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.5
Time offset between PCell and PScell		Config 1,2	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs				Synchronous cells.
T1	s	Config 1,2	5				
T2	s	Config 1,2	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.2.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in non-DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.2.2.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 5.6.2.2.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to clause C.1.2.
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.
4. The UE Rx beam peak direction for Cell 2 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.2.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.2.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.2.4.1-2. The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.2.4.1-2.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 7682 ms for UE supporting power class 1, or 4802 ms for UE supporting other power class for Test 1 and Test 3 and 81922 ms for UE supporting power class 1, or 51202 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.

7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]
9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
11. Repeat step 1-10 for each sub-test in Table 5.6.2.2.4.1-2 as appropriate.

5.6.2.2.4.3 Message contents

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

Commented [AvT1]: Please update.

Table 5.6.2.2.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests without SSB time index detection in DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ. For Test 3 and Test 4, with condition GAP NEEDED additionally. Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells Table H.3.1-4 with A3-offset = -12dB Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 3 and Test 4 Table H.3.4-4 with Condition gapUE Test 1 and Test 2 Table H.3.4-5 with Condition Pattern #0 for Test 1 and Test 2 Table H.3.1-7 with Condition INTER-FREQ Table H.3.7-1 with Condition DRX.1 for Test 1 and Test 3 Table H.3.7-1 with Condition DRX.7 for Test 2 and Test 4 Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

5.6.2.2.5 Test requirement

Table 5.6.2.2.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.2.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.9			
Assumption for UE beams ^{Note 7}		Config 1,2	Rough			
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
BW _{channel}	MHz	Config 1,2	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1		NA	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns		Config 1,2	OP.1		OP.1	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
SMTTC configuration		Config 1,2	SMTTC.1		SMTTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120 0		120 0	
EPRE ratio of PSS to SSS		Config 1,2				
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/15k Hz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SC S Note4	Config 1,2	-95.7	-95.7	-Infinity	-86.7
SSB_RP Note 3	dBm/SC S Note5	Config 1,2	-89.7	-89.7	-Infinity	9
\hat{E}_s / I_{ot}	dB	Config 1,2	6	6	-Infinity	9
\hat{E}_s / N_{oc}	dB	Config 1,2	6	6	-66.7	-57.2
I_{o} Note3	dBm/95.04 MHz Note5	Config 1,2	-59.7			
Propagation Condition						

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1, 2, 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = TTIDCCH = 1 ms; 2xTTIDCCH = 2 ms

The overall delays measured shall be less than a total of 7682 ms for power class 1 UE and 4802 ms for other power classes in test 1 and 81922 for power class 1 UE and 51202 ms for other power classes in test 2.

5.6.2.3 EN-DC FR2-FR2 event-triggered reporting in non-DRX with SSB time index detection

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.3.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.3.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 1 is applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.3.

5.6.2.3.4 Test description

5.6.2.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.3.4.1-1.

Table 5.6.2.3.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in non-DRX with SSB time index detection supported test configurations

Test Case ID	Description
5.6.2.3-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.3-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table 5.6.2.3.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	39	
SMTC-SSB parameters		Config 1,2	SSB. 3 FR2		As specified in clause A.3
offsetMO	dB	Config 1,2	16		Applied to NR Cell 3 measurement object
A3-Offset	dB	Config 1,2	-11		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	OFF		DRX is not used
Time offset between PCell and PScell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	7 for PC1; 4.5 for other PC	7 for PC1; 4.5 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.3.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in non-DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.2.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 5.6.2.3.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PScell and Cell 3 is the target cell. The power levels and settings for Cell 2 and are set according to clause C.1.2 and clause C.1.3. Cell 3 is switched off during the initial connection setup.
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.

4. The AoA setup for this test is Setup 3 as defined in clause A.9. The UE RX spherical coverage direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.2.3.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.3.4.1-1 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.3.4.1-1 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.3.4.1-2. The TE shall ensure that the NR FR2 cells are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [3] and relative angular offset between active probes are according to Table A.9.3-1. T1 starts.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.3.4.1-2. T2 starts.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 6722 ms for UE supporting power class 1, or 4162 ms for UE supporting other power class for Test 1 and Test 2, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
8. Set Cell 3 physical cell identity = [(current cell 3 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]
9. TE shall change the active probes in such way that relative angular offset between active probes differs in the following iteration.
10. The SS shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 10 fails, SS switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
11. Repeat step 2-10 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
12. Repeat step 1-11 for each sub-test in Table 5.6.2.3.4.1-2 as appropriate.

5.6.2.3.4.3 Message contents

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

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Table 5.6.2.3.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests without SSB time index detection in non-DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with condition INTER-FREQ. For Test 2, additionally with condition GAP NEEDED. Table H.3.1-3 with conditions INTER-FREQ MO and and Synchronous cells Table H.3.1-4 with condition SSB Index and A3-offset = -11dB Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 2 Table H.3.4-4 with condition gapUE for Test 1 Table H.3.4-5 with condition Pattern #0 for Test 1 Table H.3.1-7 with condition SSB Index and INTER-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

Table 5.6.2.3.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR2-FR2 measurement object configuration

Derivation Path: Table H.3.1-3			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
offsetMO SEQUENCE {			
rsrpOffsetSSB	dB16		
}			

5.6.2.3.5 Test requirement

Table 5.6.2.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.3.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 3 as specified in clause A.3.9			
			AoA1		AoA2	
Assumption for UE beams ^{Note 7}		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
BW _{channel}	MHz	Config 1,2	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Initial UL BWP		Config 1,2	DLBWP.0.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
RMSI CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
Dedicated CORESET Reference Channel		Config 1,2	CCR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
SMTC configuration		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
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)						
\hat{E}_s	dBm/SC S	Config 1	-87	-87	-Infinity	-87
SSB-RP ^{Note 3}	dBm/SC S ^{Note5}	Config 1,2	-87	-87	-Infinity	-87
\hat{E}_s / I_{ot_BB} ^{Note8}	dB	Config 1,2	1.89	1.89	-Infinity	1.89
I_o ^{Note3}	dBm/95.04 MHz ^{Note5}	Config 1,2	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1,2	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						
NOTE 3: SSB-RP, E_s/I_{ot} and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void						
NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in TS 38.133 [6] Annex B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of E_s/I_{ot_BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_s from TS 38.101-2 [3] Table 6.2.1.3-4.						

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTI_{DCCH} = 1$ ms; $2 \times TTI_{DCCH} = 2$ ms

The overall delays measured shall be less than a total of 6722 ms in this test for power class UE and 4162 ms for other power classes.

5.6.2.4 EN-DC FR2-FR2 event-triggered reporting in DRX with SSB time index detection

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

- Test frequency $f \leq 40.8$ GHz

- UE PC3

- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.4.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.4.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Test 1 is applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.4.

5.6.2.4.4 Test description

5.6.2.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.4.4.1-1.

Table 5.6.2.4.4.1-1: EN-DC FR2-FR2 event triggered reporting tests in DRX with SSB time index detection supported test configurations

Test Case ID	Description
5.6.2.4-1	LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.4-2	LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table 5.6.2.4.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2	1				One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2	1, 2				Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PSCell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		13		As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2	39		39		
SMT-C-SSB parameters		Config 1,2	SSB.3 FR2				As specified in clause A.3
A3-Offset	dB	Config 1,2	-12				Value modified by TT
Hysteresis	dB	Config 1,2	0				
CP length		Config 1,2	Normal				
TimeToTrigger	s	Config 1,2	0				
Filter coefficient		Config 1,2	0				L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.5
Time offset between PCell and PSCell		Config 1,2	3 μs				Synchronous EN-DC

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
Time offset between serving and neighbour cells		Config 1,2	3µs				Synchronous cells.
T1	s	Config 1,2	5				
T2	s	Config 1,2	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.4.4.1-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.2.4.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 5.6.2.4.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR1 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and are set according to clause C.1.2 and clause C.1.3. Cell 3 is switched off during the initial connection setup.
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.
4. The UE Rx beam peak direction for Cell 2 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.4.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.4.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.4.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.4.4.1-2.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.

4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.4.4.1-2.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 10082 ms for UE supporting power class 1, or 6242 ms for UE supporting other power class for Test 1 and Test 3 and 107522 ms for UE supporting power class 1, or 66562 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionReconfiguration message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message.
8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]
9. The SS shall transmit RRCConnectionReconfiguration message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit RRCConnectionReconfigurationComplete message. If either of the reconfiguration in step 7 or step 9 fails, SS switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
11. Repeat step 1-10 for each sub-test in Table 5.6.2.4.4.1-2 as appropriate.

5.6.2.4.4.3 Message contents

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

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Table 5.6.2.4.4.3-1: Common Exception messages for Additional EN-DC FR2-FR2 event triggered reporting tests with SSB time index detection in DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with condition INTER-FREQ. For Test 3 and Test 4, additionally with condition GAP NEEDED Table H.3.1-3 with conditions INTER-FREQ MO and and Synchronous cells Table H.3.1-4 with condition SSB Index and A3-offset = -12dB Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 3 and Test 4 Table H.3.4-4 with condition gapUE for Test 1 and Test 2 Table H.3.4-5 with condition Pattern #0 for Test 1 and Test 2 Table H.3.1-7 with condition SSB Index and INTER-FREQ Table H.3.7-1 with condition DRX.1 for Test 1 and Test 3 Table H.3.7-1 with condition DRX.7 for Test 2 and Test 4 Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

5.6.2.4.5 Test requirement

Table 5.6.2.4.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.4.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.3.9			
Assumption for UE beams ^{Note 7}		Config 1,2	Rough			
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
BW _{channel}	MHz	Config 1,2	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
SMTC configuration		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} ^{Note2}	dBm/15k Hz Note5					
N_{oc} ^{Note2}	dBm/SC S Note4	Config 1,2	-95.7		-95.7	
SSB_RP ^{Note 3}	dBm/SC S Note5	Config 1,2	-89.7	-89.7	-89.7	-89.7
\hat{E}_s / I_{ot}	dB	Config 1,2	6	6	6	6
\hat{E}_s / N_{oc}	dB	Config 1,2	6	6	6	6
I_o ^{Note3}	dBm/95.04 MHz Note5	Config 1,2	-59.7	-59.7	-59.7	-59.7
Propagation Condition		Config 1,2	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void						
NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in TS 38.133 Annex B.2.1.3, and does not limit UE implementation or test system implementation						

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $X1$ ms from the beginning of time period T2, where $X1$ is

- 10080 for UE supporting power class 1, or
- 6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $X2$ ms from the beginning of time period T2, where $X2$ is

- 107520 for UE supporting power class 1, or
- 66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1, 2, 3 and 4 UE is required to report SSB time index.

NOTE 1: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

NOTE 2: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTI_{DCCH} = 1$ ms; $2 \times TTI_{DCCH} = 2$ ms

The overall delays measured shall be less than a total of 10082 ms for power class 1 UE and 6242 ms for other power classes in test 1 and 107522 ms for power class 1 UE and 66562 ms for other power classes in test 2.

5.6.2.5 EN-DC FR1-FR2 event-triggered reporting in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.5.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements.

5.6.2.5.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 1 is applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.5.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.5.

5.6.2.5.4 Test description

5.6.2.5.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.5.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.5.4.1-2. Test environment parameters are given in Table 5.6.2.5.4.1-3.

Table 5.6.2.5.4.1-1 EN-DC FR1-FR2 event triggered reporting tests in non-DRX supported test configurations

Test Case ID	Description of serving cell	Description of target cell
5.6.2.5-1	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.5-2	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.5-3	LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	
5.6.2.5-4	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	
5.6.2.5-5	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.5-6	LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	
NOTE 1: The UE is only required to be tested in one of the supported test configurations		
NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2		

Table 5.6.2.5.4-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	13	As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	39	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1		As specified in clause A.3
		Config 2,5	SSB.1 FR1		As specified in clause A.3
		Config 3,6	SSB.2 FR1		As specified in clause A.3
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2		As specified in clause A.3
offsetMO	dB	Config 1,2,3,4,5,6	6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PScell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	5.2 for PC1; 3.5 for other PC	5.2 for PC1; 3.5 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.5.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table TBD and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.2.5.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram		

1. Message contents are defined in clause 5.6.2.5.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.
4. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.5.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.5.4.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.5.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.5.4.1-2. The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.5.4.1-2.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 5122 ms for UE supporting power class 1, or 3202 ms for UE supporting other power class for Test 1 and Test 2 then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.
8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),
- or:
- switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

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

11. Repeat step 1-10 for each sub-test in Table 4.6.2.1.4.1-2 as appropriate.

5.6.2.5.4.3 Message contents

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

Commented [AvT4]: Update

Table 5.6.2.5.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests without SSB time index detection in non-DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ. For Test 2, additionally with condition GAP NEEDED Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells Table H.3.1-4AA with A4-threshold = -105 Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 2 Table H.3.4-4 with Condition gapUE Test 1 Table H.3.4-5 with Condition Pattern #0 for Test 1 Table H.3.1-7 with Condition INTER-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

Table 5.6.2.5.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

Derivation Path: Table H.3.1-3			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
offsetMO SEQUENCE {			
rsrpOffsetSSB	6 dB		
}			

5.6.2.5.5 Test requirement

Table 5.6.2.5.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.5.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1	
Assumption for UE beams ^{Note 7}		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
BW _{channel}	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66	
BWP BW	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66	
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
Dedicated CORESET RMC configuration		Config 1,4	CCR.1.1 FDD		CCR.3.1 TDD	
		Config 2,5	CCR.1.1 TDD		CCR.3.1 TDD	
		Config 3,6	CCR.2.1 TDD		CCR.3.1 TDD	
SMTC configuration		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
\hat{E}_s	dBm/SC S	Config 1,2,3,4,5,6	Link only, see clause A.3.7A		-Infinity	-87
SSB_RP ^{Note 3}	dBm/SC S Note5	Config 1,2,3,4,5,6			-Infinity	-87
$\hat{E}_s/I_{ot\ BB}$ ^{Note 8}	dB	Config 1,2,3,4,5,6			-Infinity	14.69
I_o ^{Note3}	dBm/95. 04 MHz Note5	Config 1,2,3,4,5,6			-Infinity	-58.01
Propagation Condition		Config 1,2,3,4,5,6			AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						
NOTE 3: SSB_RP, \hat{E}_s/I_{ot} and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void.						
NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of $\hat{E}_s/I_{ot\ BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_s from TS 38.101-2 [19] Table 6.2.1.3-4.						

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%. In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTI_{DCCH} = 1$ ms; $2xTTI_{DCCH} = 2$ ms

The overall delays measured shall be less than a total of 5122 ms in this test for power class UE and 3202 ms for other power classes.

5.6.2.6 EN-DC FR1-FR2 event-triggered reporting in DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.6.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event in DRX within inter-frequency cell search requirements.

5.6.2.6.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Tests 1 and 2 are applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Tests 3 and 4 are applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.6.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.6.

5.6.2.6.4 Test description

5.6.2.6.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.6.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.6.4.1-2. Test environment parameters are given in Table 5.6.2.6.4.1-3.

Table 5.6.2.6.4.1-1: EN-DC FR1-FR2 event triggered reporting tests in DRX supported test configurations

Test Case ID	Description of serving cell	Description of target cell
5.6.2.6-1	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	120 kHz SSB SCS,
5.6.2.6-2	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	100MHz bandwidth, TDD
5.6.2.6-3	LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	duplex mode
5.6.2.6-4	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	
5.6.2.6-5	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.6-6	LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2

Table 5.6.2.6.4-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		13		As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39		39		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1				As specified in clause A.3
		Config 2,5	SSB.1 FR1				As specified in clause A.3
		Config 3,6	SSB.2 FR1				As specified in clause A.3
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2				As specified in clause A.3
	<i>offsetMO</i>	dB	Config 1,2,3,4,5,6				6
Hysteresis	dB	Config 1,2,3,4,5,6				0	
<i>a4-Threshold</i>	dBm	Config 1,2,3,4,5,6				-105	

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.5
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μ s				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms				Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3 μ s				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.6.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table TBD and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2		
Channel bandwidth	As specified by the test configuration selected from Table 4.6.2.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 4.6.2.3.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.
4. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.6.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.6.4-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.6.4-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore UE is allocated with PUSCH resource at every DRX cycle.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.6.4-2. The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.6.4-2.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 7682 ms for UE supporting power class 1, or 4802 ms for UE supporting other power class for Test 1 and Test 3 and 81922 ms for UE supporting power class 1, or 51202 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.
8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]
9. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),
 - or:
 - switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
11. Repeat step 1-10 for each sub-test in Table 5.6.2.6.4-2 as appropriate.

5.6.2.6.4.3 Message contents

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

Table 5.6.2.6.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests without SSB time index detection in DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ. For Test 3 and 4, additionally with condition GAP NEEDED Table H.3.1-3 with Conditions INTER-FREQ MO and Synchronous cells Table H.3.1-4AA with A4-threshold = -105 Table H.3.1-6 with Conditions gapFR2 and Pattern #13 for Test 3 and Test 4 Table H.3.4-4 with Condition gapUE Test 1 and Test 2 Table H.3.4-5 with Condition Pattern #0 for Test 1 and Test 2 Table H.3.1-7 with Condition INTER-FREQ Table H.3.7-1 with Condition DRX.1 for Test 1 and Test 3 Table H.3.7-1 with Condition DRX.2 for Test 2 and Test 4 Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

Table 5.6.2.6.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

Derivation Path: Table H.3.1-3			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
offsetMO SEQUENCE {			
rsrpOffsetSSB	6 dB		
}			

5.6.2.6.5 Test requirement

Table 5.6.2.6.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.6.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.9	
Assumption for UE beams ^{Note 7}		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
BW _{channel}	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66	
BWP BW	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66	
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference		Config 1,4	CR.1.1 FDD		-	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Channel		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
Dedicated CORESET RMC configuration		Config 1,4	CCR.1.1 FDD		CCR.3.1 TDD	
		Config 2,5	CCR.1.1 TDD		CCR.3.1 TDD	
		Config 3,6	CCR.2.1 TDD		CCR.3.1 TDD	
SMTC configuration		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} ^{Note2}	dBm/15k Hz Note5					-104.7
N_{oc} ^{Note2}	dBm/SC S Note4	Config 1,2,4,5			-95.7	
		Config 3,6			-95.7	
SSB_RP ^{Note 3}	dBm/SC S Note5	Config 1,2,4,5			-Infinity	-86.7
		Config 3,6			-Infinity	-86.7
\hat{E}_s/I_{ot}	dB	Config 1,2,3,4,5,6	NA Link only, see clause A.3.7A		-Infinity	9
\hat{E}_s/N_{oc}	dB	Config 1,2,3,4,5,6			-Infinity	9
I_o ^{Note3}	dBm/9.36MHz	Config 1,2,4,5			-	-
	dBm/38.16MHz	Config 3,6			-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6			-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6			AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X_1 ms from the beginning of time period T2, where X_1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X_2 ms from the beginning of time period T2, where X_2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with the confidence level of 95%.

In test 1, 2, 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTIDCCH = 1$ ms; $2xTTIDCCH = 2$ ms

The overall delays measured shall be less than a total of 7682 ms for power class 1 UE and 4802 ms for other power classes in test 1 and test 3 and 81922 for power class 1 UE and 51202 ms for other power classes in test 2 and test 4.

5.6.2.7 EN-DC FR1-FR2 event-triggered reporting in non-DRX with SSB time index detection

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

- Test frequency $f \leq 40.8$ GHz

- UE PC3

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

- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.7.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event within inter-frequency cell search requirements with SSB time index detection.

5.6.2.7.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC. Test 1 is applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Test 2 is applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.7.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.7.

5.6.2.7.4 Test description

5.6.2.7.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.7.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.7.4.1-2. Test environment parameters are given in Table 5.6.2.7.4.1-3.

Table 5.6.2.7.4.1-1: EN-DC FR1-FR2 event triggered reporting tests in non-DRX with SSB time index detection supported test configurations

Test Case ID	Description of serving cell	Description of target cell
5.6.2.7-1	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.7-2	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.7-3	LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	
5.6.2.7-4	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	
5.6.2.7-5	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.7-6	LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	
NOTE 1: The UE is only required to be tested in one of the supported test configurations		
NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2		

Table 5.6.2.7.4-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PSCell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	13	As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	39	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1		As specified in clause A.3
		Config 2,5	SSB.1 FR1		As specified in clause A.3
		Config 3,6	SSB.2 FR1		As specified in clause A.3
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2		As specified in clause A.3
offsetMO	dB	Config 1,2,3,4,5,6	6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	7 for PC1; 4.5 for other PC	7 for PC1; 4.5 for other PC	PC1 – power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.7.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection in non-DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table TBD and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2		
Channel bandwidth	As specified by the test configuration selected from Table 4.6.2.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 5.6.2.7.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.
4. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.7.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as Pcell on E-UTRA RF channel 1, NR cell 2 as PCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1 measurement gap pattern configuration # 0 as defined in Table 5.6.2.7.4.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table 5.6.2.7.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.7.4-2 The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction. T1 starts.
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.7.4.1-2.
6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 6722 ms for UE supporting power class 1, or 4162 ms for UE supporting other power class for Test 1 and Test 2 then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.
8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]

9. After the RRC connection release, the SS:

- transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),

or:

- switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.

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

11. Repeat step 1-10 for each sub-test in Table 5.6.2.7.41.-2 as appropriate.

5.6.2.7.4.3 Message contents

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

Table 5.6.2.7.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests with SSB time index detection in non-DRX 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 conditions and INTER-FREQ. For Test 2, additionally with condition GAP NEEDED Table H.3.1-3 with conditions INTER-FREQ MO and Synchronous cells Table H.3.1-4AA with condition SSB Index and A4-threshold = -105 Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 2 Table H.3.4-4 with condition gapUE for Test 1 Table H.3.4-5 with condition Pattern #0 for Test 1 Table H.3.1-7 with condition SSB Index and INTER-FREQ Table H.3.4-1 Table H.3.4-2 Table H.3.4-3 Table H.3.1-4 a4 threshold = TBD

Table 5.6.2.7.4.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

Derivation Path: Table H.3.1-3			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
offsetMO SEQUENCE {			
rsrpOffsetSSB	6 dB		
}			

5.6.2.7.5 Test requirement

Table 5.6.2.7.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.7.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6		NA		Setup 1
Assumption for UE beams ^{Note 7}		Config 1,2,3,4,5,6		N/A		Rough
NR RF Channel Number		Config 1,2,3,4,5,6		1		2
Duplex mode		Config 1,4		FDD		TDD

Parameter	Unit	Test configuration	Cell 2		Cell 3						
			T1	T2	T1	T2					
		Config 2,3,5,6	TDD		TDD						
BW _{channel}	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66						
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66						
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66						
BWP BW	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66						
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66						
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66						
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1						
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-						
		Config 2,5	SR.1.1 TDD								
		Config 3,6	SR.2.1 TDD								
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-						
		Config 2,5	CR.1.1 TDD								
		Config 3,6	CR.2.1 TDD								
Dedicated CORESET RMC configuration		Config 1,4	CCR.1.1 FDD		CCR.3.1 TDD						
		Config 2,5	CCR.1.1 TDD		CCR.3.1 TDD						
		Config 3,6	CCR.2.1 TDD		CCR.3.1 TDD						
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1						
		Config 3,6	TDDConf.2.1		TDDConf.3.1						
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA						
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA						
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA						
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA						
SMTc configuration		Config 1,4	SMTc.2		SMTc.2						
		Config 2,3,5,6	SMTc.1		SMTc.1						
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120						
		Config 3,6	30		120						
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0						
EPRE ratio of PBCH DMRS to SSS		1,2,3,4,5,6	Link only, see clause A.3.7A								
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)											
\bar{E}_s	dBm/SCS						Config 1,2,3,4,5,6			-Infinity	-87
SSB _{RP} ^{Note 3}	dBm/SCS						Config 1,2,3,4,5,6			-Infinity	-87
$\hat{E}_v/I_{out, BB}$ ^{Note 8}	dB	Config 1,2,3,4,5,6			-Infinity	14.69					
I_o ^{Note 3}	dBm/95.04 MHz	Config 1,2,3,4,5,6			-Infinity	-58.01					
Propagation Condition		Config 1,2,3,4,5,6			AWGN						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						
NOTE 3: SS-RP, Es/lot and lo levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void						
NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/lot _{BS} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB _S from TS 38.101-2 [19] Table 6.2.1.3-4.						

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTI_{DCCH} = 1$ ms; $2xTTI_{DCCH} = 2$ ms

The overall delays measured shall be less than a total of 6722 ms in this test for power class UE and 4162 ms for other power classes.

5.6.2.8 EN-DC FR1-FR2 event-triggered reporting in DRX with SSB time index detection

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

5.6.2.8.1 Test purpose

The purpose of this test is to verify that the UE makes correct reporting of an event in DRX within inter-frequency cell search requirements with SSB time index detection.

5.6.2.8.2 Test applicability

This test applies to all types of E-UTRA UE release 15 and forward, supporting EN-DC FR2 and long DRX cycle. Tests 1 and 2 are applicable to UEs not supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Tests 3 and 4 are applicable only to UEs supporting per-FR gap (*IndependentGapConfig*, as defined in TS 38.306) and Gap Pattern Id 13.

5.6.2.8.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.2.0.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.2.8.5.6.2.8.4 Test description

5.6.2.8.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.2.8.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.2.8.4.1-2. Test environment parameters are given in Table 5.6.2.8.4.1-3.

Table 5.6.2.8.4.1-1: EN-DC FR1-FR2 event triggered reporting tests in DRX with SSB time index detection supported test configurations

Test Case ID	Description of serving cell	Description of target cell
5.6.2.8-1	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
5.6.2.8-2	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.8-3	LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	
5.6.2.8-4	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode	
5.6.2.8-5	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode	
5.6.2.8-6	LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode	
NOTE 1: The UE is only required to be tested in one of the supported test configurations		
NOTE 2: The target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2		

Table A.5.6.2.8.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		13		As specified in TS 38.133 clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39		39		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1				As specified in clause A.3
		Config 2,5	SSB.1 FR1				As specified in clause A.3
		Config 3,6	SSB.2 FR1				As specified in clause A.3
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2				As specified in clause A.3
	offsetMO	dB	Config 1,2,3,4,5,6 6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105				
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.5
Time offset between PCell and PScell		Config 1,2,3,4,5,6	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms				Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs				Synchronous cells.

