GTI 5G Device Function and Performance Test Specification

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1 Scope

This specification targets enhanced Mobile Broadband (eMBB) scenario for 5G Sub-6GHz Chipset, Module and Device products testing. It stipulates the 5G device function and performance test in lab for NSA Mode (Option 3/3a/3x) and SA (Option 2).

This specification provides evaluation criteria for basic functions and performance in the 5G test. Considering various test requirements, specific test cases and methods are designed, together with the basic requirements for each test category, number of test devices, and tailored agreements.

This specification is one of the 5G Sub-6GHz device test specifications which are used in GTI 5G Device Certification.

2 Definitions, Symbols and Abbreviations

Abbreviation	Explanation
AMC	Adaptive Modulation and Coding
BLER	Block Error Rate
CP	Cyclic Prefix
DL	Downlink
eNB	Evolved NodeB
EPC	Evolved Packet Core
GBR	Guaranteed Bit Rate
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
NGBR	Non-Guaranteed Bit Rate
OMC	Operation and Maintenance Center
PDSCH	Physical Downlink Shared Channel
PUSCH	Physical Uplink Shared Channel
RSRP	Reference Signal Received Power
SIMO	Single Input Multiple Output
SM	Space Multiplexing
SNR	Signal to Noise Ratio
UDP	User Datagram Protocol
UE	User Equipment
UL	Uplink

3 Reference

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1]	3GPP TS 38.104	Base Station (BS) radio transmission and reception
[2]	3GPP TS 38.201	LTE Physical Layer – General Description
[3]	3GPP TS 38.211	Physical Channels and Modulation
[4]	3GPP TS 38.212	Multiplexing and channel coding
[5]	3GPP TS 38.213	Physical layer procedure
[6]	3GPP TS 38.214	Physical Layer – Measurements
[7]	3GPP TS 38.300	Overall description
[8]	3GPP TS 38.321	Medium Access Control (MAC) protocol
[9]	3GPP TS 38.322	Radio Link Control (RLC) protocol
[10]	3GPP TS 38.323	Packet Data Convergence Protocol (PDCP)
[11]	3GPP TS 38.331	Radio Resource Control (RRC)
[12]	3GPP TS 38.401	Architecture description
[13]	3GPP TS 38.410	Ng General aspects and principles
[14]	3GPP TS 38.411	Ng layer 1
[15]	3GPP TS 38.412	Ng signaling transport
[16]	3GPP TS 38.413	Ng Application Protocol (XnAP)
[17]	3GPP TS 38.414	Ng data transport
[18]	3GPP TS 38.420	Xn general aspects and principles
[19]	3GPP TS 38.421	Xn layer 1
[20]	3GPP TS 38.422	Xn signaling transport
[21]	3GPP TS 38.423	Xn application protocol (XnAP)
[22]	3GPP TS 38.424	Xn data transport
[23]	3GPP TS 38.304	User Equipment (UE) procedures in idle mode
[24]	3GPP TS 38.306	User Equipment (UE) radio access capabilities
[25]	3GPP TS 38.314	Evolved Universal Terrestrial Radio Access (E-UTRA); Layer 2 - Measurements
[26]	3GPP TS 23.203	Policy and charging control architecture
[27]	3GPP TS 23.401	General Packet Radio Service (GPRS) enhancements for E_UTRAN access
[28]	3GPP TS 24.301	Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS)

4 Test Environment

4.1 Default Test Environment

A network system simulator is used to model the gNB and 5GC. The default configuration of the simulator is described in “3GPP TS 38.508-1, 5GS; User Equipment (UE) conformance specification; Part 1: Common test environment” which contains definitions of reference conditions, test signals, default parameters, reference radio bearer configurations, common requirements for test equipment

and generic procedures.

4.1.1 Special Test Environment

If the test environment doesn't follow the default test environment and is common for several test cases, e.g. special cell configurations, the test environment should be described in this section.

4.1.2 Cell Configuration

4.1.2.1 Test Frequencies

Table 4-1: Test Frequencies for NR TDD

Operating Band	Frequency Configuration	Occupied Bandwidth	Range (F_low – F_high)
n41	f1	100 MHz	2515M - 2615M
	f2	80 MHz	2515M - 2595M
	f3	60 MHz	2515M - 2575M
	f4	100 MHz	2575M - 2675M
	f5	60 MHz	2615M – 2675M
n79	f1	100 MHz	4800M - 4900M

Table 4-2: Test Frequencies for NR FDD

Operating Band	Frequency Configuration	Occupied Bandwidth	Range (F_low – F_high)
n28	f1	30MHz	UL703-733MHz DL758-788MHz
	f2	20MHz	UL703-723MHz DL758-778MHz
	f3	20MHz	UL713-733MHz DL768-788MHz

Table 4-3: Test Frequencies for E-UTRA TDD

Operating Band	Frequency Configuration	Occupied Bandwidth	Range (F_low – F_high)
34	f1	15 MHz	2010M – 2025M
39	f1	20 MHz	1880M - 1900M
	f2	10 MHz	1900M - 1910M
	f3	15 MHz	1900M - 1915M
	f4	10 MHz	1905M - 1915M
40	f1	20 MHz	2325M - 2345M
	f2	20 MHz	2345M - 2365M
41	f1	20 MHz	2615M - 2635M
	f2	20 MHz	2635M - 2655M
	f3	20 MHz	2655M - 2675M

Table 4-4: Test Frequencies for E-UTRA FDD

Operating Band	Frequency Configuration	Occupied Bandwidth	Range (F_low – F_high)
3	f1	10 MHz	UL: 1710M - 1720M DL: 1805M - 1815M
	f2	15 MHz	UL: 1720M - 1735M DL: 1815M - 1830M

	f3	20 MHz	UL: 1710M - 1730M DL: 1805M - 1825M

Table 4-5: Band combinations for NSA option3 (EN-DC, two bands)

Band Combinations	E-UTRA Band	NR Band	Note
DC_3A_n41A	3A	n41A	Inter-band EN-DC
DC_39A_n41A	39A	n41A	Inter-band EN-DC
DC_3A_n79A	3A	N79A	Inter-band EN-DC
DC_39A_n79A	39A	N79A	Inter-band EN-DC

Table 4-6: Test Frequencies for E-UTRA FDD

GSM Band	Bandwidth	f1(Mid)	f2(High)	f3(Low)
Band 8 (GSM 900)	25MHz	20 (UL:894MHz/ DL:939MHz)	110 (UL:912MHz/ DL:957MHz)	5 (UL:891MHz/ DL:936MHz)
Band 3 (DCS 1800)	75MHz	590 (UL:1725.8MHz/ DL:1820.8MHz)	700 (UL:1747.8MHz/ DL:1842.8MHz)	515 (UL:1710.8MHz/ DL:1805.8MHz)

4.1.2.2 Default Configuration

If not explicitly specified in the test case prose, the following Cell Configuration parameters shall be used for NR cells in the test cases

Table 4-7: Default Parameters

Parameters	Value	Note
MCC	460	
MNC	00	
NR Frame Structure for n41	Uplink-Downlink Switch Period: 5ms[Note 1]	DD DD DD DS UU
NR Frame Structure for n79	Uplink-Downlink Switch Period: 2.5 ms Note 2	DSUUU DSUUU
	Uplink-Downlink Switch Period: 2.5 ms	DDDSU DDSUU
Special Frame for n41	DL : GP : UL = 6 : 4 : 4	DDDDDDGGGGUUUU
Special Frame for n79	DL : GP : UL = 10 : 2 : 2	DDDDDDDDDDGGUU
CP Length	Normal CP	
PRACH Format	Format 0	
PRACH Period	10ms	
PUCCH Format	Format 0 / Format 1	
	Format 2 / Format 3	
SCS for n41	30kHz	
SCS for n79	30kHz	
SCS for n28	15kHz	
PBCH Period	20ms	
PDCCH Symbols	1 symbol	
PDCCH Format	Format 0_1/Format 1_1	
PDSCH DMRS	Mapping type A & Type1	
PUSCH DMRS	Mapping type A & Type1	
PUSCH Transmission	The codebook-based transmission mode	

UL Power Control	ON	
HARQ	ON	
SRS	NR SRS Switching	
UE Maximum TX Power	NSA: 26 dBm	
	SA: 26 dBm	
Waveform	Uplink : CP-OFDM	
	Downlink: CP-OFDM	

Note1. All test cases are tested on band n41 by default

Note2. Test cases on n79 band should use this configuration by default

4.1.3 USIM Parameters

Refer to clause 4.5.3 in 3GPP TS 38.508-1 for the default parameters of the test USIM except for the following parameters

Table 4.2.2-1: USIM Elementary File Parameters

Elementary File	Parameter	Value
EF_{IMSI}	(IMSI)	460001234567890
$EF_{HPLMNwAcT}$	(HPLMN selector with Access Technology)	CMCC China (460, 00, NG-RAN), CMCC China (460, 00, EUTRAN), CMCC China (460, 00, UTRAN), CMCC China (460, 00, GSM), CMCC China (460, 02, UTRAN), CMCC China (460, 02, GSM), CMCC China (460, 07, UTRAN), CMCC China (460, 07, GSM)
K	K Value of the USIM	000102030405060708090A0B0C0D0E0F

Note: The priority of the PLMNs in EFHPLMNwAcT follows top bottom sequence i.e. PLMN on the top has highest priority.

4.1.4 Common Procedures

Step	U – S	Message	Specific Contents
1	<--	NR RRC: SYSTEM INFORMATION (BCCH)	
2	-->	NR RRC: RRCSetupRequest	
3	<--	NR RRC: RRCSetup	
4	-->	NR RRC: RRCSetupComplete 5GMM: REGISTRATION REQUEST	
5	<--	NR RRC: DLInformationTransfer 5GMM: AUTHENTICATION REQUEST	
6	-->	NR RRC: ULInformationTransfer 5GMM: AUTHENTICATION RESPONSE	
7	<--	NR RRC: DLInformationTransfer 5GMM: SECURITY MODE COMMAND	
8	-->	NR RRC: ULInformationTransfer	

		5GMM: SECURITY MODE COMPLETE	
9	<--	NR RRC: SecurityModeCommand	
10	-->	NR RRC: SecurityModeComplete	
11	<--	NR RRC: UECapabilityEnquiry	
12	-->	NR RRC: UECapabilityInformation	
13	<--	NR RRC: DLInformationTransfer 5GMM: REGISTRATION ACCEPT	"IMS-VoPS-3GPP" is set to 1 Cond: UE is pre-set as Voice-centric
14	-->	NR RRC: ULInformationTransfer 5GMM: REGISTRATION COMPLETE	
15	-->	NR RRC: ULInformationTransfer 5GMM: UL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT REQUEST	DNN=ims or DNN=cmnet DNN value is set to "ims" when UE is pre-set as Voice-centric
16	<--	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT ACCEPT	
17	-->	NR RRC: RRCReconfigurationComplete	
18	-->	NR RRC: ULInformationTransfer 5GMM: UL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT REQUEST	DNN=cmnet or DNN=ims DNN value is set to "ims" when UE is pre-set as Voice-centric
19	<--	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT ACCEPT	
20	-->	NR RRC: RRCReconfigurationComplete	
21	--> <--	IMS registration completed over SA	Cond: UE is pre-set as Voice-centric
22	<--	NR RRC: RRCRelease	

4.1.5 Default End Points

The point of measurement on the UE side will be either in a connected PC for terminals that support tethered mode only or inside the UE in case of a terminal that does not support tethered mode (and supports embedded mode), or in both places for UEs that support both modes.
The termination on the user side will be:

- Inside the terminal in case of a handset/smart phone that can install an embedded client application. This should be considered as the default mode of testing as it provides an accurate measure of user experience.

- Alternatively, to a connected PC as tethered mode in case of a handset or data module that does not support embedded mode (lacks User Interface, no embedded application installation possible etc.).

For embedded connections (non-tethered) as in the case of embedded applications or applications running on the UE itself, the end-points are the application running on the UE and a corresponding Data Server that is adjacent to the simulated lab-based Core Network and is the default mode of connection for devices that support this mode.
For tethered connections, the UE is tethered to a laptop using the appropriate UE to PC interface Modem or Network Interface Connection (NIC) drivers as recommended by the UE manufacturer for the intended use by the end user. In most cases, a laptop with an embedded modem is considered as tethered data configuration as opposed to an embedded data configuration due to the UE to PC interface. It is important to observe that the physical layer capabilities of the UE to PC Interface Connection can limit the UE Application Layer Data Throughput performance. So, due care should be taken to ensure that the physical layer capabilities of the UE to PC Interface Connection do not affect the performance results. For tethered connections, the end-points are the application running on the PC connected to the UE and a corresponding Data Server that is adjacent to the simulated lab-based Core Network. In this case, the PC drivers (typically USB) will also play a role in the UE Application Layer throughput.

4.2 Applicability for the UE Configuration

This clause defines the types of test case applicability used in this specification. Each test case shall clearly state the applicability in the section of “Applicability”

Type	Applicability
1	Test cases apply to the devices supporting both SA and NSA
2	Test cases apply to the devices supporting SA Note1
3	Test cases apply to the devices supporting NSA Note2
Note1: Test cases applying to the devices supporting SA also apply to the devices supporting both SA and NSA Note2: Test cases applying to the devices supporting NSA also apply to the devices supporting both SA and NSA	

5 Basic Function

5.1 PLMN Selection

5.1.1 PLMN Selection, Multi-RAT Background, Select the highest priority HPLMN, Automatic Mode

5.1.1.1 Test Purpose

The priority of the PLMNs in USIM HPLMN list is 5G>E-UTRAN. Verify the UE can camp on the PLMN with highest priority and setup a PS bearer successfully. Verify the UI display is correct. Use the same PLMN as the real network.

5.1.1.2 Reference specification

3GPP TS 38.304 subclause 5.1

5.1.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

5.1.1.4 Test conditions

[SS configuration]
Cell A, Cell B and Cell C are NR cells. Cell D is an E-UTRAN cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
Frequency Configuration = f1

NR Cell B
Cell Id=1 TAC = 1
MCC = 460 MNC = 03
Band n78
Frequency Range = 3400MHz-3500MHz

NR Cell C
Cell Id=1 TAC = 1
MCC = 460 MNC = 01
Band n78
Frequency Range = 3500MHz-3600MHz

E-UTRAN Cell D
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
Frequency Configuration = f1
rootSequenceIndex = 0

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]

SS

NR Cell A, Cell B and Cell C are not active.

E-UTRAN Cell D is not active.

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.1.1.5 Test procedure

Table 5.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	E-UTRAN Cell D	Remark
T0	SS/PBCH, SSS EPRE	dBm/SCS	-125	-125	-125	/	
	Reference Signal EPRE	dBm/15kHz	/	/	/	-125	
T1	SS/PBCH, SSS EPRE	dBm/SCS	-85	-85	-85	/	
	Reference Signal EPRE	dBm/15kHz	/	/	/	-85	
T2	SS/PBCH, SSS EPRE	dBm/SCS	-145	-85	-85	/	
	Reference Signal EPRE	dBm/15kHz	/	/	/	-85	

PREAMBLE

1. Activate NR Cell A, NR Cell B , NR Cell C and E-UTRAN Cell D. The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 5.1.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The SS increases the TX power of Cells according to T1 in Table 5.1.1.5-1.
5. The UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18. SS releases the RRC connection. The UE transits to Idle state.
6. The tag on the UI indicate that UE has registered on NR network.
7. Deactivate NR Cell A. (Refer Table 5.1.1.5 -1: Time T2). NR Cell B and Cell C remains exist.
8. The UE performs TAU procedure on E-UTRAN Cell D. SS releases the RRC connection. The UE transits to Idle state
9. The tag on the UI indicate that UE has registered on LTE network.

POSTAMBLE

10. The UE is powered OFF
11. The UE performs MO Detach procedure on E-UTRAN Cell D.
12. Deactivate NR Cell B, NR Cell C and E-UTRAN Cell D.

Table 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR Cell A, NR Cell B , NR Cell C and E-UTRAN Cell D		
2			Configure the initial power according to T0 in Table 5.1.1.5-1.		
3		UE	Switch On UE	AT Command	
4			Increases the TX power of Cells according to T1 in Table 5.1.1.5-1		
5	→ ←	RRC NAS	UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18.		PASS
6			The tag on the UI indicate that UE has registered on NR network.		
7			Deactivate NR Cell A. (Refer Table 5.1.1.5 -2: Time T2). NR Cell B and Cell C remains exist.		
8	→ ←	RRC NAS	UE performs TAU procedure on E-UTRAN Cell D		PASS
9			The tag on the UI indicate that UE has registered on LTE network.		
10		UE	Switch Off UE	AT Command	
	→ ←	RRC NAS	UE performs MO Detach procedure on E-UTRAN Cell D		
12			Deactivate NR Cell B, NR Cell C and E-UTRAN Cell D.		

5.1.1.6 Expected Result

Step 5, UE could camps on NR Cell A

Step 8, UE could camps on E-UTRAN Cell D

5.2 Cell Selection

5.2.1 Multi-mode Environment Cell Selection, NR Cell Available

5.2.1.1 Test Purpose

Verify that the UE will correctly select and camp on NR cell basend on the cell selection priority (NR > LTE).

5.2.1.2 Reference specification

3GPP TS 38.304, clause 5.2.3.

5.2.1.3 Applicability

This test applies to Type 1 and 2 devices as described in clause 4.2.

5.2.1.4 Test conditions

[SS configuration]
Cell A is a E-UTRAN cell.
Cell B is a NR Cell.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 41
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE= -91dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
SS/PBCH SSS EPRE = -90 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.2.1.5 Test procedure

Table 5.2.1.5-0: Time instances of cell power level and parameter changes

	Parameter	Unit	E-UTRAN Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	dBm/SCS	-85	-90

PREAMBLE
1. Activate E-UTRAN Cell A and NR Cell B. The SS configures the corresponding Master Information Block and System Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 5.2.1.5-0.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2).

POSTAMBLE

5. The UE is powered OFF.
6. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.2.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2			The SS configures the initial power according to T0 in Table 5.2.1.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2)		PASS
5		UE	Switch Off UE	AT Command	
6			Deactivate E-UTRAN Cell A and NR Cell B.		

5.2.1.6 Expected Result

Step 4, UE could select NR Cell B and camps on the NR Cell B

5.2.2 Multi-mode Environment Cell Selection, E-UTRAN Available

5.2.2.1 Test Purpose

Verify that the UE will correctly select and camp on E-UTRAN cell when E-UTRAN cell available but no NR cell available.

5.2.2.2 Reference specification

3GPP TS 36.304, clause 5.2.3.

5.2.2.3 Applicability

This test applies to Type 1 and 2 devices as described in clause 4.2.

5.2.2.4 Test conditions

[SS configuration]
Cell A is a TD-LTE cell.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 41
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85dBm/15kHz
upperLayerIndication-r15=true

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in 4G mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.2.2.5 Test procedure

Table 5.2.2.5-1: Time instances of cell power level and parameter changes

	Parameter	Unit	E-UTRAN Cell A
T0	SS/PBCH SSS EPRE	dBm/SCS	-85

PREAMBLE
1. Activate E-UTRAN Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.2.2.5-1.
3. The UE is powered ON.

MAIN BODY
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).

POSTAMBLE
5. The UE is powered OFF.
6. Deactivate E-UTRAN Cell A.

Table 5.2.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	

1	←	RRC	SS Activates E-UTRAN Cell A		
2			The SS configures the initial power according to T0 in Table 5.2.2.5-1.		
2		UE	Switch On UE	AT Command	
3	→ NAS ← RRC		The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
4		UE	Switch Off UE	AT Command	
5			Deactivate E-UTRAN Cell A.		

5.2.2.6 Expected Result

Step 3, UE could select the E-UTRA cell A and camp on the E-UTRA cell A

5.2.3. Multi-mode Environment Cell Selection, NR Cell Available

5.2.3.1. Test Purpose

When SA NR cell and NSA PS-Cell(NR) available, UE could camps on the NR cell

5.2.3.2. Reference specification

3GPP TS 38.304, clause 5.2.3.

5.2.3.3. Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

5.2.3.4. Test conditions

[SS configuration]
Cell A is a NR cell.
Cell B is a NR Cell.
Cell B supports NSA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.2.3.5. Test procedure

Table 5.2.3.5-1: Time of cell power level and parameter changes

Time	Parameter	NR Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	-85	-85

PREAMBLE
1. Activate NR Cell A and Cell B. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.2.3.5-1.
3. The UE is powered ON.

MAIN BODY
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2).

POSTAMBLE
5. The UE is powered OFF.
6. Deactivate NR Cell A and NR Cell B.

Table 5.2.3.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and Cell B		
2			The SS configures the initial power according to T0 in Table 5.2.3.5-1.		
3		UE	Switch On UE	AT Command	

4	→ NAS ← RRC		The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2).		PASS
5		UE	Switch Off UE	AT Command	
6			Deactivate NR Cell A and NR Cell B.		

5.2.3.6. Expected Result

Step 4 UE selects the NR Cell A and camps on the Cell A.

5.2.4. Multi-mode Environment Cell Selection, NSA Cell Available

5.2.4.1. Test Purpose

Verify that the UE will correctly select and camp on NSA E-UTRAN cell when NSA E-UTRAN cell available and no NR cell

5.2.4.2. Reference specification

3GPP TS 36.304, clause 5.2.3.

5.2.4.3. Applicability

This test applies to type 1 devices as described in clause 4.2.

5.2.4.4. Test conditions

[SS configuration]
Cell A is a TD-LTE cell.
Cell B is a NR Cell.
Cell A supports NSA.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 41
EARFCN= f1
Bandwidth = 20 MHz
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00

NR-ARFCN= f1

Bandwidth = 100 MHz

SS/PBCH SSS EPRE = -85 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

NR Cell B is barred with cellBarred IE in MIB

UE

UE is powered off

5.2.4.5. Test procedure

Table 5.2.4.5-1: Time of cell power level and parameter changes

Time	Parameter	E-UTRAN Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	-85	-85

PREAMBLE

1. Activate E-UTRAN Cell A and Cell B. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.2.4.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).

POSTAMBLE

5. The UE is powered OFF.
6. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.2.4.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2			The SS configures the initial power according to T0 in Table 5.2.4.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5		UE	Switch Off UE	AT Command	
6			Deactivate E-UTRAN Cell A and NR Cell B.		

5.2.4.6. Expected Result

Step 4 UE selects the E-UTRAN Cell A and camps on the Cell A.

5.2.5 Initial Cell Selection from Power-Up

5.2.5.1 Test Purpose

Verify that the UE will correctly select and camp on the right NR cell based on channel quality from power-up when inter-frequency cells with different bandwidth and inter-band cell existing simultaneously.

5.2.5.2 Reference specification

3GPP TS 38.304, clause 5.2.3.

5.2.5.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

5.2.5.4 Test conditions

[SS configuration]
Cell A is a NR Serving Cell, Cell B and Cell C are inter-frequency cell and Cell D is inter-band cell.

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Band=n41
NR-ARFCN= f4

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00

Band=n41
NR-ARFCN= f3

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Band=n41
NR-ARFCN= f2

NR Cell D
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Band=n79
NR-ARFCN= f1

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.2.5.5 Test procedure

Table 5.2.5.5-0: Time instances of cell power level and parameter changes

	Parameter	Unit	Cell A	Cell B	Cell C	Cell D
T0	SS/PBCH SSS EPRE	dBm/SCS	-88	-94	-94	-94
T1			-94	-88	-94	-94
T2			-94	-94	-88	-94
T3			-94	-94	-94	-88

PREAMBLE

1. Activate NR CellA,NR CellB,NR CellC,NR CellD. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.2.5.5-0.

MAIN BODY

3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2).
5. The UE is powered OFF.

6. The SS configures the initial power according to T1 in Table 5.2.5.5-0.
7. The UE is powered ON.
8. The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2).
9. The UE is powered OFF.
10. The SS configures the initial power according to T2 in Table 5.2.5.5-0.
11. The UE is powered ON.
12. The UE performs the registration procedure on Cell C (see 38.508, Table 4.5.2.2).
13. The UE is powered OFF.
14. The SS configures the initial power according to T3 in Table 5.2.5.5-0.
15. The UE is powered ON.
16. The UE performs the registration procedure on Cell D (see 38.508, Table 4.5.2.2).

POSTAMBLE

17. The UE is powered OFF.
18. Deactivate NR CellA,NR CellB,NR CellC,NR CellD.

Table 5.2.5.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1		RRC	Activate NR Cell A,NR Cell B,NR Cell C,NR Cell D		
2		SS	The SS configures the initial power according to T0 in Table 5.2.5.5-0.		
3		UE	Switch On UE	AT Command	
4	→ NAS ← RRC		The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2)		PASS
5		UE	Switch Off UE	AT Command	
6		SS	The SS configures the initial power according to T1 in Table 5.2.5.5-0.		
7		UE	Switch On UE	AT Command	
8	→ NAS ← RRC		The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2)		PASS
10		SS	The SS configures the initial power according to T2 in Table 5.2.5.5-0.		
11		UE	Switch On UE	AT Command	
12	→ NAS ← RRC		The UE performs the registration procedure on Cell C (see 38.508, Table 4.5.2.2)		PASS
13		UE	Switch Off UE	AT Command	
14		SS	The SS configures the initial power according to T3 in Table 5.2.5.5-0.		
15		UE	Switch On UE	AT Command	
16	→ NAS ← RRC		The UE performs the registration procedure on Cell D (see 38.508, Table 4.5.2.2)		PASS
17		UE	Switch Off UE	AT Command	
18			Deactivate NR CellA,NR CellB,NR CellC,NR CellD.		

5.2.5.6 Expected Result

Step 4, UE could select NR Cell A and camp on the NR Cell A
Step 8, UE could select NR Cell B and camps on the NR Cell B
Step 12, UE could select NR Cell C and camp on the NR Cell C
Step 16, UE could select NR Cell D and camps on the NR Cell D

5.3 RRC connection/connection reconfiguration

5.3.1 RRC connection re-establishment, radio link failure, re-establish to a Prepared Inter-Freq cell

5.3.1.1 Test Purpose

When UE in RRC_CONNECTED state, verify that UE could re-establish the RRC connection on the prepared Inter-Freq cell.

5.3.1.2 Reference specification

3GPP TS 38.331 clauses 5.3.7, 5.3.10
3GPP TS 38.304 clause 5.2.3

5.3.1.3 Applicability

This test applies to Type 1 and 2 devices as described in clause 4.2

5.3.1.4 Test conditions

[SS configuration]
Cell A is a NR cell.
Cell B is a NR Cell.

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f2
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.3.1.5 Test procedure

Table 5.3.1.5-0: Time instances of cell power level and parameter changes

	Parameter	Unit	Cell A	Cell B
T0	SS/PBCH SSS EPRE	dBm/SCS	-88	Not Active
T1	SS/PBCH SSS EPRE	dBm/SCS	Not Active	-88

PREAMBLE

1. Activate NR CellA,NR CellB. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.3.1.5-0.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The SS configures the initial power according to T1 in Table 5.3.1.5-0.
6. Verify that UE sends RRCReestablishmentRequest message on NR cell B.
7. SS sends RRCReestablishment to UE on NR cell B.
8. UE sends RRCReestablishmentComplete message to SS on NR cell B.

POSTAMBLE

9. The UE is powered OFF.
10. Deactivate NR CellA,NR CellB.

Table 5.3.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR CellA,NR CellB.		
2		SS	The SS configures the initial power according to T0 in Table 5.3.1.5-0.		

3		UE	The UE is powered ON.	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18)		PASS
5		SS	The SS configures the initial power according to T1 in Table 5.3.1.5-0.		
6	→	RRC	Verify that UE sends RRCReestablishmentRequest message on NR cell B		PASS
7	←	RRC	SS sends RRCReestablishment to UE on NR cell B.		
8	→	RRC	UE sends RRCReestablishment-Complete message to SS on NR cell B		
9		UE	The UE is powered OFF.	AT Command	
10			Deactivate NR CellA,NR CellB.		

5.3.1.6 Expected Result

Step 4, UE could select NR Cell A and camp on the NR Cell A

Step 6, UE sends RRCReestablishmentRequest message on NR cell B

5.3.2 BWP configuration, downlink and uplink BWP addition /release

5.3.2.1 Test Purpose

When UE in RRC_CONNECTED state, verify that UE could add and release downlink and uplink BWP correctly.

5.3.2.2 Reference specification

3GPP TS 38.331 clause 5.3.5.

5.3.2.3 Applicability

This test applies to the device that supports SA or SA+NSA

5.3.2.4 Test conditions

[SS configuration]

Cell A is a NR cell.

NR Cell A

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

NR-ARFCN= f1

SS/PBCH SSS EPRE = -85 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.3.2.5 Test procedure

Table 5.3.2.5-0: Time instances of cell power level and parameter changes

	Parameter	Unit	Cell A
T0	SS/PBCH SSS EPRE	dBm/SCS	-85

PREAMBLE

1. Activate NR CellA The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.3.2.5-0.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. Verify the data transmission is performed successfully by using BWP-ID = 0 on Cell A.
6. SS sends RRCReconfiguration message to add a UL BWP and DL BWP(BWP-ID=1).
7. UE sends RRCReconfigurationComplete message to SS on NR cell A.
8. Verify the data transmission with the new BWP is performed successfully on Cell A.
9. SS sends RRCReconfiguration message to delete a UL BWP and DL BWP(BWP-ID=1).
10. UE sends RRCReconfigurationComplete message to SS on NR cell A.
11. Verify the data transmission is performed successfully by using BWP-ID = 0 on Cell A.

POSTAMBLE

12. The SS initiates a Detach procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

Table 5.3.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	

1	←	RRC	Activate NR CellA		
2			The SS configures the initial power according to T0 in Table 5.3.2.5-0		
3		UE	The UE is powered ON.	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18)		PASS
5			Verify the data transmission is performed successfully by using BWP-ID = 0 on Cell A.		
6	←		SS sends RRCReconfiguration message to add a UL BWP and DL BWP(BWP-ID=1). Refer to Table 5.3.2.5-2 and Table 5.3.2.5-3 for BWP parameters		
7	→		UE sends RRCReconfigurationComplete message to SS on NR cell A.		PASS
8			Verify the data transmission with the new BWP is performed successfully on Cell A.		
9	←		SS sends RRCReconfiguration message to delete a UL BWP and DL BWP(BWP-ID=1) Refer to Table 5.3.2.5-4 for BWP parameters		
10	→		UE sends RRCReconfigurationComplete message to SS on NR cell A.		PASS
11			Verify the data transmission is performed successfully by using BWP-ID = 0 on Cell A.		
12	←		The SS initiates a Detach procedure.		
13	←		The SS initiates a RRC release procedure.		
14			Deactivate NR Cell A.		

Table 5.3.2-2: BWP configuration

Derivation Path: TS 38.508-1 [4], Table 4.6.3-167		
Information Element	**Value/remark**	**Comment**
ServingCellConfig ::= SEQUENCE {		
……..	……..	
downlinkBWP-ToReleaseList	Not Present	
downlinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Downlink		
BWP-Downlink [1] SEQUENCE {		
bwp-Id	1	
bwp-Common SEQUENCE {		
genericParameters	BWP	5.3.2.5-3
……..	……..	
……..	……..	

}		
……..	……..	
}		
firstActiveDownlinkBWP-Id	1	
bwp-InactivityTimer	Not present	
defaultDownlinkBWP-Id	1	
uplinkConfig SEQUENCE {		
……..	……..	
uplinkBWP-ToReleaseList	Not Present	
uplinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Uplink		
BWP-Uplink[1] SEQUENCE {		
bwp-Id	1	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters	BWP	5.3.2.5-3
……..	……..	
……..	……..	
}		
……..	……..	
}		
firstActiveUplinkBWP-Id	1	
}		
}		

Table 5.3.2.5-3: BWP Parameters in step 6

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
BWP ::= SEQUENCE {		
locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		

Table 5.3.2.5-4: BWP configuration

Information Element	**Value/remark**	**Comment**
ServingCellConfig ::= SEQUENCE {		
……..	……..	
downlinkBWP-ToReleaseList	bwp-Id =1	
downlinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Downlink	Not present	
firstActiveDownlinkBWP-Id	0	

bwp-InactivityTimer	Not present	
defaultDownlinkBWP-Id	0	
uplinkConfig SEQUENCE {		
……..	……..	
uplinkBWP-ToReleaseList	bwp-Id =1	
uplinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Uplink		
firstActiveUplinkBWP-Id	0	
}		
}		

5.3.2.6 Expected Result

Step 4, UE could select NR Cell A and camp on the NR Cell A

Step 7, UE sends RRCReconfigurationComplete message on NR cell A.

Step 10, UE sends RRCReconfigurationComplete message on NR cell A.

5.4 Registration/De-registration

5.4.1 Initial Registration, SA

5.4.1.1 Test Purpose

Verify the UE can register on NR Cell successfully.

5.4.1.2 Reference specification

3GPP TS 24.501, clause 5.5

3GPP TS 24.501, clause 6.4

5.4.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

5.4.1.4 Test conditions

[SS configuration]

Cell A is a NR cell.

NR Cell A

Cell Id=1 TAC = 1

MCC = 460 MNC = 00

NR-ARFCN= f1

SS/PBCH SSS EPRE = -85 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted.

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.4.1.5 Test procedure

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The UE is powered ON.

MAIN BODY

3. The UE sends an RRCConnectionRequest message.
4. The SS sends an RRCConnectionSetup message.
5. The UE sends an RRCConnectionSetupComplete message including the REGISTRATION REQUEST message to initiate the the registration procedure.
6. The SS sends an AUTHENTICATION REQUEST message to initiate the 5G AKA based primary authentication and key agreement procedure.
7. The UE sends the AUTHENTICATION RESPONSE message.
8. The SS sends a NAS SECURITY MODE COMMAND message to activate NAS security.
9. The UE sends a NAS SECURITY MODE COMPLETE message
10. The SS sends a SecurityModeCommand message to activate AS security.
11. The UE sends a SecurityModeComplete message and establishes the initial security configuration.
12. The SS sends a UECapabilityEnquiry message to initiate the UE radio access capability transfer procedure.
13. The UE sends a UECapabilityInformation message to transfer UE radio access capability.
14. The SS sends an REGISTRATION ACCEPT message.
15. The UE sends an REGISTRATION COMPLETE message.
16. The UE sends an PDU SESSION ESTABLISHMENT REQUEST message, verify that PDU session type is IPv4v6.
17. The SS sends an RRCConnectionReconfiguration message to establish the default bearer, and PDU SESSION ESTABLISHMENT ACCEPT is piggybacked.
18. The UE sends an RRCConnectionReconfigurationComplete message

POSTAMBLE

19. The UE is powered off

20. The UE sends a DEREGISTRATION REQUEST message.
21. The SS initiates a RRC release procedure.
22. Deactivate NR Cell A.

Table 5.4.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activates E-UTRAN Cell A		
2		UE	Switch On UE	AT Command	
3	→	RRC	NR RRC: RRCSetupRequest		
4	←	RRC	NR RRC: RRCSetup		
5	→	RRC NAS	NR RRC: RRCSetupComplete 5GMM: REGISTRATION REQUEST		PASS
6	←	RRC NAS	NR RRC: DLInformationTransfer 5GMM: AUTHENTICATION REQUEST		
7	→	RRC NAS	NR RRC: ULInformationTransfer 5GMM: AUTHENTICATION RESPONSE		PASS
8	←	RRC NAS	NR RRC: DLInformationTransfer 5GMM: SECURITY MODE COMMAND		
9	→	RRC NAS	NR RRC: ULInformationTransfer 5GMM: SECURITY MODE COMPLETE		PASS
10	←	RRC	NR RRC: SecurityModeCommand		
11	→	RRC	NR RRC: SecurityModeComplete		PASS
12	←	RRC	NR RRC: UECapabilityEnquiry		
13	→	RRC	NR RRC: UECapabilityInformation		PASS
14	←	RRC NAS	NR RRC: DLInformationTransfer 5GMM: REGISTRATION ACCEPT		
15	→	RRC NAS	NR RRC: ULInformationTransfer 5GMM: REGISTRATION COMPLETE		PASS
16	→	RRC NAS	NR RRC: ULInformationTransfer 5GMM: UL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT REQUEST, verify that PDU session type is IPv4v6.		PASS
17	←	RRC NAS	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT ACCEPT		
18	→	RRC	NR RRC: RRCReconfigurationComplete		PASS
19		UE	Switch Off UE,	AT Command	
20	→	NAS	UE sends a DEREGISTRATION REQUEST message.		PASS
21	←	RRC	SS initiates a RRC release procedure.		

22			Deactivate NR Cell A		

5.4.1.6 Expected Result

Verify the UE can register on NR Cell successfully.

5.5 NSA

5.5.1 Multi-mode Environment Cell selection for NSA

5.5.1.1 Test Purpose

Verify that the UE will correctly select and camp on a LTE cell based on channel quality from power-up when LTE and NSA NR cell both exist.

5.5.1.2 Reference specification

3GPP TS 36.304, clause 5.2.3.

5.5.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

5.5.1.4 Test conditions

[SS configuration]
Cell A is a E-UTRAN cell and also NSA MCG. Cell B and Cell C are 4G only cell
Cell D is a NR Cell (NSA SCG, not SA NR cell).

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
Band = B41
EARFCN= f2
rootSequenceIndex = 0
Reference Signal EPRE= -94 dBm/15kHz
upperLayerIndication-r15=false

E-UTRAN Cell C

Cell Id=03 TAC = 03
MCC-MNC = 460-00
Band = B41
EARFCN= f3
rootSequenceIndex = 0
Reference Signal EPRE= -94 dBm/15kHz
upperLayerIndication-r15=false

NR Cell D
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -94 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.1.5 Test procedure

Table 5.5.1.5-0: Time instances of cell power level and parameter changes

	Parameter	Unit	Cell A	Cell B	Cell C	Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	/	/	/	-88
	Reference Signal EPRE	dBm/15kHz	-88	-94	-94	/
T1	SS/PBCH, SSS EPRE	dBm/SCS	/	/	-88	-88
	Reference Signal EPRE	dBm/15kHz	-94	-88	-94	/
T2	SS/PBCH, SSS EPRE	dBm/SCS	/	/	-88	-88
	Reference Signal EPRE	dBm/15kHz	-94	-94	-88	/

PREAMBLE

1. Activate E-UTRAN Cell A, Cell B, Cell C and NR Cell D. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.5.1.5-0 .
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell D as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.The RRC connection is released by the SS.
10. The UE is powered OFF.
11. The SS configures the initial power according to T1 in Table 5.5.1.5-0.
12. The UE is powered ON. Verify that the UE performs the registration procedure on Cell B(see 38.508, Table 4.5.2.2).
13. The UE is powered OFF.
14. The SS configures the initial power according to T2 in Table 5.5.1.5-0.
15. The UE is powered ON. Verify that the UE performs the registration procedure on Cell C(see 38.508, Table 4.5.2.2).

POSTAMBLE

16. The SS initiates a paging preocedure to establish RRC connection for DETACH.
17. The SS initiates a MT Detach procedure.
18. The SS initiates a RRC release procedure.
19. Deactivate E-UTRAN Cell A , Cell B, Cell C and NR Cell D.

Table 5.5.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A , Cell B and Cell C and NR Cell B		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	UECapabilityInformation including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	RRCConnectionReconfiguration containing NR RRCReconfiguration to add Cell D as NR PS-Cell with Split DRB. RRCConnectionReconfiguration contains the ACTIVATE DEDICATED EPS BEARER CONTEXT		

			REQUEST message.		
8	→	RRC	RRCConnectionReconfigurationComplete containing NR RRCReconfigurationComplete.		PASS
9	→	RRC	ULInformationTransfer containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message		PASS
10			The UE is powered OFF.		
11			The SS configures the initial power according to T1 in Table 5.5.1.5-0.		
12	→ ←	NAS RRC	The UE is powered ON and performs the registration procedure on Cell B(see 38.508, Table 4.5.2.2).		PASS
13			The UE is powered OFF.		
14			The SS configures the initial power according to T1 in Table 5.5.1.5-0.		
15	→ ←	NAS RRC	The UE is powered ON and performs the registration procedure on Cell C(see 38.508, Table 4.5.2.2).		PASS
16	→ ←	RRC	SS initiates a paging preocedure to establish RRC connection for DETACH.		
17	→ ←	NAS	SS initiates a MT Detach procedure.		
18	←	RRC	SS initiates a RRC release procedure.		
19			Deactivate E-UTRAN Cell A and NR Cell B		

5.5.1.6 Expected Result

Step 4, UE could correctly select and camp on the E-UTRAN cell A

Step 6, UE could correctly report its EN-DC capability

Step 8 and 9, UE could support the establishment of NSA SCG.

Step 12, UE could correctly select and camp on the E-UTRAN cell B

Step 15, UE could correctly select and camp on the E-UTRAN cell C

5.5.2 Initial Registration, NSA

5.5.2.1 Test Purpose

Verify the UE can support NSA, and the data transmission can be performed successfully on PS-Cell after adding PS-Cell .

5.5.2.2 Reference specification

3GPP TS 38.331, clause 5.3.5

5.5.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

5.5.2.4 Test conditions

[SS configuration]
Cell A is a E-UTRAN cell.
Cell B is a NR Cell.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -94 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.2.5 Test procedure

PREAMBLE

1. Activate E-UTRAN Cell A and Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The UE is powered ON.

MAIN BODY

3. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).

4. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
5. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
6. Verify the data transmission is performed successfully on Cell A.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
10. Verify the downlink data transmission is performed successfully on Cell B.
11. Verify the uplink data transmission is performed successfully on Cell B.

POSTAMBLE

12. The SS initiates a Detach procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.5.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2		UE	Switch On UE	AT Command	
3	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2)		PASS
4	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
5	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
6			Verify the data transmission is performed successfully on Cell A.		PASS
7	←	NAS RRC	The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	RRC	UE sends an ULInformationTransfer message		PASS

			containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message		
10			Verify the downlink data transmission is performed successfully on Cell B.		
11			Verify the uplink data transmission is performed successfully on Cell B.		
12	→ ←	NAS	SS initiates a Detach procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate E-UTRAN Cell A and NR Cell B.		

- Expected Result

Verify the UE can support NSA, and the data transmission can be performed successfully on PS-Cell after adding PS-Cell.

5.5.3 Bandwidth Part Configuration, SCG, EN-DC

5.5.3.1 Test Purpose

When UE in RRC_CONNECTED state with EN-DC, and, MCG (E-UTRA PDCP) and SCG, verify when UE receives an RRCConnectionReconfiguration message to configure a BandwidthPart for SCG, UE configures BandwidthPart for SCG and sends an RRCConnectionReconfigurationComplete message.

5.5.3.2 Reference specification

3GPP TS 38.331, clause 5.3.5

5.5.3.3 Applicability

This test applies to type 1 and 3 devices as described in clause 4.2.

5.5.3.4 Test conditions

[SS configuration]
Cell A is a E-UTRAN cell.
Cell B is a NR Cell.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01

MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -94 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.3.5 Test procedure

PREAMBLE
1. Activate E-UTRAN Cell A and NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The UE is powered ON.

MAIN BODY
3. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
4. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
5. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
6. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
7. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
8. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
9. Verify the data transmission is performed successfully by using BWP-ID = 0 on Cell B.
10. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add a UL BWP and DL BWP(BWP-ID=1).
11. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
12. Switch to the new BWP(BWP-ID=1).
13. Verify the data transmission with the new BWP is performed successfully on Cell B.
14. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration

message to delete a UL BWP and DL BWP(BWP-ID=1).

15. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
16. Verify the data transmission is performed successfully by using BWP-ID = 0 on Cell B.

POSTAMBLE

17. The SS initiates a Detach procedure.
18. The SS initiates a RRC release procedure.
19. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.5.3.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2		UE	Switch On UE	AT Command	
3	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2)		PASS
4	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
5	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
6	←	NAS RRC	The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
7	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
8	→	RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message		PASS
9			Verify the data transmission is performed successfully on Cell B.		PASS
10	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add a UL BWP and DL BWP(BWP-Id=1).		
11	→	RRC	UE sends an		PASS

			RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		
12			Switch to the new BWP(BWP-Id=1).		
13			Verify the data transmission with the new BWP is performed successfully on Cell B.		PASS
14	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to delete a UL BWP and DL BWP(BWP-Id=1).		
15	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
16			Verify the data transmission is performed successfully on Cell B as previous BWP((BWP-Id=0).		
17	→ ←	NAS	SS initiates a Detach procedure.		PASS
18	←	RRC	SS initiates a RRC release procedure.		
19			Deactivate E-UTRAN Cell A and NR Cell B		

5.5.3.6 Expected Result

Verify the UE can add UL BWP and DL BWP(BWP-Id=1) successfully.
Verify the data transmission with the new BWP(BWP-Id=1) is performed successfully.
Verify the UE can delete UL BWP and DL BWP(BWP-Id=1) successfully.

5.5.4 NSA-RLF

5.5.4.1 Radio Link Failure in LTE P-Cell

5.5.4.1.1 Test Purpose

When UE enters RLF condition while connected in EN-DC mode, verify whether it can reestablish in same P-Cell and enter again to EN-DC connected mode with Data Continuity.

5.5.4.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300, TS 36.331

5.5.4.1.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.5.4.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 39
EARFCN= f1
Bandwidth = 20 MHz
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.4.1.5 Test procedure

Table 5.5.4.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	
T1	-145	-90	Condition RLF in EUTRAN Cell A
T2	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.5.4.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) performed on both EUTRAN Cell A and NR cell B

MAIN BODY

10. The SS configures the power level of the cells according to T1 in Table 5.5.4.1.5-1
11. Wait for T310 Expiry and SS configures the power level of the cells according to T2 in Table 5.5.4.1.5-1
12. Verify that UE initiates the RRC Connection Reestablishment request and completes the Reestablishment procedures
13. Verify that Data transfer(Ping) continued in EUTRAN cell A after reestablishment procedure
14. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.
15. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
16. Verify that Data tranfer(Ping) continued on both EUTRAN Cell A and NR cell B

POSTAMBLE

17. The SS initiates a Detach procedure.
18. The SS initiates a RRC release procedure.
19. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.5.4.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.5.4.1.5-1		

3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on both EUTRAN Cell A and NR Cell B.		PASS
10			SS configures the cell power according to T1 in Table 5.5.4.1.5-1		
11			Wait for T310 Expiry and SS configures the cell power according to T2 in Table 5.5.4.1.5-1		
12	→	RRC	UE sends RRC Connection Reestablishment Request		PASS
13	←	RRC	SS sends RRC Connection Reestablishment to the UE		
14	→	RRC	Verify that UE sends RRC Connection Reestablishment complete		PASS
15			Verify that Data transfer(Ping) continued in EUTRAN cell A after reestablishment procedure		
16	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
17	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
18			Verify that Data tranfer(Ping) continued on both EUTRAN Cell A and NR cell		PASS
19	→	NAS	SS initiates a Detach procedure.		PASS

	←				
20	←	RRC	SS initiates a RRC release procedure.		
21			Deactivate E-UTRAN Cell A and NR Cell B.		

5.5.4.1.6 Expected Result

When RLF introduced in EN-DC cell, UE should first Reestablish in P-Cell

5.5.4.2 Radio Link Failure in NR PS-Cell - Reattaching to the same PS-Cell

5.5.4.2.1 Test Purpose

When UE enters RLF condition in PS-Cell while connected in EN-DC mode, verify whether it can detect and attach in same PS-Cell and enter again to EN-DC connected mode with Data Continuity.

5.5.4.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300, TS 36.331

5.5.4.2.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.5.4.2.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 39
EARFCN= f1
Bandwidth = 20 MHz
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz

SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.4.2.5 Test procedure

Table 5.5.4.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	
T1	-85	-145	Condition RLF in NR Cell B
T2	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.5.4.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) performed on both EUTRAN Cell A and NR cell B

MAIN BODY

10. The SS configures the power level of the cells according to T1 in Table 5.5.4.2.5-1

11. Verify that UE sends SCGFailureInformationNR with failure type set as ‘t310-expiry’ after T310 seconds
12. The SS configures the power level of the cells according to T2 in Table 5.5.4.2.5-1

13. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.
14. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
15. Verify that Data tranfer(Ping) performed on both EUTRAN Cell A and NR cell B

POSTAMBLE

16. The SS initiates a Detach procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.5.4.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.5.4.2.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on both EUTRAN Cell A and NR Cell B.		PASS
10			SS configures the cell power according to T1		

			in Table 5.5.4.2.5-1		
11	→	RRC	Verify that after T310 expiry, UE is sending SCGFailureInformationNR with failure type set as 't310-expiry'		PASS
12			SS configures the cell power according to T2 in Table 5.5.4.2.5-1		
13	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
14	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
15			Verify the data transmission is performed successfully on both EUTRAN Cell A and NR Cell B.		PASS
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

5.5.4.2.6 Expected Result

When RLF introduced in EN-DC PS-Cell, UE should initiate the SCGFailureInformationNR message

5.5.4.3 Radio Link Failure in NR PS-Cell – Re-attaching to different PS-Cell

5.5.4.3.1 Test Purpose

When UE enters RLF condition in PS-Cell while connected in EN-DC mode, verify whether it can detect and attach in different PS-Cell and enter again to EN-DC connected mode with Data Continuity.

5.5.4.3.2 Reference specification

TS 38.304, TS 38.331, TS 38.300, TS 36.331

5.5.4.3.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.5.4.3.4 Test conditions

[SS configuration]

Cell A is E-UTRAN Cell, CellB &Cell C are NR Cells.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 39
EARFCN= f1
Bandwidth = 20 MHz
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.4.3.5 Test procedure

Table 5.5.4.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	NR Cell C	Remark
T0	-85	-90	NA	
T1	-85	-145	-90	Condition RLF in NR Cell B

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.5.4.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
10. Verify that Data tranfer(Ping) performed on both EUTRAN Cell A and NR cell B

MAIN BODY

11. The SS configures the power level of the cells according to T1 in Table 5.5.4.3.5-1
12. Verify that UE sends SCGFailureInformationNR with failure type set as ‘t310-expiry’ after T310 seconds
13. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell.
14. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
15. Verify that Data tranfer(Ping) performed on both EUTRAN Cell A and NR cell C

POSTAMBLE

16. The SS initiates a Detach procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.5.4.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		

1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.5.4.3.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message		PASS
10			Verify the data transmission is performed successfully on both EUTRAN Cell A and NR Cell B.		PASS
11			SS configures the cell power according to T1 in Table 5.5.4.3.5-1		
12	→	RRC	Verify that after T310 expiry, UE is sending SCGFailureInformationNR with failure type set as ‘t310-expiry’		PASS
13	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB.		
14	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
15			Verify the data transmission is performed successfully on both EUTRAN Cell A and NR Cell B.		PASS
16	→	NAS	SS initiates a Detach procedure.		PASS

	←				
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell C.		

5.5.4.3.6 Expected Result

When RLF introduced in EN-DC PS-Cell, UE should initiate the SCGFailureInformationNR message

5.5.4.4 Radio Link Failure Detection and Recovery in PS-Cell

5.5.4.4.1 Test Purpose

When UE enters RLF condition in PS-Cell while connected in EN-DC mode, verify whether it can detect and recover in same PS-Cell with Data Continuity.

5.5.4.4.2 Reference specification

TS 38.304, TS 38.331, TS 38.300, TS 36.331

5.5.4.4.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.5.4.4.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 39
EARFCN= f1
Bandwidth = 20 MHz
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz

SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.5.4.4.5 Test procedure

Table 5.5.4.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	
T1	-85	-145	Condition RLF in NR Cell B
T2	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.5.4.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
10. Verify that Data tranfer(Ping) performed on both EUTRAN Cell A and NR cell B

MAIN BODY

11. The SS configures the power level of the cells according to T1 in Table 5.5.4.4.5-1
12. The SS configures the power level of the cells according to T2 in Table 5.5.4.4.5-1 before T310 timer expiry

13. Verify that Data tranfer(Ping) continued on both EUTRAN Cell A and NR cell B

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.5.4.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.5.4.4.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message		PASS
10			Verify the data transmission is performed successfully on both EUTRAN Cell A and NR		PASS

			Cell B.		
11			SS configures the cell power according to T1 in Table 5.5.4.4.5-1		
12			SS configures the cell power according to T2 in Table 5.5.4.4.5-1 before T310 expiry		
13			Verify the data transmission is continued successfully on both EUTRAN Cell A and NR Cell B.		PASS
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

5.5.4.4.6 Expected Result

When RLF introduced and resolved before T310 expiry in EN-DC PS-Cell, UE should detect and recover from the RLF and continue the data transmission

5.6 CSI-RS Measurement

5.6.1 CSI Reporting Periodic in PUSCH

5.6.1.1 Test Purpose

Periodic CSI measurement configuration for CSI type 1 in NR cell when UE is connected to EN-DC.

5.6.1.2 Reference specification

TS 36.304, clause 5.2.4, TS 38.213, 38.331

5.6.1.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.6.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00

EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.6.1.5 Test procedure

Table 5.6.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	

PREAMBLE
1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.6.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

10. Send RRCConnectionReconfiguration message containing NR RRCReconfiguration to configure NR Measurement Objects, Report configuration, Report Quantity, Codebook Configuration(Type 1), Resource periodicity and offset to the UE
11. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
12. Verify that CSI-RS measurements are received for the NR cell

POSTAMBLE

13. The SS initiates a Detach procedure.
14. The SS initiates a RRC release procedure.
15. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.6.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.6.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the Periodic CSI-RS		

			Measurements		
11	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		
12	→		Verify that periodic CSI-RS measurements are received		PASS
13	→ ←	NAS	SS initiates a Detach procedure.		PASS
14	←	RRC	SS initiates a RRC release procedure.		
15			Deactivate E-UTRAN Cell A and NR Cell B.		

5.6.1.6 Expected Result

Verify that UE sends periodic CSI-RS measurements in PUCCH for NR cell

5.6.2 CSI Reporting Aperiodic in PUSCH

5.6.2.1 Test Purpose

Aperiodic CSI measurement configuration for CSI type 1 in NR cell when UE is connected to EN-DC.

5.6.2.2 Reference specification

TS 36.304, clause 5.2.4, TS 38.213, 38.331

5.6.2.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.6.2.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01

MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS

E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.6.2.5 Test procedure

Table 5.6.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.6.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

10. Send RRCConnectionReconfiguration message containing NR RRCReconfiguration to configure NR Measurement Objects, Report configuration, Report Quantity, Codebook Configuration(Type 1), Resource periodicity and offset to the UE
11. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

12. SS sends DCI to trigger the Aperiodic CSI-RS Measurements to the UE
13. Verify that CSI-RS measurements are received for the NR cell

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.6.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.6.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the Periodic CSI-RS Measurements		
11	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		
12	←		SS sends DCI to trigger Aperiodic CSI-RS		

			measurements to the UE		
13	→		Verify that Aperiodic CSI-RS measurements are received		PASS
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

5.6.2.6 Expected Result

Verify that UE sends aperiodic CSI-RS measurements in PUSCH for NR cell

5.6.3 CSI Reporting Aperiodic in PUSCH

5.6.3.1 Test Purpose

Aperiodic CSI measurement configuration for CSI type 1 in NR CA cell when UE is connected to EN-DC.

5.6.3.2 Reference specification

TS 36.304, clause 5.2.4, TS 38.213, 38.331

5.6.3.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.6.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, Cell B and Cell C are NR Cells.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex= 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.6.3.5 Test procedure

Table 5.6.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	NR Cell C	Remark
T0	-85	-90	-95	

PREAMBLE
1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.6.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY
10. SS Sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration

message to add Cell C as NR S-Cell to NR PS-Cell A

11. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
12. Send RRCConnectionReconfiguration message containing NR RRCReconfiguration to configure NR Measurement Objects, Report configuration, Report Quantity, Codebook Configuration(Type 1), Resource periodicity and offset to the UE
13. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
14. SS sends DCI to trigger the Aperiodic CSI-RS Measurements to the UE
15. Verify that CSI-RS measurements are received for the NR S-Cell

POSTAMBLE

16. The SS initiates a Detach procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.6.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.6.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	SS sends an RRCConnectionReconfiguration		

			message containing NR RRCReconfiguration message to add NR Cell C as NR S-Cell to NR PS-Cell B		
11	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
12	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the Periodic CSI-RS Measurements		
13	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		
14	←		SS sends DCI to trigger Aperiodic CSI-RS measurements to the UE		
15	→		Verify that Aperiodic CSI-RS measurements are received for NR cell C		PASS
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

5.6.3.6 Expected Result

Verify that UE sends aperiodic CSI-RS measurements in PUSCH for NR cell C

5.6.4 CSI-RS Based Intra Frequency Measurements on Neighbour Cell Beams

5.6.4.1 Test Purpose

Verify that When CSI-RSRP measurements are activated for multiple neigbour beam indexes, UE reports the beam indexes properly

5.6.4.2 Reference specification

TS 36.304, clause 5.2.4, TS 38.213, 38.331

5.6.4.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.6.4.4 Test conditions

[SS configuration]

Cell A is E-UTRAN Cell, Cell B and Cell C are intra frequency NR Cells.

Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex= 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE for Beam 1 = -125 dBm/30kHz
SS/PBCH SSS EPRE for Beam 2 = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.6.4.5 Test procedure

Table 5.6.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	NR Cell C	Remark
T0	-85	-90	-98	

T1	-85	-106	-98	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.6.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

10. SS Sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the measurement configuration to setup a SS/PBCH block based intra frequency NR measurements for NR cell B and reporting event A3
11. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
12. SS reconfigures the cell power level according to T1 in Table 5.6.4.5-1
13. Verify that UE sends measured result for Event A3 with beam information containing RsIndex[0] and RsIndex[1] for neighbour NR cell C

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.6.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.6.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on		PASS

			Cell A (see 36.508, 4.5.2).		
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the measurement configuration to setup a SS/PBCH block based intra frequency NR measurements for NR cell B and reporting event A3		
11	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
12	←	RRC	SS reconfigures the cell power level according to T1 in Table 5.6.4.5-1		
13	→	RRC	UE sends measured result in Measurement report for Event A3 with beam information containing RsIndex[0] and RsIndex[1] for NR cell C		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

5.6.4.6 Expected Result

Verify that UE sends measurement report for two beam indexes for the neighbour NR cell C

5.6.5 CSI-RS Based Inter Frequency Measurements on Neighbour Cell Beams

5.6.5.1 Test Purpose

Verify that When CSI-RSRP measurements are activated for multiple neigbour beam indexes, UE reports the beam indexes properly

5.6.5.2 Reference specification

TS 36.304, clause 5.2.4, TS 38.213, 38.331

5.6.5.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

5.6.5.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, Cell B and Cell C are inter frequency NR Cells.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE for Beam 1 = -125 dBm/30kHz
SS/PBCH SSS EPRE for Beam 2 = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active

NR Cell B is not active

NR Cell C is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.6.5.5 Test procedure

Table 5.6.5.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	NR Cell C	Remark
T0	-85	-90	-98	
T1	-85	-106	-98	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.6.5.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

10. SS Sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the measurement configuration to setup a SS/PBCH block based inter frequency NR measurements for NR cell C and reporting event A3
11. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
12. SS reconfigures the cell power level according to T1 in Table 5.6.5.5-1
13. Verify that UE sends measured result for Event A3 with beam information containing RsIndex[0] and RsIndex[1] for neighbour NR cell C

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 5.6.5.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 5.6.5.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to configure the measurement configuration to setup a SS/PBCH block based inter frequency NR measurements for NR cell C and reporting event A3		
11	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
12	←	RRC	SS reconfigures the cell power level according to T1 in Table 5.6.5.5-1		
13	→	RRC	UE sends measured result in Measurement report for Event A3 with beam information containing RsIndex[0] and RsIndex[1] for NR cell C		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS

15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

5.6.5.6 Expected Result

Verify that UE sends measurement report for two beam indexes for the neighbour NR cell C

5.7 RRC Inactive mode cases in SA

5.7.1 RRC Connected Mode to RRC Inactive Mode and RRC Resume Procedure

5.7.1.1 Test Purpose

When RRC connection Release is send to UE with Suspending RRC connection verify that UE is entering RRC Inactive mode. When Paging is sent to UE in RRC Inactive Mode verify that UE resumes the RRC Connection by inititating RRC Resume Procedure

5.7.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

5.7.1.3 Applicability

This test applies to the device that supports SA or SA+NSA.

5.7.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.7.1.5 Test procedure

Table 5.7.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.7.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A

MAIN BODY

6. The RRC connection is released by the SS with suspendConfig. The UE enters Registered, Inactive Mode
7. SS initiates paging message to UE
8. Verify that UE is initiating RRC Resume Procedure by sending RRCResumeRequest to SS
9. SS transmits RRCResume message to the UE
10. Verify that UE is sending RRCResumeComplete to SS
11. Verify that Data tranfer(Ping) perofrmed on NR cell A

POSTAMBLE

12. The SS initiates a Deregitration procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

Table 5.7.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 5.7.1.5-1.		
3		UE	Switch On UE	AT Command	

4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS with suspendConfig.		
7	←	RRC	Paging		
8	→	RRC	RRCResumeRequest		PASS
9	←	RRC	RRCResume		
10	→	RRC	RRCResumeComplete		PASS
11			Verify the data transmission is performed successfully on NR Cell A.		PASS
12	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate NR Cell A.		

5.7.1.6 Expected Result

Verify that UE moves to RRC Inactive Mode and comes back to RRC Connected mode when instructed.

5.7.2 Periodic RNA Update Procedure in RRC Inactive Mode

5.7.2.1 Test Purpose

When RNA Update timer expires in RRC Inactive Mode verify that UE initiates RRC Connection Resume Procedure for RNA Update

5.7.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

5.7.2.3 Applicability

This test applies to the device that supports SA or SA+NSA.

5.7.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41

NR-ARFCN= f1

Bandwidth = 100 MHz

SS/PBCH SSS EPRE = -125 dBm/30kHz

T380 = min5

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.7.2.5 Test procedure

Table 5.7.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.7.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A

MAIN BODY

6. The RRC connection is released by the SS with suspendConfig. The UE enters Registered, Inactive Mode
7. Wait for t380 timer duration
8. After t380 expiry Verify that UE is initiating RRC Resume Procedure by sending RRCResumeRequest with resume cause set as ‘rna-Update’ to SS
9. SS transmits RRCResume message to the UE
10. Verify that UE is sending RRCResumeComplete to SS
11. Verify that Data tranfer(Ping) perofrmed on NR cell A

POSTAMBLE

12. The SS initiates a Deregitration procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

Table 5.7.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 5.7.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS with suspendConfig.		
7			Wait for t380 timer duration		
8	→	RRC	RRCResumeRequest with resume cause rna-update		PASS
9	←	RRC	RRCResume		
10	→	RRC	RRCResumeComplete		PASS
11			Verify the data transmission is performed successfully on NR Cell A.		PASS
12	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate NR Cell A.		

5.7.2.6 Expected Result

Verify that when t380 expired, UE is initiating RRC Connection Resume Procedure

5.7.3 RNA Update in RRC Inactive Mode for Cell Reselection to new RNA cell

5.7.3.1 Test Purpose

When UE is reselecting into new RNA Cell while in RRC Inactive Mode, verify that it initiates RRC Resume Procedure to update the RNA

5.7.3.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

5.7.3.3 Applicability

This test applies to the device that supports SA or SA+NSA.

5.7.3.4 Test conditions

[SS configuration]
Cell A and Cell B are NR Cells.
Cell A and Cell B supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz
T380 = min10

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz
T380 = min5

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.7.3.5 Test procedure

Table 5.7.3.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-75	-145	
T1	-95	-75	Reselection to Cell B

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.7.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A

MAIN BODY

6. The RRC connection is released by the SS with suspendConfig. The UE enters Registered, Inactive Mode
7. The SS configures the cell power level according to T1 in Table 5.7.3.5-1
8. Verify that UE is initiating RRC Resume Procedure by sending RRCResumeRequest with resume cause set as 'rna-Update' to SS in NR Cell B
9. SS transmits RRCResume message to the UE in NR Cell B
10. Verify that UE is sending RRCResumeComplete to SS in NR Cell B
11. Verify that Data tranfer(Ping) perofrmed on NR cell B

POSTAMBLE

12. The SS initiates a Deregitration procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

Table 5.7.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 5.7.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5			Verify the data transmission is performed		PASS

			successfully on NR Cell A.		
6	←	RRC	The RRC connection is released by the SS with suspendConfig.		
7			The SS configures the cell power level according to T1 in Table 5.7.3.5-1		
8	→	RRC	RRCResumeRequest with resume cause rna-update in Cell B		PASS
9	←	RRC	RRCResume in Cell B		
10	→	RRC	RRCResumeComplete in Cell B		PASS
11			Verify the data transmission is performed successfully on NR Cell B.		PASS
12	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate NR Cell A and B.		

5.7.3.6 Expected Result

Verify that when reselection performed on new RNA cell while in RRC Inactive Mode, UE initiates the RRC Resume Procedure to SS

5.8 Access Barring, Access Class

5.8.1 Cell Barred while in RRC IDLE State

5.8.1.1 Test Purpose

When cell is barred while UE is RRC IDLE state, Verify that UE is reselecting onto another intra frequency neighbor cell

5.8.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

5.8.1.3 Applicability

This test applies to the device that supports SA or SA+NSA.

5.8.1.4 Test conditions

[SS configuration]
Cell A and Cell B are NR Cells.
Cell A and B supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00

NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.8.1.5 Test procedure

Table 5.8.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-75	-85	

PREAMBLE
1. Activate NR Cell A and B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.8.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 20a1).

MAIN BODY

5. SS transmits short message(with bit 1 set to 1) in PDCCH using P-RNTI with or without paging message using short message field in DCI_format 1_0
6. SS Transmits Cell A MIB with barred as for cellBarred IE and SIBs.
7. The UE performs the Reselection procedure on Cell B
8. SS initiates paging message to UE on Cell B
9. UE sends RRC Request to the SS on Cell B
10. SS transmits RRC Setup message to UE
11. UE sends RRC Setup Complete with Service Request NAS message
12. SS sends the Access stratum Security Mode Command to the UE
13. UE responds with AS Security Mode Complete to the SS
14. SS Transmits RRC Reconfiguration to establish SRB2 and DRB with a Service accept NAS message
15. UE sends RRC Reconfiguration Complete to the SS

POSTAMBLE

16. The SS initiates a Deregitration procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate NR Cell A and B.

Table 5.8.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 5.8.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 20a1).		PASS
5	←	MAC	SS sends short message to the UE with systemInfoModification bit set 1		
6	←	RRC	SS broadcasts MIB with cellBarred IE as barred		
7			UE performs IDLE Mode reselection procedure in Cell B		
8	←	RRC	Paging in Cell B		
9	→	RRC	RRCRequest in Cell B		PASS
10	←	RRC	RRCSetup		
11	→	NAS	RRCSetupComplete with Service Request NAS		

		RRC	message		
12	←	RRC	AS Security Mode Command		
13	→	RRC	AS Security Mode Complete		
14	←	NAS RRC	RRCReconfiguration with Service Accept NAS message		
15	→	RRC	RRCReconfigurationComplete		PASS
16	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate NR Cell A and B		

5.8.1.6 Expected Result

While UE is RRC IDLE mode if Cell is barred verify that UE is reselecting into neighbour cell.

5.8.2 Access Categories for Different Services

5.8.2.1 Test Purpose

This case is to verify when different services are initiated then different access category is requested by the device

5.8.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300 , TS 34.229-5

5.8.2.3 Applicability

This test applies to the device that supports SA or SA+NSA.

5.8.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.8.2.5 Test procedure

Table 5.8.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.8.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see clause 4.1.4)..

MAIN BODY

5. SS initiates paging message to UE
6. UE sends RRC Request with access category as 0(establishment cause as mt-Access) to the SS
7. SS transmits RRC Setup message to UE
8. UE sends RRC Setup Complete with Service Request NAS message
9. SS transmits the Access stratum Security Mode Command to the UE
10. UE responds with AS Security Mode Complete to the SS
11. SS Transmits RRC Reconfiguration to establish SRB2 and DRB with a Service accept NAS message
12. UE sends RRC Reconfiguration Complete to the SS
13. RRC connection is released by SS
14. Start the ping from UE to SS
15. UE sends RRC Request with access category as 7(establishment cause as mo-Data) to the SS
16. SS transmits RRC Setup message to UE
17. UE sends RRC Setup Complete to SS
18. SS transmits the AS Security Mode Command to the UE
19. UE responds with AS Security Mode Complete to the SS
20. SS Transmits RRC Reconfiguration to establish SRB2 and DRB with a Service accept NAS message

21. UE sends RRC Reconfiguration Complete to the SS
22. Ping is performed

(IF UE is pre-set as Voice-centric, then run step 23-24)

23. SS send SIP_Notify to de-registers the UE's contact address with event as rejected
24. UE send SIP_200_OK to acknowledges
25. RRC connection is released by SS
26. Initiate the switch off procedure from UE
27. UE sends RRC Request with access category as 3(establishment cause as mo-signaling) to the SS
28. SS transmits RRC Setup message to UE
29. UE sends RRC Setup Complete with Deregistration NAS message
30. SS Transmits Deregistration Accept to UE

POSTAMBLE

31. The SS initiates a RRC release procedure.
32. Deactivate NR Cell A.

Table 5.8.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 5.8.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 20a1).		PASS
5	←	RRC	Paging		
6	→	RRC	RRCRequest with establishment cause as mt-Access		PASS
7	←	RRC	RRCSetup		
8	→	NAS RRC	RRCSetupComplete with Service Request NAS message		
9	←	RRC	AS Security Mode Command		
10	→	RRC	AS Security Mode Complete		
11	←	NAS RRC	RRCReconfiguration with Service Accept NAS message		
12	→	RRC	RRCReconfigurationComplete		PASS
13	←	RRC	RRCRelease		

14			Start the ping from UE to SS		
15	→	RRC	RRCRequest with establishment cause as mo-Data		PASS
16	←	RRC	RRCSetup		
17	→	NAS RRC	RRCSetupComplete		
18	←	RRC	AS Security Mode Command		
19	→	RRC	AS Security Mode Complete		
20	←	NAS RRC	RRCReconfiguration		
21	→	RRC	RRCReconfigurationComplete		PASS
22			PING Request and Response		
23	←		SIP_Notify	Cond: UE is pre-set as Voice-centric	
24	→		SIP_200OK	Cond: UE is pre-set as Voice-centric	
25	←	RRC	RRCRelease		
26			Initiate the switch off Procedure from UE		
27	→	RRC	RRCRequest with establishment cause as mo-Signaling		PASS
28	←	RRC	RRCSetup		
29	→	RRC NAS	RRCSetupComplete with Deregistration Request		PASS
30	←	NAS	Deregistration Accept		
31	←	RRC	SS initiates a RRC release procedure.		
32			Deactivate NR Cell A		

5.8.2.6 Expected Result

For Different services, UE should use different access categories.

5.8.3 Access Barring Check in RRC

5.8.3.1 Test Purpose

This case is to verify access is barred for certain services verify that UE is not initiating access request for those barred services

5.8.3.2 Reference specification

TS 38.304, TS 38.331, TS 38.300, TS 24.501

5.8.3.3 Applicability

This test applies to the device that supports SA or SA+NSA.

5.8.3.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz
uac-BarringForCommon in SIB1 = for access category 7

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

5.8.3.5 Test procedure

Table 5.8.3.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.8.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).

MAIN BODY

5. Start the ping from UE to SS
6. Verify that UE is not sending any RRCRequest for access attempt
7. SS initiates paging message to UE
8. UE sends RRC Request with access category as 0(establishment cause as mt-Access) to the SS
9. SS transmits RRC Setup message to UE
10. UE sends RRC Setup Complete with Service Request NAS message
11. SS transmits the Access stratum Security Mode Command to the UE
12. UE responds with AS Security Mode Complete to the SS
13. SS Transmits RRC Reconfiguration to establish SRB2 and DRB with a Service accept NAS message
14. UE sends RRC Reconfiguration Complete to the SS

POSTAMBLE

15. The SS initiates a Deregitration procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate NR Cell A.

Table 5.8.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 5.8.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 20a1).		PASS
5			Start the ping from UE to SS		
6			Verify that UE is not sending RRCRequest for access attempt		PASS
7	←	RRC	Paging		
8	→	RRC	RRCRequest with establishment cause as mt-Access		PASS
9	←	RRC	RRCSetup		
10	→	NAS RRC	RRCSetupComplete with Service Request NAS message		
11	←	RRC	AS Security Mode Command		
12	→	RRC	AS Security Mode Complete		
13	←	NAS RRC	RRCReconfiguration with Service Accept NAS message		

14	→	RRC	RRCReconfigurationComplete		PASS
15	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate NR Cell A.		

5.8.3.6 Expected Result

If access category is barred by the cell, UE should not attempt to access for particular access category

5.9 DCI_ based BWP Switching

5.9.1 BWP change:upto2, downlink and uplink BWP switching by DCIs.

5.9.1.1 Test Purpose

Verify that UE could be able to support BWP changing based on DCIs.

5.9.1.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.521-1

5.9.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.

5.9.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
rootSequenceIndex = 0
Modulation = UL:10/DL:19
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

subcarrierSpacing=30kHz

Table 5.9.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 5.9.1.4-2: Test band configuration

Test Point	Test band	Frequency Configuration	NR Frame Structure	Specail Frame
1	n41	f1	DD DD DD DS UU	DDDDDDGGGGUUUU
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

Table 5.9.1.4-3: Bandwidth Part configurations

BWP id	Bandwidth [MHz]	Bandwidth[PRB]	subcarrierSpacing
BWP-1	100MHz	273	30kHz
BWP-2	20MHz	51	30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

IMS VoLTE Feature should be enabled on DUT

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

5.9.1.5 Test procedure

Table 5.9.1.5-1: Time of cell power level and parameter changes

Time	Parameter	NR Cell A	Remark
T0	SS/PBCH	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. Set the parameters of the propagation condition and initial power according to Table 5.9.1.5-1
3. The UE is powered ON, and random access to Cell A.
4. UE performs Registration, PDU session establish and IMS registration according to the common procedure defined in 4.1.4.

MAIN BODY

5. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP-ID = 1 on Cell A.
6. SS sends RRC Reconfiguration message to add and activate BWP2 for both UL and DL.
7. UE sends RRC Reconfiguration Complete message to SS on NR cell A .
8. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP-ID = 2 on Cell A.
9. SS sends DCI-0_1 with field:'Bandwidth part indicator="**01**" (bin)' to trigger the BWP change from BWP2 to BWP1.
10. UE correctly decode the DCIs in BWP2 and succeed switch to BWP1.
11. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP1
12. SS sends DCI-0_1 with field:'Bandwidth part indicator="**10**" (bin)' to trigger the BWP change from BWP1 to BWP2.
13. UE correctly decode the DCIs in BWP1 and succeed switch to BWP2.
14. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP2.

POSTAMBLE

15. SS initiates a de-registration procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate NR Cell A.

5.9.1.6 Expected Result

1. Check and verify UE could perform BWP switch to BWP#1 by DCI on step #10
2. Check and record PDSCH_Througput achieved in step #11
3. Check and verify UE could perform BWP siwtch to BWP#2 by DCI on step #13
4. Check and record PDSCH_Througput achieved in step #14

5.9.2 BWP Change Advance, switching BWPs upto4: BWP1/BWP2/BWP3/BWP4 by DCIs.

5.9.2.1 Test Purpose

Verify that UE could be able to support BWP changing based on DCIs, tranversing BWP1, BWP2,BWP3,BWP4 of different Bandwidth(PRB numbers).

5.9.2.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.521-1

5.9.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.

5.9.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
rootSequenceIndex = 0
Modulation = UL:10/DL:19
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz

Table 5.9.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices

NR-1	Static	N/A

Table 5.9.2.4-2: Test band configuration

Test Point	**Test band**	**Frequency Configuration**	**NR Frame Structure**	**Specail Frame**
1	n41	f1	DD DD DD DS UU	DDDDDDGGGGUUUU
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

Table 5.9.2.4-3: Bandwidth Part configurations

BWP id	**Bandwidth [MHz]**	**Bandwidth[PRB]**	**subcarrierSpacing**
BWP-1	100MHz	273	30kHz
BWP-2	80MHz	217	30kHz
BWP-3	60MHz	162	30kHz
BWP-4	20MHz	51	30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.
IMS VoLTE Feature should be enabled on DUT

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.

UE
UE is powered off

5.9.2.5 Test procedure

Table 5.9.2.5-1: Time of cell power level and parameter changes

Time	Parameter	NR Cell A	Remark
T0	SS/PBCH	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. Set the parameters of the propagation condition and initial power according to Table

5.9.2.5-1

3. The UE is powered ON, and start random access to Cell A.
4. UE performs Registration, PDU session establish and IMS registration according to the common procedure defined in 4.1.4.

MAIN BODY

5. Verify the data transmission is performed successfully by using BWP-ID = 1 on Cell A.
6. SS sends RRC Reconfiguration message to add BWP2/ BWP3/ BWP4 and activate BWP2 for both UL and DL.
7. UE sends RRC Reconfiguration Complete message to SS on NR cell A .
8. Verify the data transmission is performed successfully by using BWP-ID = 2 on Cell A.
9. SS sends DCI-0_1 with field:'Bandwidth part indicator="**00**" (bin)' to trigger BWP change from BWP2 to BWP1.
10. UE correctly decode the DCIs in BWP2 and succeed switch to BWP1.
11. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP1.
12. SS sends DCI-0_1 with field:'Bandwidth part indicator="**01**"(bin)' to trigger BWP change from BWP1 to BWP2.
13. UE correctly decode the DCIs in BWP1 and succeed switch to BWP2.
14. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP2.
15. SS sends DCI-0_1 with field:'Bandwidth part indicator="**10**"(bin)' to trigger BWP change from BWP2 to BWP3.
16. UE correctly decode the DCIs in BWP2 and succeed switch to BWP3.
17. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP3.
18. SS sends DCI-0_1 with field:'Bandwidth part indicator="**11**"(bin)' to trigger BWP change from BWP3 to BWP4.
19. UE correctly decode the DCIs in BWP3 and succeed switch to BWP4.
20. Setup a TCP session with iperf and verify that UE downloads data correctly, keep the service for 30 seconds and verify the data transmission is performed successfully by using BWP4.

POSTAMBLE

21. SS initiates a de-registration procedure.
22. The SS initiates a RRC release procedure.
23. Deactivate NR Cell A.

5.9.2.6 Expected Result

1. Check and verify UE could perform BWP switch to BWP#1 by DCI on step #10
2. Check and record PDSCH_Througput achieved in step #11
3. Check and verify UE could perform BWP siwtch to BWP#2 by DCI on step #13

4. Check and record PDSCH_Througput achieved in step #14
5. Check and verify UE could perform BWP siwtch to BWP#3 by DCI on step #16
6. Check and record PDSCH_Througput achieved in step #17.
7. Check and verify UE could perform BWP siwtch to BWP#4 by DCI on step #19
8. Check and record PDSCH_Througput achieved in step #20

6 Mobility

6.1 Intra-system (NR) Mobility

6.1.1 Intra-system cell reselection

6.1.1.1 Cell Reselection and Random Access Procedure

6.1.1.1.1 Test Purpose

When UE camps on one NR cell, based on cell selection criteria, UE correctly reselects and camp on intra-freq/inter-freq/inter-band cell, and Verify the UE will correctly choose PRACH PREAMBLE.

6.1.1.1.2 Reference specification

3GPP TS 38.304 subclause 5.2.4
3GPP TS 38.211 subclause 6.3.3
3GPP TS 24.501 subclause 5.5

6.1.1.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.1.1.1.4 Test conditions

[SS configuration]
Cell A and Cell B are intra-freq cells
Cell A and Cell C are inter-freq cells.
Cell A and Cell D are inter-band cells.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f4
SS/PBCH SSS EPRE = -85 dBm/30kHz
PRACH Configuration Index = 0(Preamble format 0)

NR Cell B

Cell Id=2 TAC = 2
MCC = 460 MNC = 00
NR-ARFCN= f4
SS/PBCH SSS EPRE = -125 dBm/30kHz
PRACH Configuration Index = 145(Preamble format B4)

NR Cell C
Cell Id=3 TAC = 3
MCC = 460 MNC = 00
NR-ARFCN= f3
SS/PBCH SSS EPRE = -125 dBm/30kHz
PRACH Configuration Index = 61(Preamble format 3)

NR Cell D
Cell Id=4 TAC = 4
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
PRACH Configuration Index = 189(Preamble format C2)

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
NR Cell B is not active.
NR Cell C is not active.
NR Cell D is not active.

The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.1.1.1.5 Test procedure

Table 6.1.1.1.5-1: Time of cell power level changes

Time	NR Cell A	NR Cell B	NR Cell C	NR Cell D	Remark
T0	-85	Not Active	Not Active	Not Active	
T1	-91	-85	Not Active	Not Active	

T2	Not Active	-91	-85	Not Active	
T3	Not Active	Not Active	-91	-85	
T4	-85	Not Active	Not Active	-91	

PREAMBLE

1. Activate NR Cell A, NR Cell B, NR Cell C and NR Cell D.The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.1.1.1.5-1.
3. The UE is powered ON.
4. UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18.
5. The RRC connection is released by the SS.

MAIN BODY

6. The SS changes the cell power according to T1 in table 6.1.1.1.5-1.
7. The UE performs the registration procedure for mobility on Cell B.
8. The RRC connection is released by the SS. The UE enters Idle Mode.
9. The SS changes the cell power according to T2 in table 6.1.1.1.5-1.
10. The UE performs the registration procedure for mobility on Cell C.
11. The RRC connection is released by the SS. The UE enters Idle Mode.
12. The SS changes the cell power according to T3 in table 6.1.1.1.5-1.
13. UE performs the registration procedure for mobility on Cell D.
14. The RRC connection is released by the SS. The UE enters Idle Mode.
15. The SS changes the cell power according to T4 in table 6.1.1.1.5-1.
16. UE performs the registration procedure for mobility on Cell A.

POSTAMBLE

17. The SS initiates a de-registration procedure.
18. The SS initiates a RRC release procedure.
19. Deactivate NR Cell A, NR Cell B, NR Cell C and NR Cell D.

Table 6.1.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR Cell A, NR Cell B, NR Cell C, NR Cell D		
2			Configure the initial power according to T0 in Table 6.1.1.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18		PASS
5	←	RRC	The RRC connection is released by the SS.		
6			The SS changes the cell power according to		

			T1 in table 6.1.1.1.5-1.		
7	→ NAS ← RRC		UE performs the registration procedure for mobility on Cell B		PASS
8	←	RRC	The RRC connection is released by the SS. The UE enters Idle Mode		
9			SS changes the cell power according to T2 in table 6.1.1.1.5-1.		
10	→ NAS ← RRC		UE performs the registration procedure for mobility on Cell C.		PASS
11	←	RRC	The RRC connection is released by the SS. The UE enters Idle Mode.		
12			The SS changes the cell power according to T3 in table 6.1.1.1.5-1.		
13	→ NAS ← RRC		UE performs the registration procedure for mobility on Cell D.		PASS
14	←	RRC	The RRC connection is released by the SS. The UE enters Idle Mode.		
15			The SS changes the cell power according to T4 in table 6.1.1.1.5-1.		
16	→ NAS ← RRC		UE performs the registration procedure for mobility on Cell A.		PASS
17	→ NAS ←		SS initiates a de-registration procedure.		PASS
18	←	RRC	The SS initiates a RRC release procedure..		
19			Deactivate NR Cell A, NR Cell B, NR Cell C, NR Cell D		

6.1.1.1.6 Expected Result

Verify the UE correctly reselect and camp on a serving cell with different preamble format.

6.1.2 Intra-system handover

6.1.2.1 Intra-freq HO with IP data transfer

6.1.2.1.1 Test Purpose

Execute handovers between two NR Intra-frequency neighbour cells with IP data transfer.

1), Perform non-contention based random access procedure and lossless handover.

2), Perform Contention based random access procedure and lossless handover.

Verify the UE is able to maintain the service.

6.1.2.1.2 Reference specification

3GPP TS 38.331 subclause 5.3.5 and 5.5

6.1.2.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.1.2.1.4 Test conditions

[SS configuration]
Cell A and Cell B are intra-freq NR cells.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

NR Cell B
Cell Id=2 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off .

6.1.2.1.5 Test procedure

Table 6.1.2.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-85	Not Active	
T1	-91	-85	
T2	-85	-91	

PREAMBLE

1. Activate NR Cell A and NR Cell B.The SS configures the transmission of the Master

Information Block and starts the System Information Block broadcasting on all cells.

2. The SS configures the initial power according to T0 in Table 6.1.2.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18. A3 measurement is configured in RRC CONNECTION RECONFIGURATION message.
5. Verify the data transmission is performed successfully on Cell A.
6. The SS changes the cell power according to T1 in table 6.1.2.1.5-1.
7. The UE performs measurements on the neighbor Cell B and provides measurement reports (Event A3) to the SS.
8. The SS initiates a handover to Cell B by sending a RRC CONNECTION RECONFIGURATION message. The RRC CONNECTION RECONFIGURATION message contains CFRA in RACH-ConfigDedicated in order to trigger non-contention based random access to the target cell. A3 measurement is configured in RRC CONNECTION RECONFIGURATION message. Cell B becomes the serving cell and Cell A becomes the new neighbor cell.
9. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CFRA procedure on target Cell B.
10. Verify the data transmission is continued on Cell B.
11. The SS changes the cell power according to T2 in table 6.1.2.1.5-1.
12. The UE performs measurements on the neighbor Cell A and provides measurement reports (Event A3) to the SS.
13. The SS initiates a handover to Cell A by sending a RRC CONNECTION RECONFIGURATION message. The RRC CONNECTION RECONFIGURATION message does not contain CFRA in RACH-ConfigDedicated in order to trigger contention based random access to the target cell. Cell A becomes the serving cell and Cell B becomes the new neighbor cell.
14. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CBRA procedure on target Cell A.
15. Verify the data transmission is continued on Cell A.