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	PC1 - power class 1 as specified in TS 38.101-2 [3] Table 6.2.1.0

Table 5.6.2.8.4-3: Test Environment test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table TBD and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and NR FR1, 7.2.3 for NR FR2		
Channel bandwidth	As specified by the test configuration selected from Table 4.6.2.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 5.6.2.8.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 and Cell 3 are NR FR2 cells in different frequencies. Cell 2 is the PSCell and Cell 3 is the target cell. The power levels and settings for Cell 2 and Cell 3 are set according to Annex TBD.
3. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.
4. The UE Rx beam peak direction for Cell 3 has been obtained previously using one of the Rx beam peak search procedures as described in Annex I.

5.6.2.8.4.2 Test procedure

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table 5.6.2.8.4.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table 5.6.2.8.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.2.8.4-2 The TE shall ensure that the NR FR2 cell will be received by the UE from the Rx beam peak direction.. T1 starts,
3. The SS shall transmit an RRCConnectionReconfiguration message on Cell 1.
4. The UE shall transmit RRCConnectionReconfigurationComplete message.
5. When T1 expires, the SS shall switch the power setting from T1 to T2 as specified in Table 5.6.2.8.4.1-2.

6. UE shall transmit a MeasurementReport message triggered by Event A3 embedded in E-UTRA RRC message *ULInformationTransferMRDC*. If the overall delay measured from the beginning of time period T2 is less than 10082 ms for UE supporting power class 1, or 6242 ms for UE supporting other power class for Test 1 and Test 3 and 107522 ms for UE supporting power class 1, or 66562 ms for UE supporting other power class for Test 2 and Test 4, then the number of successful tests is increased by one. If the UE fails to report the event within the overall delays measured requirement then the number of failure tests is increased by one.
7. After the SS receives the MeasurementReport message in step 6 or when T2 expires, the SS shall transmit RRCConnectionRelease message to release the RRC connection which includes the release of the established radio bearers as well as all radio resources.
8. Set Cell 3 physical cell identity = [(current cell 2 physical cell identity + 1) mod 1008] for next iteration of the test procedure loop.]
9. After the RRC connection release, the SS:
 - transmits in Cell 1 a Paging message (including PagingRecord with ue-Identity) for the UE and ensures the UE in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5. (if the paging fails, switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.),
 - or:
 - switches off and on the UE and ensures the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat step 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.
11. Repeat step 1-10 for each sub-test in Table 5.6.2.8.4.1-2 as appropriate.

5.6.2.8.4.3 Message contents

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

Commented [AvT5]: Update

Table 5.6.2.8.4.3-1: Common Exception messages for Additional EN-DC FR1-FR2 event triggered reporting tests with SSB time index detection in DRX test requirement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with condition INTER-FREQ. For Test 3 and 4, additionally with condition GAP NEEDED Table H.3.1-3 with conditions INTER-FREQ MO and Synchronous cells Table H.3.1-4AA with condition SSB Index and A4-threshold = -105 Table H.3.1-6 with conditions gapFR2 and Pattern #13 for Test 3 and Test 4 Table H.3.4-4 with condition gapUE for Test 1 and Test 2 Table H.3.4-5 with condition Pattern #0 for Test 1 and Test 2 Table H.3.1-7 with condition SSB Index and INTER-FREQ Table H.3.7-1 with condition DRX.1 for Test 1 and Test 3 Table H.3.7-1 with condition DRX.2 for Test 2 and Test 4 Table H.3.4-1 Table H.3.4-2 Table H.3.4-3

Table 5.6.2.5.8.3-2: MeasObjectNR-DEFAULT: EN-DC FR1-FR2 measurement object configuration

Derivation Path: Table H.3.1-3			
Information Element	Value/remark	Comment	Condition
MeasObjectNR ::= SEQUENCE {			
offsetMO SEQUENCE {			
rsrpOffsetSSB	6 dB		
}			

5.6.2.8.5 Test requirement

Table 5.6.2.8.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.2.8.5-1: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection in DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.9	
Assumption for UE beams ^{Note 7}		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
BW _{channel}	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66	
BWP BW	MHz	Config 1,4	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 2,5	10: N _{RB,c} = 52		100: N _{RB,c} = 66	
		Config 3,6	40: N _{RB,c} = 106		100: N _{RB,c} = 66	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
Dedicated CORESET RMC configuration		Config 1,4	CCR.1.1 FDD		CCR.3.1 TDD	
		Config 2,5	CCR.1.1 TDD		CCR.3.1 TDD	
		Config 3,6	CCR.2.1 TDD		CCR.3.1 TDD	
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
SMTC configuration		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} ^{Note2}	dBm/15 kHz		NA Link only, see clause A.3.7A		-104.7	
N_{oc} ^{Note2}	dBm/S CS	Config 1,2,4,5			-95.7	
	Note4	Config 3,6			-95.7	
SSB_RP ^{Note 3}	dBm/S CS	Config 1,2,4,5	-Infinity	-86.7		
		Note5	Config 3,6	-Infinity	-86.7	
\hat{E}_s / I_{ot}	dB	Config 1,2,3,4,5,6	-Infinity	9		
\hat{E}_s / N_{oc}	dB	Config 1,2,3,4,5,6	-Infinity	9		
I_o ^{Note3}	dBm/9.36MHz	Config 1,2,4,5	-	-		
	dBm/38.16MHz	Config 3,6	-	-		
	dBm/95.04 MHz	Config 1,2,3,4,5,6	-66.7	-57.2		
Propagation Condition		Config 1,2,3,4,5,6	AWGN			
<p>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.</p> <p>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.</p> <p>NOTE 3: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>NOTE 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone</p> <p>NOTE 6: As observed with 0dBi gain antenna at the centre of the quiet zone</p> <p>NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>						

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90% with a confidence level of 95%.

In test 1, 2, 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

TTI insertion uncertainty = $TTI_{DCCH} = 1$ ms; $2 \times TTI_{DCCH} = 2$ ms

The overall delays measured shall be less than a total of 10082 ms for power class 1 UE and 6242 ms for other power classes in test 1 and test 3 and 107522 for power class 1 UE and 66562 ms for other power classes in test 2 and test 4.

5.6.3 L1-RSRP measurement for beam reporting

5.6.3.0 Minimum conformance requirements

5.6.3.0.1 Minimum conformance requirements for SSB-based L1-RSRP measurement for beam reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1-RSRP_Measurement_Period_SSB}$.

The value of $T_{L1-RSRP_Measurement_Period_SSB}$ is defined in Table 9.5.4.1-2 for FR2, where

- $M=1$ if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and $M=3$ otherwise
- $N=8$.

For FR2,

- $P = \frac{1}{1 - \frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{\text{sharing factor}}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1 - \frac{T_{SSB}}{MGRP} - \frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{SMTCperiod} \neq MGRP$ or
 - $T_{SMTCperiod} = MGRP$ and $T_{SSB} < 0.5 * T_{SMTCperiod}$
- P is $\frac{P_{\text{sharing factor}}}{1 - \frac{T_{SSB}}{MGRP}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{SSB} = 0.5 * T_{SMTCperiod}$
- $P = \frac{1}{1 - \frac{T_{SSB}}{\min(T_{SMTCperiod}, MGRP)}}$, when SSB is partially overlapped with measurement gap ($T_{SSB} < MGRP$) and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- P is $\frac{P_{\text{sharing factor}}}{1 - \frac{T_{SSB}}{MGRP}}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)
- $P_{\text{sharing factor}} = 1$, if the SSB configured for L1-RSRP measurement outside measurement gap is
 - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,
 - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,
- $P_{\text{sharing factor}} = 3$, otherwise.

Where:

- $T_{SSB} = \text{ssb-periodicityServingCell}$
- $T_{SMTCperiod}$ = the configured SMTC period

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

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

Table 9.5.4.1-1: Measurement period $T_{L1-RSRP_Measurement_Period_SSB}$ for FR1

Configuration	$T_{L1-RSRP_Measurement_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M \cdot P) \cdot T_{SSB})$
DRX cycle $\leq 320\text{ms}$	$\max(T_{Report}, \text{ceil}(1.5 \cdot K \cdot M \cdot P) \cdot \max(T_{DRX}, T_{SSB}))$
DRX cycle $> 320\text{ms}$	$\text{ceil}(M \cdot P) \cdot T_{DRX}$
NOTE 1: $T_{SSB} = \text{ssb-periodicityServingCell}$ is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: $K = 1$ when $T_{SSB} \leq 40\text{ms}$ and RRM enhancements for high speed are configured; otherwise $K = 1.5$.	

Table 9.5.4.1-2: Measurement period $T_{L1-RSRP_Measurement_Period_SSB}$ for FR2

Configuration	$T_{L1-RSRP_Measurement_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M \cdot P \cdot N) \cdot T_{SSB})$
DRX cycle $\leq 320\text{ms}$	$\max(T_{Report}, \text{ceil}(1.5 \cdot M \cdot P \cdot N) \cdot \max(T_{DRX}, T_{SSB}))$
DRX cycle $> 320\text{ms}$	$\text{ceil}(1.5 \cdot M \cdot P \cdot N) \cdot T_{DRX}$
NOTE: $T_{SSB} = \text{ssb-periodicityServingCell}$ is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

The normative reference for this requirement is TS 38.133 [6] clause 9.5.3.1, 9.5.4.1 and 9.5.5.1.

5.6.3.0.2 Minimum conformance requirements for CSI-RS-based L1-RSRP measurement for beam reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1-RSRP_Measurement_Period_CSI-RS}$.

The value of $T_{L1-RSRP_Measurement_Period_CSI-RS}$ is defined in Table 9.5.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, $M=1$ if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and $M=3$ otherwise
- For aperiodic CSI-RS resources $M=1$
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
 - SSB for L1-RSRP measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, $N=\text{ceil}(\text{maxNumberRxBeam} / N_{\text{res_per_set}})$, where $N_{\text{res_per_set}}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with
 - SSB for L1-RSRP measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, $N=\text{ceil}(\text{maxNumberRxBeam} / N_{\text{res_per_set}})$, where $N_{\text{res_per_set}}$ is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with
 - SSB for L1-RSRP measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, $N=1$. UE is not required to meet the accuracy requirements in clause 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For FR2,

- $P=1$, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{\text{MGRP}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion ($T_{\text{CSI-RS}} < \text{MGRP}$)
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{T_{\text{SMTCperiod}}}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$).
- $P=P_{\text{sharing factor}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$).
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{\text{MGRP}}-\frac{T_{\text{CSI-RS}}}{T_{\text{SMTCperiod}}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} < 0.5 * T_{\text{SMTCperiod}}$
- $P=\frac{3}{1-\frac{T_{\text{CSI-RS}}}{\text{MGRP}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} = 0.5 * T_{\text{SMTCperiod}}$
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{\min(T_{\text{SMTCperiod}}, \text{MGRP})}}$, when CSI-RS is partially overlapped with measurement gap ($T_{\text{CSI-RS}} < \text{MGRP}$) and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P=\frac{P_{\text{sharing factor}}}{1-\frac{T_{\text{CSI-RS}}}{\text{MGRP}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)

- $P_{\text{sharing factor}} = 1$, if the CSI-RS configured for L1-RSRP measurement outside measurement gap is
 - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,
 - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured
- $P_{\text{sharing factor}} = 3$, otherwise.

Where:

$T_{\text{SMTCperiod}}$ = the configured SMTC period.

$T_{\text{CSI-RS}}$ = the periodicity of CSI-RS configured for L1-RSRP measurement

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{\text{SMTCperiod}}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ corresponds to the value of higher layer parameter *smtc1*. $T_{\text{SMTCperiod}}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

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

Table 9.5.4.2-2: Measurement period $T_{\text{L1-RSRP_Measurement_Period_CSI-RS}}$ for FR2

Configuration	$T_{\text{L1-RSRP_Measurement_Period_CSI-RS}}$ (ms)
non-DRX	$\max(T_{\text{Report}}, \text{ceil}(M \cdot P \cdot N) \cdot T_{\text{CSI-RS}})$
DRX cycle ≤ 320 ms	$\max(T_{\text{Report}}, \text{ceil}(1.5 \cdot M \cdot P \cdot N) \cdot \max(T_{\text{DRX}}, T_{\text{CSI-RS}}))$
DRX cycle > 320 ms	$\text{ceil}(M \cdot P \cdot N) \cdot T_{\text{DRX}}$
NOTE 1: $T_{\text{CSI-RS}}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.2.1.2 in TS 38.214 [26].

For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM/BFD/CBD/L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

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

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

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.
 - The CSI-RS for L1-RSRP measurement or the other CSI-RS in a resource set configured with repetition ON, or
 - The other CSI-RS is configured in q1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clauses 9.5.3.1, 9.5.4.2 and 9.5.5.2.

5.6.3.1 EN-DC FR2 SSB-based L1-RSRP measurement in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.3.1.1 Test purpose

To verify that the UE makes correct reporting of L1-RSRP measurement in non-DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.1.

5.6.3.1.2 Test applicability

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

5.6.3.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.1.

5.6.3.1.4 Test description

5.6.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.1.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.1.4.1-2. Test environment parameters are given in Table 5.6.3.1.4.1-3.

Table 5.6.3.1.4.1-1: EN-DC SSB based L1-RSRP measurement supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

Table 5.6.3.1.4.1-2: General test parameters for EN-DC SSB based L1-RSRP measurement

Parameter	Config	Unit	Value
SSB GSCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
BW _{channel}	1~4	MHz	100: N _{RB,c} = 66
Data RBs allocated	1~4		66
PDSCH Reference measurement channel	1,2		SR.3.2 TDD
	3,4		SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD
	3,4		CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD
	3,4		CCR.3.7 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~4		SMTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		Off
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	320
T1	1~4	s	5
T2	1~4	s	2
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
Propagation condition			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.3.1.4.1-3: Test Environment parameters for EN-DC SSB based L1-RSRP measurement

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.3.1.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part A.3.3.3.1-1 DUT Part A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.6.3.1.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.6.3.1.4.1-2. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.6.3.1.4.1-2. SSB#1 shall be muted during this step.
2. Set the parameters according to T1 in Table 5.6.3.1.5-1.
3. T1 starts. The UE shall be transmitting CSI on PUCCH with a periodicity of 320 slots.
4. When T1 expires, the SS shall set the parameters according to T2 in 5.6.3.1.5-1. T2 starts.
5. The UE shall start sending valid L1-RSRP reports. The SS shall check the following requirements:
 - R1: the UE shall start to transmit valid L1-RSRP reports no later than 1760ms for UE supporting power class 1 in configuration 1 and 2, no later than 1720 ms for UE supporting power class 1 in configuration 3 and 4, no later than 1280 ms for UE supporting power class other than 1 in configuration 1 and 2, no later than 1240 ms for UE supporting power class other than 1 in configuration 3 and 4 from the beginning of time period T2. A valid report shall meet the absolute L1-RSRP requirement for SSB#1 Table 5.6.3.1.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.1.5-3 for test configurations 3 and 4. If the first valid report is received before the specified time, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.
 - R2: the UE shall transmit L1-RSRP reports every 320 slots. If the reports are received accordingly, the number of passed iterations for R2 is increased by one. Otherwise, the number of failed iterations for R2 is increased by one.
 - R3: The L1-RSRP value of SSB#1 reported by the UE is compared to the expected L1-RSRP value for SSB#1. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding absolute accuracy requirements in Table 5.6.3.1.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.1.5-3 for test configurations 3 and 4 the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
 - R4: The DIFF-RSRP value of SSB#0 reported by the UE is compared to the expected DIFF-RSRP value. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding relative accuracy requirements in Table 5.6.3.1.5-4 for all test configurations, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.
6. The SS waits until T2 expires.
7. The SS shall transmit *RRCCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCCConnectionReconfigurationComplete* message.
8. Set the parameters according to T1 in Table 5.6.3.1.5-1. The SS then shall transmit *RRCCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCCConnectionReconfigurationComplete* message.
9. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat steps 3-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.3.1.4.3 Message contents

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

Table 5.6.3.1.4.3-1: Common Exception messages EN-DC SSB based L1-RSRP measurement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6-2 with conditions PERIODIC and SS-RSRP Table H.3.6-3 with condition SSB Table H.3.4-1

Table 5.6.3.1.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE { failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { purpose detectionResource CHOICE { ssb-Index } } }	1 entry		
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE { ssb-Index }	0		
}			
}			
}			

5.6.3.1.5 Test requirement

Table 5.6.3.1.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.1.5-1: SSB specific test parameters for EN-DC SSB based L1-RSRP measurement

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.9			
Assumption for UE beams ^{Note 4}	1~4		Rough			
N_{oc} ^{Note 2}	1~4	dBm/15kHz	-105			
N_{oc} ^{Note 2}	1,2	dBm/SSB SCS	-96			
	3,4		-93			
\hat{E}_s/I_{ot}	1~4	dB	0	0	-Infinity	9
SSB_RP ^{Note 3}	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
I_o ^{Note 3}	1,2	dBm/95.04MHz	-63.97	-63.97	-66.98	-57.47
	3,4		-63.97	-63.97	-66.98	-57.47
\hat{E}_s/N_{oc}	1~4	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in TS 38.133 Annex B.2.1.3, and does not limit UE implementation or test system implementation						

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 1680 for UE supporting power class 1
- 1200 for UE supporting power class 2, 3 or 4.

Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.1.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.1.5-3 for test configurations 3 and 4 and the corresponding relative accuracy requirements in Table 5.6.3.1.5-4 for all test configurations.

Table 5.6.3.1.5-2: L1-RSRP absolute accuracy requirements for the reported values for test configurations 1 and 2

Normal Conditions	T1	T2
Lowest reported value (SSB#1)	-	40
Highest reported value (SSB#1)	-	99

Table 5.6.3.1.5-3: L1-RSRP absolute accuracy requirements for the reported values for test configurations 3 and 4

Normal Conditions	T1	T2
Lowest reported value (SSB#1)	-	43
Highest reported value (SSB#1)	-	102

Table 5.6.3.1.5-4: L1-RSRP relative accuracy requirements for the reported values for all test configurations

	T1	T2
Lowest DIFF RSRP reported (SSB#0)	-	1
Highest DIFF RSRP reported (SSB#0)	-	7

For the test to pass, the ratio of successful reported values for each requirement (R1 to R4) shall be at least 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.6.3.2 EN-DC FR2 SSB-based L1-RSRP measurement in DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.3.2.1 Test purpose

To verify that the UE makes correct reporting of L1-RSRP measurement in DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.1.

5.6.3.2.2 Test applicability

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

5.6.3.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.2.

5.6.3.2.4 Test description

5.6.3.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.2.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.2.4.1-2. Test environment parameters are given in Table 5.6.3.2.4.1-3.

Table 5.6.3.2.4.1-1: EN-DC SSB based L1-RSRP measurement in DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

Table 5.6.3.2.4.1-2: General test parameters for EN-DC SSB based L1-RSRP measurement in DRX

Parameter	Config	Unit	Value
SSB GSCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
BW _{channel}	1~4	MHz	100: N _{RB,c} = 66
Data RBs allocated	1~4		66
PDSCH Reference measurement channel	1,2		SR.3.2 TDD
	3,4		SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD
	3,4		CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD
	3,4		CCR.3.7 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTTC configuration	1~4		SMTTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		DRX.3
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	320
T1	1~4	s	5
T2	1~4	s	3
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			

Parameter	Config	Unit	Value
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
Propagation condition			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.3.2.4.1-3: Test Environment parameters for EN-DC SSB based L1-RSRP measurement in DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.3.2.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part DUT Part	A.3.3.3.1-1 A.3.4.1.1
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.6.3.2.4.3.
2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.2.4.2 Test procedure

Same as in 5.6.3.1.4.2 with the following exception:

5. The UE shall start sending valid L1-RSRP reports. The SS shall check the following requirements:
 - R1: the UE shall start to transmit valid L1-RSRP reports no later than 2960ms for UE supporting power class 1 in configuration 1 and 2, no later than 2920ms for UE supporting power class 1 in configuration 3 and 4, no later than 2000ms for UE supporting power class other than 1 in configuration 1 and 2, no later than 1960ms for UE supporting power class other than 1 in configuration 3 and 4 from the beginning of time period T2. A valid report shall meet the absolute L1-RSRP requirement for SSB#1 Table 5.6.3.2.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.2.5-3 for test configurations 3 and 4. If the first valid report is received before the specified time, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.
 - R2: the UE shall transmit L1-RSRP reports every 320 slots. If the reports are received accordingly, the number of passed iterations for R2 is increased by one. Otherwise, the number of failed iterations for R2 is increased by one.
 - R3: The L1-RSRP value of SSB#1 reported by the UE is compared to the expected L1-RSRP value for SSB#1. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding absolute accuracy requirements in Table 5.6.3.2.5-2 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.2.5-3 for test configurations 3 and 4 the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
 - R4: The DIFF-RSRP value of SSB#0 reported by the UE is compared to the expected DIFF-RSRP value. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding relative accuracy requirements in Table 5.6.3.2.5-4 for all test configurations, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

5.6.3.2.4.3 Message contents

Same message content as in subclause 5.6.3.1.4.3 with the following exception:

Table 5.6.3.2.4.3-1: Common Exception messages EN-DC SSB based L1-RSRP measurement in DRX

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

5.6.3.2.5 Test requirement

Table 5.6.3.2.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.2.5-1: SSB specific test parameters for EN-DC SSB based L1-RSRP measurement in DRX

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.9			
Assumption for UE beams ^{Note 4}	1~4		Rough			
N_{oc} ^{Note2}	1~4	dBm/15kHz	-105			
N_{oc} ^{Note2}	1,2	dBm/SSB SCS	-96			
	3,4		-93			
\hat{E}_s / I_{ot}	1~4	dB	0	0	-Infinity	9
SSB_RP ^{Note3}	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
I_o ^{Note3}	1,2	dBm/95.04MHz	-63.97	-63.97	-66.98	-57.47
	3,4		-63.97	-63.97	-66.98	-57.47
\hat{E}_s / N_{oc}	1~4	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4.

Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.2.5-2 for for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.3.2.5-3 for test configurations 3 and 4 and the corresponding relative accuracy requirements in Table 5.6.3.2.5-4 for all test configurations.

Table 5.6.3.2.5-2: L1-RSRP absolute accuracy requirements for the reported values for test configurations 1 and 2

Normal Conditions	T1	T2
Lowest reported value (SSB#1)	-	40
Highest reported value (SSB#1)	-	99

Table 5.6.3.2.5-3: L1-RSRP absolute accuracy requirements for the reported values for test configurations 3 and 4

Normal Conditions	T1	T2
Lowest reported value (SSB#1)	-	43
Highest reported value (SSB#1)	-	102

Table 5.6.3.2.5-4: L1-RSRP relative accuracy requirements for the reported values for all test configurations

	T1	T2
Lowest DIFF RSRP reported (SSB#0)	-	1
Highest DIFF RSRP reported (SSB#0)	-	7

For the test to pass, the ratio of successful reported values for each requirement (R1 to R4) shall be at least 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.6.3.3 EN-DC FR2 CSI-RS-based L1-RSRP measurement in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.3.3.1 Test purpose

To verify that the UE makes correct reporting of CSI-RS-based L1-RSRP measurement in non-DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.2.

5.6.3.3.2 Test applicability

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

5.6.3.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 4.6.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.3.

5.6.3.3.4 Test description

5.6.3.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.3.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.3.4.1-2. Test environment parameters are given in Table 5.6.3.3.4.1-3.

Table 5.6.3.3.4.1-1: EN-DC FR2 CSI-RS based L1-RSRP measurement supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

Table 5.6.3.3.4.1-2: General test parameters for EN-D FR2 C CSI-RS based L1-RSRP measurement

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
BW _{channel}	1~2	MHz	100: N _{RB,c} = 66
Data RBs allocated	1~2		66
PDSCH Reference measurement channel	1~2		SR.3.3 TDD
RMSI CORESET Reference Channel	1~2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.7 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTc configuration	1~2		SMTc.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		aperiodic
reportQuantity	1~2		cri-RSRP
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~2		8
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.3.3.4.1-3: Test Environment parameters for EN-DC FR2 CSI-RS L1-RSRP measurement

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.3.3.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1-1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram			

1. Message contents are defined in clause 5.6.3.3.4.3.
2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.3.4.2 Test procedure

The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. UE is also configured to measure L1-RSRP based on SSB. Upon receiving the DCI trigger, UE provides the report back based on the reporting configuration as defined in table 4.6.4.3.4.1-2.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5.
 2. Set the parameters according to T1 in Table 5.6.3.3.5-1. T1 starts.
 3. After 480ms from the start of the test the SS transmits the DCI trigger in slot 1.
 4. The SS shall check following requirements:
 - R1: the UE shall send L1-RSRP report at slot 9 from the reception of DCI trigger. If the report is received at slot 9 from the reception of DCI trigger, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.
 - R2: the L1-RSRP value of CSI-RS#1 reported by the UE is compared to the expected L1-RSRP value for CSI-RS #1. If the resulting value is outside the limits in Table 5.6.3.3.5-2 or the UE fails to report the measurement value for CSI-RS #1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
 - R3: The DIFF RSRP value of CSI-RS #0 reported by the UE is compared to the expected DIFF RSRP value. If the resulting value is outside the limits in Table 5.6.3.3.5-4 or the UE fails to report the measurement value for CSI-RS #0, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
 5. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
- The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
8. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
 9. Repeat steps 2-8 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.3.3.4.3 Message contents

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

Table 5.6.3.3.4.3-1: Common Exception messages EN-DC CSI-RS based L1-RSRP measurement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6-2 with conditions APERIODIC and CSI-RSRP Table H.3.6-3 with conditions CSI-RS and APERIODIC Table H.3.4-1

Table 5.6.3.3.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE { failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { purpose	1 entry		
	both	UE is configured to perform RLM and BFD based on the SSBs.	
}			
}			

Table 5.6.3.3.4.3-3: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [14], Table 7.2.2.1-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	For 120KHz SCS: K1 = N/A if mod(i,5) = 2 - PDSCH not scheduled (K1=2 and K1=12 are the possible settings to fall into a different UL slot than CSI Report. But K1=12 is not defined in RRC and K1=12 > PdschNumHarq Process=8. For K1=2, according to TS38.214 Table 5.3-1, considering PDSCH processing time and PUCCH resource index (symbol#0,1), it is better to use different UL slot) K1 = N/A if mod(i,5) = 0 - PDSCH not scheduled (K1=9 is the only possible setting to fall into a different UL slot than CSI Report but K1=9 > PdschNumHarq Process=8) K1 = 8 if mod(i,5) = 1 where i is slot index per frame; i = {2,5,6}	-	FR2

5.6.3.3.5 Test requirement

Table 5.6.3.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.3.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-RS L1-RSRP measurement

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.9	
Assumption for UE beams ^{Note 3}	1~2		Rough	
N_{oc} ^{Note1}	1~2	dBm/15kHz	-105	
N_{oc} ^{Note1}	1~2	dBm/SSB SCS	-95.97	
\hat{E}_s / I_{ot}	1~2	dB	0	9
CSI-RS RSRP ^{Note2}	1~2	dBm/SSB SCS	-95.97	-86.97
l_0 ^{Note2}	1~2	dBm/95.04MHz	-63.97	-57.47
\hat{E}_s / N_{oc}	1~2	dB	0	9
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: CSI-RS RSRP and l_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

After 480ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1. Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.3.5-2 the corresponding relative accuracy requirements in Table 5.6.3.3.5-3.