POSTAMBLE

16. SS initiates a de-registration procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate NR Cell A and NR Cell B.

Table 6.1.2.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and NR Cell B		
2			SS configures the initial power according to T0 in Table 6.1.2.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18. A3		PASS

			measurement is configured in RRC CONNECTION RECONFIGURATION message.		
5			Verify the data transmission is performed successfully on Cell A.		PASS
6			SS changes the cell power according to T1 in table 6.1.2.1.5-1.		
7	→	RRC	UE performs measurements on the neighbor Cell B and provides measurement reports (Event A3) to the SS.		PASS
8	←	RRC	SS initiates a handover by sending RRC CONNECTION RECONFIGURATION message.		
9	→	RRC	UE sends the RRC CONNECTION RECONFIGURATION COMPLETE message and success CFRA procedure on target Cell B.		PASS
10			Verify the data transmission is continued on Cell B.		PASS
11			SS changes the cell power according to T2 in table 6.1.2.1.5-1.		
12	→	RRC	UE performs measurements on the neighbor Cell A and provides measurement reports (Event A3) to the SS.		PASS
13	←	RRC	SS SS initiates a handover by sending RRC CONNECTION RECONFIGURATION message.		
14	→	RRC	UE sends the RRC CONNECTION RECONFIGURATION COMPLETE message and success CBRA procedure on target Cell A.		PASS
15			Verify the data transmission is continued on Cell A.		PASS
16	→ ←	NAS	SS initiates a de-registration procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate NR Cell A and NR Cell B.		

6.1.2.1.6 Expected Result

Verify the UE can perform the handover procedure with non-contention based random access procedure successfully.

Verify the UE can perform the handover procedure with contention based random access procedure successfully.

6.1.2.2 Inter-freq HO with IP data transfer

6.1.2.2.1 Test Purpose

Execute handovers between NR Inter-frequency neighbour cells with IP data transfer.

1) Perform non-contention based random access procedure and lossless handover.

2) Perform Contention based random access procedure and lossless handover.

Verify that the UE supports handover between cells with different bandwidth and is able to maintain the service.

6.1.2.2.2 Reference specification

3GPP TS 38.331 subclause 5.3.5 and 5.5

6.1.2.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.1.2.2.4 Test conditions

[SS configuration]
Cell A and Cell B are inter-freq NR cells

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell B
Cell Id=2 TAC = 1
MCC = 460 MNC = 00
Frequency Configuration = f2
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=3 TAC = 1
MCC = 460 MNC = 00
Frequency Configuration = f3
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE

UE is powered off.

6.1.2.2.5 Test procedure

Table 6.1.2.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	Remark
T0	SS/PBCH, SSS EPRE	dBm/SCS	-85	Not Active	Not Active	
T1			-97	-85	Not Active	
T2			-85	-97	Not Active	
T3			-97	-97	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.1.2.2.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.
5. Verify the data transmission is performed successfully on Cell A.
6. Activate NR Cell B. The SS changes the cell power according to T1 in table 6.1.2.2.5-1.
7. The UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.
8. The SS initiates a handover to Cell B by sending a RRC CONNECTION RECONFIGURATION message. The RRC CONNECTION RECONFIGURATION message contains CFRA in RACH-ConfigDedicated in order to trigger non-contention based random access to the target cell. Cell B becomes the serving cell and Cell A becomes the new neighbor cell. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.
9. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CFRA procedure on target Cell B.
10. Verify the data transmission is continued on Cell B.
11. The SS changes the cell power according to T2 in table 6.1.2.2.5-1.
12. The UE performs measurements on the neighbor Cell A and provides measurement reports (Event A4) to the SS.
13. The SS initiates a handover to Cell A by sending a RRC CONNECTION RECONFIGURATION message. The RRC CONNECTION RECONFIGURATION message does not contain CFRA in RACH-ConfigDedicated in order to trigger contention based random access to the target cell. Cell A becomes the serving cell and Cell B becomes the new neighbor cell.
14. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CBRA procedure on target Cell A.
15. Verify the data transmission is continued on Cell A.
16. Activate NR Cell C. The SS changes the cell power according to T3 in table 6.1.2.2.5-1.

17. The UE performs measurements on the neighbor Cell C and provides measurement reports (Event A4) to the SS.
18. The SS initiates a handover to Cell C by sending a RRC CONNECTION RECONFIGURATION message. Cell C becomes the serving cell and Cell A becomes the new neighbor cell. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.
19. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CFRA procedure on target Cell C.
20. Verify the data transmission is continued on Cell C.

POSTAMBLE

21. The SS initiates a de-registration procedure.
22. The SS initiates a RRC release procedure.
23. Deactivate NR Cell A and NR Cell B.

Table 6.1.2.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and NR Cell B		
2			SS configures the initial power according to T0 in Table 6.1.2.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.		PASS
5			Data transmission is performed successfully on Cell A.		PASS
6			SS changes the cell power according to T1 in table 6.1.2.2.5-1.		
7	→	RRC	UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.		PASS
8	←	RRC	SS initiates a handover by sending RRC CONNECTION RECONFIGURATION message.		
9	→	RRC	UE sends the RRC CONNECTION RECONFIGURATION COMPLETE message and success CFRA procedure on target Cell B.		PASS
10			Data transmission is continued on Cell B.		PASS
11			SS changes the cell power according to T2 in table 6.1.2.2.5-1.		
12	→	RRC	UE performs measurements on the neighbor Cell A and provides measurement reports (Event A4) to the SS.		PASS

13	←	RRC	SS SS initiates a handover by sending RRC CONNECTION RECONFIGURATION message.		
14	→	RRC	UE sends the RRC CONNECTION RECONFIGURATION COMPLETE message and success CBRA procedure on target Cell A.		PASS
15			Data transmission is continued on Cell A.		PASS
16			Activate NR Cell C. The SS changes the cell power according to T3 in table 6.1.2.2.5-1.		
17			The UE performs measurements on the neighbor Cell C and provides measurement reports (Event A4) to the SS.		
18	←		RRC CONNECTION RECONFIGURATION message. A4 measurement is configured in RRC CONNECTION RECONFIGURATION .		
19	→	RRC	RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CFRA procedure on target Cell C.		
20			Data transmission is continued on Cell C		PASS
21	→ ←	NAS	SS initiates a de-registration procedure.		PASS
22	←	RRC	SS initiates a RRC release procedure.		
23			Deactivate NR Cell A and NR Cell B.		

6.1.2.2.6 Expected Result

Verify the UE can perform the handover procedure with non-contention based random access procedure successfully.

Verify the UE can perform the handover procedure with contention based random access procedure successfully.

6.1.2.3 Inter-Freq. HO Failure, RRC Connection Reestablish to a Prepared Inter-Freq cell

6.1.2.3.1 Test Purpose

DRB Setup with a Real Service Ongoing, Two Inter-frequency cells are prepared for handover. Handover to the target cell is failed. A successful RRC reestablish to a prepared Inter-frequency cell is performed. The test scenario is performed several times. Verify the UE is able to maintain the service.

6.1.2.3.2 Reference specification

3GPP TS 38.331 subclause 5.3.5, 5.3.7 and 5.5

6.1.2.3.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.1.2.3.4 Test conditions

[SS configuration]
Cell A , Cell B and Cell C are NR inter-freq cells.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz(adjust according to Table 6.1.2.3.5-1)

NR Cell B
Cell Id=2 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f2
SS/PBCH SSS EPRE = -125 dBm/30kHz(adjust according to Table 6.1.2.3.5-1)

NR Cell C
Cell Id=3 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz(adjust according to Table 6.1.2.3.5-1)

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
NR Cell B is not active.
NR Cell C is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.1.2.3.5 Test procedure

Table 6.1.2.3.5-1: Time of cell power level and parameter changes

Time	Cell A	Cell B	Cell C	Remark
T0	-85	Not Active	Not Active	
T1	-97	-85	Not Active	
T2	-97	Not Active	-85	

T3	Not Active	-85	-97	
T4	-85	Not Active	-97	

PREAMBLE

1. Activate NR Cell A, NR Cell B and NR Cell C.The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.1.2.3.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18.
5. Verify the data transmission is performed successfully on Cell A.
6. The SS sends RRC Connection Reconfiguration message to setup inter-freq measurement (Event A4).
7. The UE sends RRC Connection Reconfiguration Complete message.
8. The SS changes the cell power according to T1 in table 6.1.2.3.5-1.
9. The UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.
10. The SS changes the cell power according to T2 in table 6.1.2.3.5-1.
11. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-freq handover from Cell A to Cell B.
12. The UE fails to perform the Handover as Cell B is not available.
13. The UE performs RRC Connection Reestablishment procedure on Cell C.
14. Verify the data transmission is continued after the connection reestablishment on Cell C.
15. The SS sends RRC Connection Reconfiguration message to setup inter-freq measurement (Event A4).
16. The UE sends RRC Connection Reconfiguration Complete message.
17. The SS changes the cell power according to T3 in table 6.1.2.3.5-1.
18. The UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.
19. The SS changes the cell power according to T4 in table 6.1.2.3.5-1.
20. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-freq handover from Cell C to Cell B.
21. The UE fails to perform the Handover as Cell B is not available.
22. The UE performs RRC Connection Reestablishment procedure on Cell A.
23. Verify the data transmission is continued after the connection reestablishment on Cell A.
24. Repeat steps 6 to 23 four times.

POSTAMBLE

25. The SS initiates a de-registration procedure.
26. The SS initiates a RRC release procedure.
27. Deactivate NR Cell A, NR Cell B and NR Cell C.

Table 6.1.2.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR Cell A, NR Cell B and NR Cell C		
2			The SS configures the initial power according to T0 in Table 6.1.2.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18.		PASS
5			Verify the data transmission is performed successfully on Cell A.		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message to setup inter-freq measurement (Event A4).		
7	→	RRC	UE sends RRC Connection Reconfiguration Complete message.		PASS
8			SS changes the cell power according to T1 in table 6.1.2.3.5-1		
9	→	RRC	UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.		PASS
10			SS changes the cell power according to T2 in table 6.1.2.3.5-1.		
11	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-freq handover from Cell A to Cell B.		
12			UE fails to perform the Handover as Cell B is not available.		
13	→ ←	RRC	UE performs RRC Connection Reestablishment procedure on Cell C.		PASS
14			Verify the data transmission is continued after the connection reestablishment on Cell C.		PASS
15	←	RRC	SS sends RRC Connection Reconfiguration message to setup inter-freq measurement (Event A4		
16	→	RRC	UE sends RRC Connection Reconfiguration Complete message		PASS
17			SS changes the cell power according to T3 in table 6.1.2.3.5-1.		
18	→	RRC	UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS		PASS
19			SS changes the cell power according to T4 in table 6.1.2.3.5-1.		

20	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-freq handover from Cell C to Cell B.		
21			UE fails to perform the Handover as Cell B is not available.		
22	→ ←	RRC	UE performs RRC Connection Reestablishment procedure on Cell A.		PASS
23			Verify the data transmission is continued after the connection reestablishment on Cell A.		PASS
24			Repeat steps 6 to 23 four times.		
25	→ ←	NAS	SS initiates a de-registration procedure.		PASS
26	←	RRC	The SS initiates a RRC release procedure.		
27			Deactivate NR Cell A, NR Cell B and NR Cell C.		

6.1.2.3.6 Expected Result

Verify the UE can reestablish connection to an Inter-freq Cell after the inter-freq handover failure successfully.

Verify the UE can maintain the data transmission after the connection reestablishment. successfully.

6.1.2.4 Inter-band HO with IP data transfer

6.1.2.4.1 Test Purpose

Execute handovers between two NR Inter-band neighbour cells with IP data transfer.

1), Perform non-contention based random access procedure and lossless handover.

2), Perform Contention based random access procedure and lossless handover.

Verify the UE is able to maintain the service.

6.1.2.4.2 Reference specification

3GPP TS 38.331 subclause 5.3.5 and 5.5

6.1.2.4.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.1.2.4.4 Test conditions

[SS configuration]

Cell A and Cell B are inter-band NR cells

NR Cell A

Cell Id=1 TAC = 1

MCC = 460 MNC = 00
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell B
Cell Id=2 TAC = 1
MCC = 460 MNC = 00
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off.

Table 6.1.2.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency
1	Cell A	n41	f1
	Cell B	n79	f1
2	Cell A	n41	f1
	Cell B	n28	f1
3	Cell A	n41	f1
	Cell B	n28	f2
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

6.1.2.4.5 Test procedure

Table 6.1.2.4.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-85	Not Active	
T1	-97	-85	
T2	-85	-97	

PREAMBLE

1. Activate NR Cell A and NR Cell B.The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.1.2.4.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.
5. Verify the data transmission is performed successfully on Cell A.
6. The SS changes the cell power according to T1 in table 6.1.2.4.5-1.
7. The UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.
8. The SS initiates a handover to Cell B by sending a RRC CONNECTION RECONFIGURATION message. The RRC CONNECTION RECONFIGURATION message contains CFRA in RACH-ConfigDedicated in order to trigger non-contention based random access to the target cell. Cell B becomes the serving cell and Cell A becomes the new neighbor cell. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.
9. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CFRA procedure on target Cell B.
10. Verify the data transmission is continued on Cell B.
11. The SS changes the cell power according to T2 in table 6.1.2.4.5-1.
12. The UE performs measurements on the neighbor Cell A and provides measurement reports (Event A4) to the SS.
13. The SS initiates a handover to Cell A by sending a RRC CONNECTION RECONFIGURATION message. The RRC CONNECTION RECONFIGURATION message does not contain CFRA in RACH-ConfigDedicated in order to trigger contention based random access to the target cell. Cell A becomes the serving cell and Cell B becomes the new neighbor cell.
14. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message and proceeding CBRA procedure on target Cell A.
15. Verify the data transmission is continued on Cell A.

POSTAMBLE

16. The SS initiates a de-registration procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate NR Cell A and NR Cell B.

Table 6.1.2.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and NR Cell B		
2			SS configures the initial power according to T0 in Table 6.1.2.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→	NAS	UE performs Registration procedure on NR		PASS

	←	RRC	Cell A according to subclause 5.4.1 step3-18. A4 measurement is configured in RRC CONNECTION RECONFIGURATION message.		
5			Verify the data transmission is performed successfully on Cell A.		PASS
6			SS changes the cell power according to T1 in table 6.1.2.4.5-1.		
7	→	RRC	UE performs measurements on the neighbor Cell B and provides measurement reports (Event A4) to the SS.		PASS
8	←	RRC	SS initiates a handover by sending RRC CONNECTION RECONFIGURATION message.		
9	→	RRC	UE sends the RRC CONNECTION RECONFIGURATION COMPLETE message and success CFRA procedure on target Cell B.		PASS
10			Verify the data transmission is continued on Cell B.		PASS
11			SS changes the cell power according to T2 in table 6.1.2.4.5-1.		
12	→	RRC	UE performs measurements on the neighbor Cell A and provides measurement reports (Event A4) to the SS.		PASS
13	←	RRC	SS initiates a handover by sending RRC CONNECTION RECONFIGURATION message.		
14	→	RRC	UE sends the RRC CONNECTION RECONFIGURATION COMPLETE message and success CBRA procedure on target Cell A.		PASS
15			Verify the data transmission is continued on Cell A.		PASS
16	→ ←	NAS	SS initiates a de-registration procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate NR Cell A and NR Cell B.		

6.1.2.4.6 Expected Result

Verify the UE can perform the handover procedure with non-contention based random access procedure successfully.

Verify the UE can perform the handover procedure with contention based random access procedure successfully.

6.2 Inter-RAT Mobility

6.2.1 Inter-RAT cell reselection

6.2.1.1 Cell reselection, from NR cell to E-UTRAN cell

6.2.1.1.1 Test Purpose

UE could reselect from NR cell to E-UTRAN Cell and perform TAU.

6.2.1.1.2 Reference specification

TS 38.304, clause 5.2.4

6.2.1.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.1.1.4 Test conditions

[SS configuration]
Cell A is a NR cell, Cell B is an E-UTRAN cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
SS/PBCH SSS EPRE = -125 dBm/30kHz

E-UTRAN Cell B
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -125 dBm/15kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
E-UTRAN Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

Table 6.1.2.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency

1	Cell A	n41	f1
	Cell B	B39	f1
2	Cell A	n28	f1
	Cell B	B3	f1
3	Cell A	n28	f2
	Cell B	B3	f1
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

6.2.1.1.5 Test procedure

Table 6.2.1.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	E-UTRAN Cell B	Remark
T0	-85	Not Active	
T1	-97	-85	

PREAMBLE

1. Activate NR Cell A and E-UTRAN Cell B. The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.2.1.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18.
5. Verify the data transmission is performed successfully on Cell A.
6. The RRC connection is released by the SS.
7. The SS changes the cell power according to T1 in table 6.2.1.1.5-1.
8. The UE performs TAU and EPS bearer activation in E-UTRAN Cell B.
9. Verify the data transmission is performed successfully on E-UTRAN Cell B.

POSTAMBLE

10. The SS initiates a DETACH procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A and E-UTRAN Cell B.

Table 6.2.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and E-UTRAN Cell B		
2			SS configures the initial power according to T0 in Table 6.2.1.1.5-1.		
3		UE	Switch On UE	AT Command	

4	→ ←	NAS RRC	UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18.		PASS
5			Verify the data transmission is performed successfully on Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS.		
7			SS changes the cell power according to T1 in table 6.2.1.1.5-1		
8	→ ←	NAS RRC	UE performs TAU and EPS bearer activation on E-UTRAN Cell B.		PASS
9			Verify the data transmission is performed successfully on E-UTRAN Cell B.		PASS
10	→ ←	NAS	SS initiates a DETACH procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A and E-UTRAN Cell B.		

6.2.1.1.6 Expected Result

Verify the UE could reselect from NR cell to E-UTRAN Cell.

6.2.1.2 Cell reselection, from E-UTRAN cell to NR cell

6.2.1.2.1 Test Purpose

UE could reselect from E-UTRAN Cell to NR cell and perform registration procedure for mobolity.

6.2.1.2.2 Reference specification

TS 36.304, clause 5.2.4

6.2.1.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.1.2.4 Test conditions

[SS configuration]
Cell A and Cell B are E-UTRAN Cells, Cell C is a NR cell.
Cell B and Cell C are neighbor cells of Cell A

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -85 dBm/15kHz

E-UTRAN Cell B

Cell Id=2 TAC = 2
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -125 dBm/15kHz

NR Cell C
Cell Id=3 TAC = 3
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
E-UTRAN Cell B is not active.
NR Cell C is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

Table 6.2.1.2.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency
1	Cell A	B39	f1
	Cell B	B39	f2
	Cell C	n41	f1
2	Cell A	B3	f1
	Cell B	B3	f2
	Cell C	n28	f1
3	Cell A	B3	f1
	Cell B	B3	f2
	Cell C	n28	f2
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

6.2.1.2.5 Test procedure

Table 6.2.1.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	-91	Not Active	
T1	-97	-85	-85	

PREAMBLE

1. Activate E-UTRAN Cell A, E-UTRAN Cell B and NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.2.1.2.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. Verify the data transmission is performed successfully on E-UTRAN Cell A.
6. The RRC connection is released by the SS.
7. The SS changes cell power according to T1 in table 6.2.1.2.5-1.
8. UE performs the registration procedure for mobility on NR Cell C according to subclause 5.4.1 step3-18.
9. Verify the data transmission is performed successfully on NR Cell C.

POSTAMBLE

10. The SS initiates a de-registration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate E-UTRAN Cell A, E-UTRAN Cell B and NR Cell C.

Table 6.2.1.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A, E-UTRAN Cell B and NR Cell C.		
2			SS configures the initial power according to T0 in Table 6.2.1.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5			Verify the data transmission is performed successfully on E-UTRAN Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS.		
7			SS changes the cell power according to T1 in table 6.2.1.2.5-1		
8	→ ←	NAS RRC	UE performs the registration procedure for mobility on NR Cell C according to subclause		PASS

			5.4.1 step3-18.		
9			Verify the data transmission is performed successfully on NR Cell C.		PASS
10	→ ←	NAS	SS initiates a de-registration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A, E-UTRAN Cell B and NR Cell C.		

6.2.1.2.6 Expected Result

Verify the UE could reselect from E-UTRAN cell to NR Cell.

6.2.1.3 Cell reselection，from NR cell to E-UTRAN cell with NSA cell exists

6.2.1.3.1. Test Purpose

UE could reselect from NR cell to E-UTRAN Cell perform TAU.

6.2.1.3.2. Reference specification

TS 38.304, clause 5.2.4

6.2.1.3.3. Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.1.3.4. Test conditions

[SS configuration]
E-UTRAN Cell A and Cell B are TD-LTE cells, Cell C and Cell D are NR cells.
Cell A and Cell B and Cell D are neighbor cells of Cell C

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
E-UTRA Band = 41
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE = -125 dBm/15kHz

E-UTRAN Cell B
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
E-UTRA Band = 41
EARFCN= f2
rootSequenceIndex TDD = 0

Reference Signal EPRE = -125 dBm/15kHz

NR Cell C
Cell Id=3 TAC = 3
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

NR Cell D
Cell Id=4 TAC = 4
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
E-UTRAN Cell B is not active.
NR Cell C is not active.
NR Cell D is not active.

The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.2.1.3.5. Test procedure

Table 6.2.1.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	NR Cell D
T0	“Not Active”	“Not Active”	-85	“Not Active”
T1	-85	-91	-97	-91

PREAMBLE

1. Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.2.1.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell C (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. SS configures the E-UTRAN Cell B(NSA P-Cell) is barred.
6. The SS changes cell power according to T1 in table 6.2.1.3.5-1.
7. UE performs the TAU procedure for mobility on E-UTRAN Cell A.

POSTAMBLE

1. The UE is powered OFF.
9. Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.

Table 6.2.1.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.		
2			SS configures the initial power according to T0 in Table 6.2.1.3.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell C (see 38.508, Table 4.5.2.2 till Step 18)		PASS
5			SS configures the E-UTRAN Cell B(NSA P-Cell) is barred		
6			The SS changes cell power according to T1 in table 6.2.1.3.5-1.		
7	→ ←	NAS	UE performs the TAU procedure for mobility on E-UTRAN Cell A		PASS
8			The UE is powered OFF		
9			Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D		

6.2.1.3.6. Expected Result

Step 4 UE selects the E-UTRAN Cell A and camps on the Cell A..
Step 7 UE performs the TAU procedure for mobility on E-UTRAN Cell A.

6.2.1.4. Cell reselection，from E-UTRAN cell to NR cell with NSA cell exists

6.2.1.4.1. Test Purpose

UE could reselect from E-UTRAN cell to NR Cell and perform registration procedure for mobolity.

6.2.1.4.2. Reference specification

TS 36.304, clause 5.2.4

6.2.1.4.3. Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.1.4.4. Test conditions

[SS configuration]
E-UTRAN Cell A and Cell B are TD-LTE cells, Cell C and Cell D are NR cells.
Cell B and Cell C and Cell D are neighbor cells of Cell A
NR Cell C is higher priority than E-UTRAN Cell B.

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
E-UTRA Band = 39
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE = -85 dBm/15kHz

E-UTRAN Cell B
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
E-UTRA Band = 39
EARFCN= f2
rootSequenceIndex TDD = 0
Reference Signal EPRE = -125 dBm/15kHz

NR Cell C
Cell Id=3 TAC = 3
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell D
Cell Id=4 TAC = 4
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active.

E-UTRAN Cell B is not active.

NR Cell C is not active.

NR Cell D is not active.

The test shall be performed under ideal radio conditions.

UE

UE is powered off

6.2.1.4.5. Test procedure

Table 6.2.1.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	NR Cell D
T0	-85	“Not Active”	“Not Active”	“Not Active”
T1	-97	-91	-85	-91

PREAMBLE

1. Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.2.1.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).

MAIN BODY

5. The SS changes cell power according to T1 in table 6.2.1.4.5-1.
6. UE performs the registration procedure for mobility on NR Cell C.

POSTAMBLE

7. The UE is powered OFF.
8. Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.

Table 6.2.1.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.		
2			SS configures the initial power according to T0 in Table 6.2.1.4.5-1		
3		UE	Switch On UE	AT Command	
4	→	NAS	The UE performs the registration procedure		PASS

	←	RRC	with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		
5			The SS changes cell power according to T1 in table 6.2.1.4.5-1.		
6	→ ←	NAS	UE performs the registration procedure for mobility on NR Cell C.		PASS
7			The UE is powered OFF		
8			Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D		

6.2.1.4.6. Expected Result

Step 4 UE selects the E-UTRAN Cell A and camps on the Cell A.
Step 6 UE performs the registration procedure for mobility on NR Cell C

6.2.1.5. Cell reselection，from NR cell to NSA P-Cell

6.2.1.5.1. Test Purpose

UE could reselect from NR Cell to NSA P-Cell and performs TAU then setup NSA PS-Cell

6.2.1.5.2. Reference specification

TS 38.304, clause 5.2.4

6.2.1.5.3. Applicability

This test applies to type 1 devices as described in clause 4.2.

6.2.1.5.4. Test conditions

[SS configuration]
E-UTRAN Cell A and Cell B are TD-LTE cells, Cell C and Cell D are NR cells.
Cell A and Cell B and Cell D are neighbor cells of Cell C

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
E-UTRA Band = 41
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE = -125 dBm/15kHz

E-UTRAN Cell B
Cell Id=2 TAC = 2

MCC = 460 MNC = 00
E-UTRA Band = 39
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE = -125 dBm/15kHz

NR Cell C
Cell Id=3 TAC = 3
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

NR Cell D
Cell Id=4 TAC = 4
MCC = 460 MNC = 00
NR-ARFCN= f1z
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
E-UTRAN Cell B is not active.
NR Cell C is not active.
NR Cell D is not active.

The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.2.1.5.5. Test procedure

Table 6.2.1.5.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	NR Cell D
T0	“Not Active”	“Not Active”	-85	“Not Active”
T1	-91	-85	-97	-91

PREAMBLE

1. Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.The SS configures the

corresponding Master Information Block and System Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 6.2.1.5.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell C (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The SS changes cell power according to T1 in table 6.2.1.5.5-1.
6. UE performs the TAU procedure for mobility on E-UTRAN Cell B.
7. The SS transmits an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add NR PS-Cell.
8. UE transmit an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

POSTAMBLE

9. The UE is powered OFF.
10. Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.

Table 6.2.1.5.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.		
2			SS configures the initial power according to T0 in Table 6.2.1.4.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5			The SS changes cell power according to T1 in table 6.2.1.4.5-1.		
6	→ ←	NAS	UE performs the TAU procedure for mobility on E-UTRAN Cell B.		PASS
7	←	RRC	The SS transmits an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add NR PS-Cell D.		PASS
8	→	RRC	UE transmit an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			The UE is powered OFF		
10			Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D		

6.2.1.5.6. Expected Result

Step 4 UE selects the E-UTRAN Cell A and camps on the Cell A.
Step 6 UE performs the TAU procedure for mobility on E-UTRAN Cell B.
Step7 The SS transmits an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add NR PS-Cell D.
Step8 UE transmit an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

6.2.1.6. Cell reselection，from NSA P-Cell to NR cell

6.2.1.6.1. Test Purpose

UE could reselect from NSA P-Cell to NR Cell and perform registration procedure for mobolity.

6.2.1.6.2. Reference specification

TS 36.304, clause 5.2.4

6.2.1.6.3. Applicability

This test applies to type 1 devices as described in clause 4.2.

6.2.1.6.4. Test conditions

[SS configuration]
E-UTRAN Cell A and Cell B are TD-LTE cells, Cell C and Cell D are NR cells.
Cell A and Cell C and Cell D are neighbor cells of Cell B
NR Cell C is higher priority than E-UTRAN Cell A.

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
E-UTRA Band = 41
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE = -125 dBm/15kHz

E-UTRAN Cell B
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
E-UTRA Band = 39
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE = -85 dBm/15kHz

NR Cell C

Cell Id=3 TAC = 3
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell D
Cell Id=4 TAC = 4
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -91 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
E-UTRAN Cell B is not active.
NR Cell C is not active.
NR Cell D is not active.

The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.2.1.6.5. Test procedure

Table 6.2.1.6.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	NR Cell D
T0	“Not Active”	-85	“Not Active”	-91
T1	-91	-97	-85	-97

PREAMBLE

1. Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.2.1.6.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell B (see 36.508, 4.5.2).

MAIN BODY

5. The SS changes cell power according to T1 in table 6.2.1.6.5-1.

6. UE performs the registration procedure for mobility on NR Cell C.

POSTAMBLE

7. The UE is powered OFF.
8. Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.

Table 6.2.1.6.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.		
2			SS configures the initial power according to T0 in Table 6.2.1.4.5-1		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure with activation of the initial default EPS bearer on Cell B (see 36.508, 4.5.2).		PASS
5			The SS changes cell power according to T1 in table 6.2.1.4.5-1.		
6	→ ←	NAS	UE performs the registration procedure for mobility on NR Cell C.		PASS
7			The UE is powered OFF		
8			Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D		

6.2.1.6.6. Expected Result

Step 4 UE selects the E-UTRAN Cell A and camps on the Cell A
Step 6 UE performs the registration procedure for mobility on NR Cell C.

6.2.2 Inter-RAT Handover

6.2.2.1 Inter-RAT Handover from NR to E-UTRAN cell

6.2.2.1.1 Test Purpose

Setup a real PS service (e.g. streaming). The UE executes handovers from NR cell to E-UTRAN cell multi-times. Verify the UE is able to maintain the service.

6.2.2.1.2 Reference specification

3GPP TS 38.331 subclause 5.4 and 5.5
3GPP TS 36.331 subclause 5.4 and 5.5

6.2.2.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.2.1.4 Test conditions

[SS configuration]
Cell A is a NR cell, Cell B is an E-UTRAN cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
SS/PBCH SSS EPRE = -125 dBm/30kHz

E-UTRAN Cell B
Cell Id=2 TAC = 1
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -125 dBm/15kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
E-UTRAN Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

Table 6.2.2.1.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency
1	Cell A	n41	f1
	Cell B	B39	f1
2	Cell A	n28	f1
	Cell B	B3	f1
3	Cell A	n28	f2
	Cell B	B3	f1
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

6.2.2.1.5 Test procedure

Table 6.2.2.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	E-UTRAN Cell B	Remark
T0	-85	Not Active	
T1	-97	-85	
T2	-85	-91	

PREAMBLE

1. Activate NR Cell A and E-UTRAN Cell B.The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.2.2.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18.
5. Verify the data transmission is performed successfully on Cell A.
6. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).
7. The UE sends RRC Connection Reconfiguration Complete message.
8. The SS changes the cell power according to T1 in table 6.2.2.1.5-1.
9. The UE performs measurements on the neighbor Cell B and provides measurement reports (Event B2) to the SS.
10. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from NR Cell A to E-UTRAN Cell B.
11. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target E-UTRAN Cell B.
12. Verify the data transmission is continued on E-UTRAN Cell B.
13. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).
14. The UE sends RRC Connection Reconfiguration Complete message.
15. The SS changes the cell power according to T2 in table 6.2.2.1.5-1.
16. The UE performs measurements on the neighbor NR Cell A and provides measurement reports (Event B2) to the SS.
17. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from E-UTRAN Cell B to NR Cell A.
18. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target Cell A.
19. Verify the data transmission is continued on NR Cell A.
20. Repeat steps 6 to 19 four times.

POSTAMBLE

21. The SS initiates a de-registration procedure.
22. The SS initiates a RRC release procedure.

23. Deactivate NR Cell A and E-UTRAN Cell B.

Table 6.2.2.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and E-UTRAN Cell B.		
2			SS configures the initial power according to T0 in Table 6.2.2.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs Registration procedure on NR Cell A according to subclause 5.4.1 step3-18.		PASS
5			Verify the data transmission is performed successfully on Cell A.		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).		
7	→	RRC	UE sends RRC Connection Reconfiguration Complete message.		PASS
8			SS changes the cell power according to T1 in table 6.2.2.1.5-1.		
9	→	RRC	UE performs measurements on the neighbor Cell B and provides measurement reports (Event B2) to the SS.		PASS
10	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from NR Cell A to E-UTRAN Cell B.		
11	→	RRC	UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target E-UTRAN Cell B.		PASS
12			Verify the data transmission is continued on Cell B.		PASS
13	←	RRC	SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).		
14	→	RRC	UE sends RRC Connection Reconfiguration Complete message.		PASS
15			SS changes the cell power according to T2 in table 6.2.2.1.5-1.		
16	→	RRC	UE performs measurements on the neighbor NR Cell A and provides measurement reports (Event B2) to the SS.		PASS

17	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from E-UTRAN Cell B to NR Cell A.		
18	→	RRC	UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target Cell A.		PASS
19			Verify the data transmission is continued on Cell A.		PASS
20			Repeat steps 6 to 19 four times.		
21	→ ←	NAS	SS initiates a de-registration procedure.		PASS
22	←	RRC	SS initiates a RRC release procedure.		
23			Deactivate NR Cell A and E-UTRAN Cell B.		

6.2.2.1.6 Expected Result

Verify the UE can perform the inter-RAT handover procedure successfully.

6.2.3 Inter-RAT Redirection Service

6.2.3.1 Data Session continuity, Inter-RAT Redirection from NR to E-UTRAN

6.2.3.1.1 Test Purpose

While the UE is in an active PS data session on a NR cell, it is capable of successfully re-establishing its active data session when it receives an RRC Release and a redirect to a specific E-UTRAN cell .

6.2.3.1.2 Reference specification

3GPP TS 38.331 subclause 5.3.8

6.2.3.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.3.1.4 Test conditions

[SS configuration]
Cell A is a NR cell, Cell B is an E-UTRAN cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -85 dBm/30kHz

E-UTRAN Cell B
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE = -125 dBm/15kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active.
E-UTRAN Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.2.3.1.5 Test procedure

Table 6.2.3.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	E-UTRAN Cell B	Remark
T0	-85	Not Active	
T1	-97	-85	

PREAMBLE

1. Activate NR Cell A and E-UTRAN Cell B.The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 6.2.3.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18.
5. Verify the data transmission is performed successfully on Cell A.
6. The SS changes the cell power according to T1 in table 6.2.3.1.5-1.
7. The SS releases the RRC connection on NR Cell A, RRCConnectionRelease message should include redirectedCarrierInfo IE with ARFCN of E-UTRAN Cell B.
8. The UE performs Routing Area Update procedure and then PDP context establishment in E-UTRAN Cell B.
9. Verify the data transmission is continued successfully on E-UTRAN Cell B.

POSTAMBLE

10. The SS initiates a DETACH procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A and E-UTRAN Cell B.

Table 6.2.3.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates NR Cell A and E-UTRAN Cell B		
2			SS configures the initial power according to T0 in Table 6.2.3.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18.		PASS
5			Verify the data transmission is performed successfully on Cell A.		PASS
6			SS changes the cell power according to T1 in table 6.2.3.1.5-1.		
7	←	RRC	SS releases the RRC connection on NR Cell A, RRCConnectionRelease message should include redirectedCarrierInfo IE with ARFCN of E-UTRAN Cell B.		
8	→ ←	NAS RRC	UE performs Routing Area Update procedure and then PDP context establishment in E-UTRAN Cell B.		PASS
9			Verify the data transmission is continued successfully on E-UTRAN Cell B.		PASS
10	→ ←	NAS	SS initiates a DETACH procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A and E-UTRAN Cell B.		

6.2.3.1.6 Expected Result

Verify the UE could redirect from NSA P-Cell to E-UTRAN Cell.

6.2.3.2 Data Session continuity, Inter-RAT Redirection from E-UTRAN to NR

6.2.3.2.1 Test Purpose

While the UE is in an active PS data session on a E-UTRAN cell, it is capable of successfully re-establishing its active data session when it receives an RRC Release and a redirect to a specific NR cell .

6.2.3.2.2 Reference specification

3GPP TS 36.331 subclause 5.3.8

6.2.3.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

6.2.3.2.4 Test conditions

[SS configuration]
Cell A is an E-UTRAN cell, Cell B is a NR cell.
Cell B is the neighbor cell of Cell A.

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -85 dBm/15kHz

NR Cell B
Cell Id=2 TAC = 2
MCC = 460 MNC = 00
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

Table 6.2.3.2.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency
1	Cell A	B39	f1
	Cell B	n41	f1
2	Cell A	B3	f1
	Cell B	n28	f1

3	Cell A	B3	f1
	Cell B	n28	f2
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

6.2.3.2.5 Test procedure

Table 6.2.3.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	Not Active	
T1	-97	-85	

PREAMBLE

1. Activate E-UTRAN Cell A and NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.2.3.2.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. Verify the data transmission is performed successfully on E-UTRAN Cell A.
6. The SS changes cell power according to T1 in table 6.2.3.2.5-1.
7. The SS releases the RRC connection on E-UTRAN Cell A, RRCConnectionRelease message should include redirectedCarrierInfo IE with CarrierInfoNR of NR Cell B.
8. The UE performs the registration procedure for mobility on NR Cell B according to subclause 5.4.1 step3-18.
9. Verify the data transmission is performed successfully on NR Cell B.

POSTAMBLE

10. The SS initiates a Detach procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate E-UTRAN Cell A and NR Cell B.

Table 6.2.3.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 6.2.3.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→	NAS	UE performs the registration procedure with		PASS

	←	RRC	activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		
5			Verify the data transmission is performed successfully on E-UTRAN Cell A.		PASS
6			SS changes cell power according to T1 in table 6.2.3.2.5-1.		
7	←	RRC	SS releases the RRC connection on E-UTRAN Cell A, RRCConnectionRelease message should include redirectedCarrierInfo IE with CarrierInfoNR of NR Cell B.		
8	→ ←	NAS RRC	UE performs the registration procedure for mobility on NR Cell B according to subclause 5.4.1 step3-18.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	→ ←	NAS	SS initiates a de-registration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

6.2.3.2.6 Expected Result

Verify the UE could redirect from E-UTRAN Cell to NSA P-Cell.

6.3 NSA

6.3.1 Cell Reselection, from NSA P-Cell to E-UTRAN cell

6.3.1.1 Test Purpose

UE could reselect from NSA P-Cell to E-UTRAN Cell. UE works in 4G mode.

6.3.1.2 Reference specification

TS 36.304, clause 5.2.4

6.3.1.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

6.3.1.4 Test conditions

[SS configuration]

CellA and Cell B are E-UTRAN Cells, CellC is a NR Cell.

Cell A supports NSA, Cell B is a Neighbor Cell of Cell A.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
EARFCN= f2
rootSequenceIndex = 8
Reference Signal EPRE= -125 dBm/15kHz

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
E-UTRAN Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

6.3.1.5 Test procedure

Table 6.3.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	Not Active	-90	
T1	-90	-85	-90	

PREAMBLE

20. Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
21. The SS configures the initial power according to T0 in Table 6.3.1.5-1.
22. The UE is powered ON.

MAIN BODY

23. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
24. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
25. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
26. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
27. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
28. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
29. Verify the data transmission is performed successfully on NR Cell C.
30. The RRC connection is released by the SS.
31. The SS changes cell power according to T1 in table 6.3.1.5-1.
32. The UE performs TRACKING AREA UPDATE on Cell B.
33. Verify the data transmission is performed successfully on E-UTRAN Cell B.

POSTAMBLE

34. The SS initiates a Detach procedure.
35. The SS initiates a RRC release procedure.
36. Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.

Table 6.3.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		
2			SS configures the initial power according to T0 in Table 6.3.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS	SS sends an RRCConnectionReconfiguration		

		RRC	message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message..		PASS
10			Verify the data transmission is performed successfully on NR Cell C.		PASS
11	←	RRC	The RRC connection is released by the SS.		
12			SS changes cell power according to T1 in table 6.3.1.5-1.		
13	→ ←	NAS RRC	UE performs TRACKING AREA UPDATE on Cell B.		PASS
14			Verify the data transmission is performed successfully on E-UTRAN Cell B.		PASS
15	→ ←	NAS	SS initiates a Detach procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		

6.3.1.6 Expected Result

Verify the UE could reselect from NSA P-Cell to E-UTRAN Cell.

6.3.2 Cell Reselection, from E-UTRAN cell to NSA P-Cell

6.3.2.1 Test Purpose

UE could reselect from E-UTRAN Cell to NSA P-Cell. Initial UL data trasfer, UE report NSA capability then SCG PS-Cell establishment

6.3.2.2 Reference specification

TS 36.304, clause 5.2.4

6.3.2.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

6.3.2.4 Test conditions

[SS configuration]
CellA and Cell B are E-UTRAN Cells, CellC is a NR Cell.
Cell B supports NSA, it is a Neighbor Cell of Cell A.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00

EARFCN= f2
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 8
Reference Signal EPRE= -125 dBm/15kHz
upperLayerIndication-r15=true

NR Cell C
Cell Id=03 TAC = 02
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
E-UTRAN Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

6.3.2.5 Test procedure

Table 6.3.2.5-1: Time of cell power level and parameter changes

Time	Cell A	Cell B	Cell C	Remark
T0	-85	Not Active	Not Active	
T1	-91	-85	-94	

PREAMBLE

1. Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.3.2.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. Verify the data transmission is performed successfully on E-UTRAN Cell A.
8. The RRC connection is released by the SS.
9. The SS changes cell power according to T1 in table 6.3.2.5-1.
10. The UE performs TRACKING AREA UPDATE on Cell B.
11. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
12. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
13. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
14. Verify the data transmission is performed successfully on NR Cell C.

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.

Table 6.3.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		
2			SS configures the initial power according to T0 in Table 6.3.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on		PASS

			Cell A (see 36.508, 4.5.2).		
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7			Verify the data transmission is performed successfully on E-UTRAN Cell A.		PASS
8	←	RRC	The RRC connection is released by the SS.		
9			SS changes cell power according to T1 in table 6.3.2.5-1.		
10	→ ←	NAS RRC	UE performs TRACKING AREA UPDATE on Cell B.		PASS
11	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
12	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
13	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message..		PASS
14			Verify the data transmission is performed successfully on NR Cell C.		PASS
15	→ ←	NAS	SS initiates a Detach procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		

6.3.2.6 Expected Result

Verify the UE could reselect from E-UTRAN Cell to NSA P-Cell.

6.3.3 P-Cell Handover with SCG change, Data continuity

6.3.3.1 Test Purpose

Setup a real PS service (e.g. streaming).The UE perform P-Cell-P-Cell handover with SCG change.