Table 5.6.3.3.5-2: L1-RSRP absolute accuracy requirements for the reported values

Normal Conditions	T1
Lowest reported value (CSI-RS#1)	40
Highest reported value (CSI-RS#1)	99

Table 5.6.3.3.5-3: L1-RSRP relative accuracy requirements for the reported values

	T1
Lowest DIFF RSRP reported (CSI-RS#0)	1
Highest DIFF RSRP reported (CSI-RS#0)	7

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

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

5.6.3.4 EN-DC FR2 CSI-RS-based L1-RSRP measurement in DRX

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

- Test frequency $f \leq 40.8$ GHz

- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.3.4.1 Test purpose

To verify that the UE makes correct reporting of CSI-RS-based L1-RSRP measurement in non-DRX within L1-RSRP measurement requirements in TS 38.133 [6] clause 9.5.4.2.

5.6.3.4.2 Test applicability

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

5.6.3.4.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 4.6.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.3.4

5.6.3.4.4 Test description

5.6.3.4.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.3.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.3.4.1-2. Test environment parameters are given in Table 5.6.3.4.1-3.

Table 5.6.3.4.1-1: EN-DC FR2 CSI-RS based L1-RSRP measurement in DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

Table 5.6.3.4.1-2: General test parameters for EN-D FR2 C CSI-RS based L1-RSRP measurement in DRX

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
BW _{channel}	1~2	MHz	100: N _{RB,c} = 66
Data RBs allocated	1~2		66
PDSCH Reference measurement channel	1~2		SR.3.3 TDD
RMSI CORESET Reference Channel	1~2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.7 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1

TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		aperiodic
reportQuantity	1~2		cri-RSRP
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~2		8
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.3.4.4.1-3: Test Environment parameters for EN-DC FR2 CSI-RS L1-RSRP measurement

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.3.3.4.1-1.	
Propagation conditions	AWGN	As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1-1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram		

1. Message contents are defined in clause 5.6.3.3.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.3.4.4.2 Test procedure

Same test procedure as in subclause 5.6.3.3.4.2 with tables 5.6.3.3.4.1-2 and 5.6.3.3.5-1 replaced by tables 5.6.3.4.4.1-2 and 5.6.3.4.5-1 and following change in step 3.

3. After 1440ms from the start of the test the SS transmits the DCI trigger in slot 1.

5.6.3.4.4.3 Message contents

Same message content as in subclause 5.6.3.3.4.3 with the following exception:

Table 4.6.4.4.3-1: Common Exception messages EN-DC CSI-RS based L1-RSRP measurement in DRX

Default Message Contents

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

5.6.3.4.5 Test requirement

Table 5.6.3.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.3.4.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-RS L1-RSRP measurement in DRX

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.9	
Assumption for UE beams ^{Note 3}	1~2		Rough	
N_{oc} ^{Note1}	1~2	dBm/15kHz	-105	
N_{oc} ^{Note1}	1~2	dBm/SSB SCS	-95.97	
\hat{E}_s / I_{ot}	1~2	dB	0	9
CSI-RS RSRP ^{Note2}	1~2	dBm/SSB SCS	-95.97	-86.97
I_o ^{Note2}	1~2	dBm/95.04MHz	-63.97	-57.47
\hat{E}_s / N_{oc}	1~2	dB	0	9

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: CSI-RS RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

After 1440ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1. Each L1-RSRP measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.3.4.5-2 the corresponding relative accuracy requirements in Table 5.6.3.4.5-3.

Table 5.6.3.4.5-2: L1-RSRP absolute accuracy requirements for the reported values

Normal Conditions	T1
Lowest reported value (CSI-RS#1)	40
Highest reported value (CSI-RS#1)	99

Table 5.6.3.4.5-3: L1-RSRP relative accuracy requirements for the reported values

	T1
Lowest DIFF RSRP reported (CSI-RS#0)	1
Highest DIFF RSRP reported (CSI-RS#0)	7

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

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

5.6.4 CLI measurements

5.6.4.0 Minimum conformance requirements

5.6.4.0.1 Minimum conformance requirements for SRS-RSRP measurement period

The UE shall be capable of performing SRS-RSRP measurement based on the configured SRS resource, and the UE shall be capable of reporting SRS-RSRP measured over measurement period of $T_{\text{SRS_RSRP_measurement_period}}$ for FR1 and FR2.

Table 5.6.4.0.1-1 Measurement period $T_{\text{SRS_RSRP_measurement_period}}$

Configuration	$T_{\text{SRS_measurement_period}}$ (ms)
No DRX	$\text{Max}(60, 3 \times T_{\text{SRS}})$
DRX cycle $\leq 320\text{ms}$	$\text{Max}(60, \text{Ceil}(1.5 \times 3) \times \text{max}(T_{\text{SRS}}, T_{\text{DRX}}))$
DRX cycle $> 320\text{ms}$	$3 \times T_{\text{DRX}}$
Note:	T_{SRS} is SRS measurement periodicity configured <i>SRS-PeriodicityAndOffset</i> , and T_{DRX} is the DRX cycle length.

If the SRS resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{\text{SRS_RSRP_measurement_period}}$.

When configured by the network, the UE shall be able to perform SRS-RSRP measurements of configured *srs-ResourceConfigCLL*. The requirements apply when the subcarrier spacing for SRS-RSRP measurement resource configuration is the same as the subcarrier spacing of the active DL BWP of serving cell. The UE is not required to measure SRS using different SCS compared to the downlink active BWP SCS of the same carrier.

The requirements as provided:

- SRS resources configured for SRS-RSRP measurements are measurable.

An SRS resource configured for SRS-RSRP shall be considered measurable when for each relevant SRS the following conditions are met:

- SRS-RSRP related side conditions given in clauses 10.1.22.1 for FR1 and FR2 for a corresponding band,
- SRS_{RP} and SRS \hat{E}_s/I_{ot} according to Annex B.2.7 for a corresponding band.

The UE shall send SRS-RSRP reports only for report configurations according to *reportType* which is *cliPeriodical* or *cliEventTriggered* when SRS-RSRP report is configured.

The UE shall report the SRS-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clause 10.1.22.1 for FR1 and FR2.

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.22.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.7.2.3.3.

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times T_{\text{TTI}_{\text{DCCH}}}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report on.

The normative reference for this requirement is TS 38.133 [6] clause 9.7.2.5 and 9.7.2.1, 9.7.2.2 and 9.7.2.3

5.6.4.1 EN-DC FR2 SRS-RSRP measurement in non-DRX

Editor's Note: This test case is incomplete. Following aspects are either missing or TBD

- The test applicability is FFS
- The test procedure is incomplete
- The message content is FFS
- MU/TT analysis is FFS

5.6.4.1.1 Test purpose

The purpose of this test case is to verify that the UE makes correct reporting of SRS-RSRP measurement in non-DRX within SRS-RSRP measurement requirements in TS 38.133 [6] clause 9.7.2.5

5.6.4.1.2 Test applicability

FFS

5.6.4.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.4.0.1

The normative reference for this requirement is TS 38.133 [6] clause 9.7.2.5 and A.5.6.4.1.

5.6.4.1.4 Test description

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2).

5.6.4.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.4.1.4.1-1.

Table 5.6.4.1.4.1-1: Supported test configurations

Configuration	Description
5.6.4.1 - 1	NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.6.4.1 - 2	NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD
Note: UE is only required to be tested in one of the supported test configurations	

Configure the test equipment and the DUT according to the parameters in Table 5.6.4.1.4.1-2.

Table 5.6.4.1.4.1-2: Initial conditions EN-DC FR2 SRS-RSRP measurement in non-DRX

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. The test parameters are given in Table 5.6.4.1.4.1-3 below.
2. Message contents are defined in clause 5.6.4.1.4.3.

3. Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PCell (Cell 2). The test parameters for PCell is given in Table A.5.6.4.1.4.1-3
- The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

Table 5.6.4.1.4.1-3: General test parameters for SRS-RSRP event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
SRS configuration		1	SRSCConf.1	Table A.5.6.4.1.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-103	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1	DRX.11	
Time offset between DL from serving cell and SRS from test system	µs	1,2	10.67	
T1	s	1	5	
T2	s	1	1	

5.6.4.1.4.2 Test procedure

There are two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PCell (Cell 2)

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table 5.6.4.1.5-3 and the test parameters for the (virtual) neighbour cell UE in Table 5.6.4.1.5-23. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

- Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.
- Set the parameters according to Table 5.6.4.1.5-1 as appropriate.
- The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1 with event I1 configured.
- The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

Editor's note: the rest of the steps are FFS.

5.6.4.1.4.3 Message contents

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

FFS

5.6.4.1.5 Test requirement

Table 5.7.1.1.5-1 defines the cell specific settings for all tests. Table 5.7.1.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Table 5.6.4.1.5-1: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	

Table 5.6.4.1.5-2: NR OTA Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell and Neighbour cell UE in FR2

Parameter	Unit	Test configuration	Cell 2		Neighbour cell UE	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined A.3.15.1			
Beam assumption Note 4		1	Fine			
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
N_{oc} Note 2	dBm/SCS	1	-89		-89	
\hat{E}_s / I_{ot}	dB	1	-	-	-infinity	4
\hat{E}_s / N_{oc}	dB	1	-	-	-infinity	4
SRS-RSRP Note 3	dBm/SCS kHz	1	-	-	-infinity	-94
I_o	dBm/95.04 MHz	1	-70.01	-68.82	-70.01	-68.82
Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.					
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
Note 3:	SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
Note 4:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

Table 5.6.4.1.5-3: SRS configuration for measurement reporting

	Field	SRSCnf.1	Comments
SRS-ResourceSet	srs-ResourceSetId	0	
	srs-ResourceIdList	0	
	resourceType	Periodic	
	Usage	Codebook	
SRS-Resource	SRS-ResourceId	0	
	nrofSRS-Ports	Port1	
	transmissionComb	n2	
	combOffset-n2	0	
	cyclicShift-n2	0	
	resourceMapping startPosition	0	
	resourceMapping nrofSymbols	n1	
	resourceMapping repetitionFactor	n1	
	freqDomainPosition	0	
	freqDomainShift	0	
	freqHopping c-SRS	12	
	freqHopping b-SRS	0	
	freqHopping b-hop	0	
	groupOrSequenceHopping	Neither	
	resourceType	Periodic	
	periodicityAndOffset	s160, 25	
sequenceId	0	Any 10 bit number	

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

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

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

5.6.5

5.6.6 L1-SINR measurement for beam reporting

5.6.6.0 Minimum conformance requirements

5.6.6.0.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and no dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1-SINR_Measurement_Period_CSI-RS_CMR_Only}$.

The value of $T_{L1-SINR_Measurement_Period_CSI-RS_CMR_Only}$ is defined in Table 9.8.4.1-2 for FR2, where

For the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;

- For aperiodic CSI-RS resources as CMR, $M=1$.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
 - SSB for L1-RSRP or L1-SINR measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, $N=\text{ceil}(\text{maxNumberRxBeam} / N_{\text{res_per_set}})$, where $N_{\text{res_per_set}}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with
 - SSB for L1-RSRP or L1-SINR measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, $N=\text{ceil}(\text{maxNumberRxBeam} / N_{\text{res_per_set}})$, where $N_{\text{res_per_set}}$ is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with
 - SSB for L1-RSRP or L1-SINR measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, $N=1$. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured for all resources in the resource set.

For the value of P in FR2,

- $P=1$, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{\text{MGRP}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion ($T_{\text{CSI-RS}} < \text{MGRP}$)
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{T_{\text{SMTCperiod}}}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$).
- $P=3$, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$).
- $P=\frac{1}{1-\frac{T_{\text{CSI-RS}}}{\text{MGRP}}-\frac{T_{\text{CSI-RS}}}{T_{\text{SMTCperiod}}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and
 - $T_{\text{SMTCperiod}} \neq \text{MGRP}$ or
 - $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} < 0.5 * T_{\text{SMTCperiod}}$

- $P = \frac{3}{1 - \frac{T_{\text{CSI-RS}}}{\text{MGRP}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is not overlapped with measurement gap and $T_{\text{SMTCperiod}} = \text{MGRP}$ and $T_{\text{CSI-RS}} = 0.5 * T_{\text{SMTCperiod}}$
- $P = \frac{1}{1 - \frac{T_{\text{CSI-RS}}}{\min(T_{\text{SMTCperiod}}, \text{MGRP})}}$, when CSI-RS is partially overlapped with measurement gap ($T_{\text{CSI-RS}} < \text{MGRP}$) and CSI-RS is partially overlapped with SMTC occasion ($T_{\text{CSI-RS}} < T_{\text{SMTCperiod}}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = \frac{3}{1 - \frac{T_{\text{CSI-RS}}}{\text{MGRP}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{\text{CSI-RS}} = T_{\text{SMTCperiod}}$) and SMTC occasion is partially overlapped with measurement gap ($T_{\text{SMTCperiod}} < \text{MGRP}$)

Where:

$T_{\text{SMTCperiod}}$ = the configured SMTC1 period or SMTC2 period if configured.

$T_{\text{CSI-RS}}$ = the periodicity of CSI-RS configured for L1-SINR measurement

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{\text{SMTCperiod}}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

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

Table 9.8.4.1-2: Measurement period $T_{\text{L1-SINR_Measurement_Period_CSI-RS_CMR_Only}}$ for FR2

Configuration	$T_{\text{L1-SINR_Measurement_Period_CSI-RS_CMR_Only}}$ (ms)
non-DRX	$\max(T_{\text{Report}}, \text{ceil}(M * P * N) * T_{\text{CSI-RS}})$
DRX cycle \leq 320ms	$\max(T_{\text{Report}}, \text{ceil}(1.5 * M * P * N) * \max(T_{\text{DRX}}, T_{\text{CSI-RS}}))$
DRX cycle $>$ 320ms	$\text{ceil}(M * P * N) * T_{\text{DRX}}$
Note 1:	$T_{\text{CSI-RS}}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.
Note 2:	the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

The UE is required to be capable of measuring L1-SINR without measurement gaps. The UE is required to perform the SSB and CSI-RS/CSI-IM measurements with measurement restrictions as described in the following clauses.

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

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

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.
 - The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or
 - The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
 - The other CSI-RS is configured in q_1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clause 9.8.3, 9.8.4.1 and 9.8.5.

5.6.6.0.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the SSB configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to SSB configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1-SINR_Measurement_Period_SSB_CMR_IMR}$.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as SSB configured as CMR.

The value of $T_{L1-SINR_Measurement_Period_SSB_CMR_IMR}$ is defined in Table 9.8.4.2-2 for FR2, where

For the value of M

- For periodic or semi-persistent NZP CSI-RS or CSI-IM resource as dedicated IMR, $M=1$ if the higher layer parameters *timeRestrictionForChannelMeasurements* and/or *timeRestrictionForInterferenceMeasurements* are configured, and $M=3$ otherwise;

For the value of N in FR2

- $N = 8$.

P is defined as the maximum value between P_{CMR} and P_{IMR} , i.e., $P = \max(P_{CMR}, P_{IMR})$, where

- the value of P_{CMR} shall be derived in the same way as the value of P used for SSB based L1-RSRP measurement in clause 9.5.4.1, in which the occasions and period of the SSB for CMR shall be used instead.
- the value of P_{IMR} shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead.

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

For L1-SINR measurement with SSB as CMR and CSI-RS or CSI-IM as IMR, the requirement shall apply if the CSI-RS is configured as IMR with repetition field as "repetition = OFF" or CSI-IM is configured as IMR.

For L1-SINR measurement with SSB as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if SSB occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.2-2: Measurement period $T_{L1-SINR_Measurement_Period_SSB_CMR_IMR}$ for FR2

Configuration	$T_{L1-SINR_Measurement_Period_SSB_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M \cdot P \cdot N) \cdot T_{SSB})$
DRX cycle \leq 320ms	$\max(T_{Report}, \text{ceil}(1.5 \cdot M \cdot P \cdot N) \cdot \max(T_{DRX}, T_{SSB}))$
DRX cycle $>$ 320ms	$\text{ceil}(1.5 \cdot M \cdot P \cdot N) \cdot T_{DRX}$
Note 1:	$T_{SSB} = \text{ssb-periodicityServingCell}$ is the periodicity of the SSB-Index configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.
Note 2:	The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

The UE shall transmit the periodic L1-SINR reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

Reported L1-SINR measurements contained in periodic L1-SINR measurement reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

For FR2, when the SSB configured as CMR for L1-SINR measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB configured as CMR for L1-SINR measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

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

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.
 - The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or
 - The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
 - The other CSI-RS is configured in q1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and SSB. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as the CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and CSI-RS. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.
 - The CSI-RS in a resource set configured with repetition ON, or
 - The CSI-IM or the CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
 - The CSI-RS is configured in q_1 and beam failure is detected, or
 - The CMR for L1-SINR measurement and the CSI-RS are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clause 9.8.3, 9.8.4.2 and 9.8.5.

5.6.6.0.3 L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to CSI-RS resource configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of T_{L1} .

SINR_Measurement_Period_CSI-RS_CMRI-MR.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as CSI-RS resource configured as CMR.

The value of $T_{L1-SINR_Measurement_Period_CSI-RS_CMRI-MR}$ is defined in Table 9.8.4.3-2 for FR2, where

For the value of M,

- M=1 shall be applied if
 - aperiodic NZP-CSI-RS as CMR or dedicated IMR, or
 - aperiodic CSI-IMR as dedicated IMR, or
 - periodic and semi-persistent NZP-CSI-RS as CMR or dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured, or
 - periodic and semi-persistent CSI-IM as dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured;
- M=3 otherwise.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
 - SSB for L1-RSRP or L1-SINR measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, $N=\text{ceil}(\text{maxNumberRxBeam} / N_{\text{res_per_set}})$, where $N_{\text{res_per_set}}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with
 - SSB for L1-RSRP or L1-SINR measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, $N=\text{ceil}(\text{maxNumberRxBeam} / N_{\text{res_per_set}})$, where $N_{\text{res_per_set}}$ is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, $N=1$. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with
 - SSB for L1-RSRP or L1-SINR measurement, or
 - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, $N=1$. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured for all resources in the resource set.

P is defined as the maximum value between P_{CMR} and P_{IMR} , i.e., $P = \max(P_{\text{CMR}}, P_{\text{IMR}})$, where

- The value of P_{CMR} and P_{IMR} shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the CSI-RS for CMR and NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead respectively.

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

For L1-SINR measurement with CSI-RS as CMR and CSI-RS as IMR, the requirement shall apply only if CSI-RS resources as CMR and IMR are configured with the same repetition field and the number of CSI-RS resources in the resource sets for CMR and IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-IM as IMR, the requirement shall apply only if the number of CSI-RS resources in the resource set for CMR and the number of CSI-IM resources in the resource set for IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if CSI-RS occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.3-2: Measurement period $T_{L1-SINR_Measurement_Period_CSI-RS_CMR_IMR}$ for FR2

Configuration	$T_{L1-SINR_Measurement_Period_CSI-RS_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M \cdot P \cdot N) \cdot T_{CSI-RS})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5 \cdot M \cdot P \cdot N) \cdot \max(T_{DRX}, T_{CSI-RS}))$
DRX cycle > 320 ms	$\text{ceil}(M \cdot P \cdot N) \cdot T_{DRX}$
Note 1:	T_{CSI-RS} is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.
Note 2:	the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.
Note 3:	The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

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

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.
 - The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or
 - The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
 - The other CSI-RS is configured in q_1 and beam failure is detected, or
 - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and SSB. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as the CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and CSI-RS. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.
 - The CSI-RS in a resource set configured with repetition ON, or
 - The CSI-IM or the CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
 - The CSI-RS is configured in q1 and beam failure is detected, or
 - The CMR for L1-SINR measurement and the CSI-RS are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

The normative reference for this requirement is TS 38.133 [6] clause 9.8.3, 9.8.4.3 and 9.8.5.

5.6.6.1 EN-DC FR2 CSI-RS based CMR and no dedicated IMR L1-SINR measurement in DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.6.1.1 Test purpose

To verify that the UE makes correct reporting of L1-SINR measurement within L1-SINR measurement requirements in TS 38.133 [6] clause 9.8.4.1.

5.6.6.1.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC FR2 and long DRX cycle and L1-SINR measurement.

5.6.6.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.6.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.6.1.

5.6.6.1.4 Test description

5.6.6.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.6.1.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.6.1.4.1-2. Test environment parameters are given in Table 5.6.6.1.4.1-3.

Table 5.6.6.1.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-SINR test

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations

Table 5.6.6.1.4.1-2: General test parameters for FR2 CSI-RS based L1-SINR test

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
BW _{channel}	1~2	MHz	100: NR _{B,C} = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTTC configuration	1~2		SMTTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		aperiodic
reportQuantity-r16	1~2		cri-SINR-r16
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0 SSB#1 for resource#1

reportSlotOffsetList	1~2		26
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.6.1.4.1-3: Test Environment parameters for FR2 CSI-RS based L1-SINR test

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.6.1.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1-1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	N/A		

1. Message contents are defined in clause 5.6.6.1.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.6.1.4.2 Test procedure

The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. UE is also configured to measure L1-SINR based on SSB. Upon receiving the DCI trigger, UE provides the report back based on the reporting configuration as defined in Table 5.6.6.1.4.1-2.

- Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5.
- Set the parameters according to T1 in Table 5.6.6.1.5-1. T1 starts.
- After 480ms from the start of the test the SS transmits the DCI trigger in slot 8.
- The SS shall check following requirements:
 - R1: the UE shall send L1-SINR report at slot 26 from the reception of DCI trigger. If the report is received at slot 26 from the reception of DCI trigger, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.

- R2: the L1-SINR value of CSI-RS#1 reported by the UE is compared to the expected L1-SINR value for CSI-RS#1. If the resulting value is outside the limits in Table 5.6.6.1.5-2 or the UE fails to report the measurement value for CSI-RS #1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
 - R3: The DIFF SINR value of CSI-RS#0 reported by the UE is compared to the expected DIFF SINR value. If the resulting value is outside the limits in Table 5.6.6.1.5-3 or the UE fails to report the measurement value for CSI-RS 0, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
5. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
 6. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
 7. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode On according to TS 38.508-1 [14] clause 4.5.
 8. Repeat steps 2-7 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.6.1.4.3 Message contents

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

Table 5.6.6.1.4.3-1: Common Exception messages for EN-DC FR2 CSI-based CMR and no dedicated IMR L1-SINR measurement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6A-1 with conditions APERIODIC and CSI-SINR Table H.3.6A-2 with conditions CSI-RS and APERIODIC Table H.3.4-1 Table H.3.7-1 with condition DRX.3

Table 5.6.6.1.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE {			
failureDetectionResourcesToAddModList	1 entry		
SEQUENCE			
(SIZE(1..maxNrofFailureDetectionResources)) OF			
SEQUENCE {			
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
}			
}			
}			

5.6.6.1.5 Test requirement

Table 5.6.6.1.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.6.1.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-based CMR and no dedicated IMR L1-SINR measurement

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Beam assumption ^{Note 3}	1~2		Rough	
N_{oc} ^{Note1}	1~2	dBm/15kHz	-105	
N_{oc} ^{Note1}	1~2	dBm/SSB SCS	-95.97	
\hat{E}_s/I_{ot}	1~2	dB	0	9
CSI-RS RSRP ^{Note2}	1~2	dBm/SSB SCS	-95.97	-86.97
I_o ^{Note2}	1~2	dBm/95.04MHz	-63.97	-57.47
\hat{E}_s/N_{oc}	1~2	dB	0	9
<p>Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>Note 2: CSI-RS RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>				

After 480ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 and CSI-RS#1. Each L1-SINR measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.6.1.5-2 and the corresponding relative accuracy requirements in Table 5.6.6.1.5-3.

Table 5.6.6.1.5-2: L1-SINR absolute accuracy requirements for the reported values

Normal Conditions	T1
Lowest reported value (CSI-RS#1)	51
Highest reported value (CSI-RS #1)	74

Table 5.6.6.1.5-3: L1-SINR relative accuracy requirements for the reported values

Normal Conditions	T1
Lowest DIFF SINR reported (CSI-RS #0)	4
Highest DIFF SINR reported (CSI-RS #0)	13

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

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

5.6.6.2 EN-DC FR2 SSB based CMR and dedicated IMR L1-SINR measurement in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.6.2.1 Test purpose

To verify that the UE makes correct reporting of L1-SINR measurement in non-DRX within L1-SINR measurement requirements in TS 38.133 [6] clause 9.8.4.2.

5.6.6.2.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC FR2 and L1-SINR measurement reporting.

5.6.6.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.6.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.6.2.

5.6.6.2.4 Test description

5.6.6.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.6.2.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.6.2.4.1-2. Test environment parameters are given in Table 5.6.6.2.4.1-3.