6.3.3.2 Reference specification

3GPP TS 36.331 subclause 5.3.5

3GPP TS 38.331 subclause 5.3.5

6.3.3.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

6.3.3.4 Test conditions

[SS configuration]
CellA and Cell B are E-UTRAN Cells, CellC and Cell D are NR Cells.
Cell A and Cell B supports NSA.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
Frequency Configuration = f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
Frequency Configuration = f2
rootSequenceIndex = 8
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell D
Cell Id=04 TAC = 02
MCC = 460 MNC = 00
Frequency Configuration = f2
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

E-UTRAN Cell B is not active

NR Cell C is not active

NR Cell D is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

6.3.3.5 Test procedure

Table 6.3.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	NR Cell D	Remark
T0	-85	Not Active	-94	Not Active	
T1	-91	-85	-100	-94	

PREAMBLE

1. Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.1.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
10. Verify the data transmission is performed successfully on NR Cell C.
11. The SS changes cell power according to T1 in table 6.3.3.5-1.
12. The SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B and NR RRCReconfiguration message to perform SCG change with reconfigurationWithSync on Cell D.
13. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
14. The UE performs TRACKING AREA UPDATE on Cell B.

15. Verify the data transmission is performed successfully on NR Cell D.

POSTAMBLE

16. The SS initiates a Detach procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.

Table 6.3.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.		
2			SS configures the initial power according to T0 in Table 6.3.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message..		PASS
10			Verify the data transmission is performed successfully on NR Cell C.		PASS
11			The SS changes cell power according to T1 in table 6.3.3.5-1.		
12	←	RRC	SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B and NR		

			RRCReconfiguration message to perform SCG change with reconfigurationWithSync on Cell D		
13	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
14	→ ←	NAS RRC	The UE performs TRACKING AREA UPDATE on Cell B.		PASS
15			Verify the data transmission is continued successfully on NR Cell D.		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A, E-UTRAN Cell B, NR Cell C and NR Cell D.		

6.3.3.6 Expected Result

Verify the data transmission is continued after handover.

6.3.4 P-Cell Handover with SCG unchange, Data continuity

6.3.4.1 Test Purpose

Setup a real PS service (e.g. streaming).The UE perform P-Cell-P-Cell handover with SCG remains the same.

6.3.4.2 Reference specification

3GPP TS 36.331 subclause 5.3.5
3GPP TS 38.331 subclause 5.3.5

6.3.4.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

6.3.4.4 Test conditions

[SS configuration]
CellA and Cell B are E-UTRAN Cells, CellC is a NR Cell.
Cell A and Cell B supports NSA.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0

Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

E-UTRAN Cell B
Cell Id=02 TAC = 01
MCC-MNC = 460-00
EARFCN= f2
rootSequenceIndex = 8
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
E-UTRAN Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

6.3.4.5 Test procedure

Table 6.3.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	Not Active	-94	
T1	-91	-85	-94	

PREAMBLE

1. Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.3.4.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
10. Verify the data transmission is performed successfully on NR Cell C.
11. The SS changes cell power according to T1 in table 6.3.4.5-1.
12. The SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B and SCG remains the same.
13. The UE sends an RRCConnectionReconfigurationComplete message.
14. Verify the data transmission is continued successfully on NR Cell C.

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.

Table 6.3.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		
2			SS configures the initial power according to T0 in Table 6.3.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED		

			EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message..		PASS
10			Verify the data transmission is performed successfully on NR Cell C.		PASS
11			The SS changes cell power according to T1 in table 6.3.4.5-1.		
12	←	RRC	SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B and SCG remains the same.		
13	→	RRC	UE sends an RRCConnectionReconfigurationComplete message.		
14			Verify the data transmission is continued successfully on NR Cell C.		PASS
15	→ ←	NAS	SS initiates a Detach procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		

6.3.4.6 Expected Result

Verify the data transmission is continued after handover.

6.3.5 Data Session continuity, from NSA cell to E-UTRAN cell

6.3.5.1 Test Purpose

While the UE is in an active PS data session on a NSA PS-Cell, UE can keep data transmission continuity after releasing of NSA PS-Cell and handover from NSA P-Cell to E-UTRAN cell.

6.3.5.2 Reference specification

3GPP TS 36.331 subclause 5.3.5

3GPP TS 38.331 subclause 5.3.5

6.3.5.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

6.3.5.4 Test conditions

[SS configuration]
CellA and Cell B are inter-band E-UTRAN Cells, CellC is a NR Cell.
Cell A supports NSA, Cell B is a 4G only Neighbor Cell of Cell A.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 8
Reference Signal EPRE= -125 dBm/15kHz

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

Band configuration:
- Cell A is Band 3. Cell B is Band 39. Cell C is n41

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
E-UTRAN Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE

UE is powered off

6.3.5.5 Test procedure

Table 6.3.5.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	Not Active	-94	
T1	-91	-85	-94	

PREAMBLE

1. Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.3.5.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
10. Verify the data transmission is performed successfully on NR Cell C.
11. The SS changes cell power according to T1 in table 6.3.5.5-1.
12. The SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B, and containing nr-Config for EN-DC release, and containing RadioBearerConfig to release Split DRB.
13. The UE sends an RRCConnectionReconfigurationComplete message.
14. Verify the data transmission is continued successfully on E-UTRAN Cell B.

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.

Table 6.3.5.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A,E-UTRAN Cell B and		

			NR Cell C.		
2			SS configures the initial power according to T0 in Table 6.3.5.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message..		PASS
10			Verify the data transmission is performed successfully on NR Cell C.		PASS
11			The SS changes cell power according to T1 in table 6.3.5.5-1.		
12	←	RRC	SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B, and containing nr-Config for EN-DC release, and containing RadioBearerConfig to release Split DRB.		
13	→	RRC	UE sends an RRCConnectionReconfigurationComplete message.		
14			Verify the data transmission is continued successfully on E-UTRAN Cell B.		PASS
15	→ ←	NAS	SS initiates a Detach procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		

6.3.5.6 Expected Result

Verify the data transmission is continued after handover.

6.3.6 Data Session continuity, from E-UTRAN cell to NSA cell

6.3.6.1 Test Purpose

While the UE is in an active PS data session on a E-UTRAN Cell, UE can keep data transmission continuity on NSA PS-Cell after handover from E-UTRAN cell to NSA P-Cell and addition of NSA PS-Cell.

6.3.6.2 Reference specification

3GPP TS 36.331 subclause 5.3.5
3GPP TS 38.331 subclause 5.3.5

6.3.6.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

6.3.6.4 Test conditions

[SS configuration]
CellA and Cell B are E-UTRAN Cells, CellC is a NR Cell.
Cell B supports NSA, it is a Neighbor Cell of Cell A.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f2
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 8
Reference Signal EPRE= -125 dBm/15kHz
upperLayerIndication-r15=true

NR Cell C
Cell Id=03 TAC = 02
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

E-UTRAN Cell B is not active

NR Cell C is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

6.3.6.5 Test procedure

Table 6.3.6.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	Not Active	Not Active	
T1	-91	-85	-94	

PREAMBLE

1. Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 6.3.6.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. Verify the data transmission is performed successfully on E-UTRAN Cell A.
8. The SS changes cell power according to T1 in table 6.3.6.5-1.
9. The SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B.
10. The UE sends an RRCConnectionReconfigurationComplete message.
11. The UE performs TRACKING AREA UPDATE on Cell B.
12. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.
13. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

14. The UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.
15. Verify the data transmission is continued successfully on NR Cell C.

POSTAMBLE

16. The SS initiates a Detach procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.

Table 6.3.6.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		
2			SS configures the initial power according to T0 in Table 6.3.6.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7			Verify the data transmission is performed successfully on E-UTRAN Cell A.		PASS
8			SS changes cell power according to T1 in table 6.3.6.5-1		
9	←	RRC	SS sends an RRCConnectionReconfiguration message containing mobilityControlInfo to handover to E-UTRA Cell B..		
10	→	RRC	UE sends an RRCConnectionReconfigurationComplete message.		PASS
11	→ ←	NAS RRC	UE performs TRACKING AREA UPDATE on Cell B.		PASS
12	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
13	→	RRC	UE sends an		PASS

			RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		
14	→	NAS RRC	UE sends an ULInformationTransfer message containing the ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message..		PASS
15			Verify the data transmission is continued successfully on NR Cell C.		PASS
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A,E-UTRAN Cell B and NR Cell C.		

6.3.6.6 Expected Result

Verify the data transmission is continued after handover.

6.3.7 SCG change with P-Cell remain the same, Data continuity

6.3.7.1 Test Purpose

Test to verify the support of SCG change when data transmission keep continuous.

6.3.7.2 Reference specification

3GPP TS 38.331 subclause 5.3.5

6.3.7.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

6.3.7.4 Test conditions

[SS configuration]
CellA is E-UTRAN Cells, Cell B and Cell C are NR intra-frequency cells.
Cell A and Cell B supports NSA.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
Frequency Configuration = f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B

Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 02
MCC = 460 MNC = 00
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B and Cell C are not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

6.3.7.5 Test procedure

Table 6.3.7.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	E-UTRAN Cell A	NR Cell B	NR Cell C	Remark
T0	SS/PBCH, SSS EPRE	dBm/SCS	/	-90	Not Active	
	Reference Signal EPRE	dBm/15kHz	-85	/	/	
T1	SS/PBCH, SSS EPRE	dBm/SCS	/	-100	-90	
	Reference Signal EPRE	dBm/15kHz	-85	/	/	

PREAMBLE

1. Activate E-UTRAN Cell A and NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 5.1.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.

7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify the data transmission is performed successfully on NR Cell B.
10. Active NR Cell C. The SS changes cell power according to T1 in table 6.3.7.5-1.
11. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to perform SCG change with reconfigurationWithSync on NR Cell C.
12. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
13. Verify the data transmission is performed successfully on NR Cell C.

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A, NR Cell B and NR Cell C.

Table 6.3.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 6.3. 7.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10			Active NR Cell C. The SS changes cell power according to T1 in table 6.3.7.5-1.		

11	←	RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to perform SCG change with reconfigurationWithSync on Cell D		
12	→	RRC	UE sends RRCConnectionReconfigurationComplete containing NR RRCReconfigurationComplete.		PASS
13			Verify the data transmission is continued successfully on NR Cell D.		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A, NR Cell B and NR Cell C.		

6.3.7.6 Expected Result

Verify the data transmission is continued after SCG change.

6.3.8 Inter-band SCG change with P-Cell unchanged, Data continuity

6.3.8.1 Test Purpose

Test to verify the support of inter-band SCG change from n41 cell to n79 cell when data transmission keep continuous.

6.3.8.2 Reference specification

3GPP TS 38.331 subclause 5.3.5

6.3.8.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

6.3.8.4 Test conditions

[SS configuration]
CellA is E-UTRAN Cells, Cell B and Cell C are NR intra-frequency cells.
Cell A and Cell B supports NSA.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
FDD LTE Band 3
Frequency Configuration = f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band n41
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 02
MCC = 460 MNC = 00
NR Band n79
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

Band configuration:
- Cell A is LTE Band 3. Cell B is NR Band n41. Cell C is NR band n79

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B and Cell C are not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

6.3.8.5 Test procedure

The same as in 6.3.7.5

6.3.8.6 Expected Result

Verify UE support NSA band combination B3+n41 and B3+n79.
Verify the data transmission keep continuous after SCG change.

6.3.9 Inter-band SCG change with P-Cell unchanged, Voice Call and Data continuity

6.3.9.1 Test Purpose

Setup a real voice call on MCG and PS service on SCG. Test to verify the support of inter-band SCG change from n41 cell to n79 cell when voice call and data transmission keep continuous.

6.3.9.2 Reference specification

3GPP TS 36.331 subclause 5.3.5
3GPP TS 38.331 subclause 5.3.5

6.3.9.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

This test applies to the device that supports VoLTE

6.3.9.4 Test conditions

[SS configuration]
E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
TD-LTE Band 39

Frequency Configuration = f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band n41
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell C
Cell Id=03 TAC = 02
MCC = 460 MNC = 00
NR Band n79
Frequency Configuration = f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

Band configuration:
- Cell A is TD-LTE Band 39. Cell B is NR Band n41. Cell C is NR band n79

[Initial conditions]
SS
E-UTRAN Cell A is not active
E-UTRAN Cell B is not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

6.3.9.5 Test procedure

Table 6.3.9.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	E-UTRAN Cell A	NR Cell B	NR Cell C	Remark
T0	SS/PBCH, SSS EPRE	dBm/SCS	/	-90	Not Active	
	Reference Signal EPRE	dBm/15kHz	-85	/	/	
T1	SS/PBCH, SSS EPRE	dBm/SCS	/	-100	-90	
	Reference Signal EPRE	dBm/15kHz	-85	/	/	

PREAMBLE
1. Activate E-UTRAN Cell A and NR Cell B. The SS configures the corresponding Master Information Block and System Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 5.1.1.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Trigger VoLTE call. UE inititaes the PDN connectivity procedure for the IMS PDN and Default EPS procedure for IMS PDN is completed in Cell A.
10. IMS Registration is successful in Cell A
11. The UE performs the IMS MO call procedure defined in TS 36.508 table 4.5A.6.3-1.
12. Trigger donwlink data transmission. Verify the data transmission is performed successfully on NR Cell B.
13. Active NR Cell C. The SS changes cell power according to T1 in Table 6.3.9.5-1.
14. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to perform SCG change with reconfigurationWithSync on NR Cell C.
15. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
16. Verify the voice call and data transmission is performed successfully on NR Cell C without interruption.

POSTAMBLE

17. Stop voice call and data transmission.
18. The SS initiates a Detach procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate E-UTRAN Cell A, NR Cell B and NR Cell C.

6.3.9.6 Expected Result

Verify UE support NSA band combination B39+n41 and B39+n79.
Verify the voice call and data transmission keep continuous after SCG change

7 Service

7.1 Voice

7.1.1 Redirection from NR to E-UTRAN, MO call, SA mode.

7.1.1.1 Test Purpose

Verify that the UE will make a VoNR MO call,.then redirection from NR to E-UTRAN.

7.1.1.2 Reference specification

TS 36.508, TS 38.508,TS 34.229-1

7.1.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR&VoLTE

7.1.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell.
Cell B is a NR Cell.
Cell A supports SA and VoNR&VoLTE

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.
IMS VoLTE Feature should be enabled on DUT
IMS VoNR Feature should be enabled on DUT

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

Table 7.1.1.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency
1	Cell A	B41	f1
	Cell B	n41	f1
2	Cell A	B3	f1
	Cell B	n28	f1
3	Cell A	B3	f1
	Cell B	n28	f2
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

7.1.1.5 Test procedure

Table 7.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	E-UTRAN Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	-97	-85
T1	SS/PBCH SSS EPRE	-85	-97

PREAMBLE

18. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
19. The SS configures the initial power according to T0 in Table 7.1.1.5-1.
20. The UE is powered ON

MAIN BODY

21. The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2 till Step 18).
22. UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell B.
23. IMS Registration is successful in Cell B
24. The UE performs the IMS MO call procedure on Cell B.
25. The SS configures the initial power according to T1 in Table 7.1.1.5-1.
26. The SS send RRCRelease message with E-UTRAN cell information.
27. UE performs the TAU procedure for mobility on E-UTRAN Cell A.
28. SS initiated PDN connection modification to setup dedicated bearer for voice.
29. IMS Voice session establishment continued on Cell A.

POSTAMBLE

30. The UE is powered OFF
31. Deactivate E-UTRAN Cell A and NR Cell B.

Table 7.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 7.1.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5	←	NAS RRC	UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell B		
6	→ ←		IMS Registration is successful in Cell B		
7	→ ←		The UE performs the IMS MO call procedure on Cell B.		PASS
8	→ ←		The SS configures the initial power according to T1 in Table 7.1.1.5-1.		
9	←		The SS send RRCRelease message with E-UTRAN cell information		PASS
10	→ ←		UE performs the TAU procedure for mobility on E-UTRAN Cell A		PASS
11	→ ←		SS initiated PDN connection modification to setup dedicated bearer for voice.		
12	→ ←		IMS Voice session establishment continued on Cell A.		PASS
13		UE	Switch OFF UE	AT Command	
14			Deactivate E-UTRAN Cell A and NR Cell B.		

7.1.1.6 Expected Result

Step 4, UE could select NR Cell B and camp on the NR Cell B.

Step 7, UE performs the IMS MO call procedure on Cell B

Step 9, SS RRCRelease message with E-UTRAN CellA information

Step 10, UE performs the TAU procedure for mobility on E-UTRAN Cell A

Step 12, IMS Voice session establishment continued on Cell A.

7.1.2 Redirection from NR to E-UTRAN, MT call, SA mode.

7.1.2.1 Test Purpose

Verify that the UE will make a VoNR MT call,.then redirection from NR to E-UTRAN..

7.1.2.2 Reference specification

TS 36.508, TS 38.508,TS 34.229-1

7.1.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

This test applies to the device that supports VoNR&VoLTE

7.1.2.4 Test conditions

[SS configuration]

Cell A is E-UTRAN Cell.

Cell B is a NR Cell.

Cell A supports SA and VoNR&VoLTE

E-UTRAN Cell A

Cell Id=01 TAC = 01

MCC-MNC = 460-00

rootSequenceIndex TDD = 0

Reference Signal EPRE= -85 dBm/15kHz

upperLayerIndication-r15=true

NR Cell B

Cell Id=02 TAC = 01

MCC = 460 MNC = 00

SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

IMS VoLTE Feature should be enabled on DUT

IMS VoNR Feature should be enabled on DUT

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

Table7.1.2.4-1: Test Configurations

Test Point	Cell	Test Band	Test Frequency
1	Cell A	B41	f1
	Cell B	n41	f1
2	Cell A	B3	f1

	Cell B	n28	f1
3	Cell A	B3	f1
	Cell B	n28	f2
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

7.1.2.5 Test procedure

Table 7.1.2.5-1: Time of cell power level and parameter changes

Time	Parameter	E-UTRAN Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	-97	-85
T1	SS/PBCH SSS EPRE	-85	-97

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 7.1.2.5-1.
3. The UE is powered ON

MAIN BODY

4. The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2 till Step 18).
5. UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell B.
6. IMS Registration is successful in Cell B
7. The UE performs the IMS MT call procedure on Cell B.
8. The SS configures the initial power according to T1 in Table 7.1.2.5-1.
9. The SS send RRCRelease message with E-UTRAN cell information.
10. UE performs the TAU procedure for mobility on E-UTRAN Cell A.
11. SS initiated PDN connection modification to setup dedicated bearer for voice.
12. IMS Voice session establishment continued on Cell A.

POSTAMBLE

13. The UE is powered OFF
14. Deactivate E-UTRAN Cell A and NR Cell B.

Table 7.1.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in		

			Table 7.1.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5	←	NAS RRC	UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell B		
6	→ ←		IMS Registration is successful in Cell B		
7	→ ←		The UE performs the IMS MT call procedure on Cell B.		PASS
8	→ ←		The SS configures the initial power according to T1 in Table 7.1.2.5-1.		
9	←		The SS send RRCRelease message with E-UTRAN cell information		PASS
10	→ ←		UE performs the TAU procedure for mobility on E-UTRAN Cell A		PASS
11	→ ←		SS initiated PDN connection modification to setup dedicated bearer for voice.		
12	→ ←		IMS Voice session establishment continued on Cell A.		PASS
13		UE	Switch OFF UE	AT Command	
14			Deactivate E-UTRAN Cell A and NR Cell B.		

7.1.2.6 Expected Result

Step 4, UE could select NR Cell B and camp on the NR Cell B.
Step 7, UE performs the IMS MT call procedure on Cell B
Step 9, SS RRCRelease message with E-UTRAN CellA information
Step 10, UE performs the TAU procedure for mobility on E-UTRAN Cell A
Step 12, IMS Voice session establishment continued on Cell A.

7.1.3 VoLTE MO Call with E-UTRAN Cell, UE works in NSA mode.

7.1.3.1 Test Purpose

Verify that the UE will make a VoLTE MO call with E-UTRAN cell..

7.1.3.2 Reference specification

TS 36.508, TS 34.229-1

7.1.3.3 Applicability

This test applies to type 1 and 3 devices as described in clause 4.2.
This test applies to the device that supports VoLTE

7.1.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell.
Cell B is a NR Cell.
Cell A supports NSA and VoLTE

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
E-UTRA Band = 3
EARFCN= f1
rootSequenceIndex TDD = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.
IMS VoLTE Feature should be enabled on DUT

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

7.1.3.5 Test procedure

Table 7.1.3.5-1: Time of cell power level and parameter changes

Time	Parameter	E-UTRAN Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	-85	-90

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 7.1.3.5-1.
3. The UE is powered ON

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. UE inititaes the PDN connectivity procedure for the IMS PDN and Default EPS procedure for IMS PDN is completed in Cell A.
6. IMS Registration is successful in Cell A
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE performs the IMS MO call procedure defined in TS 36.508 table 4.5A.6.3-1.

POSTAMBLE

10. The UE is powered OFF
11. Deactivate E-UTRAN Cell A and NR Cell B.

Table 7.1.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 7.1.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	→ ←		UE initiates the PDN Connectivity Procedure for IMS PDN		
6	→ ←		IMS Registration Procedure is successful in Cell A		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS

9	→ ←		The UE performs the IMS MO call procedure defined in TS 36.508 table 4.5A.6.3-1.		PASS
10		UE	Switch OFF UE	AT Command	
11			Deactivate E-UTRAN Cell A and NR Cell B.		

7.1.3.6 Expected Result

Step 4, UE could select E-UTRAN Cell A and camp on the E-UTRAN Cell A.

Step 8,UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

Step 9, The UE performs the IMS MO call procedure defined in TS 36.508 table 4.5A.6.3-1.

7.1.4 VoLTE MT Call with E-UTRAN Cell, UE works in NSA mode

7.1.4.1 Test Purpose

Verify that the UE will make a VoLTE MT call with E-UTRAN cell.

7.1.4.2 Reference specification

TS 36.508, TS 34.229-1

7.1.4.3 Applicability

This test applies to type 1 and 3 devices as described in clause 4.2.

This test applies to the device that supports VoLTE

7.1.4.4 Test conditions

[SS configuration]

Cell A is E-UTRAN Cell, CellB is a NR Cell.

Cell A supports NSA and VoLTE

E-UTRAN Cell A

Cell Id=01 TAC = 01

MCC-MNC = 460-00

E-UTRA Band = 3

EARFCN= f1

rootSequenceIndex TDD = 0

Reference Signal EPRE= -85 dBm/15kHz

upperLayerIndication-r15=true

NR Cell B

Cell Id=02 TAC = 01

MCC = 460 MNC = 00

NR-ARFCN= f1

SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.
IMS VoLTE Feature should be enabled on DUT

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

7.1.4.5 Test procedure

Table 7.1.4.5-1: Time of cell power level and parameter changes

Time	Parameter	E-UTRAN Cell A	NR Cell B
T0	SS/PBCH SSS EPRE	-85	-90

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 7.1.4.5-1.
3. The UE is powered ON

MAIN BODY

4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. UE inititaes the PDN connectivity procedure for the IMS PDN and Default EPS procedure for IMS PDN is completed in Cell A.
6. IMS Registration is successful in Cell A
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. The UE performs the IMS MT call procedure defined in TS 36.508 table 4.5A.7.3-1.

POSTAMBLE

10. The UE is powered OFF
11. Deactivate E-UTRAN Cell A and NR Cell B.

Table 7.1.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 7.1.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	→ ←		UE initiates the PDN Connectivity Procedure for IMS PDN		
6	→ ←		IMS Registration Procedure is successful in Cell A		
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→ ←		The UE performs the IMS MT call procedure defined in TS 36.508 table 4.5A.7.3-1.		PASS
10		UE	Switch OFF UE	AT Command	
11			Deactivate E-UTRAN Cell A and NR Cell B.		

7.1.4.6 Expected Result

Step 4, UE could select E-UTRAN Cell A and camp on the E-UTRAN Cell A.

Step 8, UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

Step 9, The UE performs the IMS MT call procedure defined in TS 36.508 table 4.5A.7.3-1.

7.1.5 VoNR MO voice Call, UE works in SA mode.

7.1.5.1 Test Purpose

Verify that UE will make a VoNR MO voice call with NR cell.

7.1.5.2 Reference specification

TS 38.508, TS 34.229-1

7.1.5.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.

This test applies to the device that supports VoNR.

7.1.5.4 Test conditions

[SS configuration]

Cell A is a NR Cell.

Cell A supports SA and VoNR&VoLTE

NR Cell A

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

NR Band = n41

NR-ARFCN= f1

SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

IMS VoLTE Feature should be enabled on DUT

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

7.1.5.5 Test procedure

Table 7.1.5.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 7.1.5.5-1.
3. The UE is powered ON

MAIN BODY

4. The UE performs the registration procedure on Cell A(see 38.508, Table 4.5.2.2 till Step 18).
5. UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell A.
6. IMS Registration is successful in Cell A
7. The UE performs the IMS MO voice call procedure on Cell A.
8. SS sends PDU Session Modification Command message to establish a MT Dedicated EPS bearer (QFI 1) with the UE for voice call.
9. The UE shall respond with PDU Session Modification Complete.
10. SS initiates answer call procedure.
11. Verify if RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.
12. SS initiates CLEAR call procedure.
13. SS sends PDU Session Modification Command message to deactivate EPS Bearer (QFI 1).
14. The UE shall respond with PDU Session Modification Complete.

POSTAMBLE

15. SS initiates a de-registration procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate NR Cell A.

Table 7.1.5.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR CellA		
2			SS configures the initial power according to T0 in Table 7.1.5.5-1.		
3		UE	The UE is powered ON.	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell A(see 38.508, Table 4.5.2.2 till Step 18).		PASS
5	←	NAS RRC	UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell A.		
6	→ ←	SIP	IMS Registration is successful in Cell A.		
7	→ ←	SIP	The UE performs the IMS MO voice call procedure on Cell A.		PASS
8	←	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command		
9	→	NAS RRC	NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
10	← →	SIP	SS initiates answer call procedure.		PASS

11			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.		PASS
12	← →	SIP	SS initiates CLEAR call procedure.		PASS
13	←	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command		
14	→	NAS RRC	NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
15	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate NR Cell A.		

7.1.5.6 Expected Result

Verify that UE establishes a VoNR MO voice call with NR cell sucessfully, the voice RTP packets are transferred on Dedicated EPS bearer (QFI 1).

7.1.6 VoNR MT voice Call, UE works in SA mode

7.1.6.1 Test Purpose

Verify that UE will answer a VoNR MT voice call with NR cell.

7.1.6.2 Reference specification

TS 38.508, TS 34.229-1

7.1.6.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.

7.1.6.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41

NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.
IMS VoLTE Feature should be enabled on DUT

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

7.1.6.5 Test procedure

Table 7.1.6.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 7.1.6.5-1.
3. The UE is powered ON

MAIN BODY

4. The UE performs the registration procedure on Cell A(see 38.508, Table 4.5.2.2 till Step 18).
5. UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell A.
6. IMS Registration is successful in Cell A
7. SS initiates the IMS voice call procedure on Cell A.
8. SS sends PDU Session Modification Command message to establish a MT Dedicated EPS bearer (QFI 1) with the UE for voice call.
9. The UE shall respond with PDU Session Modification Complete.
10. The UE answers call procedure.
11. Verify if RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.
12. SS initiates CLEAR call procedure.
13. SS sends PDU Session Modification Command message to deactivate EPS Bearer (QFI 1).
14. The UE shall respond with PDU Session Modification Complete.

POSTAMBLE

15. SS initiates a de-registration procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate NR Cell A.

Table 7.1.6.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR CellA		
2			SS configures the initial power according to T0 in Table 7.1.5.5-1.		
3		UE	The UE is powered ON.	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell A(see 38.508, Table 4.5.2.2 till Step 18).		PASS
5	←	NAS RRC	UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell A.		
6	→ ←	SIP	IMS Registration is successful in Cell A.		
7	→ ←	SIP	SS initiates the IMS voice call procedure on Cell A.		PASS
8	←	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command		
9	→	NAS RRC	NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
10	← →	SIP	The UE answers call procedure.		 PASS
11			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.		PASS
12	← →	SIP	SS initiates CLEAR call procedure.		 PASS
13	←	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command		
14	→	NAS RRC	NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
15	→ ←	NAS	SS initiates a Deregitration procedure.		PASS

16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate NR Cell A.		

7.1.6.6 Expected Result

Verify that UE establishes a VoNR MT voice call with NR cell sucessfully, the voice RTP packets are transferred on Dedicated EPS bearer (QFI 1).

7.1.7 VoNR MO voice Call, with UL throughput under static channel

7.1.7.1 VoNR MO voice Call with UL throughput under static channel, UL 256QAM, UL2*2 MIMO ,SA mode.

7.1.7.1.1 Test Purpose

Verify that UE could make a VoNR MO voice call successfully with data transmission simultaneously. To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, UL 256QAM, UL2*2 MIMO

7.1.7.1.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.521-1

7.1.7.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.

7.1.7.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

subcarrierSpacing=30kHz

Table 7.1.7.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 7.1.7.1.4-2: Test band configuration

Test Point	Test band	Frequency Configuration	NR Frame Structure	Specail Frame
1	n41	f1	DD DD DD DS UU	DDDDDDGGGGUUUU
2	n79	f1	DSUUU DSUUU	DDDDDDDDDDGGUU
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

IMS Voice Feature should be enabled on DUT

[Initial conditions]

SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.2 for NR UL MIMO.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

7.1.7.1.5 Test procedure

Table 7.1.7.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. Set the parameters of the propagation condition and initial powe according to Table 7.1.7.1.4-1 and Table 7.1.7.1.5-1.
3. The UE is powered ON
4. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default NR bearer during the registration according to TS 38.508 subclause 4.5.2.
5. The SS transmits an RRC Connection Reconfiguration.
6. UE transmit an RRCReconfigurationComplete message to SS.
7. UE inititaes the PDU Session Establishment procedure for the IMS with QoS flow 5QI=5 (QFI1) is completed in Cell A.
8. IMS Registration is successful in Cell A.

MAIN BODY

9. Using the TCP client, begin TCP upload for [90] seconds and record Throughput result.
10. The UE performs the IMS MO voice call procedure on Cell A.
11. SS sends PDU Session Modification Command message to establish a QoS flow with 5QI=1 (QFI 2) in IMS PDU session for voice call.
12. The UE shall respond with PDU Session Modification Complete.
13. SS initiates answer call procedure.
14. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.
15. Verify the uplink data transmission is ongoing. Record the change of throughput at the TCP layer on the uplink channel during the MO voice call and calculate the average of the throughput.
16. SS initiates CLEAR call procedure.
17. Repeat step 9-16 for one more iteration.

POSTAMBLE

18. SS initiates a de-registration procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate NR Cell A.

7.1.7.1.6 Expected Result

1. Verify that UE establishes a VoNR MO voice call with NR cell sucessfully, the voice RTP packets

are transferred on PDU Session5QI=1 (QFI 2).

2. Record the change of TCP throughput during VoNR MO voice call and calculate the average TCP throughput. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table7.1.7.1.6-1: expected result

Test Point	Test Band	Expected UL TCP Throughput at Step 9	Expected UL TCP Throughput at Step 15
1	n41	[250 Mbps]	[250 Mbps]
2	n79	[760 Mbps]	[760 Mbps]

7.1.7.2 VoNR MO voice Call with UL throughput under static channel, UL 256QAM, Single TX, HPUE,SA mode.

7.1.7.2.1 Test Purpose

Verify that UE could make a VoNR MO voice call successfully with data transmission simultaneously. To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, SA Option2, Full Resource Allocation, UL 256QAM, Single TX, HPUE

7.1.7.2.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.521-1

7.1.7.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.
This test only applies for band n28.

7.1.7.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full

RB Allocation DL = Full

simultaneousAckNackAndCQI = TRUE

enableUL256QAM = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

subcarrierSpacing=15kHz

Table 7.1.7.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 7.1.7.2.4-2: Test band configuration

Test Point	Test band	Frequency Configuration	NR Frame Structure	Specail Frame
1	n28	f1	/	/
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

IMS Voice Feature should be enabled on DUT

[Initial conditions]

SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

7.1.7.2.5 Test procedure

Table 7.1.7.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. Set the parameters of the propagation condition and initial powe according to Table 7.1.7.2.4-1 and Table 7.1.7.2.5-1.
3. The UE is powered ON
4. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default NR bearer during the registration according to TS 38.508 subclause 4.5.2.
5. The SS transmits an RRCReconfiguration.
6. UE transmit an RRC ReconfigurationComplete message to SS.
7. UE inititaes the PDU Session Establishment procedure for the IMS with QoS flow 5QI=5 (QFI1) is completed in Cell A.
8. IMS Registration is successful in Cell A.

MAIN BODY

9. Using the TCP client, begin TCP upload for [90] seconds and record Throughput result.
10. The UE performs the IMS MO voice call procedure on Cell A.
11. SS sends PDU Session Modification Command message to establish a QoS flow with 5QI=1 (QFI 2) in IMS PDU session for voice call.
12. The UE shall respond with PDU Session Modification Complete.
13. SS initiates answer call procedure.
14. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.
15. Verify the uplink data transmission is ongoing. Record the change of throughput at the TCP layer on the uplink channel during the MO voice call and calculate the average of the throughput.
16. SS initiates CLEAR call procedure.
17. Repeat step 9-16 for one more iteration.

POSTAMBLE

18. SS initiates a de-registration procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate NR Cell A.

7.1.7.2.6 Expected Result

1. Verify that UE establishes a VoNR MO voice call with NR cell sucessfully, the voice RTP packets are transferred on PDU Session5QI=1 (QFI 2).).
2. Record the change of TCP throughput during VoNR MO voice call and calculate the average TCP throughput. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table7.1.7.2.6-1: expected result

Test Point	Test Band	Expected UL TCP Throughput at Step 9	Expected UL TCP Throughput at Step 15
1	n28	[175 Mbps]	[175 Mbps]

7.1.8 VoNR MT voice Call, with DL throughput under static channel

7.1.8.1 VoNR MT voice Call with DL throughput under static channel, 256QAM, DL 4*4 MIMO ,SA mode.

7.1.8.1.1 Test Purpose

Verify that UE would make a VoNR MT voice call successfully with downlink data transmission simultaneously. To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, 256QAM, DL 4*4 MIMO

7.1.8.1.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.508, TS 38.521-1

7.1.8.1.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.

7.1.8.1.4 Test conditions

[SS configuration]

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1

SS/PBCH SSS EPRE = -125 dBm/30kHz
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

Table 7.1.8.1.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

Table 7.1.8.1.4-2: Test band configuration

Test Point	**Test band**	**Frequency Configuration**	**NR Frame Structure**	**Specail Frame**
1	n41	f1	DD DD DD DS UU	DDDDDDGGGGUUUU
2	n79	f1	DSUUU DSUUU	DDDDDDDDDDGGUU
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.
IMS Voice Feature should be enabled on DUT

[Initial conditions]
SS
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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4..
2. Connect an application server to the IP output of the SS configured with a FTP server.

3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

7.1.8.1.5 Test procedure

Table 7.1.8.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. Set the parameters of the propagation condition and initial powe according to Table 7.1.8.1.4-1 and Table 7.1.8.1.5-1.
3. The UE is powered ON
4. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default NR bearer during the registration according to TS 38.508 subclause 4.5.2.
5. The SS transmits an RRCReconfiguration.
6. UE transmit an RRCReconfigurationComplete message to SS.
7. UE inititaes the PDU Session Establishment procedure for the IMS with QoS flow 5QI=5 is completed in Cell A.
8. IMS Registration is successful in Cell A.

MAIN BODY

9. Using the TCP client, begin TCP download for [90] seconds and record Throughput result.
10. SS initiates the IMS voice call procedure on Cell A.
11. SS sends PDU Session Modification Command message to establish a QoS flow with 5QI=1 (QFI 2) in IMS PDU session for voice call.
12. The UE shall respond with PDU Session Modification Complete.
13. The UE answers call procedure.
14. Verify if RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.
15. Verify the downlink data transmission is ongoing. Record the change of throughput at the TCP layer on the downlink channel during the MT voice call and calculate the average of the throughput.
16. SS initiates CLEAR call procedure.
17. Repeat step 9-16 for one more iteration.

POSTAMBLE

18. SS initiates a de-registration procedure.

19. The SS initiates a RRC release procedure.
20. Deactivate NR Cell A.

7.1.8.1.6 Expected Result

1. Verify that UE establishes a VoNR MO voice call with NR cell sucessfully, the voice RTP packets are transferred on PDU Session5QI=1 (QFI 2).
2. Record the change of TCP throughput during VoNR MT voice call and calculate the average TCP throughput. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table7.1.8.1.6-1: expected result

Test Point	Test Band	Expected DL TCP Throughput at step 9	Expected DL TCP Throughput at Step 15
1	n41	[1.53 Gbps]	[1.53 Gbps]
2	n79	[0.78 Gbps]	[0.78 Gbps]

7.1.8.2 VoNR MT voice Call with DL throughput under static channel, 256QAM, DL 2*2 MIMO ,SA mode.

7.1.8.2.1 Test Purpose

Verify that UE would make a VoNR MT voice call successfully with downlink data transmission simultaneously. To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Static Channel, SA Option2, Full Resource Allocation, 256QAM, DL 2*2 MIMO

7.1.8.2.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.508, TS 38.521-1

7.1.8.2.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR.
This test only applies for band n28.

7.1.8.2.4 Test conditions

[SS configuration]

Cell A is a NR Cell.

Cell A supports SA and VoNR&VoLTE

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=15kHz
Dl/UL switch period=5ms

Table 7.1.8.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

Table 7.1.8.4-2: Test band configuration

Test Point	**Test band**	**Frequency Configuration**	**NR Frame Structure**	**Specail Frame**
1	n28	f1	/	/
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.
IMS Voice Feature should be enabled on DUT

[Initial conditions]
SS
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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 2x2.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

7.1.8.2.5 Test procedure

Table 7.1.8.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-85	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. Set the parameters of the propagation condition and initial powe according to Table 7.1.8.2.4-1 and Table 7.1.8.2.5-1.
3. The UE is powered ON
4. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default NR bearer during the registration according to TS 38.508 subclause 4.5.2.
5. The SS transmits an RRCReconfiguration.
6. UE transmit an RRCReconfiguration Complete message to SS.
7. UE inititaes the PDU Session Establishment procedure for the IMS with QoS flow 5QI=5 is completed in Cell A.
8. IMS Registration is successful in Cell A.

MAIN BODY

9. Using the TCP client, begin TCP download for [90] seconds and record Throughput result.
10. SS initiates the IMS voice call procedure on Cell A.
11. SS sends PDU Session Modification Command message to establish a QoS flow with 5QI=1 (QFI 2) in IMS PDU session for voice call.
12. The UE shall respond with PDU Session Modification Complete.
13. The UE answers call procedure.
14. Verify if RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 30 seconds.

15. Verify the downlink data transmission is ongoing. Record the change of throughput at the TCP layer on the downlink channel during the MT voice call and calculate the average of the throughput.
16. SS initiates CLEAR call procedure.
17. Repeat step 9-16 for one more iteration.

POSTAMBLE

18. SS initiates a de-registration procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate NR Cell A.

7.1.8.2.6 Expected Result

1. Verify that UE establishes a VoNR MT voice call with NR cell sucessfully, the voice RTP packets are transferred on PDU Session5QI=1 (QFI 2).
2. Record the change of TCP throughput during VoNR MT voice call and calculate the average TCP throughput. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table7.1.8.6-1: expected result

Test Point	Test Band	Expected DL TCP Throughput at step 9	Expected DL TCP Throughput at Step 15
1	n28	[315 Mbps]	[315 Mbps]

7.1.9 Inter-RAT handover between NR and E-UTRAN cells with IMS MO voice Call

7.1.9.1 Test Purpose

Setup an IMS MO voice call. The UE executes handovers from NR cell to E-UTRAN cell and handovers from E-UTRAN cell to NR cell multi-times. Verify the UE is able to maintain the voice call.

7.1.9.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.521-1

7.1.9.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR and VoLTE.

7.1.9.4 Test conditions

[SS configuration]

Cell A is an E-UTRAN cell, Cell A supports VoLTE.
Cell B is a NR Cell, Cell B supports SA and VoNR.

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -125 dBm/15kHz

NR Cell B
Cell Id=02 TAC = 02
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA and LTE mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

Table 7.1.9.4-1: Test band configuration

Test Point	Cell	Test Band	Test Frequency
1	Cell A	B3	f1
	Cell B	n41	f1
2	Cell A	B39	f1
	Cell B	n79	f1
3	Cell A	B3	f1
	Cell B	n28	f1
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

7.1.9.5 Test procedure

Table 7.1.9.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-140	-85	
T1	-85	-97	
T2	-97	-85	

PREAMBLE

1. Activate E-UTRAN Cell A and NR Cell B. The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 7.1.9.5-1.
3. The UE is powered ON.

MAIN BODY

4. The UE performs Registration procedure on NR Cell B according to subclause 5.4.1 step3-18.
5. UE initiates the PDU Session Establishment procedure for the IMS with QoS flow 5QI=5 is completed in Cell B. IMS Registration is successful in Cell B.
6. The UE performs the IMS MO voice call procedure on Cell B.
7. SS sends PDU Session Modification Command message to establish a QoS flow with 5QI=1 in IMS PDU session for voice call. The UE shall respond with PDU Session Modification Complete.
8. SS initiates answer call procedure.
9. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.
10. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). The UE sends RRC Connection Reconfiguration Complete message.
11. The SS changes the cell power according to T1 in table 7.1.9.5-1.
12. The UE performs measurements on the neighbor Cell A and provides measurement reports (Event B2) to the SS.
13. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from NR Cell B to E-UTRAN Cell A.
14. The UE transmit a RRCReconfigurationComplete message on E-UTRAN Cell A.
15. The UE sends ULInformationTransfer message includes a TRACKING AREA UPDATE REQUEST message.
16. SS sends an DLInformationTransfer message includes a TRACKING AREA UPDATE ACCEPT message.
17 The UE transmits an ULInformationTransfer message includes a TRACKING AREA UPDATE COMPLETE message.
18. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). The UE sends RRC Connection Reconfiguration Complete message.
19. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.
20. The SS changes the cell power according to T2 in table 7.1.9.5-1.

21. The UE performs measurements on the neighbor NR Cell B and provides measurement reports (Event B2) to the SS.
22. SS transmits a MobilityFromEUTRACommand message on E-UTRA Cell A.
23. The UE transmit a RRCReconfigurationComplete message on NR Cell B.
24. The UE sends ULInformationTransfer message includes a REGISTRATION REQUEST message indicating “mobility registration updating”.
25. SS sends an DLInformationTransfer message includes a REGISTRATION ACCEPT message containing a 5G-GUTI.
26. The UE transmits an ULInformationTransfer message includes a REGISTRATION COMPLETE message.
27. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).
28. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.
29. Repeat steps 10 to 28 two times
30. SS initiates CLEAR call procedure.
31. SS sends PDU Session Modification Command message to release voice date bearer. The UE shall respond with PDU Session Modification Complete.

POSTAMBLE

32. SS initiates a de-registration procedure.
33. The SS initiates a RRC release procedure.
34. Deactivate E-UTRAN Cell A and NR Cell B.