Table 5.6.6.2.4.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations

Table 5.6.6.2.4.1-2: General test parameters for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Parameter	Config	Unit	Value
SSB GSCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
BW _{channel}	1~4	MHz	100: N _{RB,c} = 66
PDSCH Reference measurement channel	1~4		SR.3.1 TDD
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2

CSI-RS configuration	1~4		CSI-RS.3.1A TDD
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTc configuration	1~4		SMTc.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		off
reportConfigType	1~4		periodic
reportQuantity-r16	1~4		ssb-Index-SINR-r16
Number of reported RS	1~4		2
L1-SINR reporting period	1~4	slot	640
T1	1~4	s	5
T2	1~4	s	3
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
Propagation condition			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.6.2.4.1-3: Test Environment parameters for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Parameter	Value		Comment
Test environment	NC		As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.		
Channel bandwidth	As specified by the test configuration selected from Table 5.6.6.2.4.1-1.		
Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1-1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	N/A		

1. Message contents are defined in clause 5.6.6.2.4.3.

2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.6.2.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above Table 5.6.6.2.4.1-2. Before the test, UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.6.6.2.4.1-2.
2. Set the parameters according to T1 in Table 5.6.6.2.5-1. T1 starts.
3. The UE shall be transmitting CSI on PUCCH with a periodicity of 640 slots.
4. When T1 expires, the SS shall set the parameters according to T2 in 5.6.6.2.5-1. T2 starts.
5. The UE shall start sending valid L1-SINR reports. The SS shall check the following requirements:
 - R1: the UE shall start to transmit valid L1-SINR reports no later than 2960ms for UE supporting power class 1 in configuration 1 and 2, no later than 2920 ms for UE supporting power class 1 in configuration 3 and 4, no later than 2000 ms for UE supporting power class other than 1 in configuration 1 and 2, no later than 1960 ms for UE supporting power class other than 1 in configuration 3 and 4 from the beginning of time period T2. A valid report shall meet the absolute L1-SINR requirement for SSB#1 in Table 5.6.6.2.5-3 for test configurations 1 and 2 and the corresponding absolute accuracy requirements in Table 5.6.6.2.5-4 for test configurations 3 and 4. If the first valid report is received before the specified time, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.
 - R2: the UE shall transmit L1-SINR reports every 640 slots. If the reports are received accordingly, the number of passed iterations for R2 is increased by one. Otherwise, the number of failed iterations for R2 is increased by one.
 - R3: The L1-SINR value of SSB#1 reported by the UE is compared to the expected L1-SINR value for SSB#1. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding absolute accuracy requirements in Table 5.6.6.2.5-3 for all test configurations, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
 - R4: The DIFF-SINR value of SSB#0 reported by the UE is compared to the expected DIFF-SINR value. In all consecutive reports after the first valid value is received, if the resulting value is outside the corresponding relative accuracy requirements in Table 5.6.6.2.5-4 for all test configurations, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.
6. The SS waits until T2 expires.
7. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
8. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
9. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
10. Repeat steps 2-9 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.6.2.4.3 Message contents

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

Table 5.6.6.2.4.3-1: Common Exception messages for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6A-1 with conditions PERIODIC and SS-SINR and CSI-RS_IMR Table H.3.6A-2 with conditions SSB and PERIODIC Table H.3.6A-3 with conditions PERIODIC Table H.3.4-1

Table 5.6.6.2.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE { failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { purpose detectionResource CHOICE { ssb-Index } } }	1 entry		
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE { ssb-Index }	0		
}			
}			
}			

5.6.6.2.5 Test requirement

Table 5.6.6.2.5-1 and Table 5.6.6.2.5-1 define the primary level settings including test tolerances for all tests.

Table 5.6.6.2.5-1: SSB specific test parameters for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam assumption ^{Note 4}			Rough			
N_{oc} ^{Note2}	1~4	dBm/15kHz	-105			
N_{oc} ^{Note2}	1,2	dBm/SSB SCS	-96			
	3,4		-93			
\hat{E}_s/I_{ot}	1~4	dB	0	0	-Infinity	9
SSB RSRP ^{Note3}	1,2	dBm/SSB SCS	-94.5	-94.5	-Infinity	-87
	3,4		-91.5	-91.5	-Infinity	-84
I_o ^{Note3}	1,2	dBm/95.04MHz	-63.2	-63.2	-67	-57.5
	3,4		-63.2	-63.2	-67	-57.5

\hat{E}_s/N_{oc}	1~4	dB	1.5	1.5	-Infinity	9
Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.					
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
Note 3:	SSB RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
Note 4:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

Table 5.6.6.2.5-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0		CSI-RS#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam assumption ^{Note 4}			Rough			
N_{oc} ^{Note2}	1~4	dBm/15kHz	-105			
N_{oc} ^{Note2}	1~4	dBm/CSI-RS SCS	-96			
\hat{E}_s/I_{ot}	1~4	dB	1.5	1.5	-Infinity	9
\hat{E}_s/N_{oc}	1~4	dB	1.5	1.5	-Infinity	9
CSI-RS RSRP ^{Note3}	1~4	dBm/ CSI-RS SCS	-94.5	-94.5	-Infinity	-87
I_o ^{Note3}	1~4	dBm/95.04MHz	-63.2	-63.2	-67	-57.5
Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.					
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
Note 3:	CSI-RS RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
Note 4:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

The UE shall send L1-SINR report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-SINR report including the results for both SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.28.2, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2, 3 or 4.

Each L1-SINR measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.6.2.5-3 for all test configurations and the corresponding relative accuracy requirements in Table 5.6.6.2.5-4 for all test configurations.

Table 5.6.6.2.5-3: L1-SINR absolute accuracy requirements for the reported values for all test configurations

Normal Conditions	T1	T2
Lowest reported value (SSB#1)	-	54
Highest reported value (SSB#1)	-	71

Table 5.6.6.2.5-4: L1-SINR relative accuracy requirements for the reported values for test configurations

	T1	T2
Lowest DIFF SINR reported (SSB#0)	-	4
Highest DIFF SINR reported (SSB#0)	-	10

For the test to pass, the ratio of successful reported values for each requirement (R1 to R4) shall be at least 90% with a confidence level of 95%. Each requirement is evaluated independently of the others. NOTE:

The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

5.6.6.3 EN-DC FR2 CSI-RS based CMR and dedicated IMR L1-SINR measurement in non-DRX

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test case is incomplete for extreme conditions

5.6.6.3.1 Test purpose

To verify that the UE makes correct reporting of L1-SINR measurement within L1-SINR measurement requirements in TS 38.133 [6] clause 9.8.4.3.

5.6.6.3.2 Test applicability

This test applies to all types of E-UTRA UE release 16 and forward, supporting EN-DC FR2 and L1-SINR measurement.

5.6.6.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.6.6.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.6.6.3.

5.6.6.3.4 Test description

5.6.6.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.6.6.3.4.1-1. Configure the test equipment and the DUT according to the parameters in Table 5.6.6.3.4.1-2. Test environment parameters are given in Table 5.6.6.3.4.1-3.

Table 5.6.6.3.4.1-1: Applicable NR configurations for EN-DC FR2 CSI-RS based CMR and CSI-IM based IMR L1-SINR measurement

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations

Table 5.6.6.3.4.1-2: General test parameters for FR2 L1-SINR test with CMR and dedicated IMR

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
BW _{channel}	1~2	MHz	100: N _{RB,c} = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
CSI-IM configuration	1~2		CSI-IM.3.2 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTc configuration	1~2		SMTc.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		aperiodic
reportQuantity-r16	1~2		cri-SINR-r16
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~2		26
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
Propagation condition	1~2		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table 5.6.6.3.4.1-3: Test Environment parameters for FR2 L1-SINR test with CMR and dedicated IMR

Parameter	Value	Comment
Test environment	NC	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.2-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA, 7.2.3 for NR FR2.	
Channel bandwidth	As specified by the test configuration selected from Table 5.6.6.3.4.1-1.	

Propagation conditions	AWGN		As specified in clause C.2.2.
Connection Diagram	TE Part	A.3.3.3.1-1	As specified in TS 38.508-1 [14] Annex A.
	DUT Part	A.3.4.1.1	
Exceptions to connection diagram	N/A		

1. Message contents are defined in clause 5.6.6.3.4.3.
2. The AoA setup for this test is Setup 1 as defined in clause A.9. The UE RX Beam Peak direction has been obtained previously using one of the search procedures as described in Annex I.

5.6.6.3.4.2 Test procedure

The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. UE is also configured to measure L1-SINR based on SSB. Upon receiving the DCI trigger, UE provides the report back based on the reporting configuration as defined in Table 5.6.6.3.4.1-2.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to T1 in Table 5.6.6.3.5-1. T1 starts.
3. After 480ms from the start of the test the SS transmits the DCI trigger in slot 8.
4. The SS shall check following requirements:
 - R1: the UE shall send L1-SINR report at slot 26 from the reception of DCI trigger. If the report is received at slot 26 from the reception of DCI trigger, the number of passed iterations for R1 is increased by one. Otherwise, the number of failed iterations for R1 is increased by one.
 - R2: the L1-SINR value of CSI-RS#1 reported by the UE is compared to the expected L1-SINR value for CSI-RS#1. If the resulting value is outside the limits in Table 5.6.6.3.5-2 or the UE fails to report the measurement value for CSI-RS #1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
 - R3: The DIFF SINR value of CSI-RS#0 reported by the UE is compared to the expected DIFF SINR value. If the resulting value is outside the limits in Table 5.6.6.3.5-3 or the UE fails to report the measurement value for CSI-RS 0, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
5. The SS shall transmit *RRCConnectionReconfiguration* message with condition EN-DC_PSCell_Rel according to TS 36.508 [25] Table 4.6.1-8 to release NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
6. The SS then shall transmit *RRCConnectionReconfiguration* message with condition MCG_and_SCG according to TS 36.508 [25] Table 4.6.1-8 to add NR cell (PSCell). The UE shall transmit *RRCConnectionReconfigurationComplete* message.
7. If any the reconfiguration fails, switch off and on the UE and ensure the UE is in RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
8. Repeat steps 2-7 until the confidence level according to Tables G.2.3-1 in Annex G clause G.2 is achieved.

5.6.6.3.4.3 Message contents

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

Table 5.6.6.3.4.3-1: Common Exception messages for EN-DC FR2 CSI-RS based CMR and CSI-IM based IMR L1-SINR measurement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6A-1 with conditions APERIODIC and CSI-SINR and CSI-IM_IMR Table H.3.6A-2 with conditions CSI-RS and APERIODIC Table H.3.6A-4 with conditions APERIODIC Table H.3.4-1

Table 5.6.6.3.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE {			
failureDetectionResourcesToAddModList	1 entry		
SEQUENCE			
(SIZE(1..maxNrofFailureDetectionResources)) OF			
SEQUENCE {			
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
}			
}			

5.6.6.3.5 Test requirement

Table 5.6.6.3.5-1 defines the primary level settings including test tolerances for all tests.

Table 5.6.6.3.5-1: CSI-RS specific test parameters for EN-DC FR2 CSI-RS based CMR and CSI-IM based IMR L1-SINR measurement

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.9	
Assumption for UE beams ^{Note 3}	1~2		Rough	
N_{oc} ^{Note1}	1~2	dBm/15kHz	-105	
N_{oc} ^{Note1}	1~2	dBm/SSB SCS	-95.97	
\hat{E}_s/I_{ot}	1~2	dB	0	9
CSI-RS RSRP ^{Note2}	1~2	dBm/SSB SCS	-95.97	-86.97
I_o ^{Note2}	1~2	dBm/95.04MHz	-63.97	-57.47
\hat{E}_s/N_{oc}	1~2	dB	0	9
Note 1:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
Note 2:	CSI-RS RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
Note 3:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

After 480ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 as CMR + CSI-IM#0 as IMR and CSI-RS#1 as CMR + CSI-IM#1 as IMR. Each L1-SINR measurement report shall meet the corresponding absolute accuracy requirements in Table 5.6.6.3.5-2 and the corresponding relative accuracy requirements in Table 5.6.6.3.5-3. The reported L1-SINR value shall consider the Rx antenna gain in the range of [-10 ~ +20] dB when calculated.

Table 5.6.6.3.5-2: L1-SINR absolute accuracy requirements for the reported values

Normal Conditions	T1
Lowest reported value (CSI-RS#1)	53
Highest reported value (CSI-RS #1)	72

Table 5.6.6.3.5-3: L1-SINR relative accuracy requirements for the reported values

Normal Conditions	T1
Lowest DIFF SINR reported (CSI-RS #0)	5
Highest DIFF SINR reported (CSI-RS #0)	12

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

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

5.7 Measurement performance requirements

5.7.1 SS-RSRP

5.7.1.0 Minimum conformance requirements

5.7.1.0.1 Intra-frequency SS-RSRP measurement accuracy requirements

5.7.1.0.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.1.0.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.1.0.1.1-1: SS-RSRP Intra frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB \hat{E}_s /lot	I_o ^{Note 2} range		
			Minimum I_o		Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}		dBm/ $BW_{Channel}$
			$SCS_{SSB} = 120kHz$	$SCS_{SSB} = 240kHz$	
± 6	± 9	≥ -6	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		N/A
± 8	± 11		N/A		-70
					-50

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.

NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.

NOTE 3: In the test cases, the SSB \hat{E}_s /lot and related parameters may need to be adjusted to ensure \hat{E}_s /lot at UE baseband is above the value defined in this table.

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

5.7.1.0.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR2.

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.1.0.1.2-1: SS-RSRP Intra frequency relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB \hat{E}_s/lot	I_o ^{Note 2} range		$\text{dBm}/\text{BW}_{\text{Channel}}$
			Minimum I_o		
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}		
			$\text{SCS}_{\text{SSB}} = 120\text{kHz}$	$\text{SCS}_{\text{SSB}} = 240\text{kHz}$	
± 6	± 9	≥ 6	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.

NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.

NOTE 3: In the test cases, the SSB \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

NOTE 4: The parameter SSB \hat{E}_s/lot is the minimum SSB \hat{E}_s/lot of the pair of cells to which the requirement applies.

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.3.1 and 10.1.6.

5.7.1.0.2 Inter-frequency SS-RSRP measurement accuracy requirements

5.7.1.0.2.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in Table 5.7.1.0.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [2].

Table 5.7.1.0.2.1-1: SS-RSRP Inter frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB \bar{E}_s/lot	I_o ^{Note 2} range		
			Minimum I_o		Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}		dBm/ $BW_{Channel}$
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$	
± 6	± 9	≥ -4	Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival		N/A
± 8	± 11		N/A		-70
					-50

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB \bar{E}_s/lot and related parameters may need to be adjusted to ensure \bar{E}_s/lot at UE baseband is above the value defined in this table.

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.5.1 and 10.1.6.

5.7.1.0.2.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell on a frequency in FR2 compared to the SS-RSRP measured from another cell on another frequency in FR2.

The accuracy requirements in Table 5.7.1.0.2.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [3] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27\text{dB}$
- $|Channel\ 1_I_o - Channel\ 2_I_o| \leq 20\text{dB}$
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.1.0.2.2-1: SS-RSRP Inter frequency relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB \hat{E}_s/lot	I_o ^{Note 2} range	
			Minimum I_o	Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}	
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$
			dBm/ BW_{Channel}	
± 6	± 9	≥ -4	Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival	
NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.				
NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.				
NOTE 3: In the test cases, the SSB \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.				
NOTE 4: The parameter SSB \hat{E}_s/lot is the minimum SSB \hat{E}_s/lot of the pair of cells to which the requirement applies.				

The reporting range for SS-RSRP is defined from -156dBm to -31dBm with 1dB resolution. The mapping of the measured quantity to the reported value is defined by Table 4.7.1.0.1-2.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.5.1 and 10.1.6.

5.7.1.1 EN-DC FR2 SS-RSRP measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.7.1.1.1 Test purpose

The purpose of this test is to verify that the intra-frequency SS-RSRP measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.1.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.1.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.1.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.1.1.

5.7.1.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.1.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.1.1.4.1-1.

Table 5.7.1.1.4.1-1: Supported test configurations

Configuration	Description
5.7.1.1-1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.1.1-2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.1.1.4.1-2.

Table 5.7.1.1.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.1.1.4.3.
2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the SS-RSRP measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.1.1.4.2 Test procedure

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.
2. Set the parameters according to Table 5.7.1.1.5-1 as appropriate.
3. The SS shall transmit an *RRCCONNECTIONRECONFIGURATION* message on Cell 1.
4. The UE shall transmit an *RRCCONNECTIONRECONFIGURATIONCOMPLETE* message.
5. The UE shall transmit periodically MeasurementReport messages.
6. After 10s wait from Step 3, the SS shall check the SS-RSRP reported values in the periodic MeasurementReport for the following requirements:
 - R1: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

- R3: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.1.1.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G for each of the requirements is achieved. The evaluation of a specific requirement is concluded when the confidence level for that requirement is reached, even if more measurement reports are required for the remaining requirements.
8. Set the parameters according to Test 2 in Table 5.7.1.1.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:
- R4: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.
 - R5: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.
 - R6: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.1.1.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.
 - R7: The SS-RSRP value of Cell 2 reported by the UE during Test 2 is compared to the reported SS-RSRP of Cell 2 during Test 1 for the same iteration. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R7 is increased by one. Otherwise, the number of passed iterations for R7 is increased by one.
 - R8: The SS-RSRP value of Cell 3 reported by the UE during Test 2 is compared to the reported SS-RSRP of Cell 3 during Test 1 for the same iteration. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R8 is increased by one. Otherwise, the number of passed iterations for R8 is increased by one.
9. If more measurement reports with Test 1 configuration are needed in order to complete the evaluation R7 or R8, the SS shall set the parameters according to Table 5.7.1.1.5-2 as appropriate and repeat steps 5 to 8, evaluating R7 and / or R8 as appropriate.

5.7.1.1.4.3 Message contents

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

Table 5.7.1.1.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 Table H.3.1-3 with Condition Synchronous cells Table H.3.1-5 Table H.3.1-7 Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.1.1.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR ::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL
reportQuantityCell SEQUENCE {			
rsrq	false		
sinr	false		
}			
maxReportCells	2		
}			
}			
}			

5.7.1.1.5 Test requirement

Table 5.7.1.1.5-1 defines the cell specific settings for all tests. Table 5.7.1.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.1.0.1.1 and relative accuracy requirements in clause 5.7.1.0.1.2. The following eight requirements are to be verified:

During T1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-4.

During T2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.1.5-3 and Table 5.7.1.1.5-3a.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-4.

During T1 and T2:

R7: Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-5.

R8: Relative accuracy of Cell 3 during T2 compared with Cell 3 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.1.5-5.

Table 5.7.1.1.5-1: SS-RSRP Intra frequency general test parameters

Parameter ^{Note 5}	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
BW _{channel}	MHz	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		24		24	

Parameter ^{Note 5}	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.2 TDD	-	SR.3.2 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 2	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS ^{Note 1}					
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1 and 2
NOTE 6: Void

Table 5.7.1.1.5-2: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1			
Assumption for UE beams ^{Note 8}		Rough			
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-97.4		N/A	
N_{oc} ^{Note1}	dBm/SCS ^{Note4}	-88.37		N/A	

Parameter	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
\hat{E}_s / N_{oc}	dB	6.0	1.4	N/A	N/A
E_s	$\text{dBm}/\text{SCS} \times 10^{-4}$			(Table B.2.2-2 Rx Beam Peak +9.8dB)	(Table B.2.2-2 Rx Beam Peak +9.8dB)
SSB_RP ^{Note2}	dBm/SCS	-82.37	-86.97	(Table B.2.2-2 Rx Beam Peak +9.8dB)	(Table B.2.2-2 Rx Beam Peak +9.8dB)
$\hat{E}_s / I_{ot, BB}$ ^{Note6}	dB	2.20	-5.59	-1.77	-1.77
I_o ^{Note2}	$\text{dBm}/95.04 \text{ MHz}$ ^{Note4}	-55.74		(Table B.2.2-2 Rx Beam Peak +37.40dB)	
<p>NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>NOTE 2: SSB_RP, E_s/I_{ot} and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>NOTE 3: Void</p> <p>NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone</p> <p>NOTE 5: Void</p> <p>NOTE 6: Calculation of $E_s/I_{ot, BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_R from TS 38.101-2 [3] Table 6.2.1.3-4.</p> <p>NOTE 7: All parameters apply for configurations 1 and 2</p> <p>NOTE 8: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation</p>					

Table 5.7.1.1.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5

UE power class 3			
Normal Conditions	Test 1 All bands	Test 2	
		Lowest reported value (Cell 2)	50
Highest reported value (Cell 2)	108	n257, n258, n261 n260 n259	88 90 FFS
Lowest reported value (Cell 3)	46	n257, n258, n261 n260 n259	31 33 FFS
Highest reported value (Cell 3)	103	n257, n258, n261 n260 n259	88 90 FFS
Extreme Conditions	Test 1 All bands	Test 2	
Lowest reported value (Cell 2)	47+ FFS	n257, n258, n261 n260 n259	28 + FFS 30 + FFS FFS
Highest reported value (Cell 2)	111+ FFS	n257, n258, n261 n260 n259	91 + FFS 93 + FFS FFS
Lowest reported value (Cell 3)	46+ FFS	n257, n258, n261 n260	28+ FFS 30+ FFS

UE power class 3			
Normal Conditions	Test 1 All bands	Test 2	
		n259	FFS
Highest reported value (Cell 3)	106+ FFS	n257, n258, n261	91+ FFS
		n260	93+ FFS
		n259	FFS

Table 5.7.1.1.5-3a: evaluation limits for the $\Delta(\text{Max-Min})$ reported values for each cell during each time period

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
$\Delta(\text{Max-Min})$ reported value Cell 2	16	16
$\Delta(\text{Max-Min})$ reported value Cell 3	16	16
Extreme Conditions	Test 1 All bands	Test 2 All bands
$\Delta(\text{Max-Min})$ reported value Cell 2	16 + FFS	16+ FFS
$\Delta(\text{Max-Min})$ reported value Cell 3	16 + FFS	16 + FFS

Table 5.7.1.1.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
Lowest reported value (Cell 3)	$\text{RSRP}_x - 12$	$\text{RSRP}_x - 6$
Highest reported value (Cell 3)	$\text{RSRP}_x + 2$	$\text{RSRP}_x + 6$
Extreme Conditions	Test 1 All bands	Test 2 All bands
Lowest reported value (Cell 3)	$\text{RSRP}_x - 15 + \text{FFS}$	$\text{RSRP}_x - 9 + \text{FFS}$
Highest reported value (Cell 3)	$\text{RSRP}_x + 5 + \text{FFS}$	$\text{RSRP}_x + 9 + \text{FFS}$

RSRP_x is the reported value of Cell 2

Table 5.7.1.1.5-5: evaluation limits for the reported values for T2 with respect to T1 relative accuracy rules R7, R8

UE power class 3			
Test 2	Bands	Normal Conditions	Extreme Conditions
Lowest reported value (Cell 2)	n257, n258, n261	$\text{RSRP}_x - 28$	$\text{RSRP}_x - 31 + \text{FFS}$
	n260	$\text{RSRP}_x - 26$	$\text{RSRP}_x - 29 + \text{FFS}$
	n259	FFS	FFS
Highest reported value (Cell 2)	n257, n258, n261	$\text{RSRP}_x - 12$	$\text{RSRP}_x - 9 + \text{FFS}$
	n260	$\text{RSRP}_x - 10$	$\text{RSRP}_x - 7 + \text{FFS}$
	n259	FFS	FFS
Lowest reported value (Cell 3)	n257, n258, n261	$\text{RSRP}_y - 24$	$\text{RSRP}_y - 27 + \text{FFS}$
	n260	$\text{RSRP}_y - 21$	$\text{RSRP}_y - 24 + \text{FFS}$
	n259	FFS	FFS
Highest reported value (Cell 3)	n257, n258, n261	$\text{RSRP}_y - 8$	$\text{RSRP}_y - 5 + \text{FFS}$
	n260	$\text{RSRP}_y - 5$	$\text{RSRP}_y - 2 + \text{FFS}$
	n259	FFS	FFS

RSRP_x is the reported value of Cell 2 during T1
RSRP_y is the reported value of Cell 3 during T1

For the test to pass, the ratio of successful reported values for each requirement (R1 to R8) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.1.2 EN-DC FR2-FR2 SS-RSRP measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.7.1.2.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-RSRP measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.1.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.1.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.1.2.

5.7.1.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.1.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.1.2.4.1-1.

Table 5.7.1.2.4.1-1: Supported test configurations

Configuration	Description
5.7.1.2-1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.1.2-2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD
5.7.1.2-3	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.1.2-4	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.1.2.4.1-2.

Table 5.7.1.2.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1

Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.7.1.2.4.1-3.
2. Message contents are defined in clause 5.7.1.2.4.3.
3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-RSRP measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
4. The rx beam peak and directions in which the UE meets the EIS spherical coverage criteria have been found with one of the procedures from Annex I.

5.7.1.2.4.2 Test procedure

1. Configure the positioning system for a valid test point as defined in A.9.4. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to Table 5.7.1.2.5-1 as appropriate.
3. The SS shall transmit an *RRCCConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRCCConnectionReconfigurationComplete* message.
5. The UE shall transmit periodically MeasurementReport messages.
6. After 10s wait from Step 3, the SS shall check the SS-RSRP reported values in the periodic MeasurementReport for the following requirements:
 - R1: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.1.2.5-3, Table 5.7.1.2.5-3a or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.2.5-3, Table 5.7.1.2.5-3a or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
 - R3: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.1.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G for each of the requirements is achieved. The evaluation of a specific requirement is concluded when the confidence level for that requirement is reached, even if more measurement reports are required for the remaining requirements.
8. The SS shall select a new test point as defined in A.9.4 and rotate the positioning system for the selected test point.
9. Set the parameters according to Test 2 in Table 5.7.2.1.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:
 - R4: The SS-RSRP value of Cell 2 reported by the UE is compared to the expected SS-RSRP for Cell 2. If the value is outside the limits in Table 5.7.2.1.5-3, Table 5.7.1.2.5-3a or the UE fails to report the measurement

value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

- R5: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.2.1.5-3, Table 5.7.1.2.5-3a or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.
- R6: The SS-RSRP value of Cell 3 reported by the UE is compared to the reported SS-RSRP of Cell 2. If the resulting value is outside the limits in Table 5.7.2.1.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.

5.7.1.2.4.3 Message contents

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

Table 5.7.1.2.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells Table H.3.1-5 Table H.3.1-7 with Condition INTER-FREQ Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition Pattern #0 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.1.2.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR ::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL
reportQuantityCell SEQUENCE {			
rsrq	false		
sinr	false		
}			
maxReportCells	2		
}			
}			

5.7.1.2.5 Test requirement

Table 5.7.1.2.5-1 defines the cell specific settings for all tests. Table 5.7.1.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.1.0.2.1 and relative accuracy requirements in clause 5.7.1.0.2.2. The following eight requirements are to be verified:

During T1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2 and Table 5.7.1.2.5-3a for both configurations.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.2.5-5.

During T2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table 5.7.1.2.5-3 for test configuration 1 and in Table 5.7.1.2.5-4 for test configuration 2 and Table 5.7.1.2.5-3a for both configurations.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 5.7.1.2.5-5.

Table 5.7.1.2.5-1: SS-RSRP Inter frequency general test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2 freq1	Cell 3 freq2	Cell 2 freq1	Cell 3 freq2
SSB ARFCN	1~4					
BW _{channel}	1~4		100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated	1,2 3,4		24 48		24 48	
Duplex mode	1~4		TDD		TDD	
TDD configuration	1~4		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1,2 3,4		SR.3.2 TDD SR.3.3 TDD	-	SR.3.2 TDD SR.3.3 TDD	-
RMSI CORESET Reference Channel	1,2 3,4		CR.3.1 TDD CR.3.2 TDD	-	CR.3.1 TDD CR.3.2 TDD	-
Dedicated CORESET Reference Channel	1,2 3,4		CCR.3.1 TDD CCR.3.7 TDD	-	CCR.3.1 TDD CCR.3.7 TDD	-
SSB configuration	1,2 3,4		SSB.3 FR2 SSB.4 FR2		SSB.3 FR2 SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing	1~4	kHz	120		120	
OCNG Patterns	1~4		OP.3		OP.3	
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~4		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2		TCI.State.2	
SMTC configuration	1~4		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~4	µs	3		3	
EPRE ratio of PSS to SSS	1~4	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS ^{Note 1}						
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}						
Propagation condition	1~4	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1~4	-	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Void

Table 5.7.1.2.5-2: SS-RSRP Inter frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration	1~4		Setup 4b according to clause A.9.4		Setup 4b according to clause A.9.4	
			AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
Assumption for UE beams ^{Note 7}	1~4		Rough		Rough	
N_{oc} ^{Note 1}	1, 2	dBm/15kHz ^{Note 4}	-96.3	-96.3	(Table B.2.3-2 Rx Beam Peak ^{Note 8} - 4.63dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} - 3.03dB)
	3, 4		-99.3	-99.3		
N_{oc} ^{Note 1}	1, 2	dBm/SCS ^{Note 4}	-87.3	-87.3	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +4.4dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +6.0dB)
	3, 4		-87.3	-87.3	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +7.4dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +9.0dB)
\hat{E}_s / N_{oc}	1~4	dB	6.0	6.0	17.0	1.0
SSB_RP ^{Note 2}	1, 2	dBm/SCS	-81.3	-81.3	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +21.4dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +7.0dB)
	3, 4		-81.3	-81.3	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +24.4dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +10.0dB)
(SSB_RP _{Cell 2} – SSB_RP _{Cell 3})	1~4	dB	0		14.40	
$\hat{E}_s / I_{ot\ BB}$ ^{Note 6}	1, 2	dB	5.23	5.93	5.38	-1.46
	3, 4		4.58	5.87		
I_o ^{Note 2}	1, 2	dBm/95.04 MHz ^{Note 4}	-55.70	-55.70	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +46.08dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +35.13dB)
	3, 4		-55.7	-55.7	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +49.09dB)	(Table B.2.3-2 Rx Beam Peak ^{Note 8} +38.14dB)
($I_{ofreq 1} - I_{ofreq 2}$)	1~4	dB	0		11.95	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 2: SSB_RP, \hat{E}_s / I_{ot} , I_o , (SSB_RP _{Cell 3} – SSB_RP _{Cell 2}) and ($I_{ofreq 2} - I_{ofreq 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 3: Void						
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 5: Void						

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
NOTE 6: Calculation of E_s/lot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [3], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [3] Table 6.2.1.3-4.						
NOTE 7: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation						
NOTE 8: The value in Table B.2.3-2 of TS 38.133 [6] is the Minimum SSB_RP for $SCS_{SSB} = 120$ kHz, selected according to the operating band of Cell 3 and UE power class, without $\Delta MB_{P,n}$ adjustment.						

Table 5.7.1.2.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5 for test configuration 1

UE power class 3				
Normal Conditions	Test 1		Test 2	
	Lowest reported value (Cell 2)	n257, n258, n261	41	n257, n258, n261
n260		39	n260	34
n259		FFS	n259	FFS
Highest reported value (Cell 2)	All bands: 109		n257, n258, n261	101
			n260	104
			n259	FFS
Lowest reported value (Cell 3)	All bands: 52		n257, n258, n261	32
			n260	34
			n259	FFS
Highest reported value (Cell 3)	All bands: 109		n257, n258, n261	87
			n260	90
			n259	FFS
Extreme Conditions	Test 1		Test 2	
Lowest reported value (Cell 2)	n257, n258, n261	41 + FFS	n257, n258, n261	33 + FFS
	n260	39 + FFS	n260	34 + FFS
	n259	FFS	n259	FFS
Highest reported value (Cell 2)	All bands: 109 + FFS		n257, n258, n261	101 + FFS
			n260	104 + FFS
			n259	FFS
Lowest reported value (Cell 3)	All bands: 52 + FFS		n257, n258, n261	32 + FFS
			n260	34 + FFS
			n259	FFS
Highest reported value (Cell 3)	All bands: 109 + FFS		n257, n258, n261	87 + FFS
			n260	91 + FFS
			n259	FFS

Table 5.7.1.2.5-3a: evaluation limits for the $\Delta(\text{Max-Min})$ reported absolute values for cell 3 during each time period

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
$\Delta(\text{Max-Min})$ reported value Cell 3	16	16
Extreme Conditions	Test 1 All bands	Test 2 All bands
$\Delta(\text{Max-Min})$ reported value Cell 3	16 + FFS	16 + FFS

Table 5.7.1.2.5-4: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5 for test configuration 2

UE power class 3

Normal Conditions	Test 1		Test 2	
Lowest reported value (Cell 2)	n257, n258, n261	41	n257, n258, n261	36
	n260	39	n260	37
	n259	FFS	n259	FFS
Highest reported value (Cell 2)	All bands: 109		n257, n258, n261	104
			n260	107
			n259	FFS
Lowest reported value (Cell 3)	All bands: 52		n257, n258, n261	35
			n260	37
			n259	FFS
Highest reported value (Cell 3)	All bands: 109		n257, n258, n261	90
			n260	93
			n259	FFS
Extreme Conditions	Test 1		Test 2	
Lowest reported value (Cell 2)	n257, n258, n261	41 + FFS	n257, n258, n261	28 + FFS
	n260	39 + FFS	n260	30 + FFS
	n259	FFS	n259	FFS
Highest reported value (Cell 2)	All bands: 109 + FFS		n257, n258, n261	91 + FFS
			n260	93 + FFS
			n259	FFS
Lowest reported value (Cell 3)	All bands: 52 + FFS		n257, n258, n261	28+ FFS
			n260	30+ FFS
			n259	FFS
Highest reported value (Cell 3)	All bands: 109 + FFS		n257, n258, n261	91+ FFS
			n260	93+ FFS
			n259	FFS

Table 5.7.1.2.5-5: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

UE power class 3				
Normal Conditions	Test 1		Test 2 All bands	
Lowest value (RSRP report Cell 3 – RSRP report Cell 2)	All bands: -15		-29	
Highest value (RSRP report Cell 3 – RSRP report Cell 2)	n257, n258, n261	+25	n257, n258, n261	+11
	n260	+27	n260	+13
	n259	FFS	n259	FFS
Extreme Conditions	Test 1		Test 2 All bands	
Lowest value (RSRP report Cell 3 – RSRP report Cell 2)	-15 + FFS		-29+ FFS	
Highest value (RSRP report Cell 3 – RSRP report Cell 2)	n257, n258, n261	+25 + FFS	n257, n258, n261	+11 + FFS
	n260	+27+ FFS	n260	+13 + FFS
	n259	FFS	n259	FFS

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.1.3 EN-DC FR1-FR2 SS-RSRP measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz

- The test is incomplete for extreme conditions

5.7.1.3.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-RSRP measurement accuracy for NR FR2 is within the specified limits for all bands, when the PSCell is on an NR FR1 carrier.

5.7.1.3.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.1.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.1.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.1.3.

5.7.1.3.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR1 PSCell and Cell 3 is the NR FR2 neighbour cell on a NR FR2 carrier.

5.7.1.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.1.3.4.1-1.

Table 5.7.1.3.4.1-1: Supported test configurations

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Configure the test equipment and the DUT according to the parameters in Table 5.7.1.3.4.1-2.

Table 5.7.1.3.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.7.1.3.4.1-3.

2. Message contents are defined in clause 5.7.1.3.4.3.
3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR1 carrier and Cell 3 is the neighbour cell on the NR FR2 carrier. Cell 3 is the target for the SS-RSRP measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
4. The directions in which the UE meets the EIS spherical coverage criteria have been found with one of the procedures from Annex I.

5.7.1.3.4.2 Test procedure

1. Configure the positioning system for a valid test point as defined in A.9.2. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5.
2. Set the parameters according to Table 5.7.1.3.5-1 as appropriate.
3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.

5.

The UE shall transmit periodically MeasurementReport messages.

6. After 10s wait from Step 3, the SS shall check the SS-RSRP reported values in the periodic MeasurementReport for the following requirements:
 - R1: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.3.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G for each of the requirements is achieved. The evaluation of a specific requirement is concluded when the confidence level for that requirement is reached, even if more measurement reports are required for the remaining requirements.
8. The SS shall select a new test point as defined in A.9.2 and rotate the positioning system for the selected test point.
9. Set the parameters according to Test 2 in Table 5.7.1.3.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:
 - R2: The SS-RSRP value of Cell 3 reported by the UE is compared to the expected SS-RSRP for Cell 3. If the value is outside the limits in Table 5.7.1.3.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5.7.1.3.4.3 Message contents

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

Table 5.7.1.3.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	

Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells Table H.3.1-5 Table H.3.1-7 with Condition INTER-FREQ Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition Pattern #0 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1
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Table 5.7.1.3.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR ::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL
reportQuantityCell SEQUENCE {			
rsrq	false		
sinr	false		
}			
maxReportCells	2		
}			
}			
}			

5.7.1.3.5 Test requirement

Table 5.7.1.3.5-1 defines the cell specific settings for all tests. Table 5.7.1.3.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.1.0.2. The following requirements are to be verified:

During Test 1:

R1: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.3.5-3.

During Test 2:

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table 5.7.1.3.5-3.

Table 5.7.1.3.5-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1-6		freq1	freq2	freq1	freq2
BW _{channel}	1,4	MHz	10: N _{RB,c} = 52	100: N _{RB,c} = 66	10: N _{RB,c} = 52	100: N _{RB,c} = 66
	2,5		10: N _{RB,c} = 52		10: N _{RB,c} = 52	
	3,6		40: N _{RB,c} = 106		40: N _{RB,c} = 106	
Data RBs allocated	1,2,4,5 3,6		52 106	24	52 106	66
Gap pattern ID			0		0	
Duplex mode	1,4		FDD	TDD	FDD	TDD
	2,5		TDD		TDD	
	3,6		TDD		TDD	
TDD configuration	1,4		N/A		N/A	

	2,5		TDDConf. 1.1	TDDConf. 3.1	TDDConf. 1.1	TDDConf. 3.1
	3,6		TDDConf. 2.1		TDDConf. 2.1	
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	2,5		SR.1.1 TDD	-	SR.1.1 TDD	-
	3,6		SR.2.1 FDD	-	SR.2.1 FDD	-
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	2,5		CR.1.1 TDD	-	CR.1.1 TDD	-
	3,6		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2,5		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3,6		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1,4		SSB.1 FR1	SSB.3 FR2	SSB.1 FR1	SSB.3 FR2
	2,5		SSB.1 FR1		SSB.1 FR1	
	3,6		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1-6		OP.1	OP.3	OP.1	OP.1
Initial BWP Configuration	1-6		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1-6		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1-6		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1-6		TCI.State.2		TCI.State.2	
SMTC configuration	1-6		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1-6	µs	3		3	
EPRE ratio of PSS to SSS	1-6	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS ^{Note 1}						
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}						
Propagation condition	1-6	-	NA Link only, see clause A.3.7A of TS 38.133 [6]	AWGN	NA Link only, see clause A.3.7A of TS 38.133 [6]	AWGN
Antenna configuration	1-6	-		1x2		1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
Note 2: Void						

Table 5.7.1.3.5-2: SS-RSRP inter-frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 ^{NOTE 3}	
			Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration according to clause A.9			NA	Setup 2b	NA	Setup 2b
Assumption for UE beams ^{Note 4}			N/A	Rough	N/A	Rough
N_{oc}	1~6	dBm/15 kHz	NA Link only, see clause A.3.7A of TS 38.133 [6]	-95.5	NA Link only, see clause A.3.7A of TS 38.133 [6]	NA
N_{oc}	1~6	dBm/SSB SCS		-86.47		NA
\hat{E}_s / N_{oc}	1~6	dB		5		NA
E_s	1~6	dBm/SCS		NA		(Table B.2.3-2 Spherical coverage +6.5dB)
SSB_RP ^{Note 1}	1~6	dBm/SCS		-81.47		(Table B.2.3-2 Spherical coverage +6.5dB)
$\hat{E}_s / I_{ot, BB}$ ^{Note 6}	1~6	dB	4.35	1.69		
I_o ^{Note 1}	1~6	dBm/95.04MHz	-55.68	SSB_RP+34.48		

Note 1: E_s , I_o , SSB_RP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 2: Void

Note 3: No additional noise is added by the test system in Test 2.

Note 4: Information about types of UE beam is given in B.2.1.3, of TS 38.133 [6] and does not limit UE implementation or test system implementation.

Note 5: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 6: Calculation of E_s / $I_{ot, BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [2], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_s from TS 38.101-2 [2] Table 6.2.1.3-4.

Table 5.7.1.3.5-3: evaluation limits for the reported values for Test 1 and Test 2 absolute accuracy rules R1, R2

Normal Conditions	UE power class 3			
	Test 1		Test 2	
Lowest reported value (Cell 3)	n257, n258, n261	46	n257, n258, n261	46
	n260	45	n260	47
	n259	FFS	n259	FFS
Highest reported value (Cell 3)	n257, n258, n261	103	n257, n258, n261	101
	n260	102	n260	104
	n259	FFS	n259	FFS
Extreme Conditions	Test 1		Test 2	
Lowest reported value (Cell 3)	n257, n258, n261	FFS	n257, n258, n261	FFS
	n260	FFS	n260	FFS

	n259	FFS	n259	FFS
Highest reported value (Cell 3)	n257, n258, n261	FFS	n257, n258, n261	FFS
	n260	FFS	n260	FFS
	n259	FFS	n259	FFS

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.2 SS-RSRQ

5.7.2.0 Minimum conformance requirements

5.7.2.0.1 Intra-frequency SS-RSRQ measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.2.0.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.2.0.1-1: SS-RSRQ Intra frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB \bar{E}_s /lot	I_o ^{Note 2} range	
			Minimum I_o	Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}	
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$
± 2.5	± 4	≥ -3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	
± 3.5	± 4	≥ -6	-50	

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB \bar{E}_s /lot and related parameters may need to be adjusted to ensure \bar{E}_s /lot at UE baseband is above the value defined in this table.

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.2.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.8.1 and 10.1.11.

5.7.2.0.2 Inter-frequency SS-RSRQ measurement accuracy requirements

5.7.2.0.2.1 Absolute SS-RSRQ Accuracy

The requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 5.7.2.0.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.2.0.2.1-1: SS-RSRQ Inter frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB \bar{E}_s/lot	I_o ^{Note 2} range	
			Minimum I_o	Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}	
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$
± 2.5	± 4	≥ -3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	
± 3.5	± 4	≥ -4	-50	

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
 NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
 NOTE 3: In the test cases, the SSB \bar{E}_s/lot and related parameters may need to be adjusted to ensure \bar{E}_s/lot at UE baseband is above the value defined in this table.

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.2.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.10.1 and 10.1.11.

5.7.2.0.2.2 Relative SS-RSRQ Accuracy

The relative accuracy of SS-RSRQ in inter frequency case is defined as the RSRQ measured from one cell on a frequency in FR2 compared to the RSRP measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 5.7.2.0.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|\text{SSB_RP1}_{\text{dBm}} - \text{SSB_RP2}_{\text{dBm}}| \leq 27$ dB
- $|\text{Channel 1}_{I_o} - \text{Channel 2}_{I_o}| \leq 20$ dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.2.0.2.2-1: SS-RSRQ Inter frequency relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB \bar{E}_s/lot	I_o ^{Note 2} range	
			Minimum I_o	Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 1}	
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$
± 3	± 4	≥ -3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	
± 4	± 4	≥ -4	-50	

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
 NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
 NOTE 3: The parameter SSB \bar{E}_s/lot is the minimum SSB \bar{E}_s/lot of the pair of cells to which the requirement applies.

NOTE 4: In the test cases, the SSB \bar{E}_s /lot and related parameters may need to be adjusted to ensure \bar{E}_s /lot at UE baseband is above the value defined in this table.

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.2.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.10.1 and 10.1.11.

5.7.2.1 EN-DC FR2 SS-RSRQ measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.7.2.1.1 Test purpose

The purpose of this test is to verify that the intra-frequency SS-RSRQ measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.2.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.2.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.2.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.2.1.

5.7.2.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.2.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.2.1.4.1-1.

Table 5.7.2.1.4.1-1: Supported test configurations

Configuration	Description
5.7.2.1-1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.2.1-2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.2.1.4.1-2.

Table 5.7.2.1.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.2.1.4.3.
2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the SS-RSRQ measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.2.1.4.2 Test procedure

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.
2. Set the parameters according to Table 5.7.2.1.5-1 as appropriate.
3. The SS shall transmit an *RRCCConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRCCConnectionReconfigurationComplete* message.
5. The UE shall transmit periodically MeasurementReport messages.
6. After 10s wait from Step 3, the SS shall check the SS-RSRQ reported values in the periodic MeasurementReport. The SS-RSRQ value of Cell 3 reported by the UE is compared to the expected SS-RSRQ. If the value is outside the limits in Table 5.7.2.1.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.
8. Set the parameters according to each sub-test in Table 5.7.2.1.5-2 as appropriate and repeat steps 5-7.

5.7.2.1.4.3 Message contents

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

Table 5.7.2.1.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 Table H.3.1-3 with Condition Synchronous cells Table H.3.1-5 Table H.3.1-7 Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.2.1.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL
reportQuantityCell SEQUENCE {			
rsrp	false		
sinr	false		
}			
maxReportCells	2		
}			
}			

5.7.2.1.5 Test requirement

Table 5.7.2.1.5-1 defines the cell specific settings for all tests. Table 5.7.2.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each SS-RSRQ measurement report for each of the tests in Table 5.7.2.1.5-2 shall meet the corresponding absolute accuracy requirements in Table 5.7.2.1.5-3.

Table 5.7.2.1.5-1: SS-RSRQ Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1		Freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
BW _{channel}	MHz	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
BWP configuration	Initial DL BWP	DLBWP.0.1			
	Dedicated DL BWP	DLBWP.1.1			
	Initial UL BWP	ULBWP.0.1			
	Dedicated UL BWP	ULBWP.1.1			
TRS configuration		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state		TCI.State. 0		TCI.State. 0	
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1		Freq1	
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS ^{Note 1}					
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}					
Propagation condition		AWGN		AWGN	
Antenna Configuration		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void.
NOTE 3: Void.
NOTE 4: Void.
NOTE 5: Void

Table 5.7.2.1.5-2: SS-RSRQ Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1		Setup 1	
Assumption for UE beams ^{Note 9}		Rough			
N_{oc} ^{Note 1}	dBm/15kHz ^{Note 4}	-100.7		-96.7	
N_{oc} ^{Note 1}	dBm/SCS ^{Note 3}	-91.67		-87.67	
SSB_RP ^{Note 2}	dBm/SCS ^{Note 4}	-88.67	-88.67	-90.67	-90.67
SS-RSRQ ^{Note 2}	dB	-14.81	-14.81	-16.84	-16.84
\hat{E}_s / I_{ot}	dB	-1.76	-1.76	-4.76	-4.76
\hat{E}_s / N_{oc}	dB	3	3	-3	-3
I_{o} ^{Note 2}	dBm/95.04 MHz ^{Note 4}	-55.7		-55.67	-55.67

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRQ, SSB_RP, and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRQ and SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone
NOTE 6: Void.
NOTE 7: Void.
NOTE 8: Void.
NOTE 9: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation

Table 5.7.2.1.5-3: SS-RSRQ Intra frequency absolute accuracy requirements for the reported values

UE Power Class 3	Test 1 (All bands)	Test 2
	Normal Conditions	

Lowest reported value (Cell 3)	SS-RSRQ_41	n257, n258, n261	SS-RSRQ_35
		n260	SS-RSRQ_34
		n259	FFS
Highest reported value (Cell 3)	SS-RSRQ_73	All bands	SS-RSRQ_71
Extreme Conditions			
Lowest reported value (Cell 3)	SS-RSRQ_38+ FFS	n257, n258, n261	SS-RSRQ_34+ FFS
		n260	SS-RSRQ_33+ FFS
		n259	FFS
Highest reported value (Cell 3)	SS-RSRQ_76+ FFS	All bands	SS-RSRQ_72+ FFS

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

5.7.2.2 EN-DC FR2-FR2 SS-RSRQ measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.7.2.2.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-RSRQ measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.2.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.2.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.2.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.2.2.

5.7.2.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.2.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.2.2.4.1-1.

Table 5.7.2.2.4.1-1: Supported test configurations

Configuration	Description
5.7.2.2-1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.2.2-2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.2.2.4.1-2.

Table 5.7.2.2.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.7.2.2.4.1-3.
2. Message contents are defined in clause 5.7.2.2.4.3.
3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-RSRQ measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.2.2.4.2 Test procedure

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5..
2. Set the parameters according to Table 5.7.2.2.5-1 as appropriate.
3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.
5. The UE shall transmit periodically MeasurementReport messages.
6. After 10s wait from Step 3, the SS shall check the SS-RSRQ reported values in the periodic MeasurementReport for the following requirements:
 - R1: The SS-RSRQ value of Cell 2 reported by the UE is compared to the expected SS-RSRQ for Cell 2. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The SS-RSRQ value of Cell 3 reported by the UE is compared to the expected SS-RSRQ for Cell 3. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
 - R3: The SS-RSRQ value of Cell 3 reported by the UE is compared to the reported SS-RSRQ of Cell 2. If the resulting value is outside the limits in Table 5.7.2.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.2.2.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements:
- R4: The SS-RSRQ value of Cell 2 reported by the UE is compared to the expected SS-RSRQ for Cell 2. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.
 - R5: The SS-RSRQ value of Cell 3 reported by the UE is compared to the expected SS-RSRQ for Cell 3. If the value is outside the limits in Table 5.7.2.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.
 - R6: The SS-RSRQ value of Cell 3 reported by the UE is compared to the reported SS-RSRQ of Cell 2. If the resulting value is outside the limits in Table 5.7.2.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.

5.7.2.2.4.3 Message contents

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

Table 5.7.2.2.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells Table H.3.1-5 Table H.3.1-7 with Condition INTER-FREQ Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition Pattern #0 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.2.2.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR ::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL
reportQuantityCell SEQUENCE {			
rsrp	false		
sinr	false		
}			
maxReportCells	2		
}			
}			

5.7.2.2.5 Test requirement

Table 5.7.2.2.5-1 defines the cell specific settings for all tests. Table 5.7.2.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRQ measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.2.0.2.1 and relative accuracy requirements in clause 5.7.2.0.2.2. The following eight requirements are to be verified:

During T1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in Table 5.7.2.2.5-3.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in Table 5.7.2.2.5-3.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRQ meets the requirements in Table 5.7.2.2.5-4.

During T2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in table 5.7.2.2.5-3.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRQ is in the range shown in table 5.7.2.2.5-3.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRQ meets the requirements in Table 5.7.2.2.5-4.