Table 7.1.9.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 7.1.9-1.		
3		UE	The UE is powered ON.	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell B(see 38.508, Table 4.5.2.2 till Step 18).		PASS
5	←	NAS RRC	UE inititaes the PDU Session Establishment procedure for the IMS is completed in Cell B.		
	→ ←	SIP	IMS Registration is successful in Cell B.		
6	→ ←	SIP	The UE performs the IMS MO voice call procedure on Cell B.		PASS
7	← →	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT		PASS

			5GSM: PDU Session Modification Complete.		
8	← →	SIP	SS initiates answer call procedure.		PASS
9			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.		PASS
10	← →	RRC	The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). The UE sends RRC Connection Reconfiguration Complete message.		
11			The SS changes the cell power according to T1 in table 7.1.9.5-1.		
12	→	RRC	UE performs measurements on the neighbor Cell A and provides measurement reports (Event B2) to the SS.		PASS
13	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from NR Cell B to E-UTRAN Cell A.		
14	→		UE transmit a RRCReconfigurationComplete message on E-UTRAN Cell A.		PASS
15	→		The UE sends ULInformationTransfer message includes a TRACKING AREA UPDATE REQUEST message		
16	←		SS sends an DLInformationTransfer message includes a TRACKING AREA UPDATE ACCEPT message		
17	→		UE transmits an ULInformationTransfer message and includes a TRACKING AREA UPDATE COMPLETE message.		PASS
18	←	RRC	SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).		PASS
19			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.		PASS
20			The SS changes the cell power according to T2 in table 7.1.9.5-1.		
21	→	RRC	UE performs measurements on the neighbor NR Cell B and provides measurement reports (Event B2) to the SS.		PASS
22	→	RRC	SS transmits a MobilityFromEUTRACommand message on E-UTRA Cell A.		
23	→		The UE transmit a RRCReconfigurationComplete message on NR		PASS

			Cell B.		
24	→		The UE sends ULInformationTransfer message includes a REGISTRATION REQUEST message indicating “mobility registration updating”.		
25	←		SS sends an DLInformationTransfer message includes a REGISTRATION ACCEPT message containing a 5G-GUTI.		
26	→		The UE transmits an ULInformationTransfer message includes a REGISTRATION COMPLETE message.		PASS
27			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.		PASS
28	←		The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2).		PASS
29			Repeat steps 10 to 28 two times.		
30	← →	SIP	SS initiates CLEAR call procedure.		PASS
31	← →	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
32	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
33	←	RRC	SS initiates a RRC release procedure.		
34			Deactivate NR Cell A.		

7.1.9.6 Expected Result

1. Verify the UE can perform the inter-RAT handover procedure successfully.
2. The voice RTP packets are transferred on voice data bearer.

7.1.10 Data Session continuity, Inter-RAT handover between NR and E-UTRAN cells with IMS MT voice Call.

7.1.10.1 Test Purpose

While the UE is in an active PS data session on a NR cell, setup an IMS MT voice call. The UE executes handovers from NR cell to E-UTRAN cell and handovers from E-UTRAN cell to NR cell multi-times. Verify the UE is able to maintain the voice call and PS data transfer.

7.1.10.2 Reference specification

TS 38.508, TS 34.229-5, TS 38.331, TS 38.508, TS 38.521-1

7.1.10.3 Applicability

This test applies to type 1 and 2 devices as described in clause 4.2.
This test applies to the device that supports VoNR and VoLTE.

7.1.10.4 Test conditions

[SS configuration]
Cell A is an E-UTRAN cell, Cell A supports VoLTE.
Cell B is a NR Cell, Cell B supports SA and VoNR.

E-UTRAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
rootSequenceIndex = 0
Reference Signal EPRE = -125 dBm/15kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA and LTE mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

Table 7.1.10.4-1: Test band configuration

Test Point	Cell	Test Band	Test Frequency
1	Cell A	B3	f1
	Cell B	n41	f1
2	Cell A	B39	f1
	Cell B	n79	f1
3	Cell A	B3	f1
	Cell B	n28	f1
Note: 1.Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency			

7.1.10.5 Test procedure

Table 7.1.10.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-140	-85	
T1	-85	-97	
T2	-97	-85	

PREAMBLE

1. Activate E-UTRAN Cell A and NR Cell B. The SS configures the transmission of the Master Information Block and starts the System Information Block broadcasting on all cells.
2. The SS configures the initial power according to T0 in Table 7.1.10.5-1.
3. The UE is powered ON.
4. The UE performs Registration procedure on NR Cell B according to subclause 5.4.1 step3-18.
5. UE inititaes the PDU Session Establishment procedures for the IMS and internet data service is completed in Cell B. IMS Registration is successful in Cell B.

MAIN BODY

6. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). The UE sends RRC Connection Reconfiguration Complete message.
7. Start DL PING data and verify the data transmission is performed successfully on NR-Cell B.
8. SS initiates the IMS voice call procedure on Cell B.
9. SS sends PDU Session Modification Command message to establish a QoS flow with 5QI=1 in IMS PDU session for voice call. The UE shall respond with PDU Session Modification Complete.
10. The UE answers call procedure.
11. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The

call should continue for 20 seconds.

12. Verify the data transmission is performed successfully on NR-Cell B.
13. The SS changes the cell power according to T1 in table 7.1.10.5-1.
14. The UE performs measurements on the neighbor Cell A and provides measurement reports (Event B2) to the SS.
15. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from NR Cell B to E-UTRAN Cell A.
16. The UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target E-UTRAN Cell A.
17. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). The UE sends RRC Connection Reconfiguration Complete message.
18. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.
19. Verify the data transmission is performed successfully on E-Cell A.
20. The SS changes the cell power according to T2 in table 7.1.10.5-1.
21. The UE performs measurements on the neighbor NR Cell B and provides measurement reports (Event B2) to the SS.
22. The SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from E-UTRAN Cell A to NR Cell B.
23. The SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). The UE sends RRC Connection Reconfiguration Complete message.
24. Verify if RTP packets are ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.
25. Verify the data transmission is performed successfully on NR-Cell B.
26. Repeat steps 13 to 25 two times
27. SS initiates CLEAR call procedure.
28. SS sends PDU Session Modification Command message to release voice date bearer. The UE shall respond with PDU Session Modification Complete.
29. Verify the data transmission is performed successfully on NR-Cell B.

POSTAMBLE

30. SS initiates a de-registration procedure.
31. The SS initiates a RRC release procedure.
32. Deactivate E-UTRAN Cell A and NR Cell B.

Table 7.1.10.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 7.1.10-1.		
3		UE	The UE is powered ON.	AT Command	
4	→ ←	NAS RRC	The UE performs the registration procedure on Cell B(see 38.508, Table 4.5.2.2 till Step 18).		PASS

5	←	NAS RRC	UE inititaes the PDU Session Establishment procedures for the IMS and internet data service is completed in Cell B. .		
	→ ←	SIP	IMS Registration is successful in Cell B.		
6	← →	RRC	SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). UE sends RRC Connection Reconfiguration Complete message.		
7			Start DL PING data and verify the data transmission is performed successfully on NR-Cell B		PASS
8	→ ←	SIP	SS initiates the IMS voice call procedure on Cell B.		PASS
9	← →	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
10	← →	SIP	The UE answers call procedure.		PASS
11			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.		PASS
12			Verify the data transmission is performed successfully on NR-Cell B		PASS
13			The SS changes the cell power according to T1 in table 7.1.10.5-1.		
14	→	RRC	UE performs measurements on the neighbor Cell A and provides measurement reports (Event B2) to the SS.		PASS
15	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from NR Cell B to E-UTRAN Cell A.		
16	→	RRC	UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target E-UTRAN Cell A.		PASS
17	← →	RRC	SS sends RRC Connection Reconfiguration message to setup inter-RAT measurement (Event B2). UE sends RRC Connection Reconfiguration Complete message.		

18			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.		PASS
19			Verify the data transmission is performed successfully on E-Cell A		PASS
20			The SS changes the cell power according to T2 in table 7.1.10.5-1.		
21	→	RRC	UE performs measurements on the neighbor NR Cell B and provides measurement reports (Event B2) to the SS.		PASS
22	←	RRC	SS sends an RRC Connection Reconfiguration message to order the UE to perform inter-RAT handover from E-UTRAN Cell A to NR Cell B.		
23	→	RRC	UE completes the HO procedure by sending the RRC CONNECTION RECONFIGURATION COMPLETE message on target Cell B.		PASS
24			Verify RTP packets are still ongoing to confirm successful call progress via IMS PDU (IPv6). The call should continue for 20 seconds.		PASS
25			Verify the data transmission is performed successfully on NR-Cell B		PASS
26			Repeat steps 13 to 25 two times.		
27	← →	SIP	SS initiates CLEAR call procedure.		 PASS
28	← →	NAS RRC	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU Session Modification Command NR RRC: RRCReconfigurationComplete 5GMM: UL NAS TRANSPORT 5GSM: PDU Session Modification Complete.		PASS
29			Verify the data transmission is performed successfully on NR-Cell B		PASS
30	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
31	←	RRC	SS initiates a RRC release procedure.		
32			Deactivate NR Cell A.		

7.1.10.6 Expected Result

1. Verify the UE can perform the inter-RAT handover procedure successfully.
2. The voice RTP packets are transferred on voice data bearer.
3. The PS data are transferred on internet data bearer.

8 Roaming

9 Power Consumption

9.1 Idle Mode

9.1.1 Idle Mode, Power Consumption, Cell Centre, SA

9.1.1.1 Test Purpose

When UE enters RRC_Idle State after Registering in NR cell, Measure the power consumption.

9.1.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.1.1.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.1.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.1.1.5 Test procedure

Table 9.1.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.1.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A
6. The RRC connection is released by the SS. The UE enters Registered, Idle Mode

MAIN BODY

7. Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes

POSTAMBLE

8. The SS initiates a Deregitration procedure.
9. The SS initiates a RRC release procedure.
10. Deactivate NR Cell A.

Table 9.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.1.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS.		
7			Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes		
8	→ ←	NAS	SS initiates a Deregitration procedure.		PASS

9	←	RRC	SS initiates a RRC release procedure.		
10			Deactivate NR Cell A.		

9.1.1.6 Expected Result

The Current Should be less than [TBD]mA

9.1.2 Idle Mode, Power Consumption, Cell Edge, SA

9.1.2.1 Test Purpose

When UE enters RRC_Idle State after Registering in NR cell, Measure the power consumption.

9.1.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.1.2.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.1.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.1.2.5 Test procedure

Table 9.1.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-110	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.1.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A
6. The RRC connection is released by the SS. The UE enters Registered, Idle Mode

MAIN BODY

7. Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes

POSTAMBLE

8. The SS initiates a Deregitration procedure.
9. The SS initiates a RRC release procedure.
10. Deactivate NR Cell A.

Table 9.1.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.1.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS.		
7			Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes		
8	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
9	←	RRC	SS initiates a RRC release procedure.		

10			Deactivate NR Cell A.		

9.1.2.6 Expected Result

The Current Should be less than [TBD]mA

9.1.3 Idle Mode, Power Consumption, Cell Centre, NSA

9.1.3.1 Test Purpose

When UE enters RRC_Idle State after connected to NSA Mode, Measure the power consumption.

9.1.3.2 Reference specification

TS 36.304, clause 5.2.4

9.1.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.1.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.1.3.5 Test procedure

Table 9.1.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.1.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B
10. The RRC connection is released by the SS. The UE enters Registered, Idle Mode

MAIN BODY

11. Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes

POSTAMBLE

12. The SS initiates a Detach procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.1.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		

1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.1.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	The RRC connection is released by the SS.		
11			Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes		
12	→ ←	NAS	SS initiates a Detach procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate E-UTRAN Cell A and NR Cell B.		

9.1.3.6 Expected Result

The Current Should be less than [TBD]mA

9.1.4 Idle Mode, Power Consumption, Cell Edge, NSA

9.1.4.1 Test Purpose

When UE enters RRC_Idle State after connected to NSA Mode, Measure the power consumption.

9.1.4.2 Reference specification

TS 36.304, clause 5.2.4

9.1.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.1.4.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.1.4.5 Test procedure

Table 9.1.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-100	-110	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.1.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell B
10. The RRC connection is released by the SS. The UE enters Registered, Idle Mode

MAIN BODY

11. Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes

POSTAMBLE

12. The SS initiates a Detach procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.1.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.1.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		

8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell B.		PASS
10	←	RRC	The RRC connection is released by the SS.		
11			Wait for 3 minutes and then start power consumption tester records the changes of current for another 3 minutes		
12	→ ←	NAS	SS initiates a Detach procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate E-UTRAN Cell A and NR Cell B.		

9.1.4.6 9.1.4.6 Expected Result

The Current Should be less than [TBD]mA

9.1.5 Idle mode with intra Frequency Measurement, Power Consumption

9.1.5.1 Test Purpose

When UE enters idle mode and cell reselection conditions met for Intra Frequency cell check that UE reselect into neighbour cell, measure the power consumption.

9.1.5.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.1.5.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.1.5.4 Test conditions

[SS configuration]
Cell A and B are intra frequency NR Cells.
Cell A and B support only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1

Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A and NR Cell B are not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.1.5.5 Test procedure

Table 9.1.5.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-90	-95	
T1	-106	-90	For cell reselection

PREAMBLE
1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.1.5.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A and release the RRC connection (see TS 38.508-1, Table 4.5.2.2-2 till Step 20a1).

MAIN BODY
5. Start power consumption tester to record the changes of current and voltage of idle mode
6. The SS changes the power level according to T1 in Table 9.1.5.5-1.
7. The power consumption tester records the value between step 5 and 6 for 3 minutes.
8. Initiate the paging procedure to check whether UE reselected into cell B or not.

POSTAMBLE

9. The SS initiates a Deregitration procedure.
10. The SS initiates a RRC release procedure.
11. Deactivate NR Cell A and Cell B

Table 9.1.5.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1			Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.1.5.5-1.		
3			Switch On UE	AT Command	
4	→ NAS ← RRC		UE performs the registration procedure (see TS-38.508-1, Table 4.5.2.2-2 till Step 20a1).		PASS
5			Start power consumption tester to record the changes of current and voltage of cell reselection procedure		
6			The SS changes the power level according to T1 in Table 9.1.5.5-1		
7			The power consumption tester records the value between step 5 and 6 for 3 minutes.		
8	→ RRC ←		Initiate the paging procedure to check whether UE reselected into cell B or not		PASS
9	→ NAS ←		SS initiates a Deregitration procedure.		PASS
10	←	RRC	SS initiates a RRC release procedure.		
11			Deactivate NR Cell A and B.		

9.1.5.6 Expected Result

The current should be less than [TBD]mA

9.1.6 Idle mode with inter Frequency Measurement, Power Consumption

9.1.6.1 Test Purpose

When UE enters idle mode and cell reselection conditions met for Inter Frequency cell check that UE reselect into neighbour cell, measure the power consumption.

9.1.6.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.1.6.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.1.6.4 Test conditions

[SS configuration]
Cell A and B are inter frequency NR Cells.
Cell A and B support only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR Band = n79
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A and NR Cell B are not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.1.6.5 Test procedure

Table 9.1.6.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-90	-95	
T1	-106	-90	For cell reselection

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.1.6.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A and release the RRC connection (see TS 38.508-1, Table 4.5.2.2-2 till Step 20a1).

MAIN BODY

5. Start power consumption tester to record the changes of current and voltage of idle mode
6. The SS changes the power level according to T1 in Table 9.1.6.5-1.
7. Initiate the paging procedure to check whether UE reselected into cell B or not.
8. Get the value of power consumption tester between step 5 and 7.

POSTAMBLE

9. The SS initiates a Deregistration procedure.
10. The SS initiates a RRC release procedure.
11. Deactivate NR Cell A and Cell B

Table 9.1.6.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1			Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.1.6.5-1.		
3			Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see TS 38.508-1, Table 4.5.2.2-2 till Step 20a1).		PASS
5			Start power consumption tester to record the changes of current and voltage of cell reselection procedure		
6			The SS changes the power level according to T1 in Table 9.1.6.5-1		
7	→ ←	RRC	Initiate the paging procedure to check whether UE reselected into cell B or not		PASS
8			Get the power concumption tester values at the time of cell reselection r between step 5 and 7.		
9	→	NAS	SS initiates a Deregitration procedure.		PASS

	←				
10	←	RRC	SS initiates a RRC release procedure.		
11			Deactivate NR Cell A and B.		

9.1.6.6 Expected Result

The current should be less than [TBD]mA

9.2 RRC Connection mode

9.2.1 Connected Mode, Power Consumption

9.2.1.1 Connected Mode, Power Consumption, SA

9.2.1.1.1 Test Purpose

When UE is in RRC Connected State after Registering in NR cell, Measure the power consumption.

9.2.1.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.2.1.1.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.2.1.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.2.1.1.5 Test procedure

Table 9.2.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.2.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A

MAIN BODY

6. Wait for 3 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes

POSTAMBLE

7. The SS initiates a Deregitration procedure.
8. The SS initiates a RRC release procedure.
9. Deactivate NR Cell A.

Table 9.2.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.2.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6			Wait for 3 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes		
7	→	NAS	SS initiates a Deregistration procedure.		PASS

	←				
8	←	RRC	SS initiates a RRC release procedure.		
9			Deactivate NR Cell A.		

9.2.1.1.6 Expected Result

The Current Should be less than [TBD]mA

9.2.1.2 Connected Mode with DRX, Power Consumption, SA

9.2.1.2.1 Test Purpose

When UE is in RRC Connected State after Registering in NR cell, measure the power consumption with DRX on.

9.2.1.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.2.1.2.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2

9.2.1.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.2.1.2.5 Test procedure

Table 9.2.1.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.2.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. Keep the NR RRC connection without DRX configured. Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes.
6. Stop power consumption measurement.
7. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters. Refer to Table 9.2.1.2.5-3 for DRX parameters
8. UE transmits RRCConnectionReconfigurationComplete
9. Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes
10. Stop power consumption measurement.

POSTAMBLE

11. The SS initiates a Deregitration procedure.
12. The SS initiates a RRC release procedure.
13. Deactivate NR Cell A.

Table 9.2.1.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.2.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes	Without DRX	PASS
6			Stop power consumption measurement.		
7	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific DRX parameters.	Table 9.2.1.2.5-3 for DRX parameters	

8	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
9			Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes		PASS
10			Stop power consumption measurement.		
11	→ ←	NAS	SS initiates a Deregistration procedure.		
12	←	RRC	SS initiates a RRC release procedure.		
13			Deactivate NR Cell A.		

Table 9.2.1.2.5-3: NR DRX Parameters in step 7

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
DRX-Config ::= SEQUENCE {		
drx-onDurationTimer CHOICE {		
milliSeconds	ms10	
}		
drx-InactivityTimer	[ms60]	
drx-HARQ-RTT-TimerDL	[14]	
drx-HARQ-RTT-TimerUL	[14]	
drx-RetransmissionTimerDL	[sl 8]	
drx-RetransmissionTimerUL	[sl 8]	
drx-LongCycleStartOffset CHOICE {		
ms160	0	
}		
shortDRX	not present	
drx-SlotOffset	0	
}		

9.2.1.2.6 Expected Result

Record the average current in step 5 (current without DRX) and step 9 (current with DRX). The Current with DRX should be less than the current without DRX.

Table 9.2.1.2.6-1: Test Results

Test Step	Average Current(mA)
Step 5: without DRX	
Step 9: with DRX	

9.2.1.3 Connected Mode with DRX on SCG, Power Consumption, NSA

9.2.1.3.1 Test Purpose

When UE is in RRC Connected State after Registering in E-UTRAN and NR cell, measure the power consumption with DRX configured on SCG cell.

9.2.1.3.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.2.1.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2

9.2.1.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
LTE Cell A and NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.2.1.3.5 Test procedure

Table 9.2.1.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.2.1.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message

MAIN BODY

9. Keep the LTE RRC connection and NR RRC connection without DRX configured. Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes.
10. Stop power consumption measurement.
11. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on SCG NR Cell B. The DRX parameters are the same as in Table 9.2.1.2.5-3
12. UE transmits RRCConnectionReconfigurationComplete
13. Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes
14. Stop power consumption measurement.

POSTAMBLE

15. The SS initiates a Deregitration procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.2.1.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.2.1.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS

5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes	Without DRX	PASS
10			Stop power consumption measurement.		
11	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific DRX parameters.	Table 9.2.1.2.5-3 for DRX parameters	
12	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
13			Wait for 1 minutes and then start power consumption tester records the changes of current for another 3 minutes		PASS
14			Stop power consumption measurement.		
15	→ ←	NAS	SS initiates a Deregistration procedure.		
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A and NR Cell B.		

9.2.1.3.6 Expected Result

Record the average current in step 9 (current without DRX) and step 13 (current with DRX on SCG). The Current with DRX on SCG should be less than the current without DRX.

Table 9.2.1.3.6-1: Test Results

Test Step	Average Current(mA)
Step 9: without DRX	
Step 13: with DRX on SCG	

9.2.1.4 Connected Mode with DRX on MCG and SCG, Power Consumption, NSA

9.2.1.4.1 Test Purpose

When UE is in RRC Connected State after Registering in E-UTRAN and NR cell, measure the power

consumption with DRX configured on both MCG and SCG cell.

9.2.1.4.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.2.1.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2

9.2.1.4.4 Test conditions

The same as in 9.2.1.3.4

9.2.1.4.5 Test procedure

The same as in 9.2.1.3.5 except step 11 . Step 11 is changed as following

“ 11. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A and SCG NR Cell B. Refer to Table 9.2.1.4.5-1 for E-UTRAN DRX parameters for MCG and Table 9.2.1.4.5-2 for NR DRX parameters for SCG”

Table 9.2.1.4.5-1: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	
longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.2.1.4.5-2: NR DRX Parameters for SCG

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	Value/remark	Comment
DRX-Config ::= SEQUENCE {		
drx-onDurationTimer CHOICE {		
milliSeconds	ms10	
}		
drx-InactivityTimer	[ms60]	
drx-HARQ-RTT-TimerDL	[14]	

drx-HARQ-RTT-TimerUL	[14]	
drx-RetransmissionTimerDL	[sl 8]	
drx-RetransmissionTimerUL	[sl 8]	
drx-LongCycleStartOffset CHOICE {		
ms160	0	
}		
shortDRX	not present	
drx-SlotOffset	0	
}		

9.2.1.4.6 Expected Result

Record the average current in step 9 (current without DRX) and step 13 (current with DRX on MCG and SCG). The Current with DRX on SCG should be less than the current without DRX.

Table 9.2.1.3.6-1: Test Results

Test Step	Average Current(mA)
Step 9: without DRX	
Step 13: with DRX on MCG and SCG	

9.2.2 Inter Frequency Handover, Power Consumption, LTE to LTE

9.2.2.1 Test Purpose

The UE Executes the handovers between Inter-Frequency LTE cells for many times with contention based random access procedure and verify the power consumption.

9.2.2.2 Reference specification

TS 36.300, TS 36.331, TS 38.300

9.2.2.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

9.2.2.4 Test conditions

[SS configuration]
Cell A and CellB are E-UTRAN Cells, CellC is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0

Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

E-UTRAN Cell B
Cell Id=02 TAC = 02
MCC-MNC = 460-00
EARFCN= f2
rootSequenceIndex = 22
Reference Signal EPRE= -125 dBm/15kHz
upperLayerIndication-r15=true

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A and Cell B are not active
NR Cell C is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.2.2.5 Test procedure

Table 9.2.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	-infinity	-90	Cell B shall be off
T1	-91	-85	-90	Cell B better than Cell A
T2	-85	-91	-90	Cell A better than Cell B

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell C.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.2.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer

on Cell A (see 36.508, 4.5.2).

5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Verify that Data tranfer(Ping) perofrmed on NR cell C

MAIN BODY

10. The SS initiate the RRCConnectionReconfiguration procedure to configure the A4 measurement event to measure cell B
11. The SS changes the power levels according to T1 in Table 9.2.4.5-1.
12. The UE perrforms measurements on Cell B and provides measurement reports (Event A4) to SS
13. The SS initiates the handover procedure to Cell B with adding and releasing same PS-Cell(NR Cell C) and RRCConnectionReconfiguration doesn’t contain a dedicated PRACH preamble to make Contention based RACH procedure in cell B
14. The UE completes the Handover in Cell B by sending RRCConnectionReconfiguration Complete to the SS
15. Measure the minimum, maximum, average power consumption during the random access procedure between step 13 and 14.
16. Verify that Data transfer(Ping) performed on NR Cell C
17. The SS initiate the RRCConnectionReconfiguration procedure to configure the A4 measurement event to measure cell A
18. The SS changes the power levels according to T2 in Table 9.2.4.5-1
19. The UE perrforms measurements on Cell A and provides measurement reports (Event A4) to SS
20. The SS initiates the handover procedure to Cell A with adding and releasing same PS-Cell(NR Cell C) and RRCConnectionReconfiguration doesn’t contain a dedicated PRACH preamble to make Contention based RACH procedure in cell A
21. The UE completes the Handover in Cell A by sending RRCConnectionReconfiguration Complete to the SS
22. Measure the minimum, maximum, average power consumption during the random access procedure between step 20 and 21.
23. Verify that Data transfer(Ping) performed on NR Cell C
24. Get the value of power consumption tester and calulate the power consumption
25. The handover procedure between 10 to 24 are repeated for four times
26. Calculate the overall minimum, maximum and average power consumption values

POSTAMBLE

27. The SS initiates a Detach procedure.
28. The SS initiates a RRC release procedure.

29. Deactivate E-UTRAN Cell A, Cell B and NR Cell C.

Table 9.2.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A, Cell B and NR Cell C.		
2			SS configures the initial power according to T0 in Table 9.2.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Verify the data transmission is performed successfully on NR Cell C.		PASS
10	← →	RRC	RRC Connection Reconfiguration procedure to UE to configure the measurement Event for Cell B		
11			TX Power modification according to step T1 in table 9.2.4.5-1		
12	→	RRC	Measurement Report (Event A4)		PASS
13	←	RRC	RRC Connection Reconfiguration to the UE to Handover to Cell B		
14	→	RRC	UE inititates RACH procedure in Cell B and send RRC Connection Reconfiguration complete to SS		PASS
15			Get the maximum, minimum and average power consumption during the random access procedure between step 13 and 14		

16			Verify the data transmission is performed successfully on NR Cell C.		PASS
17	← →	RRC	RRC Connection Reconfiguration procedure to UE to configure the measurement Event for Cell A		
18			TX Power modification according to step T2 in table 9.2.4.5-1		
19	→	RRC	Measurement Report (Event A4)		PASS
20	←	RRC	RRC Connection Reconfiguration to the UE to Handover to Cell A		
21	→	RRC	UE inititates RACH procedure in Cell A and send RRC Connection Reconfiguration complete to SS		PASS
22			Get the maximum, minimum and average power consumption during the random access procedure between step 20 and 21		
23			Verify the data transmission is performed successfully on NR Cell C.		PASS
24			Get the value of power consumption tester and calulate the power consumption		
25			Repeat the Handover procedure (between 10 to 24) for four times		
26			Calculate the overall minimum, maximum and average power consumption values		
27	→ ←	NAS	SS initiates a Detach procedure.		PASS
28	←	RRC	SS initiates a RRC release procedure.		
29			Deactivate E-UTRAN Cell A, Cell B and NR Cell C.		

9.2.2.6 Expected Result

The Current Should be less than [TBD]mA

9.2.3 Inter Frequency Handover, Power Consumption, NR Cell

9.2.3.1 Test Purpose

When UE enters inter frequency handover procedure , measure the power consumption.

9.2.3.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.2.3.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.2.3.4 Test conditions

[SS configuration]
Cell A and B are inter frequency NR Cell.
Cell A and B support only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f2
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A and Cell B are not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.2.3.5 Test procedure

Table 9.2.3.5-1: Time of cell power level and parameter changes

Time	NR Cell A	NR Cell B	Remark
T0	-90	-95	
T1	-106	-90	For Blind Handover
T2	-90	-106	For Blind Handover

PREAMBLE
1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 9.2.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see TS 38.508-1, Table 4.5.2.2-2 till Step 19a1).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A.
6. SS reconfigures the cell power level according to T1 in Table 9.2.3.5-1

MAIN BODY

7. Start power consumption tester to record the changes of current and voltage of handover procedure.
8. The SS send RRCReconfiguration message to make handover from Cell A to Cell B.
9. Verify that RACH procedure is successful and UE send RRC ReconfigurationComplete in Cell B
10. Get the value of power consumption tester between step 8 and 9
11. SS reconfigures the cell power level according to T2 in Table 9.2.3.5-1
12. The SS sends RRCReconfiguration message to make handover from Cell B to Cell A
13. Verify that RACH procedure is successful and UE send RRCReconfiguration Complete in Cell A
14. Get the value of power consumption tester between step 12 and 13.
15. Repeat Step 8 to 13 for four times and calculate the overall average power consumption at the time of handover procedure

POSTAMBLE

16. The SS initiates a Deregitration procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate NR Cell A and Cell B.

Table 9.2.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1			Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.2.3.5-1.		
3			Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see TS 38.508-1, Table 4.5.2.2-2 till Step 19a1).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6			SS reconfigures the cell power level according to T1 in Table 9.2.3.5-1		
7			Start power consumption tester to record the changes of current and voltage of handover procedure		

8	←	RRC	The SS sendsRRC Reconfiguration message to make handover from Cell A to Cell B		
9	→	RRC	UE sends RRCReconfigurationComplete in Cell B		PASS
10			Get the power consumption tester values at the time of handover between step 8 and 9		
11			SS reconfigures the cell power level according to T2 in Table 9.2.3.5-1		
12	←	RRC	The SS sends RRCReconfiguration message to make handover from Cell B to Cell A		PASS
13	→	RRC	UE sends RRCReconfigurationComplete in Cell A		
14			Get the power consumption tester values at the time of handover between step 12 and 13		
15			Repeat steps between 8 to 14 for 4 times and calculate the overall average power consumption value for handover procedure		PASS
16	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate NR Cell A and B.		

9.2.3.6 Expected Result

The current should be less than [TBD]mA

9.3 Voice (VoLTE/VoNR)

9.3.1 VoLTE MO Call with E-UTRAN Cell, Power Consumption

9.3.1.1 Test Purpose

To measure the average current of MO VoLTE call procedure when call is ongoing in good coverage area.

9.3.1.2 Reference specification

TS 36.508, TS 24.299, RFC 4867

9.3.1.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

This test applies to the device that supports VoLTE

9.3.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA and VoLTE

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.
IMS VoLTE Feature should be enabled on DUT

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.3.1.5 Test procedure

Table 9.3.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	

PREAMBLE
1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.3.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer

on Cell A (see 36.508, 4.5.2).

5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. UE inititaes the PDN connectivity procedure for the IMS PDN and Default EPS procedure for IMS PDN is completed in Cell A.
10. IMS Registration is successful in Cell A
11. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

12. start power consumption tester records the changes of current and voltage and start the MO VoLTE call
13. Verify the RTP packet flow between UE and SS in both directions and stop the VoLTE call after 3 minutes
14. Stop the power consumption measurement and calculate the average current for VoLTE call

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.3.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.3.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		

8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→ ←		UE initiates the PDN Connectivity Procedure for IMS PDN		
10	→ ←		IMS Registration Procedure is successful in Cell A		PASS
11			Verify the data transmission is performed successfully on NR Cell B.		PASS
12	→ ←		Start the power consumption recorder for current measurements and Start MO VoLTE call		
13			Verify the RTP packet flow between UE and SS and stop the VolTE call after 3 minutes		PASS
14			Stop the power consumption and calculte the average current of the VoLTE call		
15	→ ←	NAS	SS initiates a Detach procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A and NR Cell B.		

9.3.1.6 Expected Result

Record the test results of the current

9.3.2 VoNR MO call, Power Consumption

9.3.2.1 Test Purpose

To measure the average current of VoNR call for the MO call

9.3.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.3.2.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.3.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

NR Band = n41

NR-ARFCN= f1

Bandwidth = 100 MHz

SS/PBCH SSS EPRE = -125 dBm/30kHz

PDN = IMS PDN

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.3.2.5 Test procedure

Table 9.3.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.3.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. UE sends REGISTER message
6. SS responds to REGISTER with 401 Unauthorized
7. UE sends REGISTER again with proper IPSec settings and SS responds with 200 OK
8. UE sends SUBSCRIBE message and the SS responds with with 200 OK
9. SS sends NOTIFY. The UE responds NOTIFY with 200 OK

MAIN BODY

10. Initiate the MO IMS call
11. UE sends INVITE Request
12. SS transmits 100 Trying and 183 Session Progress
13. UE sends PRACK and SS responds with 200 OK

14. SS transmits PDU session establishment request for voice call
15. UE sends PDU session establishment accept
16. SS transmits 180 ringing and 200 OK for INVITE
17. UE sends ACK for 200 OK
18. Start the power consumption tester
19. Verify if RTP packets are ongoing to confirm successful call progress and keep the call active for 3 minutes
20. Stop the power consumption measurement and note down the current values
21. UE initiates the call release procedure

POSTAMBLE

22. The SS initiates a Deregitration procedure.
23. The SS initiates a RRC release procedure.
24. Deactivate NR Cell A.

Table 9.3.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.3.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5	→	SIP	REGISTER		
6	←	SIP	401 Unauthorized		
7	→ ←	SIP	UE sends REGISTER via IPSec and SS responds with 200 OK		PASS
8	→ ←	SIP	UE sends SUBSCRIBE Message. The SS responds SUBSCRIBE with 200 OK		
9	→ ←	SIP	SSsends NOTIFY. The UEresponds NOTIFY with 200 OK		
10			Initiate the MO IMS call		
11	→	SIP	INVITE		PASS
12	→ ←	SIP	SS responses with 183 Session Progress		
13	→ ←	SIP	UE sends PRACK and ss responds with 200 OK		
14	←	NAS	PDU session establishment request		
15	→	NAS	PDU session establishment accept		

16	←	SIP	SS transmits 180 ringing and 200 OK for INVITE		
17	→	SIP	UE sends ACK for 200 OK		
18			Start the power consumption tester		
19			Verify the bidirectional RTP packet flow and keep the call active for 3 minutes		PASS
20			Stop the power consumption measurements and note down the measurements		
21	→ ←	RRC SIP	UE initiates clear call procedure		
22	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
23	←	RRC	SS initiates a RRC release procedure.		
24			Deactivate NR Cell A.		

9.3.2.6 Expected Result

The Current Should be less than [TBD]mA

9.3.3 VoLTE MT Call with E-UTRAN Cell, Power Consumption

9.3.3.1 Test Purpose

To measure the average current of MT VoLTE call procedure when call is ongoing in good coverage area.

9.3.3.2 Reference specification

TS 36.508, TS 24.299, RFC 4867

9.3.3.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

This test applies to the device that supports VoLTE

9.3.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA and VoLTE

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1

rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.
IMS VoLTE Feature should be enabled on DUT

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.3.3.5 Test procedure

Table 9.3.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.3.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

9. UE inititaes the PDN connectivity procedure for the IMS PDN and Default EPS procedure for IMS PDN is completed in Cell A.
10. IMS Registration is successful in Cell A
11. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

12. start power consumption tester records the changes of current and voltage and start the MT VoLTE call from tester
13. Verify the RTP packet flow between UE and SS in both directions and stop the VoLTE call after 3 minutes
14. Stop the power consumption measurement and calculate the average current for VoLTE call

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.3.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.3.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	→ ←		UE initiates the PDN Connectivity Procedure for IMS PDN		

10	→ ←		IMS Registration Procedure is successful in Cell A		PASS
11			Verify the data transmission is performed successfully on NR Cell B.		PASS
12	→ ←		Start the power consumption recorder for current measurements and Start MT VoLTE call from SS		
13			Verify the RTP packet flow between UE and SS and stop the VolTE call after 3 minutes		PASS
14			Stop the power consumption and calculte the average current of the VoLTE call		
15	→ ←	NAS	SS initiates a Detach procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			Deactivate E-UTRAN Cell A and NR Cell B.		

9.3.3.6 Expected Result

Record the test results of the current

9.3.4 VoNR MT call, Power Consumption

9.3.4.1 Test Purpose

To measure the average current of VoNR call for the MT call.

9.3.4.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.3.4.3 Applicability

This test applies to the device that supports SA or SA+NSA

9.3.4.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz

SS/PBCH SSS EPRE = -125 dBm/30kHz
PDN = IMS PDN

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.3.4.5 Test procedure

Table 9.3.4.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.3.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. UE sends REGISTER message
6. SS responds to REGISTER with 401 Unauthorized
7. UE sends REGISTER again with proper IPSec settings and SS responds with 200 OK
8. UE sends SUBSCRIBE message and the SS responds with with 200 OK
9. SS sends NOTIFY. The UE responds NOTIFY with 200 OK

MAIN BODY

10. Initiate the MT IMS call
11. SS sends INVITE Request
12. UE transmits 100 Trying and 183 Session Progress
13. SS sends PRACK and SS responds with 200 OK
14. SS transmits PDU session establishment request for voice call
15. UE sends PDU session establishment accept
16. UE transmits 180 ringing and 200 OK for INVITE
17. SS sends ACK for 200 OK
18. Start the power consumption tester

19. Verify if RTP packets are ongoing to confirm successful call progress and keep the call active for 3 minutes
20. Stop the power consumption measurement and note down the current values
21. SS initiates the call release procedure

POSTAMBLE

22. The SS initiates a Deregitration procedure.
23. The SS initiates a RRC release procedure.
24. Deactivate NR Cell A.

Table 9.3.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.3.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5	→	SIP	REGISTER		
6	←	SIP	401 Unauthorized		
7	→ ←	SIP	UE sends REGISTER via IPSec and SS responds with 200 OK		PASS
8	→ ←	SIP	UE sends SUBSCRIBE Message. The SS responds SUBSCRIBE with 200 OK		
9	→ ←	SIP	SSsends NOTIFY. The UEresponds NOTIFY with 200 OK		
10			Initiate the MT IMS call		
11	←	SIP	INVITE		PASS
12	→ ←	SIP	UE responses with 183 Session Progress		
13	→ ←	SIP	SS sends PRACK and ss responds with 200 OK		
14	→	NAS	PDU session establishment request		
15	←	NAS	PDU session establishment accept		
16	→	SIP	UE transmits 180 ringing and 200 OK for INVITE		
17	←	SIP	SS sends ACK for 200 OK		
18			Sart the power consumption tester		
19			Verify the bidirectional RTP packet flow and		PASS

			keep the call active for 3 minutes		
20			Stop the power consumption measurements and note down the measurements		
21	→ ←	RRC SIP	SS initiates clear call procedure		
22	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
23	←	RRC	SS initiates a RRC release procedure.		
24			Deactivate NR Cell A.		

9.3.4.6 Expected Result

The Current Should be less than [TBD]mA

9.4 Data Transmission, Power Consumption

9.4.1 UL Data Transmission, Power Consumption， SA

9.4.1.1 Power Consumption with UL Data Transfer, SA (UL Single Tx – 64 QAM)

9.4.1.1.1 Test Purpose

Setup a Data bearer with NR cell with typical transmit level. Measure the power consumption when UE transmits TCP data with uplink 64QAM

9.4.1.1.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.1.1.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.1.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full

UL Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
P_Max = 3 dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
UL MCS = 18
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.1.1.5 Test procedure

Table 9.4.1.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE
1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.1.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY
5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE uploads data correctly. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes.
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE
10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.1.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current and voltage		
6	←	UE	UE uploads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.1.1.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.1.1.6-1: Average throughput and current

UL TCP Throughput(Mbps)	Average Current(mA)

9.4.1.2 Power Consumption with UL Data Transfer, SA (UL 2 Tx – 64 QAM)

9.4.1.2.1 Test Purpose

Setup a Data bearer with NR cell with typical transmit level. Measure the power consumption when UE transmits TCP data with uplink 64QAM and 2X2 MIMO

9.4.1.2.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.1.2.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.1.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full

UL Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
P_Max = 0 dBm
UL MIMO = 2X2

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.1.2.5 Test procedure

Table 9.4.1.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.1.2.5-1.
3. The UE is powered ON.

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE uploads data correctly. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.1.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.1.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current and voltage		
6	←	UE	UE uploads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more times		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.1.2.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.1.2.6-1: Average throughput and current

UL TCP Throughput(Mbps)	Average Current(mA)

9.4.1.3 Power Consumption with UL Data Transfer, SA (UL Single Tx – 256 QAM)

9.4.1.3.1 Test Purpose

Setup a Data bearer with NR cell with maximum transmit level at UE. Measure the power consumption when UE transmits TCP data with uplink 256QAM

9.4.1.3.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.1.3.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.1.3.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full

UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
P_Max = 16 dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.1.3.5 Test procedure

Table 9.4.1.3.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.1.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE uploads data correctly. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.1.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.1.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current and voltage		

6	←	UE	UE uploads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCPData throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.1.3.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.1.3.6-1: Average throughput and current

UL TCP Throughput(Mbps)	Average Current(mA)

9.4.1.4 Power Consumption with UL Data Transfer, SA (UL 2 Tx – 256 QAM)

9.4.1.4.1 Test Purpose

Setup a Data bearer with NR cell with maximum transmit level at UE. Measure the power consumption when UE transmits TCP data with uplink 256QAM and 2X2 MIMO

9.4.1.4.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.1.4.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.1.4.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00

NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
P_Max = 16 dBm
UL MIMO = 2X2

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.1.4.5 Test procedure

Table 9.4.1.4.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE
1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.1.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY
5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE uploads data correctly. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE
10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.

12. Deactivate NR Cell A.

Table 9.4.1.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.1.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current and voltage		
6	←	UE	UE uploads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.1.4.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.1.4.6-1: Average throughput and current

UL TCP Throughput(Mbps)	Average Current(mA)

9.4.2 DL Data Transmission, Power Consumption, SA

9.4.2.1 Power Consumption with DL Data Transfer, SA (64 QAM)

9.4.2.1.1 Test Purpose

Setup a Data bearer with NR cell with typical transmit level. Measure the power consumption when UE receives TCP data with downlink 64QAM

9.4.2.1.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.2.1.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.2.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation DL = Full
DL Modulation / Coding= 28
mcs-Table in PDSCH-Config = qam64
P_Max = 0 dBm
DL MIMO = 4*4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.2.1.5 Test procedure

Table 9.4.2.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE
1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System

Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 9.4.2.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE downloads data correctly. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.2.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.2.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current		
6	←	UE	UE downloads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		

12			Deactivate NR Cell A.		

9.4.2.1.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.2.1.6-1: Average throughput and current

DL TCP Throughput(Mbps)	Average Current(mA)

9.4.2.2 Power Consumption with DL Data Transfer, SA (256 QAM)

9.4.2.2.1 Test Purpose

Setup a Data bearer with NR cell with typical transmit level. Measure the power consumption when UE receives TCP data with downlink 256QAM

9.4.2.2.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.2.2.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.2.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation DL = Full
DL Modulation / Coding= 27
mcs-Table in PDSCH-Config = qam256
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.2.2.5 Test procedure

Table 9.4.2.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.2.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current.
6. Setup a TCPsession and verify that UE downloads data correctly. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.2.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.2.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→	NAS	UE performs the registration procedure (see		PASS

	←	RRC	38.508, Table 4.5.2.2 till Step 18).		
5			Power consumption tester records the chnages of current and voltage		
6	←	UE	UE downloads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.2.2.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.2.2.6-1: Average throughput and current

DL TCP Throughput(Mbps)	Average Current(mA)

9.4.3 Bi-direction Data Transmission, Power Consumption, SA

9.4.3.1 Power Consumption with Bidirectional Data Transfer, SA (UL Single Tx – 64 QAM)

9.4.3.1.1 Test Purpose

Setup a Data bearer with NR cell with typical transmit level. Measure the power consumption when UE transmits and receives TCP data simultaneously with 64QAM

9.4.3.1.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.3.1.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.3.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
DL Modulation / Coding = 28
mcs-Table in PDSCH-Config = qam64
P_Max = 3 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.3.1.5 Test procedure

Table 9.4.3.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE
1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.3.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY
5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE downloads and uploads the data simultaneously. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes

7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for onemore time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.3.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.3.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current		
6	←	UE	UE donwloads/uploads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.3.1.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.3.1.6-1: Average throughput and current

UL TCP Throughput (Mbps)	DL TCP Throughput (Mbps)	Average Current (mA)

9.4.3.2 Power Consumption with Bidirectional Data Transfer, SA (UL 2 Tx – 64 QAM)

9.4.3.2.1 Test Purpose

Setup a Data bearer with NR cell with typical transmit level.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits and receives TCP data simultaneously with 64QAM and UL 2X2 MIMO

9.4.3.2.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.3.2.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2

9.4.3.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
DL Modulation / Coding = 28
mcs-Table in PDSCH-Config = qam64
P_Max = 0 dBm
UL MIMO = 2X2
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.3.2.5 Test procedure

Table 9.4.3.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-90	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.3.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE downloads and uploads data simultaneously. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.3.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.3.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current		
6	←	UE	UE downloads/uploads the data correctly in		PASS

			NR Cell A. Keep services for 5 minutes		
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.3.2.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.3.2.6-1: Average throughput and current

UL TCP Throughput (Mbps)	DL TCP Throughput (Mbps)	Average Current (mA)

9.4.3.3 Power Consumption with Bidirectional Data Transfer, SA (UL Single Tx – 256 QAM)

9.4.3.3.1 Test Purpose

Setup a Data bearer with NR cell with maximum transmit level at UE. Measure the power consumption when UE transmits and receives TCP data simultaneously with 256QAM

9.4.3.3.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.3.3.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.3.3.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1

SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
DL Modulation / Coding = 27
mcs-Table in PDSCH-Config = qam256
P_Max = 16 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.3.3.5 Test procedure

Table 9.4.3.3.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.3.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current.
6. Setup a TCP session and verify that UE downloads and uploads the data simultaneously. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.3.3.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.3.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current		
6	←	UE	UE downloads/uploads the data correctly in NR Cell A. Keep services for 5 minutes		PASS
7			Get the power concumption tester values and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.3.3.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.3.3.6-1: Average throughput and current

UL TCP Throughput (Mbps)	DL TCP Throughput (Mbps)	Average Current (mA)

9.4.3.4 Power Consumption with Bidirectional Data Transfer, SA (UL 2 Tx – 256 QAM)

9.4.3.4.1 Test Purpose

Setup a Data bearer with NR cell with maximum transmit level at UE. Measure the power

consumption when UE transmits and receives TCP data simultaneously with 256QAM and uplink 2X2 MIMO

9.4.3.4.2 Reference specification

TS 38.508, TS 38.331, TS 38.300

9.4.3.4.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2.

9.4.3.4.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
DL Modulation / Coding = 27
mcs-Table in PDSCH-Config = qam256
P_Max = 16 dBm
DL MIMO = 4X4
UL MIMO = 2X2

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.3.4.5 Test procedure

Table 9.4.3.4.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.3.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

5. The power consumption tester records the changes of current and voltage.
6. Setup a TCP session and verify that UE uploads data correctly. Verify that UE TX power can reach to the P_max value definited in test conditions. Keep the service for 5 minutes
7. Get the value of power consumption tester during step 6 and calculate the average TCP throughput
8. Repeat Step 6 and 7 for one more time
9. Calculate the overall average power consumption and TCP throughput

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 9.4.3.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.4.3.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2 till Step 18).		PASS
5			Power consumption tester records the chnages of current		
6	←	UE	UE uploads the data correctly in NR Cell A. Verfiy that UE TX power can reach to the P_max value definited in test conditions. Keep services for 5 minutes		PASS
7			Get the power consumption tester values		

			and note down the TCP throughput value		
8			Repeat step 6 and 7 for one more time		
9			Calculate the overall average power consumption value and TCP Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate NR Cell A.		

9.4.3.4.6 Expected Result

Record the average TCP throughput and current in the following Table. The Current Should be less than [TBD]mA

Table 9.4.3.4.6-1: Average throughput and current

UL TCP Throughput (Mbps)	DL TCP Throughput (Mbps)	Average Current (mA)

9.4.4 UL Data Transmission, Power Consumption， NSA

9.4.4.1 Power Consumption with UL Data Transfer, NSA (SCG – 64 QAM)

9.4.4.1.1 Test Purpose

Setup a SCG bearer with NR as UL data path with typical transmit level. Measure the power consumption with DRX configured on MCG cell when UE transmits TCP data with a TX power of 0 dBm

9.4.4.1.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.4.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.4.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0

Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
UL_Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
P_Max = 0 dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.4.1.5 Test procedure

Table 9.4.4.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell B	Remark
T0	-85	-90	

PREAMBLE

1. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A. Refer to Table 9.4.4.3.5-2 for E-UTRAN DRX parameters for MCG.
2. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
3. The SS configures the initial power according to T0 in Table 9.4.4.1.5-1.
4. The UE is powered ON.
5. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
6. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
7. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
8. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.

9. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

10. The power consumption tester records the changes of current.
11. Setup a TCP session and verify that UE uploads data correctly. Verify that data transfer happening in NR data path. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes.
12. Get the value of power consumption tester during step 11 and calculate the average throughput at transport layer
13. Repeat Step 9 to 12 for two more time
14. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.4.1.5-2: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	
longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.4.4.1.5-3: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.4.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on		PASS

			Cell A (see 36.508, 4.5.2).		
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific MCG DRX parameters.	Table 9.4.4.1.5-2 for DRX parameters	
10	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
11			Power consumption tester records the chnages of current		
12	←	UE	UE uploads the TCP data correctly in NR data path. Keep services for 5 minutes		PASS
13			Get the power concumption tester values and note down the throughput put value at application layer level		
14			Repeat step 9 to 13 for two times		
15			Calculate the overall average power consumption value and TCP Data throughput		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.4.1.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.4.1.6-1. The Current Should be less than [TBD]mA

Table 9.4.4.1.6-1: Average throughput and current

UL TCP Throughput (Mbps)	Average Current (mA)
[TBD]	[TBD]

9.4.4.2 Power Consumption with UL Data Transfer, NSA (MCG & SCG – 64 QAM)

9.4.4.2.1 Test Purpose

Setup a MCG & SCG data bearer with with typical transmit level in a NSA cell. Measure the power consumption when UE transmits TCP data with total TX power of 0 dBm for both LTE and NR cell

9.4.4.2.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.4.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.4.2.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
RB Allocation UL = Full
UL Modulation / Coding = 27
UL 64QAM=TRUE
P_Max = 0 dBm
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
UL Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
P_Max = 0 dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.4.2.5 Test procedure

Table 9.4.4.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.4.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with MCG bearer.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current.
10. Setup a FTP session and verify that UE uploads data correctly. Verify that data transfer happening in both MCG and SCG bearers. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at transport layer
12. Repeat Step 9 to 11 for two more time
13. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.4.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	

			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.4.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with existing MCG DRB		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the changes of current		
10	←	UE	UE uploads the data correctly in both MCG and SCG data path. Keep services for 5 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at transport layer level		
12			Repeat step 9 to 11 for two times		
13			Calculate the overall average power consumption value and TCP Data throughput value		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.4.2.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.4.2.6-1.The Current Should be less than [TBD]mA

Table 9.4.4.2.6-1: Average throughput and current

Throughput (Mbps)	Average

UL TCP Throughput	UL MAC Throughput in MCG	UL MAC Throughput in SCG	Current(mA)
[TBD]	[TBD]	[TBD]	[TBD]

9.4.4.3 Power Consumption with UL Data Transfer, NSA (SCG – 256 QAM)

9.4.4.3.1 Test Purpose

Setup a SCG bearer with NR as UL data path with maximum transmit level. Measure the power consumption with DRX configured on MCG cell when UE transmits TCP data with a power of 23 dBm

9.4.4.3.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.4.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.4.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
UL Modulation / Coding= 25
mcs-Table in PUSCH-Config = qam256
P_Max = 23 dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.

UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.4.3.5 Test procedure

Table 9.4.4.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.4.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A. Refer to Table 9.4.4.3.5-2 for E-UTRAN DRX parameters for MCG.
10. The power consumption tester records the changes of current.
11. Setup a TCP session and verify that UE uploads data correctly. Verify that data transfer happening in NR data path. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
12. Get the value of power consumption tester during step 11 and calculate the average throughput at application layer
13. Repeat Step 9 to 12 for two more time
14. Calculate the overall average power consumption and throughput at the transpport layer

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.

17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.4.3.5-2: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	
longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.4.4.3.5-3: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.4.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	←	NAS	SS transmits RRCConnectionReconfiguration	Table 9.4.4.3.5-2 for	

		RRC	to configure specific MCG DRX parameters.	DRX parameters	
10	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
11			Power consumption tester records the chnages of current		
12	←	UE	UE uploads the data correctly in NR data path. Keep services for 5 minutes		PASS
13			Get the power concumption tester values and note down the throughput put value at transport layer level		
14			Repeat step 9 to 13 for four times		
15			Calculate the overall average power consumption value and Application Data throughput value		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.4.3.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.4.3.6-1. The Current Should be less than [TBD]mA

Table 9.4.4.3.6-1: Average throughput and current

UL TCP Throughput (Mbps)	Average Current (mA)
[TBD]	[TBD]

9.4.4.4 Power Consumption with UL Data Transfer, NSA (MCG & SCG – 256 QAM)

9.4.4.4.1 Test Purpose

Setup a MCG & SCG data bearer with with typical transmit level in a NSA cell. Measure the power consumption when UE transmits TCP data with a power of 23 dBm for both LTE and NR cell

9.4.4.4.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.4.4.3 Applicability

This test applies to the device that supports NSA or SA+NSA.

9.4.4.4.4 Test conditions

[SS configuration]

Cell A is E-UTRAN Cell, CellB is a NR Cell.

Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
RB Allocation UL = Full
UL Modulation / Coding = 27
P_Max = 10 dBm
UL 64QAM = TRUE
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
P_Max = 23 dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.4.4.5 Test procedure

Table 9.4.4.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.4.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with MCG bearer.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current.
10. Setup a TCP session and verify that UE uploads data correctly. Verify that data transfer happening in both MCG and SCG bearers. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at transpport layer
12. Repeat Step 9 to 11 for two more time
13. Calculate the overall average power consumption and throughput at the transport level

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.4.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.4.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS

7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with existing MCG DRB		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the changes of current		
10	←	UE	UE uploads the data correctly in both MCG and SCG data path. Keep services for 5 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at transpoprt layer level		
12			Repeat step 9 to 11 for two times		
13			Calculate the overall average power consumption value and transpport Data throughput value		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.4.4.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.4.4.6-1. The Current Should be less than [TBD]mA

Table 9.4.4.4.6-1: Average throughput and current

Throughput (Mbps)			Average Current(mA)
UL TCP Throughput	UL MAC Throughput in MCG	UL MAC Throughput in SCG	

9.4.5 DL Data Transmission, Power Consumption, NSA

9.4.5.1 Power Consumption with DL Data Transfer, NSA (SCG – 64 QAM)

9.4.5.1.1 Test Purpose

Setup a SCG bearer with NR as DL data path with typical transmit level. Measure the power consumption with DRX configured on MCG cell when UE receives TCP data

9.4.5.1.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.5.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.5.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation DL = Full
DL Modulation / Coding= 28
mcs-Table in PDSCH-Config = qam64
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.5.1.5 Test procedure

Table 9.4.5.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-75	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.5.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A. Refer to Table 9.4.5.1.5-2 for E-UTRAN DRX parameters for MCG.
10. The power consumption tester records the changes of current.
11. Setup a TCP session and verify that UE downloads data correctly. Verify that data transfer happening in NR data path. Keep the service for 5 minutes
12. Get the value of power consumption tester during step 11 and calculate the average throughput at transpport layer
13. Repeat Step 9 to 12 for two more time
14. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.5.1.5-2: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	

longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.4.5.1.5-3: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.5.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific MCG DRX parameters.	Table 9.4.5.1.5-2 for DRX parameters	
10	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
11			Power consumption tester records the chnages of current		
12	←	UE	UE downloads the data correctly in NR data path. Keep services for 5 minutes		PASS
13			Get the power concumption tester values and note down the throughput put value at transpport layer level		
14			Repeat step 9 to 13 for two times		

15			Calculate the overall average power consumption value and TCP Data throughput		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.5.1.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.5.1.6-1. The Current Should be less than [TBD]mA

Table 9.4.5.1.6-1: Average throughput and current

DL TCP Throughput (Mbps)	Average Current (mA)
[TBD]	[TBD]

9.4.5.2 Power Consumption with DL Data Transfer, NSA (MCG & SCG – 64 QAM)

9.4.5.2.1 Test Purpose

Setup a MCG & SCG data bearer with with typical transmit level in a NSA cell. Measure the power consumption when UE receives TCP data

9.4.5.2.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.5.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.5.2.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
RB Allocation DL = Full
DL Modulation / Coding = 27
DL 256 QAM = FALSE
P_Max = 0 dBm

upperLayerIndication-r15=true
DL MIMO = 2X2

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation DL = Full
DL Modulation / Coding = 28
mcs-Table in PDSCH-Config = qam64
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.5.2.5 Test procedure

Table 9.4.5.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.5.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with MCG bearer.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR

RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current.
10. Setup a TCP session and verify that UE downloads data correctly. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 5 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at transport layer
12. Repeat Step 9 to 11 for two more time
13. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.5.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.5.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with existing MCG DRB		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the changes of current		
10	←	UE	UE downloads the data correctly in both		PASS

			MCG and SCG data path. Keep services for 5 minutes		
11			Get the power concumption tester values and note down the throughput put value at transport layer level		
12			Repeat step 9 to 11 for two times		
13			Calculate the overall average power consumption value and TCP Data throughput		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.5.2.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.5.2.6-1. The Current Should be less than [TBD]mA

Table 9.4.5.2.6-1: Average throughput and current

Throughput (Mbps)			Average Current(mA)
DL TCP Throughput	DL MAC Throughput in MCG	DL MAC Throughput in SCG	
[TBD]	[TBD]	[TBD]	[TBD]

9.4.5.3 Power Consumption with DL Data Transfer, NSA (SCG – 256 QAM)

9.4.5.3.1 Test Purpose

Setup a SCG bearer with NR as DL data path. Measure the power consumption with DRX configured on MCG cell when UE receives TCP data

9.4.5.3.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.5.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.5.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00

EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation DL = Full
DL Modulation / Coding = 27
mcs-Table in PDSCH-Config = qam256
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.5.3.5 Test procedure

Table 9.4.5.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-75	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.5.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration

message to add Cell B as NR PS-Cell with SCG DRB.

8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A. Refer to Table 9.4.5.3.5-2 for E-UTRAN DRX parameters for MCG.
10. The power consumption tester records the changes of current.
11. Setup a TCP session and verify that UE downloads data correctly. Verify that data transfer happening in NR data path. Keep the service for 5 minutes
12. Get the value of power consumption tester during step 11 and calculate the average throughput at transport layer
13. Repeat Step 9 to 11 for two more time
14. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.5.3.5-2: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	
longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.4.5.3.5-3: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to		

			T0 in Table 9.4.5.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific MCG DRX parameters.	Table 9.4.5.3.5-2 for DRX parameters	
10	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
11			Power consumption tester records the chnages of		
12	←	UE	UE downloads the data correctly in NR data path. Keep services for 5 minutes		PASS
13			Get the power concumption tester values and note down the throughput put value at transport layer level		
14			Repeat step 9 to 13 for two times		
15			Calculate the overall average power consumption value and TCP Data throughput		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.5.3.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.5.3.6-1. The Current Should be less than [TBD]mA

Table 9.4.5.3.6-1: Average throughput and current

DL TCP Throughput (Mbps)	Average Current (mA)

9.4.5.4 Power Consumption with DL Data Transfer, NSA (MCG & SCG – 256 QAM)

9.4.5.4.1 Test Purpose

Setup a MCG & SCG data bearer with with typical transmit level in a NSA cell. Measure the power consumption when UE receives TCP data

9.4.5.4.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.5.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.5.4.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
RB Allocation DL = Full
DL Modulation / Coding = 27
P_Max = 0 dBm
DL 256 QAM = TRUE
upperLayerIndication-r15=true
DL MIMO = 2X2

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation DL = Full
DL Modulation / Coding = 27
mcs-Table in PDSCH-Config = qam256
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.5.4.5 Test procedure

Table 9.4.5.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-75	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.5.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with MCG bearer.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current.
10. Setup a TCP session and verify that UE uploads data correctly. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 5 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at transport layer
12. Repeat Step 9 to 11 for two more time
13. Calculate the overall average power consumption and throughput at the transpport layer

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.5.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.5.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with existing MCG DRB		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the changes of current		
10	←	UE	UE downloads the data correctly in both MCG and SCG data path. Keep services for 5 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at transport layer level		
12			Repeat step 9 to 11 for two times		
13			Calculate the overall average power consumption value and TCP Data throughput		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.5.4.6 Expected Result

Record the average TCP throughput and current in the Table 9.4.5.4.6-1. Current Should be less than

[TBD]mA

Table 9.4.5.4.6-1: Average throughput and current

Throughput (Mbps)			Average Current(mA)
DL TCP Throughput	DL MAC Throughput in MCG	DL MAC Throughput in SCG	
[TBD]	[TBD]	[TBD]	[TBD]

9.4.6 Bi-direction Data Transmission, Power Consumption, NSA

9.4.6.1 Power Consumption with Bidirectional Data Transfer, NSA (SCG – 64 QAM)

9.4.6.1.1 Test Purpose

Setup a SCG bearer with NR as DL/UL data path with typical transmit level.. Measure the power consumption with DRX configured on MCG cell when UE transmits and receives UDP data simultaneously with a power of 0 dBm

9.4.6.1.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.6.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.6.1.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 28

mcs-Table in PUSCH-Config = qam64
DL Modulation / Coding = 28
mcs-Table in PDSCH-Config = qam64
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.6.1.5 Test procedure

Table 9.4.6.1.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.6.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A. Refer to Table 9.4.6.1.5-2 for E-UTRAN DRX parameters for MCG.
10. The power consumption tester records the changes of current.
11. Setup a UDP session and verify that UE downloads/uploads data simultaneously. Verify that data transfer happening in NR data path. Verify that UE TX power meeting the requirement

in test conditions. Keep the service for 5 minutes

12. Get the value of power consumption tester during step 10 and calculate the average throughput at transport layer
13. Repeat Step 9 to 12 for two more time
14. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.6.1.5-2: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	
longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.4.6.1.5-3: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.6.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		

6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific MCG DRX parameters.	Table 9.4.6.1.5-2 for DRX parameters	
10	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
11			Power consumption tester records the chnages of current a		
12	←	UE	UE downloads/uploads the data correctly in NR data path. Keep services for 5 minutes		PASS
13			Get the power concumption tester values and note down the throughput value at transport layer		
14			Repeat step 9 to 13 for two times		
15			Calculate the overall average power consumption value and UDP Data throughput		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.6.1.6 Expected Result

Record the average UDP throughput and current in the Table 9.4.6.1.6-1. The Current Should be less than [TBD]mA.

Table 9.4.6.1.6-1: Average throughput and current

UL UDP Throughput (Mbps)	DL UDP Throughput (Mbps)	Average Current (mA)
[TBD]	[TBD]	[TBD]

9.4.6.2 Power Consumption with Bidirectional Data Transfer, NSA (MCG & SCG – 64 QAM)

9.4.6.2.1 Test Purpose

Setup a MCG & SCG data bearer with with typical transmit level in a NSA cell. Measure the power consumption when UE transmits and receives UDP data simultaneously with a power of 0 dBm for

both LTE and NR cell

9.4.6.2.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.6.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.6.2.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 27
DL Modulation / Coding = 27
UL 64QAM = TRUE
DL 256QAM = FALSE
P_Max = 0 dBm
upperLayerIndication-r15=true
DL MIMO = 2X2

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 28
mcs-Table in PUSCH-Config = qam64
DL Modulation / Coding = 28
mcs-Table in PDSCH-Config = qam64
P_Max = 0 dBm
DL MIMO = 4X4

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

DL MCS = 22

UL MCS = 18

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.6.2.5 Test procedure

Table 9.4.6.2.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-90	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.6.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with MCG bearer.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of.
10. Setup a UDP session and verify that UE downloads/uploads data simultaneously. Verify that data transfer happening in both MCG and SCG bearers. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at transport layer
12. Repeat Step 9 to 11 for two more time
13. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.6.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.6.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with existing MCG DRB		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the changes of current		
10	←	UE	UE downloads/uploads the data correctly in both MCG and SCG data path. Keep services for 5 minutes		PASS
11			Get the power concumption tester values and note down the throughput value at transport layer		
12			Repeat step 9 to 11 for two times		
13			Calculate the overall average power consumption value and UDP Data throughput		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		

16			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.6.2.6 Expected Result

Record the average UDP throughput and current in the Table 9.4.6.2.6-1. The Current Should be less than [TBD]mA

Table 9.4.6.2.6-1: Average throughput and current

UL UDP Throughput (Mbps)	DL UDP Throughput (Mbps)	Average Current (mA)

9.4.6.3 Power Consumption with Bidirectional Data Transfer, NSA (SCG – 256 QAM)

9.4.6.3.1 Test Purpose

Setup a SCG bearer with NR as DL/UL data path with maximum transmit level. Measure the power consumption with DRX configured on MCG cell when UE transmits and receives UDP data simultaneously with a power of 23 dBm

9.4.6.3.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.6.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.6.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full

RB Allocation DL = Full
UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
DL Modulation / Coding = 27
mcs-Table in PDSCH-Config = qam256
P_Max = 23 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.6.3.5 Test procedure

Table 9.4.6.3.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-75	

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.6.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. SS transmits RRCConnectionReconfiguration to configure specific DRX parameters on MCG E-UTRAN Cell A. Refer to Table 9.4.6.3.5-2 for E-UTRAN DRX parameters for MCG.
10. The power consumption tester records the changes of current.

11. Setup a UDP session and verify that UE downloads and uploads data simultaneously. Verify that data transfer happening in NR data path. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
12. Get the value of power consumption tester during step 11 and calculate the average throughput at transport layer
13. Repeat Step 9 to 12 for two more time
14. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

15. The SS initiates a Detach procedure.
16. The SS initiates a RRC release procedure.
17. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.6.3.5-2: E-UTRAN DRX Parameters for MCG

Derivation Path: TS 36.331, clause 6.3.2		
Information Element	Value/remark	Comment
drx-Config CHOICE {		
setup SEQUENCE {		
onDurationTimer	psf8	
}		
drx-InactivityTimer	psf60	
drx-RetransmissionTimer	psf4	
longDRX-CycleStartOffset CHOICE {		
sf160	0	
}		
shortDRX	Not present	
}		
}		

Table 9.4.6.3.5-3: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.6.3.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest		

			including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9	←	NAS RRC	SS transmits RRCConnectionReconfiguration to configure specific MCG DRX parameters.	Table 9.4.6.3.5-2 for DRX parameters	
10	→	NAS RRC	UE transmits RRCConnectionReconfigurationComplete		PASS
11			Power consumption tester records the chnages of current		
12	←	UE	UE downloads/uploads the data correctly in NR data path. Keep services for 5 minutes		PASS
13			Get the power concumption tester values and note down the throughput value at transport layer		
14			Repeat step 9 to 13 for two times		
15			Calculate the overall average power consumption value and UDP Data throughput		
16	→ ←	NAS	SS initiates a Detach procedure.		PASS
17	←	RRC	SS initiates a RRC release procedure.		
18			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.6.3.6 Expected Result

Record the average UDP throughput and current in the Table 9.4.6.3.6-1. The Current Should be less than [TBD]mA

Table 9.4.6.3.6-1: Average throughput and current

UL UDP Throughput (Mbps)	DL UDP Throughput (Mbps)	Average Current (mA)
[TBD]	[TBD]	[TBD]

9.4.6.4 Power Consumption with Bidirectional Data Transfer, NSA (MCG & SCG – 256 QAM)

9.4.6.4.1 Test Purpose

Setup a MCG & SCG data bearer with with typical transmit level in a NSA cell. Measure the power

consumption when UE transmits and receives UDP data simultaneously with a power of 23 dBm for both LTE and NR cell

9.4.6.4.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.6.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

9.4.6.4.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 27
DL Modulation / Coding = 27
UL 64QAM = TRUE
DL 256QAM = TRUE
P_Max = 10 dBm
upperLayerIndication-r15=true
DL MIMO = 2X2

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz
RB Allocation UL = Full
RB Allocation DL = Full
UL Modulation / Coding = 25
mcs-Table in PUSCH-Config = qam256
DL Modulation / Coding = 27
mcs-Table in PDSCH-Config = qam256
P_Max = 23 dBm
DL MIMO = 4X4

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.4.6.4.5 Test procedure

Table 9.4.6.4.5-1: Time of cell power level and parameter changes

Time	E-UTRAN Cell A	NR Cell C	Remark
T0	-85	-75	

PREAMBLE
1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.4.6.4.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.
7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with MCG bearer.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY
9. The power consumption tester records the changes of current.
10. Setup a UDP session and verify that UE downloads and uploads data simultaneously. Verify that data transfer happening in both MCG and SCG bearers. Verify that UE TX power meeting the requirement in test conditions. Keep the service for 5 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at transport layer
12. Repeat Step 9 to 11 for two more time
13. Calculate the overall average power consumption and throughput at the transport layer

POSTAMBLE

14. The SS initiates a Detach procedure.
15. The SS initiates a RRC release procedure.
16. Deactivate E-UTRAN Cell A and NR Cell B.

Table 9.4.6.4.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate E-UTRAN Cell A and NR Cell B.		
2			SS configures the initial power according to T0 in Table 9.4.6.4.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
5	←	RRC	The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.		
6	→	RRC	Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.		PASS
7	←	NAS RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB in addition with existing MCG DRB		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the changes of current		
10	←	UE	UE downloads/uploads the data correctly in both MCG and SCG data path. Keep services for 5 minutes		PASS
11			Get the power concumption tester values and note down the throughput value at transport layer		
12			Repeat step 9 to 11 for two times		
13			Calculate the overall average power consumption value and UDP Data throughput		
14	→ ←	NAS	SS initiates a Detach procedure.		PASS
15	←	RRC	SS initiates a RRC release procedure.		
16			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.6.4.6 Expected Result

Record the average UDP throughput and current in the Table 9.4.6.4.6-1. The Current Should be less than [TBD]mA

Table 9.4.6.4.6-1: Average throughput and current

UL UDP Throughput (Mbps)	DL UDP Throughput (Mbps)	Average Current (mA)
[TBD]	[TBD]	[TBD]

9.5 Power Consumption - Inactive Mode

9.5.1 RRC Inactive Mode, Power Consumption, SA

9.5.1.1 Test Purpose

When UE enters RRC_Inactive State after Registering in NR cell, Measure the power consumption.

9.5.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.5.1.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.5.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz
t380 = min10

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.5.1.5 Test procedure

Table 9.5.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.5.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A
6. The RRC connection is released by the SS with suspendConfig to make UE to enter into Inactive Mode. The UE enters Registered, Inactive Mode

MAIN BODY

7. Wait for 3 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes
8. SS initiates paging message to UE
9. Verify that UE is initiating RRC Resume Procedure by sending RRCResumeRequest to SS
10. SS transmits RRCResume message to the UE
11. Verify that UE is sending RRCResumeComplete to SS

POSTAMBLE

12. The SS initiates a Deregitration procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

Table 9.5.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		

2			SS configures the initial power according to T0 in Table 9.5.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS with suspendConfig.		
7			Wait for 3 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes		
8	←	RRC	Paging		
9	→	RRC	RRCResumeRequest		PASS
10	←	RRC	RRCResume		
11	→	RRC	RRCResumeComplete		PASS
12	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate NR Cell A.		

9.5.1.6 Expected Result

The Current Should be less than [TBD]mA

9.5.2 RRC Inactive Mode – RNA Update Timer Expiry, Power Consumption

9.5.2.1 Test Purpose

When RNA Update timer expires in RRC Inactive Mode verify that UE initiates RRC Connection Resume Procedure for RNA Update and measure the power consumption

9.5.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.5.2.3 Applicability

This test applies to the device that supports SA or SA+NSA.

9.5.2.4 Test conditions

[SS configuration]

Cell A is a NR Cell.

Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz
T380 = min5

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.5.2.5 Test procedure

Table 9.5.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.5.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).
5. Verify that Data tranfer(Ping) perofrmed on NR cell A

MAIN BODY

6. The RRC connection is released by the SS with suspendConfig. The UE enters Registered, Inactive Mode
7. Start the power consumption tester which records the changes of current and Voltage Wait for t380 timer duration expiry
8. After t380 expiry Verify that UE is initiating RRC Resume Procedure by sending RRCResumeRequest with resume cause set as ‘rna-Update’ to SS

9. SS transmits RRCResume message to the UE
10. Verify that UE is sending RRCResumeComplete to SS
11. Get the value of power consumption tester during Step 8 to Step 9
12. Verify that Data tranfer(Ping) perofrmed on NR cell A

POSTAMBLE

13. The SS initiates a Deregitration procedure.
14. The SS initiates a RRC release procedure.
15. Deactivate NR Cell A.

Table 9.5.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 9.5.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5			Verify the data transmission is performed successfully on NR Cell A.		PASS
6	←	RRC	The RRC connection is released by the SS with suspendConfig.		
7			Start Power consumption tester to record the chnages of current and voltage and Wait for t380 timer duration to expire		
8	→	RRC	RRCResumeRequest with resume cause rna-update		PASS
9	←	RRC	RRCResume		
10	→	RRC	RRCResumeComplete		PASS
11			Verify the data transmission is performed successfully on NR Cell A.		PASS
12	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate NR Cell A.		

9.5.2.6 Expected Result

The Current Should be less than [TBD]mA

9.6 BWP, Power Consumption

9.6.1 Downlink Data Transmission with different BWP, Power Consumption, SA

9.6.1.1 Test Purpose

To measure UE power consumption of donwlink data transmission with different BWP configuration in SA mode.

9.6.1.2 Reference specification

TS 38.321, clause 5.15
TS 38.331, clause 5.2.1, clause 5.3.5.3

9.6.1.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2

9.6.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
SS/PBCH SSS EPRE = -80 dBm/30kHz
DL Modulation / Coding= 20
DL RB=50
mcs-Table in PDSCH-Config = qam64
UL TX Power=0dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.6.1.5 Test procedure

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to test conditions.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 15).

MAIN BODY

5. SS transmits NR RRCConnectionReconfiguration to configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=100MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-2 for BWP parameters
6. UE transmits RRCConnectionReconfigurationComplete
7. Setup donwlink TCP session and verify that UE downloads data correctly by using BWP-ID = 1.
8. Start power consumption tester records the changes of current for 3 minutes
9. Stop power consumption measurement. Stop data transmission
10. SS sends RRCRelease. UE returns to Idle mode.
11. Wait for 2 minutes. The SS transmits a Paging message. UE is in RRCConnected mode.
12. SS transmits NR RRCConnectionReconfiguration to configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=20MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-3 for BWP parameters.
13. Setup downlink TCP session and verify that UE downloads data correctly by using BWP-ID = 1.
14. Start power consumption tester records the changes of current for 3 minutes
15. Stop power consumption measurement. Stop data transmission

POSTAMBLE

16. The SS initiates a Deregitration procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate NR Cell A.

Table 9.6.1.5-1: BWP configuration

Derivation Path: TS 38.508-1 [4], Table 4.6.3-167		
Information Element	**Value/remark**	**Comment**
ServingCellConfig ::= SEQUENCE {		
……..	……..	
downlinkBWP-ToReleaseList	Not Present	
downlinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Downlink		
BWP-Downlink [1] SEQUENCE {		
bwp-Id	1	
bwp-Common SEQUENCE {		
genericParameters	BWP	9.6.1.5-2 /9.6.1.5-3

……..	……..	
……..	……..	
}		
……..	……..	
}		
firstActiveDownlinkBWP-Id	1	
bwp-InactivityTimer	Not present	
defaultDownlinkBWP-Id	Not present	
uplinkConfig SEQUENCE {		
……..	……..	
uplinkBWP-ToReleaseList	Not Present	
uplinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Uplink		
BWP-Uplink[1] SEQUENCE {		
bwp-Id	1	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters	BWP	9.6.1.5-2 / 9.6.1.5-3
……..	……..	
……..	……..	
}		
……..	……..	
}		
firstActiveUplinkBWP-Id	1	
}		
}		

Table 9.6.1.5-2: BWP Parameters in step 5

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
BWP ::= SEQUENCE {		
locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		

Table 9.6.1.5-3: BWP Parameters in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
BWP ::= SEQUENCE {		
locationAndBandwidth	13750	20M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		

9.6.1.6 Expected Result

Record the average current in step 8 and step 14.

Table 9.2.1.2.6-1: Test Results

Test Step	Average Current(mA)
Step 8: BWP=100MHz	
Step 14: BWP=20MHz	

9.6.2 Uplink Data Transmission with different BWP, Power Consumption, SA

9.6.2.1 Test Purpose

To measure UE power consumption of uplink data transmission with different BWP configuration in SA mode.

9.6.2.2 Reference specification

TS 38.321, clause 5.15

TS 38.331, clause 5.2.1, clause 5.3.5.3

9.6.2.3 Applicability

This test applies to Type 1 and Type 2 devices as described in clause 4.2

9.6.2.4 Test conditions

[SS configuration]

Cell A is a NR Cell.

Cell A supports only SA

NR Cell A

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

NR-ARFCN= f1

SS/PBCH SSS EPRE = -80 dBm/30kHz

UL Modulation / Coding= 20

UL RB=50

mcs-Table in PUSCH-Config = qam64

UL TX Power=0dBm

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.6.2.5 Test procedure

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to test conditions.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 15).

MAIN BODY

5. SS transmits NR RRCConnectionReconfiguration to configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=100MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-2 for BWP parameters
6. UE transmits RRCConnectionReconfigurationComplete
7. Setup uplink TCP session and verify that UE transmits data correctly by using BWP-ID = 1.
8. Start power consumption tester records the changes of current for 3 minutes
9. Stop power consumption measurement. Stop data transmission
10. SS sends RRC Release. UE returns to Idle mode.
11. Wait for 2 minutes. The SS transmits a Paging message. UE is in RRCConnected mode.
12. SS transmits NR RRCConnectionReconfiguration to configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=20MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-3 for BWP parameters.
13. Setup uplink TCP session and verify that UE transmits data correctly by using BWP-ID = 1.
14. Start power consumption tester records the changes of current for 3 minutes
15. Stop power consumption measurement. Stop data transmission

POSTAMBLE

16. The SS initiates a Deregitration procedure.
17. The SS initiates a RRC release procedure.
18. Deactivate NR Cell A.

9.6.2.6 Expected Result

Record the average current in step 8 and step 14.

Table 9.2.1.2.6-1: Test Results

Test Step	Average Current(mA)
Step 8: BWP=100MHz	
Step 14: BWP=20MHz	

9.6.3 Downlink Data Transmission with different BWP, Power Consumption, NSA

9.6.3.1 Test Purpose

To measure UE power consumption of donwlink data transmission with different BWP configuration in NSA mode.

9.6.3.2 Reference specification

TS 38.321, clause 5.15
TS 38.331, clause 5.2.1, clause 5.3.5.3

9.6.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2

9.6.3.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
NR-ARFCN= f1
SS/PBCH SSS EPRE = -80 dBm/30kHz
DL Modulation / Coding= 20
DL RB=50
mcs-Table in PDSCH-Config = qam64
UL TX Power=0dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.

UE works in NSA mode.

[Initial conditions]

SS

E-UTRAN Cell A is not active

NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.6.3.5 Test procedure

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to test conditions.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.

MAIN BODY

7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB and configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=100MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-2 for BWP parameters
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Setup downlink TCP session and verify that UE downloads data correctly by using BWP-ID = 1.
10. Start power consumption tester records the changes of current for 3 minutes
11. Stop power consumption measurement. Stop data transmission
12. SS releases RRC connection in both cell A and cell B. UE returns to Idle mode.
13. Wait for 2 minutes. The SS transmits a Paging message. UE is in LTE RRCConnected mode.
14. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB and configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=20MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-3 for BWP parameters
15. Setup downlink TCP session and verify that UE downloads data correctly by using BWP-ID = 1.
16. Start power consumption tester records the changes of current for 3 minutes
17. Stop power consumption measurement. Stop data transmission

POSTAMBLE

18. The SS initiates a Detach procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate E-UTRAN Cell A and NR Cell B.

9.6.3.6 Expected Result

Record the average current in step 8 and step 14.

Table 9.2.1.2.6-1: Test Results

Test Step	Average Current(mA)
Step 10: BWP=100MHz	
Step 16: BWP=20MHz	

9.6.4 Uplink Data Transmission with different BWP, Power Consumption, NSA

9.6.4.1 Test Purpose

To measure UE power consumption of uplink data transmission with different BWP configuration in NSA mode.

9.6.4.2 Reference specification

TS 38.321, clause 5.15
TS 38.331, clause 5.2.1, clause 5.3.5.3

9.6.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2

9.6.4.4 Test conditions

[SS configuration]
Cell A is E-UTRAN Cell, CellB is a NR Cell.
Cell A supports NSA

E-UTRAN Cell A
Cell Id=01 TAC = 01
MCC-MNC = 460-00
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE= -85 dBm/15kHz
upperLayerIndication-r15=true

NR Cell B
Cell Id=02 TAC = 01
NR-ARFCN= f1
SS/PBCH SSS EPRE = -80 dBm/30kHz
UL Modulation / Coding= 20

UL RB=50
mcs-Table in PUSCH-Config = qam64
UL TX Power=0dBm

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in NSA mode.

[Initial conditions]
SS
E-UTRAN Cell A is not active
NR Cell B is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

9.6.4.5 Test procedure

PREAMBLE

1. Activate E-UTRAN Cell A, NR Cell B.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to test conditions.
3. The UE is powered ON.
4. The UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).
5. The SS sends an ue-CapabilityRequest including the RAT type “eutra-nr”.
6. Verify the UE sends UECapabilityInformation message including the RAT type “eutra-nr”.

MAIN BODY

7. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB and configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=100MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-2 for BWP parameters
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.
9. Setup uplink TCP session and verify that UE transmits data correctly by using BWP-ID = 1.
10. Start power consumption tester records the changes of current for 3 minutes
11. Stop power consumption measurement. Stop data transmission
12. SS releases RRC connection in both cell A and cell B. UE returns to Idle mode.
13. Wait for 2 minutes. The SS transmits a Paging message. UE is in LTE RRCConnected mode.
14. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PS-Cell with SCG DRB and configure DL BWP and UL BWP with BWP-ID=1 and bandwidth=20MHz. Refer to Table 9.6.1.5-1 and Table 9.6.1.5-3 for BWP parameters

15. Setup uplink TCP session and verify that UE downloads data correctly by using BWP-ID = 1.
16. Start power consumption tester records the changes of current for 3 minutes
17. Stop power consumption measurement. Stop data transmission

POSTAMBLE

18. The SS initiates a Detach procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate E-UTRAN Cell A and NR Cell B.

9.6.4.6 Expected Result

Record the average current in step 8 and step 14.

Table 9.2.1.2.6-1: Test Results

Test Step	Average Current(mA)
Step 10: BWP=100MHz	
Step 16: BWP=20MHz	

9.7 R16 Power saving

9.7.1 UAI

9.7.1.1 R15 Overheating Reduced CC with Uplink Data Transmission

9.7.1.1.1 Test Purpose

Test to verify the signaling procedure of UAI reporting from 2CC to 1CC with uplink Data transmission due to overheating and test the power consumption between them.

9.7.1.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.1.1.3 Applicability

This test applies to Type2 UEs

9.7.1.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE

absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.1.1.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.1.1.5 Test procedure

Table 9.7.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH,	dBm/SCS	-75	Not Active

T1	SSS EPRE		-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.1.1.5-1
3. Set the parameters of the propagation condition according to Table 9.7.1.1.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with overheatingInd=supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. SS activates Cell B and configures the cell power according to T1 in Table 9.7.1.1.5-1
10. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
11. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B.
12. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 9.7.1.1.5-2 for parameter configuration, and release measurement GAP configuration.
13. The UE transmits an RRCReconfigurationComplete message
14. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
15. The power consumption tester records the changes of current.
16. Begin TCP uploads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on both PCC and SCC.
17. Get the value of power consumption tester during step 16 and calculate the average throughput.
18. The SS transmits an RRCReconfiguration message to configure overheatingIndicationProhibitTimer = s5.
19. The UE transmit an RRCReconfigurationComplete.
20. Use AT/ADB command to push UE sent UEAssistanceInformation including OverheatingAssistance which set reducedMaxCCs.
21. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321, clauses 5.9, 6.1.3.10).
22. Begin TCP uploads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on both PCC and SCC.
23. Get the value of power consumption tester during step 22 and calculate the average throughput.

24. The SS transmits an RRCReconfiguration message to add measurement GAP configuration.
25. SS configures the cell power according to T2 in Table 9.7.1.1.5-1
26. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
27. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
28. UE transmit an RRCReconfigurationComplete

POSTAMBLE

29. Switch Off UE, UE initiates a Detach procedure.
30. Deactivate Cell A and Cell B.

Table 9.7.1.1.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	
frequencyBandList	n41	
absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		

}		
ss-PBCH-BlockPower	0	
}		
}		

9.7.1.1.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.1.1.6-1. The Current Should be less than [TBD]mA .

Table 9.7.1.1.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 17	[TBD]	[TBD]
Step 23	[TBD]	[TBD]

9.7.1.2 R15 Overheating Reduced Maximum MIMO layers with Uplink Data Transmission

9.7.1.2.1 Test Purpose

Test to verify the signaling procedure of UAI reporting from 2 Maximum MIMO layers to 1 Maximum MIMO layers (UL)with uplink Data transmission due to overheating and test the power consumption between UAI reporting ON and UAI reporting OFF.