Table 5.7.2.2.5-1: SS-RSRQ Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1	freq2	freq1	Freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c} = 66$		100: $N_{RB,c} = 66$	
Data RBs allocated		66		66	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS ^{Note 1}					

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Void					
NOTE 3: Void					
NOTE 4: Void					

Table 5.7.2.2.5-2: SS-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
AoA setup		Setup 1		Setup 1	
Assumption for UE beams ^{Note 8}		Rough		Rough	
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-95.93	-95.93	-95.44	-95.44
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-86.9	-86.9	-86.41	-86.41
\hat{E}_s / N_{oc}	dB	-1.75	-1.75	-3	-3
SSB_RP ^{Note2}	dBm/SCS ^{Note4}	-88.65	-88.65	-89.41	-89.41
SS-RSRQ ^{Note2}	dB	-14.75	-14.75	-15.56	-15.56
\hat{E}_s / I_{ca}	dB	-1.75	-1.75	-3	-3
I_o ^{Note2}	dBm/95.04 MHz ^{Note4}	-55.7	-55.7	-55.7	-55.7
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-RSRQ, SSB_RP, and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone					
NOTE 6: Void					
NOTE 7: Void					
NOTE 8: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation					

Table 5.7.2.2.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5

UE power class 3		
Normal Conditions	Test 1	Test 2
	All bands	All bands
Lowest reported value (Cell 2)	RSRQ_41	RSRQ_37
Highest reported value (Cell 2)	RSRQ_73	RSRQ_74
Lowest reported value (Cell 3)	RSRQ_41	RSRQ_37
Highest reported value (Cell 3)	RSRQ_73	RSRQ_74
Extreme Conditions	Test 1	Test 2
	All bands	All bands
Lowest reported value (Cell 2)	RSRQ_41 + FFS	RSRQ_37 + FFS
Highest reported value (Cell 2)	RSRQ_73 + FFS	RSRQ_74 + FFS
Lowest reported value (Cell 3)	RSRQ_41 + FFS	RSRQ_37 + FFS
Highest reported value (Cell 3)	RSRQ_73 + FFS	RSRQ_74 + FFS

Table 5.7.2.2.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
Lowest value (RSRQ report Cell 3 – RSRQ report Cell 2)	- 7	- 9
Highest value (RSRQ report Cell 3 – RSRQ report Cell 2)	+ 7	+ 9
Extreme Conditions	Test 1 All bands	Test 2 All bands
Lowest value (RSRQ report Cell 3 – RSRQ report Cell 2)	- 7 + FFS	- 9 + FFS
Highest value (RSRQ report Cell 3 – RSRQ report Cell 2)	+ 7 + FFS	+ 9 + FFS

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.3 SS-SINR

5.7.3.0 Minimum conformance requirements

5.7.3.0.1 Intra-frequency SS-SINR measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of SS-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 5.7.3.0.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.3.0.1-1: SS-SINR Intra frequency absolute accuracy in FR2

Accuracy		Conditions	
Normal condition	Extreme condition	SSB \hat{E} s/lot	I_o ^{Note 2} range
dB	dB		Minimum I_o dBm / SCS_{SSB} ^{Note 1}
± 3	± 4	≥ -3	$SCS_{SSB} = 120\text{kHz}$ $SCS_{SSB} = 240\text{kHz}$
± 3.5	± 4	≥ -6	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB \hat{E} s/lot and related parameters may need to be adjusted to ensure \hat{E} s/lot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for SSB \hat{E} s/lot ≤ 25 dB.

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.3.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.13.1 and 10.1.16.

5.7.3.0.2 Inter-frequency SS-SINR measurement accuracy requirements

5.7.3.0.2.1 Absolute SS-SINR Accuracy

The requirements for absolute accuracy of SS-SINR in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 5.7.3.0.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.3.0.2.1-1: SS-SINR Inter frequency absolute accuracy in FR2

Accuracy		Conditions	
Normal condition	Extreme condition	SSB \bar{E}_s/lot	I_o ^{Note 2} range
dB	dB		Minimum I_o dBm / SCS_{SSB} ^{Note 1}
± 3	± 4	≥ -3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival
± 3.5	± 4	≥ -4	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival

NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 2: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB \bar{E}_s/lot and related parameters may need to be adjusted to ensure \bar{E}_s/lot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for SSB $\bar{E}_s/\text{lot} \leq 25$ dB.

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.3.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.15.1 and 10.1.16.

5.7.3.0.2.2 Relative SS-SINR Accuracy

The relative accuracy of SS-SINR in inter frequency case is defined as the SS-SINR measured from one cell on a frequency in FR2 compared to the SS-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 5.7.3.0.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- $|\text{SSB_RP1}_{\text{dBm}} - \text{SSB_RP2}_{\text{dBm}}| \leq 27$ dB
- $|\text{Channel 1_}I_o - \text{Channel 2_}I_o| \leq 20$ dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.3.0.2.2-1: SS-SINR Inter frequency relative accuracy in FR2

Accuracy		Conditions	
Normal condition	Extreme condition	SSB \bar{E}_s/lot	I_o ^{Note 2} range
dB	dB		Minimum I_o dBm / SCS_{SSB} ^{Note 1}
± 3.5	± 4	≥ -3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival
± 4	± 4	≥ -6	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival

			class, operating band and angle of arrival
NOTE 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.			
NOTE 2: I_{0} specified at the Reference point, and assumed to have constant EPRE across the bandwidth.			
NOTE 3: The parameter SSB \hat{E}_s/lot is the minimum SSB \hat{E}_s/lot of the pair of cells to which the requirement applies.			
NOTE 4: In the test cases, the SSB \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.			
NOTE 5: The requirements apply for SSB $\hat{E}_s/\text{lot} \leq 25$ dB.			

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 4.7.3.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.15.1 and 10.1.16.

5.7.3.1 EN-DC FR2 SS-SINR measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.7.3.1.1 Test purpose

The purpose of this test is to verify that the intra-frequency SS-SINR measurement accuracy for NR FR2 is within the specified limits for all bands.

5.7.3.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards, which support ss-SINR-Meas.

5.7.3.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.3.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.3.1.

5.7.3.1.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on the same frequency as the PSCell.

5.7.3.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.3.1.4.1-1.

Table 5.7.3.1.4.1-1: Supported test configurations

Configuration	Description
5.7.3.1-1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.3.1-2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.3.1.4.1-2.

Table 5.7.3.1.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.3.1.4.3.
2. There are two carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on the NR FR2 carrier and Cell 3 is the neighbour cell on the same NR FR2 carrier. Cell 3 is the target for the SS-SINR measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.3.1.4.2 Test procedure

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.
2. Set the parameters according to Table 5.7.3.1.5-1 as appropriate.
3. The SS shall transmit an *RRCCConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRCCConnectionReconfigurationComplete* message.
5. The UE shall transmit periodically MeasurementReport messages.
6. After 10s wait from Step 3, the SS shall check the SS-SINR reported values in the periodic MeasurementReport. The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR. If the value is outside the limits in Table 5.7.3.1.5-2 or the UE fails to report the measurement value for Cell 3, the number of failed iterations is increased by one. Otherwise, the number of passed iterations is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.
8. Set the parameters according to each sub-test in Table 5.7.3.1.5-1 as appropriate and repeat steps 5-7.

5.7.3.1.4.3 Message contents

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

Table 5.7.3.1.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	

Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 Table H.3.1-3 with Condition Synchronous cells, SS-SINR Table H.3.1-5 Table H.3.1-7 Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1
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Table 5.7.3.1.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR ::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL
reportQuantityCell SEQUENCE {			
rsrp	false		
rsrq	false		
sinr	true		
}			
maxReportCells	2		
}			
}			

5.7.3.1.5 Test requirement

Table 5.7.3.1.5-1 defines the cell specific settings for all tests. Table 5.7.3.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each SS-SINR measurement report for each of the tests in Table 5.7.3.1.5-2 shall meet the corresponding absolute accuracy requirements in Table 5.7.3.1.5-3.

Table 5.7.3.1.5-1: SS-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
BW _{channel}	MHz	100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0

EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS ^{Note 1}					
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}					
Propagation condition		AWGN		AWGN	
Antenna Configuration		1x2		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Void					
NOTE 3: Void					
NOTE 4: Void					

Table 5.7.3.1.5-2: SS-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1		Setup 1	
Assumption for UE beams ^{Note 9}		Rough		Rough	
N_{oc} ^{Note 1}	dBm/15kHz ^{Note 4}	-105		-105	
N_{oc} ^{Note 1}	dBm/SCS ^{Note 3}	-96		-96	
SSB_RP ^{Note 2}	dBm/SCS ^{Note 4}	-91.46	-93.34	-98.8	-98.8
SS-SINR ^{Note 2}	n257, 258, n261	-0.18	-3.32	-4.95	-4.95
	n260	-0.31	-3.42	-5.20	-5.20
	n259	-0.39	-3.48	-5.48	-5.48
\hat{E}_s / I_{ot}	n257, 258, n261	-0.18	-3.32	-4.95	-4.95
	n260	-0.31	-3.42	-5.20	-5.20
	n259	-0.39	-3.48	-5.48	-5.48
\hat{E}_s / N_{oc}	dB	4.54	2.66	-3	-3
I_o ^{Note 2}	dBm/95.04 MHz ^{Note 4}	-59.43		-63.87	
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-SINR, SSB_RP, and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-SINR and SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone					
NOTE 6: Void					
NOTE 7: Void					
NOTE 8: Void					
NOTE 9: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation					

Table 5.7.3.1.5-3: SS-SINR Intra frequency absolute accuracy requirements for the reported values

UE Power Class 3	Test 1		Test 2	
	Normal Conditions			
Lowest reported value (Cell 3)	n257, n258, n261	SS-SINR_22	All bands	SS-SINR_18
	n260	SS-SINR_21		
	n259	FFS		
Highest reported value (Cell 3)	All bands	SS-SINR_58	n257, n258, n261	SS-SINR_55
			n260	SS-SINR_54
			n259	FFS

Extreme Conditions				
Lowest reported value (Cell 3)	n257, n258, n261	SS-SINR_21+ FFS	All bands	SS-SINR_17+ FFS
	n260	SS-SINR_20+ FFS		
	n259	FFS		
Highest reported value (Cell 3)	All bands	SS-SINR_59+ FFS	n257, n258, n261	SS-SINR_56+ FFS
			n260	SS-SINR_55+ FFS
			n259	FFS

For the test to pass, the ratio of successful reported values in each test shall be more than 90% with a confidence level of 95%.

5.7.3.2 EN-DC FR2-FR2 SS-SINR measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions

5.7.3.2.1 Test purpose

The purpose of this test is to verify that the inter-frequency SS-SINR measurement accuracy for NR FR2 is within the specified limits for all bands

5.7.3.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards, which support ss-SINR-Meas.

5.7.3.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.3.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.3.2.

5.7.3.2.4 Test description

Three cells are configured in this test: E-UTRA Cell 1 is the E-UTRAN PCell, Cell 2 is the NR FR2 PSCell and Cell 3 is the NR FR2 neighbour cell on a different NR FR2 frequency.

5.7.3.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.3.2.4.1-1. Table 5.7.3.2.4.1-1: Supported test configurations

Configuration	Description
5.7.3.2-1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE FDD
5.7.3.2-2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.3.2.4.1-2.

Table 5.7.3.2.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. The general test parameter settings are set up according to Table 5.7.3.2.4.1-3.
2. Message contents are defined in clause 5.7.3.2.4.3.
3. There are three carriers and three cells specified in the test, where E-UTRA Cell 1 is the E-UTRA PCell on the E-UTRA carrier, Cell 2 is the NR PSCell on one of the NR FR2 carriers and Cell 3 is the neighbour cell on the other NR FR2 carrier. Cell 3 is the target for the SS-SINR measurements. E-UTRA Cell 1 is configured according to TS 36.521-3 [26] clause C.1.0 and C.1.1.
4. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.3.2.4.2 Test procedure

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On* according to TS 38.508-1 [14] clause 4.5
2. Set the parameters according to Table 5.7.3.2.5-1 as appropriate.
3. The SS shall transmit an *RRCConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRCConnectionReconfigurationComplete* message.
5. The UE shall transmit periodically MeasurementReport messages.
6. After 10s wait from Step 3, the SS shall check the SS-SINR reported values in the periodic MeasurementReport for the following requirements:
 - R1: The SS-SINR value of Cell 2 reported by the UE is compared to the expected SS-SINR for Cell 2. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR for Cell 3. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
 - R3: The SS-SINR value of Cell 3 reported by the UE is compared to the reported SS-SINR of Cell 2. If the resulting value is outside the limits in Table 5.7.3.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
7. The SS shall continue checking the MeasurementReport messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

8. Set the parameters according to each sub-test in Table 5.7.3.2.5-2 as appropriate and repeat steps 5-7. In Step 6, the SS shall check the following requirements for Test 2:

- R4: The SS-SINR value of Cell 2 reported by the UE is compared to the expected SS-SINR for Cell 2. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.
- R5: The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR for Cell 3. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R5 is increased by one. Otherwise, the number of passed iterations for R5 is increased by one.
- R6: The SS-SINR value of Cell 3 reported by the UE is compared to the reported SS-SINR of Cell 2. If the resulting value is outside the limits in Table 5.7.3.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R6 is increased by one. Otherwise, the number of passed iterations for R6 is increased by one.

And the following requirements for Test 3:

- R7: The SS-SINR value of Cell 2 reported by the UE is compared to the expected SS-SINR for Cell 2. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 2, the number of failed iterations for R7 is increased by one. Otherwise, the number of passed iterations for R7 is increased by one.
- R8: The SS-SINR value of Cell 3 reported by the UE is compared to the expected SS-SINR for Cell 3. If the value is outside the limits in Table 5.7.3.2.5-3 or the UE fails to report the measurement value for Cell 3, the number of failed iterations for R8 is increased by one. Otherwise, the number of passed iterations for R8 is increased by one.
- R9: The SS-SINR value of Cell 3 reported by the UE is compared to the reported SS-SINR of Cell 2. If the resulting value is outside the limits in Table 5.7.3.2.5-4 or the UE fails to report the measurement value for Cell 2 or Cell 3, the number of failed iterations for R9 is increased by one. Otherwise, the number of passed iterations for R9 is increased by one.

5.7.3.2.4.3 Message contents

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

Table 5.7.3.2.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.1-1 Table H.3.1-2 with Condition INTER-FREQ Table H.3.1-3 with Condition INTER-FREQ MO, Synchronous cells, SS-SINR Table H.3.1-5 Table H.3.1-7 with Condition INTER-FREQ Table H.3.4-1 Table H.3.4-1a Table H.3.4-2 Table H.3.4-4 with Condition gapUE Table H.3.4-5 with Condition Pattern #0 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.3. 2.4.3-2: ReportConfigNR-DEFAULT(Periodical)

Derivation Path: 38.508-1 [14] Table 4.6.3-142 with condition PERIODICAL			
Information Element	Value/remark	Comment	Condition
ReportConfigNR ::= SEQUENCE {			
reportType CHOICE {			
periodical SEQUENCE {			PERIODICAL

reportQuantityCell SEQUENCE {			
rsrp	false		
rsrq	false		
sinr	true		
}			
maxReportCells	2		
}			
}			
}			

5.7.3.2.5 Test requirement

Table 5.7.3.2.5-1 defines the cell specific settings for all tests. Table 5.7.3.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-SINR measurement accuracy shall fulfil the absolute accuracy requirements in clause 5.7.3.0.2.1 and relative accuracy requirements in clause 5.7.3.0.2.2. The following eight requirements are to be verified:

During Test 1:

R1: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in Table 5.7.3.2.5-3.

R2: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in Table 5.7.3.2.5-3.

R3: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-SINR meets the requirements in Table 5.7.3.2.5-4.

During Test 2:

R4: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R5: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R6: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-SINR meets the requirements in Table 5.7.3.2.5-4.

During Test 3:

R7: Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R8: Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-SINR is in the range shown in table 5.7.3.2.5-3.

R9: Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-SINR meets the requirements in Table 5.7.3.2.5-4.

Table 5.7.3.2.5-1: SS-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1	freq2	freq1	Freq2	freq1	Freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
BW _{channel}	MHz	100: N _{RB,c} = 66		100: N _{RB,c} = 66		100: N _{RB,c} = 66	
Data RBs allocated		66		66		66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					

TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS ^{Note 1}							
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}							
Propagation conditions		AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna Configuration		1x2	1x2	1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Void							
NOTE 3: Void							
NOTE 4: Void							

Table 5.7.3.2.5-2: SS-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration	degrees	Setup 1		Setup 1		Setup 1	
Assumption for UE beams ^{Note 10}		Rough		Rough		Rough	
N_{oc} ^{Note1}	dBm/15kHz ^{Note4}	-105	-105	-105.1	-105.1	-105	-105
N_{oc} ^{Note1}	dBm/SCS ^{Note3}	-96	-96	-96.1	-96.1	-96	-96
\hat{E}_s / N_{oc}	dB	-0.5	-0.5	11	11	-2.1	-2.1
SS-RSRP ^{Note2}	dBm/SCS ^{Note4}	-96.5	-96.5	-85.1	-85.1	-98.1	-98.1
SS-SINR ^{Note2}	dB	-0.5	-0.5	11	11	-2.1	-2.1
\hat{E}_s / I_{ot}	dB	-0.5	-0.5	11	11	-2.1	-2.1
I_o ^{Note2}	dBm/95.04 MHz ^{Note4}	-69.3	-69.3	-55.75	-55.75	-64.9	-64.9
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-SINR, SSB_RP, and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0dBi gain antenna at the centre of the quiet zone							
NOTE 6: Void							
NOTE 7: Void							
NOTE 8: Void							
NOTE 9: Void							
NOTE 10: Information about types of UE beam is given in B.2.1.3 of TS 38.133 [6], and does not limit UE implementation or test system implementation							

Table 5.7.3.2.5-3: evaluation limits for the reported values for T1 and T2 absolute accuracy rules R1, R2, R4, R5

UE power class 3						
Normal Conditions	Test 1 All bands		Test 2 All bands		Test 3 All bands	
Lowest reported value (Cell 2)	SINR_27		SINR_48		n257, n258, n261	SINR_23
					n260	SINR_22
					n259	FFS
Highest reported value (Cell 2)	n257, n258, n261	SINR_62	n257, n258, n261	SINR_87	n257, n258, n261	SINR_60
	n260	SINR_61	n260	SINR_86	n260	SINR_59
	n259	FFS	n259	FFS	n259	FFS
Lowest reported value (Cell 3)	SINR_27		SINR_48		n257, n258, n261	SINR_23
					n260	SINR_22
					n259	FFS
Highest reported value (Cell 3)	n257, n258, n261	SINR_62	n257, n258, n261	SINR_87	n257, n258, n261	SINR_60
	n260	SINR_61	n260	SINR_86	n260	SINR_59
	n259	FFS	n259	FFS	n259	FFS
Extreme Conditions	Test 1 All bands		Test 2 All bands		Test 3 All bands	
Lowest reported value (Cell 2)	SINR_27 + FFS		SINR_48 + FFS		n257, n258, n261	SINR_23 + FFS
					n260	SINR_22 + FFS
					n259	FFS
Highest reported value (Cell 2)	n257, n258, n261	SINR_62 + FFS	n257, n258, n261	SINR_87 + FFS	n257, n258, n261	SINR_60 + FFS
	n260	SINR_61 + FFS	n260	SINR_86 + FFS	n260	SINR_59 + FFS
	n259	FFS	n259	FFS	n259	FFS
Lowest reported value (Cell 3)	SINR_27 + FFS		SINR_48 + FFS		n257, n258, n261	SINR_23 + FFS
					n260	SINR_22 + FFS
					n259	FFS
Highest reported value (Cell 3)	n257, n258, n261	SINR_62 + FFS	n257, n258, n261	SINR_87 + FFS	n257, n258, n261	SINR_60 + FFS
	n260	SINR_61 + FFS	n260	SINR_86 + FFS	n260	SINR_59 + FFS
	n259	FFS	n259	FFS	n259	FFS

Table 5.7.3.2.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R3, R6

UE power class 3			
Normal Conditions	Test 1 All bands	Test 2 All bands	Test 3 All bands
Lowest value (SINR report Cell 3 – SINR report Cell 2)	- 8	- 17	- 9
Highest value (SINR report Cell 3 – SINR report Cell 2)	+ 8	+ 17	+ 9
Extreme Conditions	Test 1 All bands	Test 2 All bands	Test 3 All bands
Lowest value (SINR report Cell 3 – SINR report Cell 2)	- 8 + FFS	- 17 + FFS	- 9 + FFS
Highest value (SINR report Cell 3 – SINR report Cell 2)	+ 8 + FFS	+ 17 + FFS	+ 9 + FFS

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.4 L1-RSRP

5.7.4.0 Minimum conformance requirements

5.7.4.0.1 SSB-based L1-RSRP absolute measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 5.7.4.0.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.4.0.1-1: SSB based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB \hat{E}_s/lot	I_o ^{Note 1} range		
			Minimum I_o		Maximum I_o
dB	dB	dB	dBm / SCS_{SSB} ^{Note 2}		dBm/ BW_{Channel}
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$	
± 6.5	± 9.5	≥ -3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival		N/A
± 8.5	± 11.5	≥ -3	N/A		-70

NOTE 1: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.1.1 and 10.1.6.

5.7.4.0.2 SSB-based L1-RSRP relative measurement accuracy requirements

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in Table 5.7.4.0.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 of TS 38.133 [6] for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

Table 5.7.4.0.2-1: SSB based L1-RSRP relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB \hat{E}_s/lot	I_0 ^{Note 1} range	
dB	dB		Minimum I_0	
		dBm / SCS _{SSB} ^{Note 3}		
			SCS _{SSB} = 120kHz	SCS _{SSB} = 240kHz
±6.5	±9.5	≥-3	Same value as SSB _{RP} in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	
NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.				
NOTE 2: The parameter SSB \hat{E}_s/lot is the minimum SSB \hat{E}_s/lot of the pair of SSBs to which the requirement applies.				
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.				
NOTE 4: In the test cases, the SSB \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.				

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.1.2 and 10.1.6.

5.7.4.0.3 CSI-RS-based L1-RSRP absolute measurement accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 5.7.4.0.3-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 of TS 38.133 [6] for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.4.0.3-1.

Table 5.7.4.0.3-1: CSI-RS based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	CSI-RS Es/lot	Io ^{Note 1} range			
dB	dB		Minimum Io		Maximum Io	
		dBm / SCS _{CSI-RS} ^{Note 2}	dBm/BW _{Channel}	dBm/BW _{Channel}		
SCS _{CSI-RS} = 60kHz	SCS _{CSI-RS} = 120kHz					
±6.5	±9.5	≥3	Same value as CSI-RS _{RP} in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8.5	±11.5	≥3	N/A		-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS Es/lot and related parameters may need to be adjusted to ensure Es/lot at UE baseband is above the value defined in this table.

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.2.1 and 10.1.6.

5.7.4.0.4 CSI-RS-based L1-RSRP relative measurement accuracy requirements

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 5.7.4.0.4-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 of TS 38.133 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 5.7.4.0.4-1.

Table 5.7.4.0.4-1: CSI-RS based L1-RSRP relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	CSI-RS \hat{E}_s/lot	I_0 ^{Note 1} range	
dB	dB		Minimum I_0	
		dBm / SCS _{CSI-RS}		
			SCS _{CSI-RS} = 60kHz	SCS _{CSI-RS} = 120kHz
±6.5	±9.5	≥-3	Same value as CSI-RS RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival	
NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.				
NOTE 2: The parameter CSI-RS \hat{E}_s/lot is the minimum CSI-RS \hat{E}_s/lot of the pair of CSI-RS resources to which the requirement applies.				
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.				
NOTE 4: In the test cases, the CSI-RS \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.				

The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 4.7.4.0.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

The normative reference for this requirement is TS 38.133 [6] clauses 10.1.20.2.2 and 10.1.6.

5.7.4.1 EN-DC FR2 SSB based L1-RSRP measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions
- This test case does not check absolute L1-RSRP test requirement for weaker SSB even when it is stated in TS 38.133. L1-RSRP reports defined in TS 38.214 do not include absolute L1-RSRP value for weaker SSB

5.7.4.1.1 Test purpose

The purpose of this test is to verify that the SSB based L1-RSRP absolute measurement accuracy is within the specified limits for all bands.

5.7.4.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.4.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.4.0.1 and 5.7.4.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.4.1.

5.7.4.1.4 Test description

5.7.4.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.4.1.4.1-1.

Table 5.7.4.1.4.1-1: Supported test configurations

Test Case ID	Description
5.7.4.1-1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.7.4.1-2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.7.4.1-3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.7.4.1-4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.4.1.4.1-2.

Table 5.7.4.1.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC, TL/VL, TL/VH, TH/VL, TH/VH	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.4-1 and TS 38.508-1 [14] clause 4.3.1.	
Channel bandwidth	As specified by the test configuration selected from Table 5.7.4.1.4.1-1.	
Propagation conditions	AWGN	As specified in Annex C.2.2.
Connection Diagram	TE Part	A.3.3.3.1-1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.4.1.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for SSB-based L1-RSRP measurements. The UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.4.1.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.7.4.1.4.1-2.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On and Test Mode On , according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.4.1.4.1-2.
2. Set the parameters according to T1 in Table 5.7.4.1.5-1.
3. After 320 ms from the beginning of T1, the UE shall start sending L1-RSRP report including results of both SSB#0 and SSB#1 every 80 slots.
4. The UE shall start sending valid L1-RSRP reports, a valid report shall meet the absolute L1-RSRP requirement for SSB#0 and the relative L1-RSRP requirement for SSB#1. The SS shall check following requirements:

- R1: The L1-RSRP value of SSB#0 reported by the UE is compared to the expected L1-RSRP value for SSB#0. If the value is outside the limits in Table 5.7.4.1.5-3, Table 5.7.4.1.5-3a or Table 5.7.4.1.5-4 (depending on the test configuration) or the UE fails to report the measurement value for SSB#0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The DIFF-RSRP value of SSB#1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for SSB#1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
5. The SS shall continue checking the L1-RSRP report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.
6. Set the parameters according T2 in Table 5.7.4.1.5-1 and repeat steps 3-5. In Step 4, The SS shall check the L1-RSRP reported values of SSB#0 and SSB#1 in the periodic L1-RSRP reports for the following requirements.
- R3: The L1-RSRP value of SSB#0 or SSB#1 reported by the UE is compared to the expected L1-RSRP value. If the value is outside the limits in Table 5.7.4.1.5-3, Table 5.7.4.1.5-3a or Table 5.7.4.1.5-4 (depending on the test configuration) or the UE fails to report the measurement value for SSB#0 or SSB#1, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
 - R4: The DIFF-RSRP value of SSB#0 or SSB#1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for SSB#0 or SSB#1, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

5.7.4.1.4.3 Message contents

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

Table 5.7.4.1.4.3-1: Common Exception messages EN-DC SSB based L1-RSRP measurement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6-2 with conditions PERIODIC and SS-RSRP Table H.3.6-3 with conditions SSB and PERIODIC Table H.3.4-1 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.4.1.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE { failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE { purpose	1 entry		
	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE { ssb-Index	0		
}			
}			
}			

5.7.4.1.5 Test requirement

Table 5.7.4.1.5-1 defines the primary level settings including test tolerances for all tests.

Each L1-RSRP measurement report for each of the tests in Table 5.7.4.1.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.4.1.5-2 for test configurations 1, 2, 4 and 5, and the corresponding absolute accuracy requirements in Table 5.7.4.1.5-3 for test configurations 3 and 6 and Table 5.7.4.1.5-3a for all configurations.

Table 5.7.4.1.5-1: L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~4		freq1	freq1
Duplex mode	1~4		TDD	TDD
TDD Configuration	1~4		TDDConf.3.1	TDDConf.3.1
BW_{channel}	1~4	MHz	100: $N_{\text{RB},c} = 66$	100: $N_{\text{RB},c} = 66$
Data RBs allocated	1~4		66	66
PDSCH Reference measurement channel	1,2		SR.3.2 TDD	SR.3.2 TDD
	3,4		SR.3.3 TDD	SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD	CR.3.1 TDD
	3,4		CR.3.2 TDD	CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD	CCR.3.1 TDD
	3,4		CCR.3.7 TDD	CCR.3.7 TDD
SSB configuration	1,2		SSB.1 FR2	SSB.1 FR2
	3,4		SSB.2 FR2	SSB.2 FR2

OCNG Patterns	1~4		OP.1	OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~4		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2	TCI.State.2
SMTC configuration	1~4		SMTC.1	SMTC.1
reportConfigType	1~4		periodic	periodic
reportQuantity	1~4		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~4		2	2
L1-RSRP reporting period	1~4		slot320	slot320
Propagation condition	1~4		AWGN	AWGN
Antenna configuration			1x2	1x2
EPRE ratio of PSS to SSS	1~4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS ^{Note 1}				
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}				
<p>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.</p> <p>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.</p>				

Table 5.7.4.1.5-2: L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 ^{NOTE 3}	
			SSB0	SSB1	SSB0	SSB1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams ^{Note 4}			Rough		Rough	
N_{oc}	1~4	dBm/15 kHz	-104.1		n.a.	
N_{oc}	1,2	dBm/SSB SCS	-95.1		n.a.	
	3,4		-92.1		n.a.	
\hat{E}_s/I_{ot}	1~4	dB	10	-1.6	n.a.	
SSB_RP ^{Note 1}	1,2	dBm/SCS	-85.1	-96.9	As in Table B.2.4-2 + 5.7	
	3,4		-78	-90	As in Table B.2.4-2 + 5.7	

I_0 ^{Note1}	1~4	dBm/ 95.04M Hz	-55.67		SSB_RP+34.68
\hat{E}_s / N_{oc}	1~4	dB	10	-1.6	n.a.
<p>Note 1: SSB_RP and I_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 2: Void</p> <p>Note 3: No additional noise is added by the test system in Test 2.</p> <p>Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>					

Table 5.7.4.1.5-3: L1-RSRP absolute accuracy requirements for the reported values for test configurations 1 and 2 for the absolute accuracy rules R1, R3

UE power class 3			
Normal Conditions	Test 1 (SSB#0) All bands	Test 2 (SSB#0 or SSB#1)	
		Lowest reported value	42
Highest reported value	101	n257, n258, n261 n260 n259	83 86 FFS
Extreme Conditions	Test 1 (SSB#0) All bands	Test 2 (SSB#0 or SSB#1)	
		Lowest reported value	39+ FFS
Highest reported value	104+ FFS	n257, n258, n261 n260 n259	86 + FFS 89 + FFS FFS

Table 5.7.4.1.5-3a: evaluation limits for the Δ (Max-Min) reported values for SSB#0 for rules R1, R2, R4, R5

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
Extreme Conditions	Test 1 All bands	Test 2 All bands

Table 5.7.4.1.5-4: L1-RSRP absolute accuracy requirements for the reported values for test configurations 3 and 4 for the absolute accuracy rules R1, R3

UE power class 3			
Normal Conditions	Test 1 (SSB#0) All bands	Test 2 (SSB#0 or SSB#1)	
Lowest reported value	45	n257, n258, n261	30
		n260	33
		n259	FFS
Highest reported value	104	n257, n258, n261	86
		n260	90
		n259	FFS
Extreme Conditions	Test 1 (SSB#0) All bands	Test 2 (SSB#0 or SSB#1)	
Lowest reported value	42+ FFS	n257, n258, n261	27 + FFS
		n260	30 + FFS
		n259	FFS
Highest reported value	107+ FFS	n257, n258, n261	89 + FFS
		n260	92 + FFS
		n259	FFS

Table 5.7.4.1.5-5: evaluation limits for the reported values for T1 and T2 relative accuracy rules R2, R4

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
Lowest DIFF RSRP reported value	2	0
Highest DIFF RSRP reported value	9	+4
Extreme Conditions	Test 1 All bands	Test 2 All bands
Lowest DIFF RSRP reported value	0+ FFS	0+ FFS
Highest DIFF RSRP reported value ((L1-RSRP SSB#1 – L1-RSRP SSB#0))	12+ FFS	+ 7+ FFS

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.4.2 EN-DC FR2 CSI-RS based L1-RSRP measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- The test is incomplete for extreme conditions
- This test case does not check absolute L1-RSRP test requirement for weaker CSI-RS resource even when it is stated in TS 38.133. L1-RSRP reports defined in TS 38.214 do not include absolute L1-RSRP value for weaker CSI-RS resource

5.7.4.2.1 Test purpose

The purpose of this test is to verify that the CSI-RS based L1-RSRP absolute measurement accuracy is within the specified limits for all bands.

5.7.4.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 15 onwards.

5.7.4.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.4.0. 3 and 5.7.4.0.4.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.4.1.

5.7.4.2.4 Test description

5.7.4.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.4.2.4.1-1.

Table 5.7.4.2.4.1-1: Supported test configurations

Test Case ID	Description
5.7.4.2-1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5.7.4.2-2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations

Configure the test equipment and the DUT according to the parameters in Table 5.7.4.2.4.1-2.

Table 5.7.4.2.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC, TL/VL, TL/VH, TH/VL, TH/VH	As specified in TS 38.508-1 [14] clause 4.1.
Test frequencies	As specified in Annex E, Table E.4-1 and TS 38.508-1 [14] clause 4.3.1.	
Channel bandwidth	As specified by the test configuration selected from Table 5.7.4.2.4.1-1.	
Propagation conditions	AWGN	As specified in Annex C.2.2.
Connection Diagram	TE Part	A.3.3.1.1
	DUT Part	A.3.4.1.1
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.4.2.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for CSI-RS-based L1-RSRP measurements. The UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.4.2.4.2 Test procedure

Prior to the start of the time duration T1, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in the above table 5.7.4.2.4.1-2.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release O_n and Test Mode O_n , according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.4.2.4.1-2.
2. Set the parameters according to T1 in Table 5.7.4.2.5-1.
3. After 320 ms from the beginning of T1, the UE shall start sending L1-RSRP report including results of both CSI-RS0 and CSI-RS1.
4. The UE shall start sending valid L1-RSRP reports, a valid report shall meet the absolute L1-RSRP requirement for CSI-RS0 and the relative L1-RSRP requirement for CSI-RS1. The SS shall check for the following requirements:
 - R1: The L1-RSRP value of CSI-RS0 reported by the UE is compared to the expected L1-RSRP value for CSI-RS0. If the value is outside the limits in Table 5.7.4.2.5-3, Table 5.7.4.2.5-3a or Table 5.7.4.2.5-4 (depending on the test configuration) or the UE fails to report the measurement value for CSI-RS0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The DIFF-RSRP value of CSI-RS1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for CSI-RS1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
5. The SS shall continue checking the L1-RSRP report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.
6. Set the parameters according T2 in Table 5.7.4.2.5-1 and repeat steps 3-5. In Step 4, The SS shall check the L1-RSRP reported values of CSI-RS0 and CSI-RS1 in the periodic L1-RSRP reports for the following requirements.
 - R3: The L1-RSRP value of CSI-RS0 or CSI-RS1 reported by the UE is compared to the expected L1-RSRP value. If the value is outside the limits in Table 5.7.4.2.5-3, Table 5.7.4.2.5-3a or Table 5.7.4.2.5-4 (depending on the test configuration) or the UE fails to report the measurement value for CSI-RS0 or CSI-RS1, the number of failed iterations for R3 is increased by one. Otherwise, the number of passed iterations for R3 is increased by one.
 - R4: The DIFF-RSRP value of CSI-RS0 or CSI-RS1 reported by the UE is compared to the expected DIFF-RSRP value. If the resulting value is outside the limits in Table 5.7.1.1.5-5 or the UE fails to report the measurement value for CSI-RS0 or CSI-RS1, the number of failed iterations for R4 is increased by one. Otherwise, the number of passed iterations for R4 is increased by one.

5.7.4.2.4.3 Message contents

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

Table 5.7.4.2.4.3-1: Common Exception messages EN-DC CSI-RS based L1-RSRP measurement

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6-2 with conditions PERIODIC and CSI-RSRP Table H.3.6-3 with conditions CSI-RS and PERIODIC Table H.3.4-1 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.4.2.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE {			
failureDetectionResourcesToAddModList	1 entry		
SEQUENCE			
(SIZE(1..maxNrofFailureDetectionResources)) OF			
SEQUENCE {			
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE {			
csi-RS-Index	0		
}			
}			
}			

5.7.4.2.5 Test requirement

Table 5.7.4.2.5-1 defines the primary level settings including test tolerances for all tests.

Each L1-RSRP measurement report for each of the tests in Table 5.7.4.2.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.4.2.5-2 for test configurations 1, 2, 4 and 5, and the corresponding absolute accuracy requirements in Table 5.7.4.2.5-3 for test configurations 3 and 6 and Table 5.7.4.2.5-3a for all configurations.

Table 5.7.4.2.5-1: L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2				
SSB GSCN	1~2		freq1	freq1				
Duplex mode	1~2		TDD	TDD				
TDD Configuration	1~2		TDDConf.3.1	TDDConf.3.1				
$BW_{channel}$	1~2	MHz	100: $N_{RB,c} = 66$	100: $N_{RB,c} = 66$				
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD				
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD				
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD				
SSB configuration	1~2		SSB.1 FR2	SSB.1 FR2				
OCNG Patterns	1~2		OP.1	OP.1				
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1				
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1				
TRS Configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD				
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	TCI.State.2				
SMTC configuration	1~2		SMTC.1	SMTC.1				
CSI-RS	1~2		CSI-RS.3.2 TDD	CSI-RS.3.2 TDD				
reportConfigType	1~2		periodic	periodic				
reportQuantity	1~2		cri-RSRP	cri-RSRP				
Number of reported RS	1~2		2	2				
L1-RSRP reporting period	1~2		slot320	slot320				
Propagation condition	1~2		AWGN	AWGN				
Antenna configuration	1~2		1x2	1x2				
EPRE ratio of PSS to SSS	1~2	dB	0	0				
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS ^{Note 1}								
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}								
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								

Table 5.7.4.2.5-2: L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 ^{NOTE 3}	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams ^{Note 4}			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-104.10		n.a.	
N_{oc}	1~2	dBm/SSB SCS	-95.11		n.a. n.a.	
\hat{E}_s / I_{ot}	1~2	dB	10	-1.8	n.a.	
CSI-RS_RP ^{Note1}	1~2	dBm/SCS	-85.11	-96.93	As in Table B.2.4.2-2 + 5.7	
I_0 ^{Note1}	1~2	dBm/95.04MHz	-55.67		CSI-RS_RP+34.68	
\hat{E}_s / N_{oc}	1~2	dB	10	-1.82	n.a.	
<p>Note 1: RSRP and I_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>Note 3: No additional noise is added by the test system in Test 2.</p> <p>Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>						

Table 5.7.4.2.5-3: L1-RSRP absolute accuracy requirements for the reported values for the absolute accuracy rules R1, R3

UE power class 3			
Normal Conditions	Test 1 (CSI-RS0) All bands	Test 2 (CSI-RS0 or CSI-RS1)	
		Lowest reported value	42
Highest reported value	101	n257, n258, n261 n260 n259	83 86 FFS
Extreme Conditions	Test 1 (CSI-RS0) All bands	Test 2 (CSI-RS0 or CSI-RS1)	
		Lowest reported value	39+ FFS
Highest reported value	104+ FFS	n257, n258, n261 n260 n259	86 + FFS 89 + FFS FFS

Table 5.7.4.2.5-3a: evaluation limits for the Δ (Max-Min) reported values for CSI-RS#0 for rules R1, R2, R4, R5.

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
Extreme Conditions	Test 1 All bands	Test 2 All bands

Table 5.7.4.2.5-4: evaluation limits for the reported values for T1 and T2 relative accuracy rules R2, R4

UE power class 3		
Normal Conditions	Test 1 All bands	Test 2 All bands
Lowest DIFF RSRP reported value	- 92	- 40
Highest DIFF RSRP reported value	9	+ 4
Extreme Conditions	Test 1 All bands	Test 2 All bands
Lowest reported value ((L1-RSRP CSI-RS1 – L1-RSRP CSI-RS0))	0+ FFS	0+ FFS
Highest reported value ((L1-RSRP CSI-RS1 – L1-RSRP CSI-RS0))	12+ FFS	+ 7+ FFS

For the test to pass, the ratio of successful reported values for each requirement (R1 to R6) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.5 SRS-RSRP

5.7.5.0 Minimum conformance requirements

5.7.5.0.1 Minimum conformance requirements for SRS-RSRP measurement accuracy

The SRS-RSRP measurement reported by the UE shall fulfil the accuracy requirements defined in Table 5.7.5.0.1-1 for FR1 and Table 5.7.7.0.1-2 for FR2, provided that the following conditions are met. The accuracy requirements in this clause are derived based on AWGN radio propagation conditions.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for SRS-RSRP measurements are fulfilled according to Annex B.2.z for a corresponding Band for each relevant SRS resource configured for measurement.
- The time difference between UE's DL reference timing in the serving cell and SRS arrival time is no larger than $T_{\text{error_SRS_RSRP}}$, where
 - $T_{\text{error_SRS_RSRP}} = T_C \times N_{\text{TA_offset}} + 4.67\mu\text{s}$ for FR1
 - $T_{\text{error_SRS_RSRP}} = T_C \times N_{\text{TA_offset}} + 3.67\mu\text{s}$ for FR2
 - $N_{\text{TA_offset}}$ is defined in Table 7.1.2-2
 - T_C is 0.509ns
- The number of SRS ports in the SRS resource configured for measurement is 1,
- The number of symbols in the SRS resource configured for measurement is 1,
- The number of repetitions in the SRS resource configured for measurement is 1,
- Frequency hopping, sequence group hopping or sequence hopping is disabled in the SRS resource configured for measurement,
- The bandwidth of the SRS resource is 48 PRBs.
- One of the following conditions is met
 - There is no other SRS resource with the same root sequence and on the same symbol and with same comb as the relevant SRS resource.
 - If multiple SRS resources are on the same symbol and with same comb, the distance between cyclic shifts of any two resources is no less than 6 if $\text{transmissionComb} = n4$, and no less than 4 if $\text{transmissionComb} = n2$.

Table 5.7.5.0.1-1: SRS-RSRP absolute accuracy in FR1

Accuracy						Conditions						
Normal condition			Extreme condition			SRS Es/lot	Io ^{Note 1} range					
							NR operating band groups ^{Note 2}	Minimum Io			Maximum Io	
dB						dB		dBm / SCS _{SRS}			dBm/BW _{Channel}	dBm/BW _{Channel}
SCS _{SRS} (kHz)		SCS _{SRS} (kHz)					SCS _{SRS} s = 15 kHz	SCS _{SRS} s = 30 kHz	SCS _{SRS} s = 60 kHz			
15	30	60	15	30	60							
±3	±3.5	±5	±7.5	±8	±9.5	≥1	NR_TDD_FR1_A	-120	-117	-114	N/A	-70
							NR_TDD_FR1_C	-119	-116	-113	N/A	-70
							NR_TDD_FR1_D	-118.5	-115.5	-112.5	N/A	-70
							NR_TDD_FR1_E	-118	-115	-112	N/A	-70
±6.5	±7	±8.5	±9.5	±10	±11.5	≥1	NR_TDD_FR1_A	N/A	N/A	N/A	-70	-50
							NR_TDD_FR1_C					
							NR_TDD_FR1_D					
							NR_TDD_FR1_E					

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

Table 5.7.5.0.1-2: SRS-RSRP absolute accuracy in FR2

Accuracy				Conditions			
Normal condition		Extreme condition		SRS Es/lot	Io ^{Note 1} range		
					Minimum Io		Maximum Io
dB		dB		dB	dBm / SCS _{SRS} ^{Note 2}		dBm/BW _{Channel}
SCS _{SRS} (kHz)		SCS _{SRS} (kHz)			SCS _{SRS} = 60kHz	SCS _{SRS} = 120kHz	
60	120	60	120				
±6	±8.5	±9	±11.5	≥1	Same value as SRS_RP in Table B.2.7-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±9	±11.5	±11	±13.5	≥1	N/A	-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Es/lot and related parameters may need to be adjusted to ensure Es/lot at UE baseband is above the value defined in this table.

5.7.5.0.1.1 SRS-RSRP report mapping

The reporting range of SRS-RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution. The mapping of measured quantity is defined in Table 5.7.7.0.1.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 5.7.7.0.1.2-1: SRS-RSRP measurement report mapping

Reported value	Measured quantity value	Unit
SRS-RSRP_0	SRS-RSRP<-140	dBm
SRS-RSRP_1	-140≤ SRS-RSRP<-139	dBm
SRS-RSRP_2	-139≤ SRS-RSRP<-138	dBm
SRS-RSRP_3	-138≤ SRS-RSRP<-137	dBm
SRS-RSRP_4	-137≤ SRS-RSRP<-136	dBm
..
SRS-RSRP_95	-46≤ SRS-RSRP<-45	dBm
SRS-RSRP_96	-45≤ SRS-RSRP<-44	dBm
SRS-RSRP_97	-44≤ SRS-RSRP	dBm
SRS-RSRP_98	Infinity	
Note:	'Infinity' means that UE cannot detect SRS due to too strong signal to measure.	

The normative reference for this requirement is TS 38.133 [6] clause 10.1.22.1.

5.7.5.1 EN-DC FR2 SRS-RSRP measurement accuracy

Editor's Note: This test case is incomplete. Following aspects are either missing or TBD:

- The test procedure is incomplete
- The message content is FFS
- MU/TT analysis is FFS

5.7.5.1.1 Test purpose

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits with SRS-RSRP measurement requirements in TS 38.133 [6] clause 10.1.22.1.1.

5.7.5.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards and CLI-SRS-RSRP

5.7.5.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.5.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.5.1.

5.7.5.1.4 Test description

5.7.5.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.5.1.4.1-1.

Table 5.7.5.1.4.1-1: EN-DC FR2 SRS-RSRP accuracy supported test configurations

Config	Description
5.7.5.1 - 1	LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
5.7.5.1 - 2	LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
Note:	The UE is only required to be tested in one of the supported test configurations in each supported band

Configure the test equipment and the DUT according to the parameters in Table 5.7.5.1.4.1-2.

Table 5.7.5.1.4.1-2: Initial conditions EN-DC FR2 SRS-RSRP measurement accuracy

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1 for E-UTRA and 7.2.3 for NR.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in clause C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.5.1.4.3.
2. In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2).
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.5.1.4.2 Test procedure

There are two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2)

The test parameters and applicability for Cell 1 are defined in A.3.7.2 of 38.133. The test parameters for the Cell 2 are given in Table 5.7.5.1.5-1 and 5.7.5.1.5-2 below. The test parameter for the (virtual) neighbour cell UE transmitting SRS are given in Table 5.7.5.1.5-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table 5.7.5.1.5-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

1. Ensure the UE is in State 3A-RF according to TS 36.508 [25] clause 7.2A.3.
2. Set the parameters according to Table 5.7.5.1.5-1 as appropriate.
3. The SS shall transmit an *RRConnectionReconfiguration* message on Cell 1.
4. The UE shall transmit an *RRConnectionReconfigurationComplete* message.
5. The UE shall transmit periodically MeasurementReport messages.

<rest of the steps are FFS>

5.7.5.1.4.3 Message contents

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

FFS

5.7.5.1.5 Test requirement

Table 5.7.5.1.5-1 defines the cell specific settings for all tests. Table 5.7.5.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in table 5.7.5.1.5-3 and absolute accuracy requirements in table 5.7.5.1.5-4. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

Table 5.7.5.1.5-1: FR2 test parameters for SRS-RSRP accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD configuration	1~2		TDDConf.3.1	TDDConf.3.1
BW _{channel}	1~2	MHz	100: N _{RB,c} = 66	100: N _{RB,c} = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.3 FR2	SSB.3 FR2
OCNG Patterns	1~2		OP.1	OP.1
TRS configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTTC configuration	1~2		SMTTC.1	SMTTC.1
Time offset between DL from serving cell and SRS from test system	1~2	μs	10.76	10.67
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS ^{Note 1}				
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}	1~2		AWGN	AWGN
Propagation condition	1~2		1x2	1x2
Antenna configuration	1~2		SRSCConf.1	SRSCConf.1

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table 5.7.5.1.5-2: SRS-RSRP accuracy OTA related test parameters for PSCell and Neighbour cell UE in FR2

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	Setup 1 defined A.3.15.1
Beam assumption Note 5		Fine	Fine
N_{oc} ^{Note1}	dBm/15kHz _{z ^{Note3}}	-100	N/A
N_{oc} ^{Note1}	dBm/SCS _{Note3}	-91	N/A
\hat{E}_s / N_{oc}	dB	2	N/A
E_s	dBm/SCS _{Note3}		(Table B.2.7-2 Rx Beam Peak)
SRS_RP ^{Note2}	dBm/SCS	-89	(Table B.2.7-2 Rx Beam Peak)
\hat{E}_s / I_{ot_BB} ^{Note4}	dB	>1	1
I_o ^{Note2}	dBm/95.04 MHz _{Note3}	-57.89	(Table B.2.7-2 Rx Beam Peak +50.79dB)
<p>Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.</p> <p>Note 2: SRS_RP, E_s/I_{ot} and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone</p> <p>Note 4: Calculation of E_s/I_{ot_BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4.</p> <p>Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.</p>			

Table 5.7.5.1.5-3: SRS configuration parameters for FR2 SRS-RSRP accuracy

	Field	SRSCnf.1
SRS-ResourceSet	srs-ResourceSetId	0
	srs-ResourceIdList	0
	resourceType	Periodic
	Usage	Codebook
SRS-Resource	SRS-ResourceId	0
	nrofSRS-Ports	Port1
	transmissionComb	n2
	combOffset-n2	0
	cyclicShift-n2	0
	resourceMapping startPosition	0
	resourceMapping nrofSymbols	n1
	resourceMapping repetitionFactor	n1
	freqDomainPosition	0
	freqDomainShift	0
	freqHopping c-SRS	12
	freqHopping b-SRS	0
	freqHopping b-hop	0
	groupOrSequenceHopping	Neither
	resourceType	Periodic
	periodicityAndOffset-p	sl160,25
	sequenceId	0

Table 5.7.5.1.5-4: SRS-RSRP absolute accuracy test requirement

SRS	Test requirement ^{Notes1,2,3}
	$SRS_RP - \delta + G_{min} \leq \text{Reported SRS-RSRP(dBm)} \leq SRS_RP + \delta + G_{max}$
Note 1:	SRS_RP is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test
Note 2:	δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the I_o used in the test
Note 3:	G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

The SRS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 5.7.5.0.10.1 The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table 5.7.5.1.5-4.

For the test to pass, the ratio of successful reported values for each requirement shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.6 L1-SINR measurement for beam reporting

5.7.6.0 Minimum conformance requirements

5.7.6.0.1 L1-SINR accuracy requirements with CSI-RS based CMR and no dedicated IMR configured

5.7.6.0.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-SINR in this clause apply to all CSI-RS resources configured as CMR and no dedicated resource configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements in Table 5.7.6.0.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.
- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in Table 5.7.6.0.1.1-1.

Table 5.7.6.0.1.1-1: L1-SINR absolute accuracy for CSI-RS based CMR only in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR $\hat{E}s/lot$ ^{Note 3}	I_o ^{Note 1} range		
			Minimum I_o		Maximum I_o
dB	dB	dB	dBm / SCS_{CSI-RS} ^{Note 2}		$dBm/BW_{Channel}$
			$SCS_{CSI-RS} = 60kHz$	$SCS_{CSI-RS} = 120kHz$	
±5.5	±6.5	≥-3	Same value as CSI-RS_RP in Table in B.2.8.1, according to UE Power class, operating band and angle of arrival		N/A
NOTE 1: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the CSI-RS CMR $\hat{E}s/lot$ and related parameters may need to be adjusted to ensure $\hat{E}s/lot$ at UE baseband is above the value defined in this table.					

5.7.6.0.1.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-SINR is defined as the L1-SINR measured from one CSI-RS compared to the largest measured value of L1-SINR among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 5.7.6.0.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.
- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in Table 5.7.6.0.1.2-1.

Table 5.7.6.0.2.1-1: L1-SINR relative accuracy for CSI-RS based CMR only in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR \hat{E}_s/lot ^{Note 2, Note 4}	I_o ^{Note 1} range		
			Minimum I_o		Maximum I_o
dB	dB	dB	$\text{dBm} / \text{SCS}_{\text{CSI-RS}}$ ^{Note 3}		$\text{dBm}/\text{BW}_{\text{Channel}}$
			$\text{SCS}_{\text{CSI-RS}} = 60\text{kHz}$	$\text{SCS}_{\text{CSI-RS}} = 120\text{kHz}$	
$\pm[4.5]$	$\pm[5.5]$	≥ -3	Same value as CSI-RS_RP in Table in B.2.8.1, according to UE Power class, operating band and angle of arrival		N/A
<p>NOTE 1: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.</p> <p>NOTE 2: The parameter CSI-RS CMR \hat{E}_s/lot is the minimum CSI-RS CMR \hat{E}_s/lot of the pair of CSI-RS resources to which the requirement applies.</p> <p>NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.</p> <p>NOTE 4: In the test cases, the CSI-RS CMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.</p>					

5.7.6.0.2 L1-SINR accuracy requirements with SSB based CMR and dedicated IMR configured

5.7.6.0.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-SINR in this clause apply to all SSBs configured as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in Table 5.7.6.0.2.1-1 for SSB based CMR and NZP-IMR and in Table 5.7.6.0.2.1-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.2.1-1 and 5.7.6.0.2.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.
- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].
- AWGN radio propagation conditions.
- SSB based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.2.1-1 and 5.7.6.0.2.1-2.

Table 5.7.6.0.2.1-1: L1-SINR absolute accuracy for SSB based CMR and NQP-IMR in FR2

Accuracy		Conditions					
Normal condition	Extreme condition	SSB CMR \hat{E}_s/lot Note 3	NQP-IMR \hat{E}_s/lot Note 3	I_o Note 1 range			
				Minimum I_o		Maximum I_o	
dB	dB	dB	dB	dBm / SCS_{SSB} Note 2		dBm/BW _{Channel}	dBm/BW _{Channel}
				$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$		
±4.0	±5.0	≥0	≥0	Same value as SSB_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival		N/A	-50

NOTE 1: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB \hat{E}_s/lot , NQP-IMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

Table 5.7.6.0.2.1-2: L1-SINR absolute accuracy for SSB based CMR and ZP-IMR in FR2

Accuracy		Conditions					
Normal condition	Extreme condition	SSB CMR \hat{E}_s/lot Note 3	I_o Note 1 range				
			Minimum I_o		Maximum I_o		
dB	dB	dB	dBm / SCS_{SSB} Note 2		dBm/BW _{Channel}	dBm/BW _{Channel}	
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$			
±4.5	±5.5	≥-3	Same value as SSB_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival		N/A	-50	

NOTE 1: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB CMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

5.7.6.0.2.2 Relative Accuracy

The relative accuracy of SSB based L1-SINR is defined as the L1-SINR measured from one SSB configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all SSB based CMRs and IMRs of the serving cell.

The accuracy requirements are defined in Table 5.7.6.0.2.2-1 for SSB based CMR and NQP-IMR and in Table 5.7.6.0.2.2-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.2.2-1 and 5.7.6.0.2.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.
- The bandwidth of NQP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].

- AWGN radio propagation conditions.
- SSB based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.2.2-1 and 5.7.6.0.2.2-2.

Table 5.7.6.0.2.2-1: L1-SINR relative accuracy for SSB based CMR and NZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	SSB CMR \hat{E}_s/lot Note 2, Note 4	NZP-IMR \hat{E}_s/lot Note 4	I_0 Note 1 range		
				Minimum I_0		Maximum I_0
dB	dB	dB	dB	dBm / SCS_{SSB} Note 3		dBm/ $BW_{Channel}$
				$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$	
$\pm[3.0]$	$\pm[4.0]$	≥ 0	≥ 0	Same value as SSB_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival		N/A
						-50

NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB CMR \hat{E}_s/lot is the minimum SSB CMR \hat{E}_s/lot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB CMR \hat{E}_s/lot , NZP-IMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

Table 5.7.6.0.2.2-2: L1-SINR relative accuracy for SSB based CMR and ZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	SSB CMR \hat{E}_s/lot Note 2, Note 4	I_0 Note 1 range			
			Minimum I_0		Maximum I_0	
dB	dB	dB	dBm / SCS_{SSB} Note 3		dBm/ $BW_{Channel}$	
			$SCS_{SSB} = 120\text{kHz}$	$SCS_{SSB} = 240\text{kHz}$		
$\pm[3.5]$	$\pm[4.5]$	≥ -3	Same value as SSB_RP in Table in B.2.8.2, according to UE Power class, operating band and angle of arrival		N/A	
					-50	

NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB CMR \hat{E}_s/lot is the minimum SSB CMR \hat{E}_s/lot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB CMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

5.7.6.0.3 L1-SINR accuracy requirements with CSI-RS based CMR and dedicated IMR configured

5.7.6.0.3.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-SINR in this clause apply to all CSI-RS resources as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in Table 5.7.6.0.3.1-1 for CSI-RS based CMR and NZP-IMR and in Table 5.7.6.0.3.1-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.3.1-1 and 5.7.6.0.3.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.
- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].
- AWGN radio propagation conditions.
- CSI-RS based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.3.1-1 and 5.7.6.0.3.1-2.

Table 5.7.6.0.3.1-1: L1-SINR absolute accuracy for CSI-RS based CMR and NZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	CSI-RS CMR $\hat{E}s/lot$ Note 3	NZP-IMR $\hat{E}s/lot$ Note 3	I_o Note 1 range		
				Minimum I_o		Maximum I_o
dB	dB	dB	dB	dBm / SCS_{CSI-RS} Note 2		$dBm/BW_{Channel}$
				$SCS_{CSI-RS} = 60kHz$	$SCS_{CSI-RS} = 120kHz$	
± 4.0	± 5.0	≥ 0	≥ 0	Same value as CSI-RS_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival		N/A
						-50

NOTE 1: I_o specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS $\hat{E}s/lot$, NZP-IMR $\hat{E}s/lot$ and related parameters may need to be adjusted to ensure $\hat{E}s/lot$ at UE baseband is above the value defined in this table.

Table 5.7.6.0.3.1-2: L1-SINR absolute accuracy for CSI-RS based CMR and ZP-IMR in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR \hat{E}_s/lot Note 3	I_0 Note 1 range		
			Minimum I_0		Maximum I_0
dB	dB	dB	dBm / $SCS_{\text{CSI-RS}}$ Note 2		dBm/BW _{Channel}
			$SCS_{\text{CSI-RS}} = 60\text{kHz}$	$SCS_{\text{CSI-RS}} = 120\text{kHz}$	
±4.5	±5.5	≥-3	Same value as CSI-RS _{RP} in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

5.7.6.0.3.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-SINR is defined as the L1-SINR measured from one CSI-RS configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all CSI-RS based CMRs and IMRs of the serving cell.

The accuracy requirements are defined in Table 5.7.6.0.3.2-1 for CSI-RS based CMR and NZP-IMR and in Table 5.7.6.0.3.2-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in Tables 5.7.6.0.3.2-1 and 5.7.6.0.3.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [3] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to Annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.
- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [3].
- AWGN radio propagation conditions.
- CSI-RS based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in Tables 5.7.6.0.3.2-1 and 5.7.6.0.3.2-2.

Table 5.7.6.0.3.2-1: L1-SINR relative accuracy for CSI-RS based CMR and NZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	CSI-RS CMR \hat{E}_s/lot Note 2, Note 4	NZP-IMR \hat{E}_s/lot Note 4	I_0 Note 1 range		
				Minimum I_0		Maximum I_0
dB	dB	dB	dB	dBm / $SCS_{\text{CSI-RS}}$ Note 3		dBm/ BW_{Channel}
				$SCS_{\text{CSI-RS}} = 60\text{kHz}$	$SCS_{\text{CSI-RS}} = 120\text{kHz}$	
$\pm[3.0]$	$\pm[4.0]$	≥ 0	≥ 0	Same value as CSI-RS_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR \hat{E}_s/lot is the minimum CSI-RS CMR \hat{E}_s/lot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS CMR \hat{E}_s/lot , NZP-IMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

Table 5.7.6.0.3.2-2: L1-SINR relative accuracy for CSI-RS based CMR and ZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	CSI-RS CMR \hat{E}_s/lot Note 2, Note 4	I_0 Note 1 range			
			Minimum I_0		Maximum I_0	
dB	dB	dB	dBm / $SCS_{\text{CSI-RS}}$ Note 3		dBm/ BW_{Channel}	
			$SCS_{\text{CSI-RS}} = 60\text{kHz}$	$SCS_{\text{CSI-RS}} = 120\text{kHz}$		
$\pm[3.5]$	$\pm[4.5]$	≥ -3	Same value as CSI-RS_RP in Table in B.2.8.3, according to UE Power class, operating band and angle of arrival		-50	

NOTE 1: I_0 specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR \hat{E}_s/lot is the minimum CSI-RS CMR \hat{E}_s/lot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [3]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS CMR \hat{E}_s/lot and related parameters may need to be adjusted to ensure \hat{E}_s/lot at UE baseband is above the value defined in this table.

5.7.6.1 EN-DC FR2 CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off L1-SINR measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3

- The test is incomplete for test frequencies > 40.8 GHz

- This test case does not check absolute L1-SINR test requirement for weaker CSI-RS even when it is stated in TS 38.133. L1-SINR reports defined in TS 38.214 do not include absolute L1-SINR value for weaker CSI-RS

5.7.6.1.1 Test purpose

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits.

5.7.6.1.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards, and supporting L1-SINR measurement.

5.7.6.1.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.6.0.1.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.6.1.

5.7.6.1.4 Test description

5.7.6.1.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.6.1.4.1-1.

Table 5.7.6.1.4.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations in each supported band

Configure the test equipment and the DUT according to the parameters in Table 5.7.6.1.4.1-2.

Table 5.7.6.1.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in Annex C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.6.1.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for CSI-RS-based L1-SINR measurements. The UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.

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

5.7.6.1.4.2 Test procedure

Prior to the start of testing, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH format 2 with a reporting periodicity as mentioned in Table 5.7.6.1.5-1.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release O_n and Test Mode O_n , according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.6.1.5-1.
2. Set the parameters according to Table 5.7.6.1.5-1.
3. After 640 ms from step 2, the UE shall start sending L1-SINR report including results of both CSI-RS#0 and CSI-RS#1.
4. The SS shall check the L1-SINR reported values of CSI-RS0 and CSI-RS1 in the periodic L1-SINR reports for the following requirements:
 - R1: The L1-SINR value of CSI-RS0 reported by the UE is compared to the expected L1-SINR value for CSI-RS0. If the value is outside the limits in Table 5.7.6.1.5-3 or the UE fails to report the measurement value for CSI-RS0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The DIFF SINR value of CSI-RS1 reported by the UE is compared to the expected DIFF SINR value. If the resulting value is outside the limits in Table 5.7.6.1.5-4 or the UE fails to report the measurement value for CSI-RS1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.
5. The SS shall continue checking the L1-SINR report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

5.7.6.1.4.3 Message contents

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

Table 5.7.6.1.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6A-1 with conditions PERIODIC and CSI-SINR Table H.3.6A-2 with conditions CSI-RS and PERIODIC Table H.3.4-1 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.6.1.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE {			
failureDetectionResourcesToAddModList	1 entry		
SEQUENCE			
(SIZE(1..maxNrofFailureDetectionResources)) OF			
SEQUENCE {			
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE {			
csi-RS-Index	0		
}			
}			
}			

5.7.6.1.5 Test requirement

Table 5.7.6.1.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each L1-SINR measurement report for each of the tests in Table 5.7.6.1.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.6.1.5-3 for all test configurations, and the corresponding relative accuracy requirements in Table 5.7.6.1.5-4 for all test configurations.

Table 5.7.6.1.5-1: FR2 CSI-RS based L1-SINR general test parameters

Parameter	Config	Unit	Test 1
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
BW_{channel}	1~2	MHz	100: $N_{RB,c} = 66$
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
SMTc configuration	1~2		SMTc.1
CSI-RS	1~2		CSI-RS.3.2 TDD
reportConfigType	1~2		periodic
reportQuantity-r16	1~2		cri-SINR-r16
nrofReportedRS	1~2		2
L1-RSRP reporting period	1~2		slot640
Propagation condition	1~2		AWGN
Antenna configuration	1~2		1x2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
<p>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.</p> <p>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.</p>			

Table 5.7.6.1.5-2: FR2 CSI-RS based L1-SINR OTA related test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.9	
Assumption for UE beams ^{Note 4}			Rough	
N_{oc}	1~2	dBm/15 kHz	-104.1	
N_{oc}	1~2	dBm/SS B SCS	-95.1	
\hat{E}_s / I_{ot}	1~2	dB	10	-1.8
CSI-RS-RSRP ^{Note1}	1~2	dBm/SC S	-85.07	-96.87
I_0 ^{Note1}	1~2	dBm/95.04M Hz	-55.67	-63.88
\hat{E}_s / N_{oc}	1~2	dB	10	-1.8
<p>Note 1: RSRP and I_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>Note 3: Void.</p> <p>Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>				

Table 5.7.6.1.5-3: L1-SINR absolute accuracy requirements for the reported values for the absolute accuracy rules R1

UE power class 3	
Normal Conditions	Test 1 All bands
Lowest reported value (CSI-RS0)	53
Highest reported value (CSI-RS0)	76
Extreme Conditions	Test 1 All bands
Lowest reported value (CSI-RS0)	51
Highest reported value (CSI-RS0)	78

Table 5.7.6.1.5-4: Evaluation limits for the reported values for T1 and T2 relative accuracy rules R2

UE power class 3	
Normal Conditions	Test 1 All bands
Lowest DIFF L1-SINR reported value	6
Highest DIFF L1-SINR reported value	15
Extreme Conditions	Test 1 All bands
Lowest DIFF L1-SINR reported value	5
Highest DIFF L1-SINR reported value	15

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.6.2 EN-DC FR2 SSB based CMR and dedicated IMR L1-SINR absolute measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- This test case does not check absolute L1-SINR test requirement for weaker SSB and CSI-RS even when it is stated in TS 38.133. L1-SINR reports defined in TS 38.214 do not include absolute L1-SINR value for weaker SSB and CSI-RS

5.7.6.2.1 Test purpose

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits.

5.7.6.2.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards, and supporting L1-SINR measurement.

5.7.6.2.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.6.0.2.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.6.2.

5.7.6.2.4 Test description

5.7.6.2.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.6.2.4.1-1. Test environment parameters are given in Table 5.7.6.2.4.1-3.

Table 5.7.6.2.4.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Note: The UE is only required to be tested in one of the supported test configurations in each supported band

Configure the test equipment and the DUT according to the parameters in Table 5.7.6.2.4.1-2.

Table 5.7.6.2.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in Annex C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.6.2.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for SSB-based L1-SINR measurements. The UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.6.2.4.2 Test procedure

Prior to the start of testing, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH [format 2] with a reporting periodicity as mentioned in Table 5.7.6.2.5-1.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.6.2.5-1.
2. Set the parameters according to Table 5.7.6.2.5-1.
3. After 640 ms from step 2, the UE shall start sending L1-SINR report including results of both SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1.
4. The SS shall check the L1-SINR reported values of SSB#0 and SSB#1 in the periodic L1-SINR reports for the following requirements:
 - R1: The L1-SINR value of SSB#0+CSI-RS#0 reported by the UE is compared to the expected L1-SINR value for SSB#0+CSI-RS#0. If the value is outside the limits in Table 5.7.6.2.5-4 or the UE fails to report the measurement value for SSB#0+CSI-RS#0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The DIFF L1-SINR value of SSB#1+CSI-RS#1 reported by the UE is compared to the expected DIFF L1-SINR value. If the resulting value is outside the limits in Table 5.7.6.2.5-5 or the UE fails to report the

measurement value for SSB#0+CSI-RS#0 or SSB#1+CSI-RS#1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-SINR report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

5.7.6.2.4.3 Message contents

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

Table 5.7.6.2.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6A-1 with conditions PERIODIC and SS-SINR and CSI-RS_IMR Table H.3.6A-2 with conditions SSB and PERIODIC Table H.3.6A-3 with conditions PERIODIC Table H.3.4-1

Table 5.7.6.2.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE {			
failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF SEQUENCE {	1 entry		
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE {			
ssb-Index	0		
}			
}			

5.7.6.2.5 Test requirement

Table 5.7.6.2.5-2 defines the OTA primary level settings including test tolerances for all tests.

Table 5.7.6.2.5-1: FR2 L1-SINR measurement test parameters with SSB based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1
SSB GSCN	1-4		freq1
Duplex mode	1-4		TDD
TDD Configuration	1-4		TDDConf.3.1
BW _{channel}	1-4	MHz	100: N _{RB,c} = 66
PDSCH Reference measurement channel	1-4		SR.3.1 TDD
RMSI CORESET Reference Channel	1-4		CR.3.1 TDD
Dedicated CORESET Reference Channel	1-4		CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2

CSI-RS configuration	1~4		CSI-RS 3.1A TDD
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
SMTC configuration	1~4		SMTC.1
reportConfigType	1~4		periodic
reportQuantity-r16	1~4		ssb-Index-SINR-r16
Number of reported RS	1~4		2
L1-SINR reporting period	1~4		slot640
Propagation condition	1~4		AWGN
Antenna configuration	1~4		1x2
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
<p>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.</p> <p>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.</p>			

Table 5.7.6.2.5-2: FR2 SSB specific test parameters

Parameter	Config	Unit	Test 1	
			SSB#0	SSB#1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams ^{Note 4}			Rough	
N_{oc}	1~4	dBm/15 kHz	-104.1	
N_{oc}	1,2	dBm/SS	-95.1	
	3,4	B SCS	-92.1	
\hat{E}_s/I_{oc}	1~4	dB	10	1.2
SSB RSRP ^{Note1}	1,2	dBm/SC	-85.07	-93.87
	3,4	S	-82.07	-90.87
I_0 ^{Note1}	1~4	dBm/95.04M Hz	-55.67	-62.43
\hat{E}_s/N_{oc}	1~4	dB	10	1.2
<p>Note 1: RSRP and I_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>				

Table 5.7.6.2.5-3: FR2 CSI-RS specific test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS#0	CSI-RS#1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams ^{Note 4}			Rough	
N_{sc}	1~4	dBm/15k Hz	-104.1	
N_{sc}	1~4	dBm/CSI-RS SCS	-95.1	
\hat{E}_s / I_{ca}	1~4	dB	10	1.2
CSI-RS RSRP ^{Note 1}	1~4	dBm/SCS	-85.07	-93.87
I_0 ^{Note 1}	1~4	dBm/95.04MHz	-55.67	-62.43
\hat{E}_s / N_{sc}	1~4	dB	10	1.2
Note 1:	RSRP and I_0 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
Note 2:	RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
Note 3:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table 5.7.6.2.5-4: L1-SINR absolute accuracy requirements for the reported values for the absolute accuracy rules R1

UE power class 3	
Normal Conditions	Test 1 All bands
Lowest reported value (SSB#0+CSI-RS#0)	56
Highest reported value (SSB#0+CSI-RS#0)	73
Extreme Conditions	Test 1 All bands
Lowest reported value (SSB#0+CSI-RS#0)	54
Highest reported value (SSB#0+CSI-RS#0)	75

Table 5.7.6.2.5-5: Evaluation limits for the reported values for T1 and T2 relative accuracy rules R2

UE power class 3	
Normal Conditions	Test 1 All bands
Lowest DIFF L1-SINR reported value	5
Highest DIFF L1-SINR reported value	12
Extreme Conditions	Test 1 All bands
Lowest DIFF L1-SINR reported value	4
Highest DIFF L1-SINR reported value	13

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.

5.7.6.3 EN-DC FR2 CSI-RS based CMR and dedicated IMR L1-SINR measurement accuracy

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

- Test frequency $f \leq 40.8$ GHz
- UE PC3
- Normal conditions
- The test is incomplete for UE power classes other than PC3
- The test is incomplete for test frequencies > 40.8 GHz
- This test case does not check absolute L1-SINR test requirement for weaker CSI-RS even when it is stated in TS 38.133. L1-SINR reports defined in TS 38.214 do not include absolute L1-SINR value for weaker CSI-RS

5.7.6.3.1 Test purpose

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits.

5.7.6.3.2 Test applicability

This test applies to all types of NR UE supporting E-UTRA and EN-DC from Release 16 onwards, and supporting L1-SINR measurement.

5.7.6.3.3 Minimum conformance requirements

The minimum conformance requirements are specified in clause 5.7.6.0.3.

The normative reference for this requirement is TS 38.133 [6] clause A.5.7.6.3.

5.7.6.3.4 Test description

5.7.6.3.4.1 Initial conditions

This test shall be tested using any of the test configurations in Table 5.7.6.3.4.1-1.

Table 5.7.6.3.4.1-1: Supported test configurations

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

Configure the test equipment and the DUT according to the parameters in Table 5.7.6.3.4.1-2.

Table 5.7.6.3.4.1-2: Initial conditions

Parameter	Value	Comment
Test environment	NC	As specified in TS 36.508 [25] clause 4.1.
Test frequencies	As specified in Annex E, E.1.1, E.1.3.1 and Table E.3-1 and TS 38.508-1 [14] clause 4.3.1.	
Channel bandwidth	As specified by the selected test configuration.	
Propagation conditions	AWGN	As specified in Annex C.2.1
Connection Diagram	TE Part: A.3.3.1.1 DUT Part: A.3.4.1.1	As specified in TS 38.508-1 [14] Annex A.
Exceptions to connection diagram	N/A	

1. Message contents are defined in clause 5.7.6.3.4.3.
2. Cell 1 is the E-UTRA serving cell (PCell) for the EN-DC setup. The power levels and settings for Cell 1 are set according to Annex A.6. Cell 2 is the NR FR2 cell. Cell 2 is the PSCell and the target for CSI-RS-based L1-SINR measurements. The UE is configured to perform RLM, BFD and L1-SINR measurement based on the SSBs. The connection setup is done according to the settings in Annex C.1.1.
3. The UE Rx beam peak direction has been obtained previously using one of the Rx Beam Peak Search procedures as described in Annex I.

5.7.6.3.4.2 Test procedure

Prior to the start of testing, the UE shall be fully synchronized to PSCell. The UE shall be configured for periodic CSI reporting in PUCCH format 2 with a reporting periodicity as mentioned in Table 5.7.6.3.5-1.

1. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* and Test Mode *On*, according to TS 38.508-1 [14] clause 4.5 and general test parameters set according to Table 5.7.6.3.5-1.
2. Set the parameters according to T1 in Table 5.7.6.3.5-1.
3. After 640 ms from step 2, the UE shall start sending L1-SINR report including results of both CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM#1.
4. The SS shall check the L1-SINR reported values of CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM#1 in the periodic L1-SINR reports for the following requirements:
 - R1: The L1-SINR value of CSI-RS#0+CSI-IM#0 reported by the UE is compared to the expected L1-SINR value for CSI-RS#0+CSI-IM#0. If the value is outside the limits in Table 5.7.6.3.5-3 or the UE fails to report the measurement value for CSI-RS#0+CSI-IM#0, the number of failed iterations for R1 is increased by one. Otherwise, the number of passed iterations for R1 is increased by one.
 - R2: The DIFF L1-SINR value of CSI-RS#1+CSI-IM#1 reported by the expected DIFF L1-SINR. If the resulting value is outside the limits in Table 5.7.6.3.5-4 or the UE fails to report the measurement value for CSI-RS#1+CSI-IM#1, the number of failed iterations for R2 is increased by one. Otherwise, the number of passed iterations for R2 is increased by one.

5. The SS shall continue checking the L1-SINR report messages transmitted by the UE until the confidence level according to Table G.2.3-1 in Annex G is achieved.

5.7.6.3.4.3 Message contents

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

Table 5.7.6.3.4.3-1: Common Exception messages

Default Message Contents	
Common contents of system information blocks exceptions	
Default RRC messages and information elements contents exceptions	Table H.3.6A-1 with conditions PERIODIC and CSI-SINR Table H.3.6A-2 with conditions CSI-RS and PERIODIC Table H.3.6A-4 with conditions APERIODIC Table H.3.4-1 Table 7.3.1-3 in TS 38.508-1 [14] with condition SMTC.1

Table 5.7.6.3.4.3-2: RadioLinkMonitoringConfig

Derivation Path: TS 38.508-1 [14], Table 4.6.3-133			
Information Element	Value/remark	Comment	Condition
RadioLinkMonitoringConfig ::= SEQUENCE {			
failureDetectionResourcesToAddModList	1 entry		
SEQUENCE			
(SIZE(1..maxNrofFailureDetectionResources)) OF			
SEQUENCE {			
purpose	both	UE is configured to perform RLM and BFD based on the SSBs.	
detectionResource CHOICE {			
csi-RS-Index	0		
}			
}			
}			

5.7.6.3.5 Test requirement

Table 5.7.6.3.5-2 defines the OTA primary level settings including test tolerances for all tests.

Each L1-SINR measurement report for each of the tests in Table 5.7.6.3.5-1 shall meet the corresponding absolute accuracy requirements in Table 5.7.6.3.5-3 for all test configurations, and the corresponding relative accuracy requirements in Table 5.7.6.1.5-4 for all test configurations.

Table 5.7.6.3.5-1: FR2 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
BW _{channel}	1~2	MHz	100: N _{RB,c} = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
SMTc configuration	1~2		SMTc.1
CSI-RS configuration as CMR	1~2		CSI-RS.3.2 TDD
CSI-IM configuration as IMR	1~2		CSI-IM.3.3 TDD
reportConfigType	1~2		periodic
reportQuantity-r16	1~2		cri-SINR-r16
nrofReportedRS	1~2		2
L1-RSRP reporting period	1~2		slot640
Propagation condition	1~2		AWGN
Antenna configuraion	1~2		1x2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS ^{Note 1}			
EPRE ratio of OCNG to OCNG DMRS ^{Note 1}			
<p>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.</p> <p>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.</p>			

Table 5.7.6.3.5-2: FR2 CSI-RS based L1-SINR OTA related test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams ^{Note 4}			Rough	
N_{oc}	1~2	dBm/15 kHz	-104.1	
N_{oc}	1~2	dBm/SS B SCS	-95.1	
\hat{E}_s / I_{ot}	1~2	dB	10	-1.8
CSI-RS-RSRP ^{Note1}	1~2	dBm/SC S	-85.07	-96.87
I_o ^{Note1}	1~2	dBm/95.04M Hz	-55.67	-63.88
\hat{E}_s / N_{oc}	1~2	dB	10	-1.8
<p>Note 1: RSRP and I_o levels have been derived from other parameters for information purposes. They are not settable parameters themselves.</p> <p>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.</p> <p>Note 3: No additional noise is added by the test system in Test 2.</p> <p>Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</p>				

Table 5.7.6.3.5-3: L1-SINR absolute accuracy requirements for the reported values for the absolute accuracy rules R1

UE power class 3	
Normal Conditions	Test 1 All bands
Lowest reported value (CSI-RS0)	55
Highest reported value (CSI-RS0)	74
Extreme Conditions	Test 1 All bands
Lowest reported value (CSI-RS0)	53
Highest reported value (CSI-RS0)	76

Table 5.7.6.3.5-4: Evaluation limits for the reported values for T1 and T2 relative accuracy rules R2

UE power class 3	
Normal Conditions	Test 1 All bands
Lowest DIFF L1-SINR reported value	7
Highest DIFF L1-SINR reported value	15
Extreme Conditions	Test 1 All bands
Lowest DIFF L1-SINR reported value	6
Highest DIFF L1-SINR reported value	15

For the test to pass, the ratio of successful reported values for each requirement (R1 and R2) shall be more than 90% with a confidence level of 95%. Each requirement is evaluated independently of the others.