9.7.1.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.1.2.3 Applicability

This test applies to Type2 UEs

9.7.1.2.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.1.2.5 Test procedure

Table 9.7.1.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.1.2.5-1
3. Set the parameters of the propagation condition according to Table 9.7.1.2.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with overheatingInd=supported.

7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. The power consumption tester records the changes of current.
10. Begin TCP uploads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
11. Get the value of power consumption tester during step 10 and calculate the average throughput.
12. The SS transmits an RRCReconfiguration message to configure overheatingIndicationProhibitTimer = s5.
13. The UE transmit an RRCReconfigurationComplete.
14. Use AT/ADB command to push UE sent UEAssistanceInformation including OverheatingAssistance which set reducedMIMO-LayersFR1-UL=1.
15. The SS transmits an RRCReconfiguration message to configure maxMIMO-Layers=1 of PUSCH-ServingCellConfig and sets maxMIMO-Layers=1 of DCI format 0_1.
16. The UE transmit an RRCReconfigurationComplete.
17. Begin TCP uploads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
18. Get the value of power consumption tester during step 17 and calculate the average throughput.

POSTAMBLE

19. Switch Off UE, UE initiates a Detach procedure.
20. Deactivate Cell A.

9.7.1.2.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.1.2.6-1. The Current Should be less than [TBD]mA .

Table 9.7.1.2.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 11	[TBD]	[TBD]
Step 18	[TBD]	[TBD]

9.7.1.3 R16 UAI Reduced CC with Downlink Data Transmission

9.7.1.3.1 Test Purpose

Test to verify the signaling procedure of UAI reporting from 2CC to 1CC with downlink Data transmission and test the power consumption between them.

9.7.1.3.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.1.3.3 Applicability

This test applies to Type2 UEs

9.7.1.3.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.1.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.1.3.5 Test procedure

Table 9.7.1.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.1.3.5-1
3. Set the parameters of the propagation condition according to Table 9.7.1.3.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with UEAssistanceInformation supported which maxCC-Preference-r16= supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. SS activates Cell B and configures the cell power according to T1 in Table 9.7.1.3.5-1
10. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
11. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B.
12. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 9.7.1.3.5-2 for parameter configuration, and release measurement GAP configuration.
13. The UE transmits an RRCReconfigurationComplete message
14. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
15. The power consumption tester records the changes of current.

16. Begin TCP downloads(100Mbps) for 3 minutes s and record TCP average throughput result. Verify data transmission on both PCC and SCC.
17. Get the value of power consumption tester during step 16 and calculate the average throughput.
18. The SS transmits an RRCReconfiguration message to configure maxCC-PreferenceProhibitTimer-r16= s5
19. The UE transmit an RRCReconfigurationComplete.
20. Use AT/ADB command to push UE sent UEAssistanceInformation including maxCC-Preference-r16 which set reducedMaxCCs-r16.
21. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321, clauses 5.9, 6.1.3.10).
22. Begin TCP downloads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on both PCC and SCC.
23. Get the value of power consumption tester during step 21 and calculate the average throughput.
24. The SS transmits an RRCReconfiguration message to add measurement GAP configuration.
25. SS configures the cell power according to T2 in Table 9.7.1.3.5-1
26. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
27. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
28. UE transmit an RRCReconfigurationComplete

POSTAMBLE

29. Switch Off UE, UE initiates a Detach procedure.
30. Deactivate Cell A and Cell B.

Table 9.7.1.3.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	
frequencyBandList	n41	
absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		

}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

9.7.1.3.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.1.3.6-1. The Current Should be less than [TBD]mA .

Table 9.7.1.3.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 17	[TBD]	[TBD]
Step 23	[TBD]	[TBD]

9.7.1.4 R16 UAI Reduced Maximum MIMO layers with Downlink Data Transmission

9.7.1.4.1 Test Purpose

Test to verify the signaling procedure of UAI reporting from 4 Maximum MIMO layers to 2 Maximum MIMO layers (DL) and test the power consumption between UAI reporting ON and UAI reporting OFF.

9.7.1.4.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.1.4.3 Applicability

This test applies to Type2 UEs

9.7.1.4.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.1.4.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE
UE is powered off

9.7.1.4.5 Test procedure

Table 9.7.1.4.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH,	dBm/SCS	-75

	SSS EPRE		

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.1.4.5-1
3. Set the parameters of the propagation condition according to Table 9.7.1.4.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with UEAssistanceInformation supported which maxMIMO-LayerPreference-r16= supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. The power consumption tester records the changes of current.
10. Begin TCP downloads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
11. Get the value of power consumption tester during step 9 and calculate the average throughput.
12. The SS transmits an RRCReconfiguration message to configure maxMIMO-LayerPreferenceProhibitTimer-r16= s5.
13. The UE transmit an RRCReconfigurationComplete.
14. Use AT/ADB command to push UE sent UEAssistanceInformation including maxMIMO-LayerPreference-r16 which set reducedMIMO-LayersFR1-DL-r16=2.
15. The SS transmits an RRCReconfiguration message to configure maxMIMO-Layers=2 of PDSCH-ServingCellConfig and sets maxMIMO-Layers=2 of DCI format 1_1.
16. The UE transmit an RRCReconfigurationComplete.
17. Begin TCP downloads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
18. Get the value of power consumption tester during step 16 and calculate the average throughput.

POSTAMBLE

19. Switch Off UE, UE initiates a Detach procedure.
20. Deactivate Cell A.

9.7.1.4.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.1.4.6-1. The Current Should be less than [TBD]mA .

Table 9.7.1.4.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 11	[TBD]	[TBD]
Step 18	[TBD]	[TBD]

9.7.1.5 R16 UAI RRC release

9.7.1.5.1 Test Purpose

Test to verify the signaling procedure of UAI reporting from releasing RRC connection in advance and test the power consumption between UAI reporting ON and UAI reporting OFF. (Only idle state needed)

9.7.1.5.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.1.5.3 Applicability

This test applies to Type2 UEs

9.7.1.5.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.1.5.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.

UE

UE is powered off

9.7.1.5.5 Test procedure

Table 9.7.1.5.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.1.5.5-1
3. Set the parameters of the propagation condition according to Table 9.7.1.5.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with UEAssistanceInformation supported which releasePreference-r16= supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. Wait for 1 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes.
10. The SS transmits an RRCReconfiguration message to configure releasePreferenceProhibitTimer-r16= s5.
11. The UE transmit an RRCReconfigurationComplete.
12. Use AT/ADB command to push UE sent UEAssistanceInformation including ReleasePreference-r16 which set preferredRRC-State-r16= idle.
13. The SS transmits an RRCRelease.
14. Wait for 1 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes.

POSTAMBLE

15. Switch Off UE, UE initiates a Detach procedure.
16. Deactivate Cell A.

9.7.1.5.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.1.5.6-1. The Current Should be less than [TBD]mA .

Table 9.7.1.5.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 9	[TBD]	[TBD]
Step 14	[TBD]	[TBD]

9.7.2 R16 Wakeup Signal (WUS)

9.7.2.1 DCI 2_6 signal configuration

9.7.2.1.1 Test Purpose

Test to verify the signaling procedure of WUS and test the power consumption between WUS feature ON and WUS feature OFF.

9.7.2.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.2.1.3 Applicability

This test applies to Type2 UEs

9.7.2.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.2.1.5 Test procedure

Table 9.7.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.2.1.5-1
3. Set the parameters of the propagation condition according to Table 9.7.2.1.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message which drx-Adaptation-r16 = supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. The SS transmits an RRCReconfiguration message to configure DRX-Config. Refer to Table 9.7.2.1.5-2 for parameter configuration.
10. The UE transmit an RRCReconfigurationComplete.
11. Wait for 1 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes.

12. The SS transmits an RRCReconfiguration message to configure DCP-Config-r16. Refer to Table 9.7.2.1.5-3 for parameter configuration.
13. The UE transmit an RRCReconfigurationComplete.
14. Wait for 1 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes.

POSTAMBLE

15. Switch Off UE, UE initiates a Detach procedure.
16. Deactivate Cell A.

Table 9.7.2.1.5-2: DRX-Config in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
DRX-Config CHOICE {		
setup SEQUENCE {		
drx-onDurationTimer CHOICE {		
milliSeconds	ms10	
}		
drx-InactivityTimer	[ms80]	
drx-HARQ-RTT-TimerDL	[14]	
drx-HARQ-RTT-TimerUL	[14]	
drx-RetransmissionTimerDL	[sl 8]	
drx-RetransmissionTimerUL	[sl 8]	
drx-LongCycleStartOffset CHOICE {		
ms160	0	
}		
shortDRX	not present	
drx-SlotOffset	0	
}		
}		

Table 9.7.2.1.5-3: DCP-Config-r16 in *RRCReconfiguration* Message in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
DCP-Config-r16 ::= SEQUENCE {	1 entry	
ps-RNTI-r16	RNTI value for scrambling CRC of DCI format 2-6 used for power saving	
ps-Offset-r16	40	
sizeDCI-2-6-r16	39	
ps-PositionDCI-2-6-r16	0	
ps-WakeUp-r16	true	
ps-TransmitPeriodicL1-RSRP-r16	Not present	

ps-TransmitOtherPeriodicCSI-r16	Not present	
}		

9.7.2.1.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.2.1.6-1. The Current Should be less than [TBD]mA .

Table 9.7.2.1.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 11	[TBD]	[TBD]
Step 14	[TBD]	[TBD]

9.7.2.2 DCI 2_6 signal configuration & periodic RSRP, periodic CSI-RS, ps-offset configuraiton

9.7.2.2.1 Test Purpose

Test to verify the signaling procedure of configuring periodic RSRP, periodic CSI-RS, ps-offset configuraiton in WUS feature.

9.7.2.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.2.2.3 Applicability

This test applies to Type2 UEs

9.7.2.2.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.2.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.2.2.5 Test procedure

Table 9.7.1.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.2.2.5-1
3. Set the parameters of the propagation condition according to Table 9.7.2.2.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message which drx-Adaptation-r16= supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. The SS transmits an RRCReconfiguration message to configure DRX-Config. Refer to Table 9.7.2.2.5-2 for parameter configuration.
10. The UE transmit an RRCReconfigurationComplete.
11. Wait for 1 minutes and then start power consumption tester records the changes of current

and voltage for another 3 minutes.

12. The SS transmits an RRCReconfiguration message to configure DCP-Config-r16. Refer to Table 9.7.2.2.5-3 for parameter configuration.
13. The UE transmit an RRCReconfigurationComplete.
14. Wait for 1 minutes and then start power consumption tester records the changes of current and voltage for another 3 minutes.

POSTAMBLE

15. Switch Off UE, UE initiates a Detach procedure.
16. Deactivate Cell A.

Table 9.7.2.2.5-2: DRX-Config in *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
DRX-Config CHOICE {		
setup SEQUENCE {		
drx-onDurationTimer CHOICE {		
milliSeconds	ms10	
}		
drx-InactivityTimer	[ms80]	
drx-HARQ-RTT-TimerDL	[14]	
drx-HARQ-RTT-TimerUL	[14]	
drx-RetransmissionTimerDL	[sl 8]	
drx-RetransmissionTimerUL	[sl 8]	
drx-LongCycleStartOffset CHOICE {		
ms160	0	
}		
shortDRX	not present	
drx-SlotOffset	0	
}		
}		

Table 9.7.2.2.5-3: DCP-Config-r16 in *RRCReconfiguratio*n Message in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
DCP-Config-r16 {	1 entry	
ps-RNTI-r16	RNTI value for scrambling CRC of DCI format 2-6 used for power saving	
ps-Offset-r16	1	
sizeDCI-2-6-r16	1	
ps-PositionDCI-2-6-r16	0	
ps-WakeUp-r16	true	

ps-TransmitPeriodicL1-RSRP-r16	true	
ps-TransmitOtherPeriodicCSI-r16	true	
}		

9.7.2.2.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.2.2.6-1. The Current Should be less than [TBD]mA .

Table 9.7.2.2.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 11	[TBD]	[TBD]
Step 14	[TBD]	[TBD]

9.7.3 R16 Maximum MIMO layers Adaptation (BWP spatial domain adaptation)

9.7.3.1 DL 4 Maximum MIMO layers to 2 Maximum MIMO layers

9.7.3.1.1 Test Purpose

Test to verify the signaling procedure of R16 Maximum MIMO layers adaptation feature from 4 Maximum MIMO layers to 2 Maximum MIMO layers and test the power consumption between them.

9.7.3.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.3.1.3 Applicability

This test applies to Type2 UEs

9.7.3.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = FALSE
UL TX Power=0dBm

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.3.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.3.1.5 Test procedure

Table 9.7.3.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.3.1.5-1
3. Set the parameters of the propagation condition according to Table 9.7.3.1.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message which maxLayersMIMO-Adaptation-r16 = supported.

7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. The power consumption tester records the changes of current.
10. Begin TCP downloads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
11. Get the value of power consumption tester during step 10 and calculate the average throughput.
12. SS transmits NR RRCConnectionReconfiguration to configure BWP-1 and BWP-2. Refer to Table 9.7.3.1.5-2.
13. UE transmits RRCConnectionReconfigurationComplete
14. Begin TCP downloads(100Mbps) and keeps. Verify data transmission on Cell A.
15. SS sends DCI-0_1 with field:'Bandwidth part indicator="01" (bin)' to trigger the BWP change from BWP2 to BWP1.
16. UE correctly decode the DCIs in BWP2 and succeed switch to BWP1 and wait for 5 seconds.
17. SS sends DCI-0_1 with field:'Bandwidth part indicator="10" (bin)' to trigger the BWP change from BWP1 to BWP2.
18. UE correctly decode the DCIs in BWP1 and succeed switch to BWP2 and wait for 5 seconds.
19. Repeat steps 15 to 18 fifteen times.
20. Stop TCP and get the value of power consumption tester during step 15 to 19 and calculate the average throughput.
21. Begin TCP downloads(100Mbps) for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
22. Get the value of power consumption tester during step 21 and calculate the average throughput.

POSTAMBLE

23. Switch Off UE, UE initiates a Detach procedure.
24. Deactivate Cell A and Cell B.

Table 9.7.3.1.5-2: BWP-1 and BWP-2 in *RRCReconfiguratio*n Message in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
ServingCellConfig ::= SEQUENCE {		
……..		
downlinkBWP-ToReleaseList	Not Present	
downlinkBWP-ToAddModList SEQUENCE (SIZE (2)) OF BWP-Downlink		
BWP-Downlink [1] SEQUENCE {		
bwp-Id	1	
bwp-Common SEQUENCE {		
genericParameters ::= SEQUENCE {		

locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
bwp-Dedicated ::= SEQUENCE {		
……..		
pdsch-Config::= SEQUENCE {		
……..		
maxMIMO-Layers-r16	4	
……..		
}		
}		
}		
BWP-Downlink [2] SEQUENCE {		
bwp-Id	2	
bwp-Common SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	13750	20M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
bwp-Dedicated ::= SEQUENCE {		
……..		
pdsch-Config::= SEQUENCE {		
……..		
maxMIMO-Layers-r16	2	
……..		
}		
}		
}		
firstActiveDownlinkBWP-Id	2	
bwp-InactivityTimer	Not present	
defaultDownlinkBWP-Id	Not present	
uplinkConfig SEQUENCE {		
……..	……..	
uplinkBWP-ToReleaseList	Not Present	
uplinkBWP-ToAddModList SEQUENCE (SIZE (2)) OF BWP-Uplink		
BWP-Uplink[1] SEQUENCE {		

bwp-Id	1	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
……..		
}		
}		
BWP-Uplink[2] SEQUENCE {		
bwp-Id	2	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	13750	20M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
……..		
}		
}		
firstActiveUplinkBWP-Id	2	
}		
}		

9.7.3.1.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.3.1.6-1. The Current Should be less than [TBD]mA .

Table 9.7.3.1.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 11	[TBD]	[TBD]
Step 20	[TBD]	[TBD]
Step 22	[TBD]	[TBD]

9.7.3.2 DL 4 Maximum MIMO layers to 2 Maximum MIMO layers & UL 2 Maximum MIMO layers to 1 Maximum MIMO layers

9.7.3.2.1 Test Purpose

Test to verify the signaling procedure of R16 Maximum MIMO layers adaptation feature for both UL and DL and test the power consumption between feature ON and feature OFF.

9.7.3.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.3.2.3 Applicability

This test applies to Type2 UEs

9.7.3.2.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = FALSE
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = FALSE
UL TX Power=0dBm

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.3.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.

2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.3.2.5 Test procedure

Table 9.7.3.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.3.2.5-1
3. Set the parameters of the propagation condition according to Table 9.7.3.2.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message which maxLayersMIMO-Adaptation-r16 = supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. SS transmits NR RRCConnectionReconfiguration to configure BWP-1 and BWP-2. Refer to Table 9.7.3.2.5-2.
10. UE transmits RRCConnectionReconfigurationComplete
11. The power consumption tester records the changes of current.
12. Begin TCP downloads(100Mbps) and uploads(100Mbps) simultaneously and keeps. Verify data transmission on Cell A.
13. SS sends DCI-0_1 with field:‘Bandwidth part indicator=”01” (bin)’ to trigger the BWP change from BWP2 to BWP1.
14. UE correctly decode the DCIs in BWP2 and succeed switch to BWP1 and wait for 5 seconds.
15. SS sends DCI-0_1 with field:‘Bandwidth part indicator=”10” (bin)’ to trigger the BWP change from BWP1 to BWP2.
16. UE correctly decode the DCIs in BWP1 and succeed switch to BWP2 and wait for 5 seconds.
17. Repeat steps 13 to 16 fifteen times.
18. Stop TCP and get the value of power consumption tester during step 13 to 17 and calculate the average throughput.

19. Begin TCP downloads(100Mbps) and uploads(100Mbps) simultaneously for 3 minutes and record TCP average throughput result. Verify data transmission on Cell A.
20. Get the value of power consumption tester during step 17 and calculate the average throughput.

POSTAMBLE

21. Switch Off UE, UE initiates a Detach procedure.
22. Deactivate Cell A.

Table 9.7.3.2.5-2: BWP-1 and BWP-2 in *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
ServingCellConfig ::= SEQUENCE {		
……..		
downlinkBWP-ToReleaseList	Not Present	
downlinkBWP-ToAddModList SEQUENCE (SIZE (2)) OF BWP-Downlink		
BWP-Downlink [1] SEQUENCE {		
bwp-Id	1	
bwp-Common SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
bwp-Dedicated ::= SEQUENCE {		
……..		
pdsch-Config::= SEQUENCE {		
……..		
maxMIMO-Layers-r16	4	
……..		
}		
}		
}		
BWP-Downlink [2] SEQUENCE {		
bwp-Id	2	
bwp-Common SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	13750	20M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	

}		
……..		
}		
bwp-Dedicated ::= SEQUENCE {		
……..		
pdsch-Config::= SEQUENCE {		
……..		
maxMIMO-Layers-r16	2	
……..		
}		
}		
}		
firstActiveDownlinkBWP-Id	2	
bwp-InactivityTimer	Not present	
defaultDownlinkBWP-Id	Not present	
uplinkConfig SEQUENCE {		
……..	……..	
uplinkBWP-ToReleaseList	Not Present	
uplinkBWP-ToAddModList SEQUENCE (SIZE (2)) OF BWP-Uplink		
BWP-Uplink[1] SEQUENCE {		
bwp-Id	1	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
bwp-Dedicated ::= SEQUENCE {		
……..		
pusch-Config ::= SEQUENCE {		
……..		
maxRank	2	
……..		
}		
……..		
srs-Config CHOICE {		
setup ::= SEQUENCE {		
srs-ResourceSetToReleaseList	Not Present	
srs-ResourceSetToAddModList SEQUENCE (SIZE (1)) OF SRS-ResourceSet		

SRS-ResourceSet [1] SEQUENCE {		
srs-ResourceSetId	1	
nrofSRS-Ports	ports2	
……..		
}		
}		
}		
……..		
}		
BWP-Uplink[2] SEQUENCE {		
bwp-Id	2	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters ::= SEQUENCE {		
locationAndBandwidth	13750	20M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		
……..		
}		
bwp-Dedicated ::= SEQUENCE {		
……..		
pusch-Config ::= SEQUENCE {		
……..		
maxRank	1	
……..		
}		
……..		
srs-Config CHOICE {		
setup ::= SEQUENCE {		
srs-ResourceSetToReleaseList	Not Present	
srs-ResourceSetToAddModList SEQUENCE (SIZE (1)) OF SRS-ResourceSet		
SRS-ResourceSet [1] SEQUENCE {		
srs-ResourceSetId	1	
nrofSRS-Ports	port1	
……..		
}		
}		
}		
……..		
}		
}		
firstActiveUplinkBWP-Id	2	

}		
}		

9.7.3.2.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.3.2.6-1. The Current Should be less than [TBD]mA .

Table 9.7.3.2.6-1: Average throughput and current

Test point	Throughput (Mbps)	Average Current(mA)
Step 18	[TBD]	[TBD]
Step 20	[TBD]	[TBD]

9.7.4 Enhanced SkipUplinkTxDynamic

9.7.4.1 Enhanced SkipUplinkTxDynamic in normal pre-scheduling scene

9.7.4.1.1 Test Purpose

Test to verify the signaling procedure of Enhanced SkipUplinkTxDynamic feature in normal pre-scheduling scene and test the power consumption between feature ON and feature OFF.

9.7.4.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

9.7.4.1.3 Applicability

This test applies to Type2 UEs

9.7.4.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.4.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

9.7.4.1.5 Test procedure

Table 9.7.4.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.4.1.5-1
3. Set the parameters of the propagation condition according to Table 9.7.4.1.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message which enhancedSkipUplinkTxDynamic-r16 = supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE

message.UE is in state RRC_CONNECTED.

9. SS configs pro-scheduling and keep it all the time.
10. The power consumption tester records the changes of current.
11. Begin TCP(64Byte per 200ms) downloads for 3 minutes.
12. Get the value of power consumption tester during step 11 and calculate the average throughput.
13. SS transmits NR RRCConnectionReconfiguration to configure enhancedSkipUplinkTxDynamic-r16 = true.
14. UE transmits RRCConnectionReconfigurationComplete
15. Begin TCP(64Byte per 200ms) downloads for 3 minutes.
16. Get the value of power consumption tester during step 15 and calculate the average throughput.

POSTAMBLE

17. Switch Off UE, UE initiates a Detach procedure.
18. Deactivate Cell A and Cell B.

9.7.4.1.6 Expected Result

Record the average TCP throughput and current in the Table 9.7.4.1.6-1. The Current Should be less than [TBD]mA .

Table 9.7.4.1.6-1: Average throughput and current

Test point	PHY Throughput (Mbps)	PDCP Throughput (Mbps)	Average Current(mA)
Step 12	[TBD]	[TBD]	[TBD]
Step 16	[TBD]	[TBD]	[TBD]

9.7.5 Scell Dormancy

9.7.5.1 Scell Dormant BWP

9.7.5.1.1 Test Purpose

Test to verify the signaling procedure of Scell Dormancy and test the power consumption between feature ON and feature OFF. Comparing the power consumption between Scell Dormancy feature and MAC-CE deactivation method.

9.7.5.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.212,,3GPP TS 38.213,3GPP TS 38.331,3GPP TS 38.508

9.7.5.1.3 Applicability

This test applies to Type2 UEs

9.7.5.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 9.7.5.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

9.7.5.1.5 Test procedure

Table 9.7.5.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B

T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 9.7.5.1.5-1
3. Set the parameters of the propagation condition according to Table 9.7.5.1.4-1.

MAIN BODY

4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with CA-ParametersNR supported which scellDormancyInsideActiveTime-r16= supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.UE is in state RRC_CONNECTED.
9. SS activates Cell B and configures the cell power according to T1 in Table 9.7.5.1.5-1
10. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
11. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B.
12. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 9.7.5.1.5-2 for parameter configuration, and release measurement GAP configuration.
13. The UE transmits an RRCReconfigurationComplete message
14. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
15. The power consumption tester records the changes of current.
16. SS deactivates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.Wait for 2 seconds.
17. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10. Wait for 2 seconds.
18. Repeat steps 16 to 17 ten times.
19. Get the value of power consumption tester during step 16 to 18.
20. The SS transmits an RRCReconfiguration message to configure BWP-1 and DormantBWP-Config-r16. Refer to Table 9.7.5.1.5-4, Table 9.7.5.1.5-5 and Table 9.7.5.1.5-6
21. The UE transmit an RRCReconfigurationComplete.
22. SS instructs the UE to switch to the dormant DL BWP by sending the DCI format 1_1 include a SCell dormancy indication field ‘0’.Wait for 2 seconds.
23. SS instructs the UE to switch to the active DL BWP by sending the DCI format 1_1 include a SCell dormancy indication field ‘1’. Wait for 2 seconds.

24. Repeat steps 22 to 23 ten times.
25. Get the value of power consumption tester during step 22 to 24.
26. The SS transmits an RRCReconfiguration message to add measurement GAP configuration.
27. SS configures the cell power according to T2 in Table 9.7.5.1.5-1
28. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
29. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
30. UE transmit an RRCReconfigurationComplete

POSTAMBLE

31. Switch Off UE, UE initiates a Detach procedure.
32. Deactivate Cell A and Cell B.

Table 9.7.5.1.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 12

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	
frequencyBandList	n41	
absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	

nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

Table 9.7.5.1.5-4: BWP in *RRCReconfiguration* Message in step 20

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
ServingCellConfig ::= SEQUENCE {		
……..		
downlinkBWP-ToReleaseList	Not Present	
downlinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Downlink		
BWP-Downlink [1] SEQUENCE {		
bwp-Id	1	
bwp-Common SEQUENCE {		
genericParameters	BWP	Table 9.7.5.1.5-5
……..		
}		
……..		
}		
firstActiveDownlinkBWP-Id	0	
bwp-InactivityTimer	Not present	
defaultDownlinkBWP-Id	Not present	
uplinkConfig SEQUENCE {		
……..	……..	
uplinkBWP-ToReleaseList	Not Present	
uplinkBWP-ToAddModList SEQUENCE (SIZE (1)) OF BWP-Uplink		
BWP-Uplink[1] SEQUENCE {		
bwp-Id	1	
BWP-UplinkCommon ::= SEQUENCE {		
genericParameters	BWP	Table 9.7.5.1.5-5
……..		
……..		
}		
……..		
}		
}		
firstActiveUplinkBWP-Id	0	
}		

dormantBWP-Config-r16 CHOICE {		
setup	DormantBWP-Config-r16	Table 9.7.5.1.5-6
}		
}		

Table 9.7.5.1.5-5: BWP Parameters in step 20

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
BWP ::= SEQUENCE {		
locationAndBandwidth	1099	100M
subcarrierSpacing	kHz30	
cyclicPrefix	Not present	
}		

Table 9.7.5.1.5-6: DormantBWP-Config-r16 Parameters in step 20

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
DormantBWP-Config-r16 ::= SEQUENCE {		
dormantBWP-Id-r16	1	
withinActiveTimeConfig-r16 CHOICE {		
setup SEQUENCE{		
firstwithinActiveTimeBWP-Id-r16	0	
dormancyGroupwithinActiveTime-r16 SEQUENCE{		
DormancyGroupID-r16	0	
}		
}		
}		
outsideActiveTimeConfig-r16	Not present	
}		

9.7.5.1.6 Expected Result

Record the average current in the Table 9.7.5.1.6-1. The Current Should be less than [TBD]mA .

Table 9.7.5.1.6-1: Average current

Test point	Average Current(mA)
Step 19	[TBD]
Step 25	[TBD]

10 Data Throughput

10.1 Downlink TCP Throughput

10.1.1 DL Throughput under static channel, DL 256QAM, DL4*4 MIMO

10.1.1.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation,256QAM, DL 4*4 MIMO

10.1.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.1.1.3 Applicability

This test applies to Type 2 UEs.

10.1.1.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.1.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.1.1.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

Table 10.1.1.4-3: Test band configuration

Test Point	Test band	NR Frame Structure	Specail Frame
1	n41	DD DD DD DS UU	DDDDDDGGGGUUUU
2	n79	DSUUU DSUUU	DDDDDDDDDDGGUU
3	n79	DDDSU DDSUU	DDDDDDDDDDGGUU

Each test point should be tested as an independent test case

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.1.1.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the

fixed transport format and transport block size.

3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.1.1.4-1 & Table 10.1.1.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.1.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 1-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
			Cell Power is set		
4	UE		Switch On UE	AT Command	
5	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message		
7	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
8			Using FTP Client begin FTP Download		PASS

9			Repeat Step 8		
10	SS		Calculate Average Throughput		PASS
11			Switch Off UE	AT Command	
12	SS		Deactivate Cell A		

10.1.1.6 Expected Result

1. Calculate and record the average throughput on TCP layer.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.1.1.6-1: Expected Result

Test Point	Test band	Expected DL TCP Throughput
1	n41	[1.53 Gbps]
2	n79	[0.78 Gbps]
3	n79	[TBD]

10.1.2 DL Throughput under fading channel, DL 256QAM, DL4*4 MIMO

10.1.2.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Fading Channel, SA Option2, 100 MHz BW, Full Resource Allocation,256QAM, DL 4*4 MIMO

10.1.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.1.2.3 Applicability

This test applies to Type 2 UEs.

10.1.2.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full

simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Fading Profile : TDLA30	Low
NR-2	Fading Profile : TDLB100	Low
NR-3	Fading Profile : TDLC300	Low

Table 10.1.2.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.1.2.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.1.2.4-1 & Table 10.1.2.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.1.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		

2	SS		SS transmits PDSCH via PDCCH DCI format 1-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
			Cell Power is set		
4	UE		Switch On UE	AT Command	
5	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message		
7	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
8			Using FTP Client begin FTP Download		PASS
9			Repeat Step 8		
10	SS		Calculate Average Throughput		PASS
11			Switch Off UE	AT Command	
12	SS		Deactivate Cell A		

10.1.2.6 Expected Result

1. Calculate and record the average throughput.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.1.2.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]
NR-1	FFS
NR-2	FFS
NR-3	FFS

10.1.3 DL Throughput under static channel, DL 256QAM, DL2*2 MIMO

10.1.3.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Static Channel, SA Option2, Full Resource Allocation,256QAM, DL 2*2 MIMO

10.1.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.1.3.3 Applicability

This test applies to Type 2 UEs.

10.1.3.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableDL2x2MIMO = TRUE
enableDL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.1.3.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

Table 10.1.3.4-3: Test band configuration

Test Point	Test band	NR Frame Structure	Specail Frame	Test Frequency
1	n28	/	/	f1
2	n28	/	/	f2
Note: 1. Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency				

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 2x2.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.1.3.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.1.3.4-1 & Table 10.1.3.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.1.3.5-1: Message Sequence

Step	Message Sequence	Verdict

	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 1-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
			Cell Power is set		
4	UE		Switch On UE	AT Command	
5	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message		
7	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
8			Using FTP Client begin FTP Download		PASS
9			Repeat Step 8		
10	SS		Calculate Average Throughput		PASS
11			Switch Off UE	AT Command	
12	SS		Deactivate Cell A		

10.1.3.6 Expected Result

1. Calculate and record the average throughput on TCP layer.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.1.3.6-1: Expected Result

Test Point	Test band	Expected DL TCP Throughput
1	n28	[TBD]
2	n28	[TBD]

10.2 Uplink TCP Throughput

10.2.1 UL Throughput under static channel, UL 64QAM, UL2*2 MIMO

10.2.1.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted,

Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, UL 64QAM, UL 2*2 MIMO

10.2.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.2.1.3 Applicability

This test applies to Type 2 UEs.

10.2.1.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL2x2MIMO = TRUE
enableUL64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.2.1.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)

N_{oc} at antenna port	dBm/30kHz	-98
Reporting mode		PUCCH 1-0
Note 1: $P_B = 1$		

Table 10.2.1.4-3: Test band configuration

Test Point	Test band	NR Frame Structure	Specail Frame
1	n41	DD DD DD DS UU	DDDDDDGGGGUUUU
2	n79	DSUUU DSUUU	DDDDDDDDDDGGUU
3	n79	DDDSU DDSUU	DDDDDDDDDDGGUU

Each test point should be tested as an independent test case.

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.2 for NR UL MIMO.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.2.1.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.2.1.4-1 & Table 10.2.1.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the TCPclient, begin TCP upload from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.2.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PUSCH via PUCCH DCI format 0-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
			Cell Power is set		
4	UE		Switch On UE	AT Command	
5	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message		
7	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
8			Using TCP Client begin TCP Upload		PASS
9			Repeat Step 8		
10	SS		Calculate Average Throughput on Uplink		PASS
11			Switch Off UE	AT Command	
12	SS		Deactivate Cell A		

10.2.1.6 Expected Result

1. Calculate and record the average TCP throughput.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.2.1.6-1: expected result

Test Point	Test band	Expected DL TCP Throughput
1	n41	[188 Mbps]
2	n79	[571 Mbps]
3	n79	[TBD]

10.2.2 UL Throughput under static channel, UL 256QAM, Single TX, HPUE

10.2.2.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, SA Option2, Full Resource Allocation, UL 256QAM, Single TX, HPUE

10.2.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.2.2.3 Applicability

This test applies to Type 2 UEs.

10.2.2.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.2.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.2.2.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

Table 10.2.2.4-3: Test band configuration

Test Point	Test band	NR Frame Structure	Specail Frame	Test Frequency
1	n41	DD DD DD DS UU	DDDDDDGGGGUUUU	f1
2	n79	DSUUU DSUUU	DDDDDDDDDDGGUU	f1
3	n79	DDDSU DDSUU	DDDDDDDDDDGGUU	f1
4	n28	/	/	f1
5	n28	/	/	f2
Note: 1. Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency.				

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.1.1.1 for basic single cell.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.2.2.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.2.2.4-1 & Table 10.2.2.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the TCP client, begin TCP upload from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.2.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PUSCH via PUCCH DCI format 0-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		

			Cell Power is set		
4	UE		Switch On UE	AT Command	
5	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message		
7	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
8			Using TCP Client begin TCP Upload		PASS
9			Repeat Step 8		
10	SS		Calculate Average Throughput on Uplink		PASS
11			Switch Off UE	AT Command	
12	SS		Deactivate Cell A		

10.2.2.6 Expected Result

1. Calculate and record the average TCP throughput.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.2.2.6-1: expected result

Test Point	Test band	Expected UL TCP Throughput
1	n41	[125 Mbps]
2	n79	[380 Mbps]
3	n79	[TBD]
4	n28	[TBD]
5	n28	[TBD]

10.2.3 UL Throughput under static channel, UL 256QAM, UL2*2 MIMO

10.2.3.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, UL 256QAM, UL2*2 MIMO

10.2.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.2.3.3 Applicability

This test applies to Type 2 UEs.

10.2.3.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = FFS MNC = FFS
NR-ARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.2.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.2.3.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

Table 10.2.3.4-3: Test band configuration

Test Points	Test band	NR Frame Structure	Specail Frame
1	n41	DD DD DD DS UU	DDDDDDGGGGUUUU
2	n79	DSUUU DSUUU	DDDDDDDDDDGGUU
3	n79	DDDSU DDSUU	DDDDDDDDDDGGUU

Each test point should be tested as an independent test case.

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.2 for NR UL MIMO.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.2.3.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.2.3.4-1 & Table 10.2.3.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the TCP client, begin TCP upload from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.2.3.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PUSCH via PUCCH DCI format 0-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
			Cell Power is set		
4	UE		Switch On UE	AT Command	
5	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
6	←	RRC	SS sends RRC Connection Reconfiguration message		
7	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
8			Using TCP Client begin TCP Upload		PASS
9			Repeat Step 8		
10	SS		Calculate Average Throughput on Uplink		PASS
11			Switch Off UE	AT Command	
12	SS		Deactivate Cell A		

10.2.3.6 Expected Result

1. Calculate and record the average TCP throughput.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.2.3.6-1: expected result

Test Point	Test band	Expected DL TCP Throughput
1	n41	[250Mbps]
2	n79	[760 Mbps]
3	n79	[TBD]

10.3 Bidirectional UDP Throughput

10.3.1 Bidirectional Throughput under static channel,256QAM, DL 4*4 and UL 2*2 MIMO

10.3.1.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, 256QAM, DL 4*4 and UL 2*2 MIMO

10.3.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.3.1.3 Applicability

This test applies to Type 2 UEs.

10.3.1.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableDL4x4MIMO = TRUE
enableDL256QAM = TRUE
enableUL2x2MIMO = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.3.1.4-1: Test Points Configuration

Test Point	Propagation	Correlation

	Conditions	Matrices
NR-1	Static	N/A

Table 10.3.1.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

Table 10.3.1.4-3: Test band configuration

Test Points	Test band	NR Frame Structure	Specail Frame
1	n41	DD DD DD DS UU	DDDDDDGGGGUUUU

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.3.1.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.3.1.4-1 & Table 10.3.1.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the UDP client, begin UDP download and upload simultaneously from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.3.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 1-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	← →	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
7	←	RRC	SS sends RRC Connection Reconfiguration message		

8	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
9			Using UDP Client begin UDP Download and Upload simultaneously		PASS
10			Repeat Step 9		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.3.1.6 Expected Result

1. Calculate and record the average TCP throughput.
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.3.1.6-1: expected result

Test Point	Band	Expected DL UDP Throughput	Expected UL UDP Throughput
1	n41	[1.53 Gbps]	[250 Mbps]

10.3.2 Bidirectional Throughput under fading channel,256QAM, DL 4*4 and UL 2*2 MIMO

10.3.2.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Fading Channel, SA Option2, 100 MHz BW, Full Resource Allocation, 256QAM, DL 4*4 and UL 2*2 MIMO

10.3.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.3.2.3 Applicability

This test applies to Type 2 UEs.

10.3.2.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
rootSequenceIndex = 0

DL Modulation / Coding = 27
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableDL4x4MIMO = TRUE
enableDL256QAM = TRUE
enableUL2x2MIMO = TRUE
enableUL64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=5ms

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.3.2.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Fading Profile : TDLA30	Low
NR-2	Fading Profile : TDLB100	Low
NR-3	Fading Profile : TDLC300	Low

Table 10.3.2.4-2: Test Parameters for Testing

Parameter		**Unit**	**Value**
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.3.2.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.3.2.4-1 & Table 10.3.2.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the UDP client, begin UDP download and upload simultaneously from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.3.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 1-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
7	←	RRC	SS sends RRC Connection Reconfiguration message		
8	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
9			Using UDP Client begin UDP Download and Upload Simultaneously		PASS
10			Repeat Step 9		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.3.2.6 Expected Result

1. Calculate and record the average throughput.

2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.

3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.3.2.6-1: expected result

Band	Test Point	Expected DL Throughput	Expected UL Throughput
n41	NR-1	FFS	FFS
n41	NR-2	FFS	FFS
n41	NR-3	FFS	FFS

10.3.3 Bidirectional Throughput under static channel,256QAM, DL 2*2 and UL Single TX

10.3.3.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Static Channel, SA Option2, Full Resource Allocation, 256QAM, DL 2*2 and UL Single TX.

10.3.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.3.3.3 Applicability

This test applies to Type 2 UEs.

10.3.3.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
rootSequenceIndex = 0
DL Modulation / Coding = 27
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableDL2x2MIMO = TRUE
enableDL256QAM = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.3.1.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

Table 10.3.1.4-3: Test band configuration

Test Point	Test band	NR Frame Structure	Specail Frame	Frequency Range
1	n28	/	/	f1
2	n28	/	/	f2
Note:				

1. Each test point should be tested as an independent test case. 2. Check section 4.1.2.1 for details of test frequency

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 2x2.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.3.3.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 10.3.1.4-1 & Table 10.3.1.4-2.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.

7. UE transmit an RRC Connection Reconfiguration Complete message to SS.
8. Using the UDP client, begin UDP download and upload simultaneously from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

Table 10.3.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 1-0 for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	← →	NAS RRC	UE performs Registration procedure on NR-RAN Cell A		PASS
7	←	RRC	SS sends RRC Connection Reconfiguration message		
8	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
9			Using UDP Client begin UDP Download		PASS
10			Repeat Step 9		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.3.3.6 Expected Result

1. Calculate and record the average TCP throughput.

2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.

3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.3.1.6-1: expected result

Test Point	Band	Expected DL UDP Throughput	Expected UL UDP Throughput
1	n28	[TBD]	[TBD]
2	n28	[TBD]	[TBD]

10.4 Downlink TCP Throughput, NSA

10.4.1 DL Throughput under static channel, NSA

10.4.1.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, 256QAM, DL NR 4*4 MIMO + LTE 2*2 MIMO, data transmission on MCG and SCG simultaneously

10.4.1.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.4.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.4.1.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,

Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.4.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	Static	N/A

Table 10.4.1.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.
Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

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1. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
2. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
3. Connect an application server to the IP output of the SS configured with a FTP server.
4. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
5. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
6. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
7. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.4.1.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.4.1.4-1, Table 10.4.1.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 5.1.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish MCG & SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.

12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.4.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.4.1.6 Expected Result

1. Calculate and record the average downlink TCP throughput
2. Calculate and record the average downlink throughput in MAC layer in SCG cell and MCG cell respectively
3. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.

4. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.4.1.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected DL TCP Throughput	Expected DL MAC Throughput in MCG	Expected DL MAC Throughput in SCG
B3+n41	[1.8 Gbps]	[100 Mbps]	[1.7 Gbps]

10.4.2 DL Throughput under fading channel, NSA

10.4.2.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, fading Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, dynamic scheduling based on channel condition, data transmission on MCG and SCG simultaneously

10.4.2.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.4.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.4.2.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full
RB Allocation DL = Full

simultaneousAckNackAndCQI = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.4.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	LTE Fading Profile : EPA5 , NR Fading Profile : TDLA30	Low
NSA-2	LTE Fading Profile : EPA5 , NR Fading Profile : TDLB100	Low
NSA-3	LTE Fading Profile : EVA5 , NR Fading Profile : TDLC300	Low

Table 10.4.2.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

Frequencies to be tested: Mid Range, as defined in TS 36.508 & TS 38.508-1 for LTE & NR respectively.

1. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
2. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
3. Connect an application server to the IP output of the SS configured with a FTP server.
4. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
5. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
6. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
7. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.4.2.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.4.2.4-1, Table 10.4.2.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.4.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish MCG & SCG.

9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.4.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.4.2.6 Expected Result

1. Calculate and record the average downlink TCP throughput.
2. Calculate and record the average downlink throughput in MAC layer in SCG cell and MCG cell respectively

3. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
4. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.4.2.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Test Point	Expected DL TCP Throughput	Expected DL MAC Throughput in MCG	Expected DL MAC Throughout in SCG
B3+n41	NSA-1	FFS	FFS	FFS
B3+n41	NSA-2	FFS	FFS	FFS
B3+n41	NSA-3	FFS	FFS	FFS

10.4.3 DL Throughput under static channel on SCG, DL 256QAM, NSA

10.4.3.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, Static Channel, NSA Option3x, 100 MHz BW, Full Resource Allocation, 256QAM, DL NR 4*4 MIMO, data transmission on SCG

10.4.3.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.4.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.4.3.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.4.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	Static	N/A

Table 10.4.3.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

.

1. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
2. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
3. Connect an application server to the IP output of the SS configured with a FTP server.
4. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
5. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
6. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
7. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.4.3.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.4.1.4-1, Table 10.4.1.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 5.1.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.

10. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.4.3.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.4.3.6 Expected Result

1. Calculate and record the average downlink TCP throughput
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.

3. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.4.3.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected DL TCP Throughput
B3+n41	[1.7Gbps]
B3+n79	[0.78 Gbps]

10.4.4 DL Throughput under fading channel on SCG, NSA

10.4.4.1 Test Purpose

To measure the UE application layer downlink performance while downloading TCP based data in Conducted, fading Channel, NSA Option3x, 100 MHz BW, Full Resource Allocation, dynamic scheduling based on channel condition, data transmission on SCG

10.4.4.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.4.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.4.4.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full

RB Allocation DL = Full

simultaneousAckNackAndCQI = TRUE

CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.4.4.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NSA-1	LTE Fading Profile : EPA5 , NR Fading Profile : TDLA30	Low
NSA-2	LTE Fading Profile : EPA5 , NR Fading Profile : TDLB100	Low
NSA-3	LTE Fading Profile : EVA5 , NR Fading Profile : TDLC300	Low

Table 10.4.4.4-2: Test Parameters for Testing

Parameter		**Unit**	**Value**
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

1. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
2. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
3. Connect an application server to the IP output of the SS configured with a FTP server.
4. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
5. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
6. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
7. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.4.4.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.4.2.4-1, Table 10.4.2.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.4.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 sub clause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.

9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.4.4.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.4.4.6 Expected Result

1. Calculate and record the average downlink TCP throughput.
2. Calculate and record the average downlink throughput in MAC layer in SCG cell

3. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
4. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 10.4.4.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Test Point	Expected DL TCP Throughput	Expect DL MAC Throughout in SCG
B3+n41	NSA-1	FFS	FFS
B3+n41	NSA-2	FFS	FFS
B3+n41	NSA-3	FFS	FFS

10.5 Uplink TCP Throughput, NSA

10.5.1 UL Throughput under static channel, UL 64QAM, NSA

10.5.1.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, UL NR 64QAM+LTE 64QAM,data transmission on MCG and SCG simultaneously

10.5.1.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.5.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.5.1.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE

enableUl64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUl64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.5.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.5.1.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Configurations of LTE PUSCH and PUCCH before measurement are specified in Annex H.2 of TS 36.521-1.

Configurations of NR PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
4. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
5. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
6. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.5.1.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.5.1.4-1, Table 10.5.1.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.5.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish MCG & SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.

10. Using the FTP client, begin FTP upload from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the uplink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.5.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0_for C_RNTI to transmit the DL data using the fixed transport format and transport block size.		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Upload		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A		

10.5.1.6 Expected Result

1. Calculate and record the average uplink TCP throughput.
2. Calculate and record the average uplink throughput in MAC layer in SCG cell and MCG cell respectively
3. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
4. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.5.1.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL TCP Throughput	Expected UL MAC Throughput in MCG	Expected UL MAC Throughput in SCG
B3+n41	[130 Mbps]	[37 Mbps]	[95 Mbps]

10.5.2 UL Throughput under static channel, UL 256QAM, NSA

10.5.2.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, UL NR 256QAM+LTE 64QAM,data transmission on MCG and SCG simultaneously

10.5.2.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.5.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.5.2.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUl64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUl256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.5.2.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

Table 10.5.2.4-2: Test Parameters for Testing

Parameter		**Unit**	**Value**
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
LTE N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Configurations of LTE PUSCH and PUCCH before measurement are specified in Annex H.2 of TS 36.521-1.
Configurations of NR PUSCH and PUCCH before measurement are specified in Annex G.2 of

TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
4. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
5. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
6. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.5.2.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the DL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.5.2.4-1, Table 10.5.2.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.5.2.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish MCG & SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the FTP client, begin FTP upload from the application server for [90] seconds and

record Throughput result.

11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.5.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Upload		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A		

10.5.2.6 Expected Result

1. Calculate and record the average UL TCP throughput.
2. Calculate and record the average uplink throughput in MAC layer in SCG cell and MCG cell respectively
3. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
4. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.5.2.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL TCP Throughput	Expected UL MAC Throughput in MCG	Expected UL MAC Throughput in SCG
B3+n41	[162 Mbps]	[37 Mbps]	[125 Mbps]

10.5.3 UL Throughput under static channel on SCG, UL 64QAM, NSA

10.5.3.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, UL NR 64QAM，data transmission on SCG

10.5.3.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.5.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.5.3.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 10
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUl64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.5.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.5.3.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Configurations of LTE PUSCH and PUCCH before measurement are specified in Annex H.2 of TS 36.521-1.
Configurations of NR PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
4. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
5. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
6. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.5.3.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.5.1.4-1, Table 10.5.1.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.5.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the FTP client, begin FTP upload from the application server for [90] seconds and record Throughput result.

11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.5.3.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Upload		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A		

10.5.3.6 Expected Result

1. Calculate and record the average uplink TCP throughput.

2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
3. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.5.3.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL TCP Throughput
B3+n41	[95Mbps]
B3+n79	[285 Mbps]

10.5.4 UL Throughput under static channel on SCG, UL 256QAM, NSA

10.5.4.1 Test Purpose

To measure the UE application layer uplink performance while uploading TCP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, UL NR 256QAM data transmission on SCG

10.5.4.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.5.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.5.4.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
UL Modulation / Coding = 10
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1

rootSequenceIndex = 0
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUl256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.5.4.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 10.5.4.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Configurations of LTE PUSCH and PUCCH before measurement are specified in Annex H.2 of TS 36.521-1.
Configurations of NR PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.
Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.1.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
4. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
5. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
6. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.5.4.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.5.2.4-1, Table 10.5.2.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.5.2.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the FTP client, begin FTP upload from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during

the file transfer over all iterations.

13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.5.4.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits LTE PUSCH via PUCCH DCI format 0 for C_RNTI to transmit the UL data using the transport format and transport block size. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using FTP Client begin FTP Upload		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A		

10.5.4.6 Expected Result

1. Calculate and record the average UL TCP throughput
2. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.

3. The average uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.5.4.6-1: Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL TCP Throughput
B3+n41	[125Mbps]
B3+n79	[380 Mbps]

10.6 Bidirectional UDP Throughput, NSA

10.6.1 Bidirectional Throughput under static channel, 256QAM, NSA

10.6.1.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, DL NR 4*4 MIMO+ LTE2*2 MIMO, DL NR 256QAM+ LTE 256QAM, UL NR 256QAM+LTE 64QAM, data transmission on MCG and SCG simultaneously

10.6.1.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.6.1.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.6.1.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
UL Modulation / Coding = 28RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableDL256QAM= TRUE
enableUL64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enableDL256QAM = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.6.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	Static	N/A

Table 10.6.1.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of

TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

Frequencies to be tested: Mid Range, as defined in TS 36.508 & TS 38.508-1 for LTE & NR respectively.

1. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
2. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
3. Connect an application server to the IP output of the SS configured with a UDP server.
4. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
5. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
6. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
7. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.6.1.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.6.1.4-1, Table 10.6.1.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.6.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish MCG & SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.

10. Using the UDP client, begin UDP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.6.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using UDP Client begin UDP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.6.1.6 Expected Result

1. Calculate and record the average uplink UDP throughput and downlink UDP throughput.
2. Calculate and record the average downlink throughput in MAC layer in SCG cell and MCG cell respectively

3. Calculate and record the average uplink throughput in MAC layer in SCG cell and MCG cell respectively
4. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
5. The average downlink and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.1.6-1: DL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected DL UDP Throughput	Expected DL MAC Throughput in MCG	Expected DL MAC Throughput in SCG
B3+n41	FFS	FFS	FFS

Table 10.6.1.6-2: UL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL UDP Throughput	Expected UL MAC Throughput in MCG	Expected UL MAC Throughput in SCG
B3+n41	FFS	FFS	FFS

10.6.2 Bidirectional Throughput under fading channel, NSA

10.6.2.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, fading Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, dynamic scheduling based on channel condition, data transmission on MCG and SCG simultaneously

10.6.2.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.6.2.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2..

10.6.2.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full

RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.6.2.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NSA-1	LTE Fading Profile : EPA5 , NR Fading Profile : TDLA30	Low
NSA-2	LTE Fading Profile : EPA5 , NR Fading Profile : TDLB100	Low
NSA-3	LTE Fading Profile : EVA5 , NR Fading Profile : TDLC300	Low

Table 10.6.2.4-2: Test Parameters for Testing

Parameter		**Unit**	**Value**
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

Frequencies to be tested: Mid Range, as defined in TS 36.508 & TS 38.508-1 for LTE & NR respectively.

1. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
2. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
3. Connect an application server to the IP output of the SS configured with a UDP server.
4. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
5. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
6. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
7. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.6.2.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.6.2.4-1, Table 10.6.2.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.6.2.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish MCG & SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the UDP client, begin UDP download and upload with the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.6.2.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using UDP Client begin UDP Download		PASS
11			Repeat Step 10		

12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.6.2.6 Expected Result

1. Calculate and record the average uplink UDP throughput and downlink UDP throughput.
2. Calculate and record the average downlink throughput in MAC layer in SCG cell and MCG cell respectively
3. Calculate and record the average uplink throughput in MAC layer in SCG cell and MCG cell respectively
4. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
5. The average downlink and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.2.6-1: DL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Test Point	Expected DL UDP Throughput	Expected DL MAC Throughput in MCG	Expected DL MAC Throughput in SCG
B3+n41	NSA-1	FFS	FFS	FFS
B3+n41	NSA-2	FFS	FFS	FFS
B3+n41	NSA-3	FFS	FFS	FFS

Table 10.6.2.6-2: UL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Test Point	Expected UL UDP Throughput	Expected UL MAC Throughput in MCG	Expected UL MAC Throughput in SCG
B3+n41	NSA-1	FFS	FFS	FFS
B3+n41	NSA-2	FFS	FFS	FFS
B3+n41	NSA-3	FFS	FFS	FFS

10.6.3 Bidirectional Throughput under static channel on SCG, UL 64QAM, NSA

10.6.3.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, DL NR 256QAM+4*4 MIMO, UL NR 64QAM,data transmission on SCG

10.6.3.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.6.3.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.6.3.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 10
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enableDL256QAM = TRUE
enableUL64QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.6.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	Static	N/A

Table 10.6.3.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

8. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
9. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
10. Connect an application server to the IP output of the SS configured with a UDP server.
11. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
12. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
13. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
14. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.6.3.5 Test procedure

PREAMBLE

1. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
3. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.6.1.4-1, Table 10.6.1.4-2, as appropriate. Transmission mode is set to TM3.
4. SNR is set according to Table 10.6.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

5. The UE is powered ON.
6. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
7. SS Activates NR Cell B.
8. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. Using the UDP client, begin UDP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 10 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell A and Cell B.

Table 10.6.3.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		

4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using UDP Client begin UDP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.6.3.6 Expected Result

1. Calculate and record the average uplink UDP throughput and downlink UDP throughput.
2. Calculate and record the average downlink throughput in MAC layer in SCG cell
3. Calculate and record the average uplink throughput in MAC layer in SCG cell
4. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
5. The average downlink and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.3.6-1: DL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected DL UDP Throughput	Expected DL MAC Throughput in SCG
B3+n41	[1.7Gbps]	[1.7Gbps]

Table 10.6.3.6-2: UL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL UDP Throughput	Expected UL MAC Throughput in SCG
B3+n41	[95Mbps]	[95Mbps]

10.6.4 Bidirectional Throughput under static channel on SCG, UL 256QAM, NSA

10.6.4.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, DL NR 256QAM+4*4 MIMO, UL NR 256QAM,data transmission on SCG

10.6.4.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.6.4.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2.

10.6.4.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 10
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
DL Modulation / Coding = 27
UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enable4x4MIMO = TRUE
enableDL256QAM = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.6.4.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	Static	N/A

Table 10.6.4.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

15. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
16. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
17. Connect an application server to the IP output of the SS configured with a UDP server.
18. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
19. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
20. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
21. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.6.4.5 Test procedure

PREAMBLE

15. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
16. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
17. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.6.1.4-1, Table 10.6.1.4-2, as appropriate. Transmission mode is set to TM3.
18. SNR is set according to Table 10.6.1.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

19. The UE is powered ON.
20. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
21. SS Activates NR Cell B.
22. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.
23. UE transmit an RRC Connection Reconfiguration Complete message to SS.
24. Using the UDP client, begin UDP download from the application server for [90] seconds and record Throughput result.
25. Repeat step 10 for one more iteration.
26. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
27. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

28. Deactivate Cell A and Cell B.

Table 10.6.4.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		
3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		

4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using UDP Client begin UDP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.6.4.6 Expected Result

1. Calculate and record the average uplink UDP throughput and downlink UDP throughput.
2. Calculate and record the average downlink throughput in MAC layer in SCG cell
3. Calculate and record the average uplink throughput in MAC layer in SCG cell
4. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
5. The average downlink and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.4.6-1: DL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected DL UDP Throughput	Expected DL MAC Throughput in SCG
B3_n41	[1.7Gbps]	[1.7Gbps]

Table 10.6.4.6-2: UL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Expected UL UDP Throughput	Expected UL MAC Throughput in SCG
B3_n41	[125Mbps]	[125Mbps]

10.6.5 Bidirectional Throughput under fading channel on SCG, NSA

10.6.5.1 Test Purpose

To measure the UE application layer Bidirectional performance while downloading & uploading simultaneously UDP based data in Conducted, Static Channel, NSA Option3, 100 MHz BW, Full Resource Allocation, dynamic scheduling based on channel condition, data transmission on SCG

10.6.5.2 Reference specification

3GPP TS 36.331, 3GPP TS 36.508, 3GPP TS 36.521-1, 3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

10.6.5.3 Applicability

This test applies to Type 1 and Type 3 devices as described in clause 4.2..

10.6.5.4 Test conditions

[SS configuration]
E-UTRAN Cell A,
NR-RAN Cell B

E-UTRAN Cell A,
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
EARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

NR-RAN Cell B,
Cell Id=02 TAC = 01
NR-ARFCN= f1
rootSequenceIndex = 0
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
CPConfig = UL: Normal CP/DL: Normal CP

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 10.6.5.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	LTE Fading Profile : EPA5 , NR Fading Profile : TDLA30	Low
NSA-2	LTE Fading Profile : EPA5 , NR Fading Profile : TDLB100	Low
NSA-3	LTE Fading Profile : EVA5 , NR Fading Profile : TDLC300	Low

Table 10.6.5.4-2: Test Parameters for Testing

Parameter		Unit	Value
Downlink power allocation	ρ_A	dB	-3
	ρ_B	dB	-3(Note 1)
LTE N_{oc} at antenna port		dBm/15kHz	-98
NR N_{oc} at antenna port		dBm/30kHz	-98
Reporting mode			PUCCH 1-0
Note 1: $P_B = 1$			

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Configurations of LTE PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 36.521-1.

Configurations of NR PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 36.508 & TS 38.508-1 clause 4.1 for LTE & NR respectively.

Frequencies to be tested: Mid Range, as defined in TS 36.508 & TS 38.508-1 for LTE & NR respectively.

8. Connect the LTE SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 36.508 Annex A, Figure A.10 for antenna configuration 2x2.
9. Connect the NR SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
10. Connect an application server to the IP output of the SS configured with a UDP server.
11. LTE Downlink signals are initially set up according to Annex C.0, C.1 and Annex C.3.2 in TS 36.521-1 and uplink signals according to Annex H.1 and H.3.2 in TS 36.521-1.
12. NR Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
13. LTE Propogation conditions are set according to Annex B.0 in TS 36.521-1.
14. NR Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

10.6.5.5 Test procedure

PREAMBLE

15. SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
16. SS transmits LTE PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL data using the transport format and transport block size.
17. Set the parameters of the bandwidth, the propagation condition, the correlation matrix, EN-DC Configuration, Special subframe configuration, antenna configuration according to Table 10.6.2.4-1, Table 10.6.2.4-2, as appropriate. Transmission mode is set to TM3.
18. SNR is set according to Table 10.6.2.4-1. Here SNR = Cell_power / Noc, in which Cell_power(EPRE) is a constant of -68dBm/15kHz, following the definition of TS 36.508 & 38.508.

MAIN BODY

19. The UE is powered ON.
20. UE performs a Registration procedure on E-UTRAN Cell A to register for PS services. The UE establishes the default EPS bearer during the registration according to TS 36.508 subclause 4.5.2(steps 1-16).
21. SS Activates NR Cell B.
22. The SS transmits an RRC Connection Reconfiguration message containing information regarding NR Cell B and to establish SCG.
23. UE transmit an RRC Connection Reconfiguration Complete message to SS.
24. Using the UDP client, begin UDP download and upload with the application server for [90] seconds and record Throughput result.
25. Repeat step 10 for one more iteration.
26. Calculate the average throughput at the application layer on the downlink and uplink channel during the file transfer over all iterations.
27. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

28. Deactivate Cell A and Cell B.

Table 10.6.5.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	The SS Activates E-UTRAN Cell A configures the corresponding Master Information Block and System Information Block broadcast		
2	SS		SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI		

3	SS		Set the parameters of the bandwidth, propagation condition, correlation matrix, EN-DC Configuration, Special subframe configuration and antenna configuration		
4			Cell Power is set		
5	UE		Switch On UE	AT Command	
6	←→	NAS RRC	UE performs Registration procedure on E-UTRAN Cell A		PASS
7			The SS activates NR Cell B		
8	←	RRC	SS sends RRC Connection Reconfiguration message		
9	→	RRC	The UE transmits RRC Connection Reconfiguration Complete message		PASS
10			Using UDP Client begin UDP Download		PASS
11			Repeat Step 10		
12	SS		Calculate Average Throughput		PASS
13			Switch Off UE	AT Command	
14	SS		Deactivate Cell A & Cell B		

10.6.5.6 Expected Result

6. Calculate and record the average uplink UDP throughput and downlink UDP throughput.
7. Calculate and record the average downlink throughput in MAC layer in SCG cell
8. Calculate and record the average uplink throughput in MAC layer in SCG cell
9. Count and record the overall number of ACK and NACK/DTX on the PUSCH/PUCCH during the test interval.
10. The average downlink and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.5.6-1: DL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Test Point	Expected DL UDP Throughput	Expected DL MAC Throughput in SCG
B3+n41	NSA-1	FFS	FFS
B3+n41	NSA-2	FFS	FFS
B3+n41	NSA-3	FFS	FFS

Table 10.6.5.6-2: UL Expected Result for EN-DC FDD LTE Band + NR Band

Band Combination	Test Point	Expected UL UDP Throughput	Expected UL MAC Throughput in SCG
B3+n41	NSA-1	FFS	FFS
B3+n41	NSA-2	FFS	FFS
B3+n41	NSA-3	FFS	FFS

11 Latency

11.1 Latency Basic Tests

11.1.1 Control Plane Latency – Basic Test

11.1.1.1 Test Purpose

Calculate the latency for different signaling messages exchange between SS and UE

11.1.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

11.1.1.3 Applicability

This test applies to the device that supports SA or SA+NSA.

11.1.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

11.1.1.5 Test procedure

Table 11.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 11.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 20a1).

MAIN BODY

5. SS initiates paging message to UE
6. UE initiates the Rach Procedure to start the service request procedure
7. Calculte the time taken between the Rach Request to Msg4
8. SS transmits RRC Setup message to UE
9. UE sends RRC Setup Complete with Service Request NAS message
10. SS sends the Access stratum Security Mode Command to the UE
11. UE responds with AS Security Mode Complete to the SS
12. Calculate the time taken between Security Mode Command and Security Mode Complete
13. SS Transmits RRC Reconfiguration to establish SRB2 and DRB with a Service accept NAS message
14. UE sends RRC Reconfiguration Complete to the SS
15. The RRC connection is released by the SS. The UE enters Registered, Idle Mode
16. Repeat Steps 5 to 15 for 4 times(on 4th iteration skip 15th step for initiating Deregistration – POSTAMBLE step)
17. Calculate the average time taken at step 7 and step 12

POSTAMBLE

18. The SS initiates a Deregitration procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate NR Cell A.

Table 11.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to		

			T0 in Table 11.1.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 20a1).		PASS
5	←	RRC	Paging		
6	→ ←	RRC/ MAC	Rach Procedure to start the Service Request Procedure till msg4		PASS
7			Calculate the time taken between Rach Request to Msg4		
8	←	RRC	RRCSetup		
9	→	NAS RRC	RRCSetupComplete with Service Request NAS message		
10	←	RRC	AS Security Mode Command		
11	→	RRC	AS Security Mode Complete		
12			Calculate the time taken between Step 10 and Step 11		
13	←	NAS RRC	RRCReconfiguration with Service Accept NAS message		
14	→	RRC	RRCReconfigurationComplete		PASS
15	←	RRC	RRCRelease		
16			Repeat Steps 5 to Step 15 for 4 times(on 4th iteration skip Step 15)		
17			Calculate the average time taken at Step 7 and Step 12		
18	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
19	←	RRC	SS initiates a RRC release procedure.		
20			Deactivate NR Cell A.		

11.1.1.6 Expected Result

The Average time taken for RACH procedure should be less than [TBD]ms.
The Average time taken for RRC Signaling message pair should be less than [TBD]ms.

11.1.2 User Plane Latency – Basic Test

11.1.2.1 Test Purpose

Calculate the latency of User plane data exchange between SS and UE

11.1.2.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

11.1.2.3 Applicability

This test applies to the device that supports SA or SA+NSA.

11.1.2.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR Band = n41
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.
UE
UE is powered off

11.1.2.5 Test procedure

Table 11.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A	Remark
T0	-75	

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 11.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).

MAIN BODY

5. SS Transmits an ICMP Echo Request packet(PING) to the UE
6. UE replies with an ICMP Echo Reply packet to SS
7. SS calculates the RTT time it takes for ICMP Echo Request sending and Response reception
8. Repeat steps 5 to 7 for 10 times and calculate the average time taken for ICMP Echo Requese transmission and Response reception
9. Set the length of PING package to 32 bytes, repeat steps 5 to 8
10. Set the length of PING package to 1000 bytes, repeat steps 5 to 8
11. Set the length of PING package to 1500 bytes, repeat steps 5 to 8

POSTAMBLE

12. The SS initiates a Deregitration procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

Table 11.2.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate NR Cell A.		
2			SS configures the initial power according to T0 in Table 11.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure (see 38.508, Table 4.5.2.2-2 till Step 18).		PASS
5	←		ICMP ECHO Request		
6	→		ICMP ECHO Response		PASS
7			SS calculates the RTT of the PING		
8			Repeat steps 5 to 7 for 10 times and calculates the average time taken		
9			Set the length of PING packets to 32 bytes, repeat step 5 to 8		
10			Set the length of PING packets to 1000 bytes, repeat step 5 to 8		
11			Set the length of PING packets to 1500 bytes, repeat step 5 to 8		
12	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
13	←	RRC	SS initiates a RRC release procedure.		
14			Deactivate NR Cell A.		

11.1.2.6 Expected Result

The RTT for the ICMP Echo Request and Response should be less than [TBD]ms

12 High Speed Train

13 Beam Management

13.1 Beam Determination – Beam change based on power level

13.1.1 Test Purpose

Verify that UE selects better power beam when serving beam power is reduced

13.1.2 Reference specification

TS 38.300, 38.331, 38.508

13.1.3 Applicability

This test applies to Type 2 devices as described in clause 4.2

13.1.4 Test conditions

[SS configuration]
Cell A is a NR Cell.
Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE for Beam 1 = -125 dBm/30kHz
SS/PBCH SSS EPRE for Beam 2 = -125 dBm/30kHz

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE

UE is powered off

13.1.5 Test procedure

Table 13.1.5-1: Time of cell power level and parameter changes

Time	NR Cell A Beam 1	NR Cell A Beam 2	Remark
T0	-75	-98	
T1	-106	-78	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 13.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 15).

MAIN BODY

5. Setup donwlink TCP session and verify that UE downloads data correctly on beam ID 1.
6. The SS Configures the cell power level according to T1 in table 13.1.5-1
7. Setup donwlink TCP session and SS configures the DL DCIs in beam ID 2
8. Verify that UE downloads data correctly on beam ID 2.

POSTAMBLE

9. The SS initiates a Deregitration procedure.
10. The SS initiates a RRC release procedure.
11. Deactivate NR Cell A.

13.1.6 Expected Result

UE should able to decode the DCI after beam change is initiated by the network

13.2 Beam Sweeping – Initial Access

13.2.1 Test Purpose

When multiple beam is configured and beam sweeping is happening, verify that UE ia able to select any one beam and attach to network.

13.2.2 Reference specification

TS 38.331, 38.300, 38.508

13.2.3 Applicability

This test applies to Type 2 devices as described in clause 4.2

13.2.4 Test conditions

[SS configuration]

Cell A is a NR Cell.

Cell A supports only SA

NR Cell A

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

NR-ARFCN= f1

SS/PBCH SSS EPRE for Beam 1 = -125 dBm/30kHz

SS/PBCH SSS EPRE for Beam 2 = -125 dBm/30kHz

SS/PBCH SSS EPRE for Beam 3 = -125 dBm/30kHz

SS/PBCH SSS EPRE for Beam 4 = -125 dBm/30kHz

[UE configuration]

The test UICC with USIM should be inserted

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

13.2.5 Test procedure

Table 13.2.5-1: Time of cell power level and parameter changes

Time	NR Cell A Beam 1	NR Cell A Beam 2	NR Cell A Beam 3	NR Cell A Beam 4	Remark
T0	-98	-75	-98	-98	
T1	-75	-98	-98	-98	
T2	-98	-98	-98	-75	

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to test conditions T0 in table 13.2.5-1 and Beam sweeping is on.
3. The UE is powered ON.

MAIN BODY

4. The UE performs the registration procedure on Cell A on Beam 2(see 38.508, Table 4.5.2.2-2

till Step 15).

5. Initiate ICMP PING request(4 requests) from SS and verify that PING is successful.
6. The SS initiates a Deregitration procedure.
7. The SS initiates a RRC release procedure.
8. The SS Configures the cell power level according to T1 in table 13.2.5-1
9. The UE is powered ON.
10. The UE performs the registration procedure on Cell A on Beam 1(see 38.508, Table 4.5.2.2-2 till Step 15).
11. Initiate ICMP PING request(4 requests) from SS and verify that PING is successful.
12. The SS initiates a Deregitration procedure.
13. The SS initiates a RRC release procedure.
14. The SS Configures the cell power level according to T2 in table 13.2.5-1
15. The UE is powered ON.
16. The UE performs the registration procedure on Cell A on Beam 4(see 38.508, Table 4.5.2.2-2 till Step 15).
17. Initiate ICMP PING request(4 requests) from SS and verify that PING is successful.

POSTAMBLE

18. The SS initiates a Deregitration procedure.
19. The SS initiates a RRC release procedure.
20. Deactivate NR Cell A.

13.2.6 Expected Result

When multiple beams present with different power level during initial attach, verify that UE performs registartion at better beam during initial sweep.

13.3 Beam Failure and Recovery

13.3.1 Test Purpose

Veirfy that UE is able to detect the beam failure and recover in same beam as instructed in BFR(Beam failure recovery) parameters

13.3.2 Reference specification

TS 38.300, 38.331, 38.508, 38.321

13.3.3 Applicability

This test applies to Type 2 devices as described in clause 4.2

13.3.4 Test conditions

[SS configuration]

Cell A is a NR Cell.

Cell A supports only SA

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
Bandwidth = 100 MHz
SS/PBCH SSS EPRE for Beam 1 = -125 dBm/30kHz
beamFailureInstanceMaxCount for Beam1 = n10
beamFailureDetectionTimer for Beam1 = pbfd10

[UE configuration]
The test UICC with USIM should be inserted
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

13.3.5 Test procedure

Table 13.3.5-1: Time of cell power level and parameter changes

Time	NR Cell A Beam 1	Remark
T0	-75	
T1	OFF	

PREAMBLE
1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 13.3.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A Beam1(see 38.508, Table 4.5.2.2-2 till Step 15) with RadioLinkMonitoringConfig included in RRC Reconfiguration to check the beam failure.

MAIN BODY
5. Setup donwlink TCP session and verify that UE downloads data correctly on beam ID 1.
6. The SS Configures the cell power level according to T1 in table 13.3.5-1
7. Verify that UE doesn’t initiate RACH Proceudre for Beam Failure
8. The SS Configures the cell power level according to T0 in table 13.3.5-1 before 10 ms(before beamFailureDetectionTimer expiry)

9. Setup donwlink TCP session and verify that UE downloads data correctly on beam ID 1
10. Verify that UE downloads data correctly on beam ID 1.

POSTAMBLE

11. The SS initiates a Deregitration procedure.
12. The SS initiates a RRC release procedure.
13. Deactivate NR Cell A.

13.3.6 Expected Result

When Beam failure is not exceeding beamFailureDetectionTimer, verify that UE continue to do data transfer in same beam and doesn't initiate the RACH procedure for Beam failure and recovery.

14 NR Carrier Aggregation

14.1 Downlink NR Carrier Aggregation

14.1.1 Throughput with DL NR CA

14.1.1.1 DL Throughput under static channel, CA_n41C

14.1.1.1.1 Test Purpose

To measure the UE downlink throughput performance while downloading TCP based data in Conducted with NR Intra-band Contiguous CA in n41

14.1.1.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.1.1.3 Applicability

This test applies to Type2 UEs supporting NR DL CA_n41C

14.1.1.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE

absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1.1.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.1.1.5 Test procedure

Table 14.1.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B

T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.1.1.5-1
3. Set the parameters of the propagation condition according to Table 14.1.1.1.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table 14.1.1.1.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.1.5-2 for parameter configuration, and release measurement GAP configuration.
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin TCP download from the application server for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. Stop downlink data transmission.
14. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
15. Repeat step 11-14 for one more iteration.
16. Calculate the average TCP throughput on the downlink channel during the file transfer over all iterations.
17. The SS transmits an RRCReconfiguration message to add measurement GAP configuration.
18. SS configures the cell power according to T2 in Table 14.1.1.1.5-1
19. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
20. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
21. UE transmit an RRCReconfigurationComplete

POSTAMBLE

22. Switch Off UE, UE initiates a Detach procedure.
23. Deactivate Cell A and Cell B.

Table 14.1.1.1.5-2: *sCellToAddMod* in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	
frequencyBandList	n41	
absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.1.1.1.6 Expected Result

Calculate and record the average throughput on TCP layer. The average downlink TCP throughput shall meet or exceed the value in following table.

Table 14.1.1.1.6-1: Expected Result

Test band	Expected DL TCP Throughput

CA_n41C 100M+60M	[TBD]

14.1.1.2 DL Throughput under static channel, CA_n41A-n28A

14.1.1.2.1 Test Purpose

To measure the UE downlink throughput performance while downloading TCP based data in Conducted with NR Inter-band CA between n41 and n28.

14.1.1.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.1.2.3 Applicability

This test applies to Type2 UEs supporting NR DL CA_n41A-n28A

14.1.1.2.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 2x2MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.1.2.5 Test procedure

Table 14.1.1.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.1.2.5-1
3. Set the parameters of the propagation condition according to Table 14.1.1.2.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED

6. SS activates Cell B and configures the cell power according to T1 in Table 14.1.1.2.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.2.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin TCP download from the application server for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. Stop downlink data transmission.
14. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
15. Repeat step 11-14 for one more iteration.
16. Calculate the average TCP throughput on the downlink channel during the file transfer over all iterations.
17. SS configures the cell power according to T2 in Table 14.1.1.2.5-1
18. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
19. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
20. UE transmit an RRCReconfigurationComplete

POSTAMBLE

21. Switch Off UE, UE initiates a Detach procedure.
22. Deactivate Cell A and Cell B.

Table 14.1.1.2.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		

}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		
}		

14.1.1.2.6 Expected Result

Calculate and record the average throughput on TCP layer. The average downlink TCP throughput shall meet or exceed the value in following table.

Table 14.1.1.2.6-3: Expected Result

Test band	Expected DL TCP Throughput
CA_n41A-n28A 100M+30M	[TBD]

14.1.1.3 DL Throughput under static channel, CA_n41A-n79A , Unaligned frame boundary

14.1.1.3.1 Test Purpose

To measure the UE downlink throughput performance while downloading TCP based data in Conducted with NR Inter-band CA between n41 and n79.

Verify UE support the unaligned frame boundary with slot alignment for R16 inter-band CA.

14.1.1.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.1.3.3 Applicability

This test applies to Type2 UEs supporting NR DL CA_n41A-n79A

14.1.1.3.4 Test conditions

[SS configuration]

NR Cell A, PCell

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

Test Band=n41

Test Frequency= f1

DL Modulation / Coding = 27

DL RB Allocation = Full

DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.

Cell A (n41)				*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*
Cell B (n79)	*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*			

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1.3.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.1.3.5 Test procedure

Table 14.1.1.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.1.3.5-1
3. Set the parameters of the propagation condition according to Table 14.1.1.3.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table 14.1.1.3.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.3.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin TCP download from the application server for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. Stop downlink data transmission.
14. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
15. Repeat step 11-14 for one more iteration.
16. Calculate the average TCP throughput on the downlink channel during the file transfer over all iterations.
17. SS configures the cell power according to T2 in Table 14.1.1.3.5-1
18. The UE sends MeasurementReport message to report event A2 with the measured RSRP

value for NR Cell A and B

19. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
20. UE transmit an RRCReconfigurationComplete

POSTAMBLE

21. Switch Off UE, UE initiates a Detach procedure.
22. Deactivate Cell A and Cell B.

Table 14.1.1.3.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	721824	
frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*

nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	
nrofUplinkSymbols	2	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.1.1.3.6 Expected Result

Calculate and record the average throughput on TCP layer. The average downlink TCP throughput shall meet or exceed the value in following table.

Table 14.1.1.1.5-3: Expected Result

Test band	Expected DL TCP Throughput
CA_n41A-n79A 100M+100M	[TBD]

14.1.1.4 DL Throughput under static channel, CA_n41A-n79A, Aligned frame boundary

Note: This test case is not mandatory required.

The same as 14.1.1.3 except that n41 Cell A and n79 Cell B are frame boundary aligned with slot alignment as indicated below

Cell A (n41)	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*
Cell B (n79)	*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*

14.1.2 Mobility

14.1.2.1 Intra-frequency Handover, PCell and SCell, CA_n41C

14.1.2.1.1 Test Purpose

Test to verify that UE could support intra-frequency handover with continuous downlink data transmission in NR Intra-band Contiguous CA

14.1.2.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.1.3 Applicability

This test applies to Type2 UEs supporting NR DL CA_n41C

14.1.2.1.4 Test conditions

[SS configuration]

NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=524910
absoluteFrequencyPointA=523170

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE

DL 256QAM = TRUE

absoluteFrequencySSB=524910

absoluteFrequencyPointA=523170

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.2.1.5 Test procedure

Table 14.1.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	NR Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active	Not Active
T1			-75	-75	Not Active	Not Active
T2			-95	-95	-75	-75
T3			-75	-75	-95	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.2.1.5-1

3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.1.2.1.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.1.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin TCP download from the application server for 60 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
12. SS configures the cell power according to T2 in Table 14.1.2.1.5-1
13. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell A, Cell Band Cell C
14. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToReleaseList to release Cell B as the SCell. Refer to Table 14.1.2.1.5-2 for parameter configuration
15. Verify that UE sends RRCReconfigurationComplete message in Cell C to indicate the successful handover
16. Verify that UE sends MeasurementReport message in Cell C to report event A4 with the measured RSRP value for NR Cell D
17. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell D. Refer to Table 14.1.2.1.5-3 for parameter configuration
18. Verify that UE sends RRCReconfigurationComplete
19. SS activates Cell D as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
20. Verify the TCP data transmission is continued on Cell C and Cell D. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
21. SS configures the cell power according to T3 in Table 14.1.2.1.5-1
22. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell C, Cell D and Cell A
23. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToReleaseList to release Cell D as the SCell. Refer to Table 14.1.2.1.5-2 for parameter configuration
24. Verify that UE sends RRCReconfigurationComplete message in Cell A to indicate the successful handover
25. Verify that UE sends MeasurementReport message in Cell A to report event A4 with the measured RSRP value for NR Cell B

26. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell B. Refer to Table 14.1.2.1.5-3 for parameter configuration
27. Verify that UE sends RRCReconfigurationComplete
28. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
29. Verify the TCP data transmission is continued on Cell A and Cell B. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
30. Stop downlink data transmission.
31. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
32. UE transmit an RRCReconfigurationComplete

POSTAMBLE

33. Switch Off UE, UE initiates a Detach procedure.
34. Deactivate Cell A , Cell B, Cell C and Cell D.

Table 14.1.2.1.5-2: RRCReconfiguration in step 14 and step 23

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 23
}		
}		
}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.1.1.1.5-3: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 17 and Step 26

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell D	Step 17
	Physical cell id of Cell B	Step 26
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		

absoluteFrequencySSB	524910	
frequencyBandList	n41	
absoluteFrequencyPointA	523170	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.1.2.1.6 Expected Result

UE could support intra-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.2.1.6-1: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41C 100M+60M	Step 11	[TBD]
	Step 20	[TBD]
	Step 29	[TBD]

14.1.2.2 Inter-frequency Handover, PCell and SCell, CA_n41C

14.1.2.2.1 Test Purpose

Test to verify that UE could support inter-frequency handover with continuous downlink data transmission in NR Intra-band contiguous CA

14.1.2.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.2.3 Applicability

This test applies to Type2 UEs supporting NR DL CA_n41C

14.1.2.2.4 Test conditions

The same as 14.1.2.1.4 except the cell configuration as indicated below

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=524910
absoluteFrequencyPointA=523170

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27

DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB= 504990
absoluteFrequencyPointA= 503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523170

14.1.2.2.5 Test procedure

The same as 14.1.2.1.5 except the parameter configuration as indicated below

Table 14.1.2.2.5-1 RRCReconfiguration in step14 and Step23

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 23
downlinkConfigCommon {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	504990	Step 14, Cell C
	513150	Step 23, Cell A
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		

}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.1.2.2.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 17 and Step 26

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell D	Step 17
	Physical cell id of Cell B	Step 26
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	Step 16, Cell D
	524910	Step 25, Cell B
frequencyBandList	n41	
absoluteFrequencyPointA	523170	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	

}		
}		

14.1.2.2.6 Expected Result

UE could support intra-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.1.1.5-3: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41C 100M+60M	Step 11	[TBD]
	Step 20	[TBD]
	Step 29	[TBD]

14.1.2.3 Intra-frequency SCell Removal and Addition, CA_n41A-n79A

14.1.2.3.1 Test Purpose

Test to verify that UE could support intra-frequency SCell removal and addition with continuous downlink data transmission in NR Inter-band CA _n41A-n79A

14.1.2.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.3.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n79A

14.1.2.3.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell

Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

NR Cell C, SCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.

Cell A (n41)				*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*
Cell B (n79)	*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*			

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1.1.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.2.3.5 Test procedure

Table 14.1.2.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active
T1			-75	-75	Not Active
T2			-75	-95	-75
T3			-75	-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.2.3.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.1.2.3.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.3.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin TCP download from the application server for 60 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.

12. SS configures the cell power according to T2 in Table 14.1.2.3.5-1
13. Verify tht UE sends MeasurementReport message to report event A2 and A4 with the measured RSRP value for NR Cell A, Cell B and Cell C
14. The SS transmits an RRCReconfiguration message including sCellToReleaseList to release Cell B as the SCell an sCellToAddModList to add Cell C as the SCell. Refer to Table 14.1.2.3.5-2 for parameter configuration
15. Verify that UE sends RRCReconfigurationComplete message in Cell A
16. SS activates Cell C as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
17. Verify the TCP data transmission is continued on Cell A and Cell C. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
18. SS configures the cell power according to T3 in Table 14.1.2.3.5-1
19. Verify that UE sends MeasurementReport message to report event A2 and A4 with the measured RSRP value for NR Cell A, Cell C and Cell B
20. The SS transmits an RRCReconfiguration message including sCellToReleaseList to release Cell C as the SCell an sCellToAddModList to add Cell B as the SCell. Refer to Table 14.1.2.3.5-2 for parameter configuration
21. Verify that UE sends RRCReconfigurationComplete message in Cell A
22. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
23. Verify the TCP data transmission is continued on Cell A and Cell B. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
24. Stop downlink data transmission.
25. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
26. UE transmit an RRCReconfigurationComplete

POSTAMBLE

27. Switch Off UE, UE initiates a Detach procedure.
28. Deactivate Cell A , Cell B and Cell C.

Table 14.1.2.3.5-2: *RRCReconfiguratio*n Message in step 14 and Step 20

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
CellGroupConfig ::= SEQUENCE {		
sCellToReleaseList {	1 entry	
sCellIndex[1]	1	
}		
sCellToAddModList {	1 entry	
sCellIndex	2	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell C	Step 14
	Physical cell id of Cell B	Step 20
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		

absoluteFrequencySSB	721824	
frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	
nrofUplinkSymbols	2	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		
}		

14.1.2.3.6 Expected Result

UE could support intra-frequency SCell removal and addtion with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.1.1.5-3: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n79A	Step 11	[TBD]

100M+100M	Step 17	[TBD]
	Step 23	[TBD]

14.1.2.4 Inter-frequency SCell Removal and Addition, CA_n41A-n79A

14.1.2.4.1 Test Purpose

Test to verify that UE could support inter-frequency SCell removal and addition with continuous downlink data transmission in NR Inter-band CA _n41A-n79A

14.1.2.4.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.4.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n79A

14.1.2.4.4 Test conditions

The same as 14.1.2.3.4 except the cell configuration as indicated below

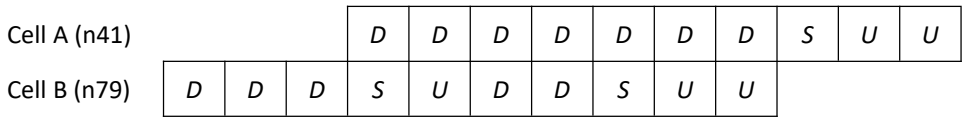
[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2

absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

NR Cell C, SCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 723360
absoluteFrequencyPointA= 720048

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.



14.1.2.4.5 Test procedure

The same as 14.1.2.3.5 except the parameter configuration as indicated below

Table 14.1.2.4.5-1: *RRCReconfiguration* Message in step 14 and step 20

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
CellGroupConfig ::= SEQUENCE {		
sCellToReleaseList {	1 entry	
sCellIndex[1]	1	
}		
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell C	Step 14
	Physical cell id of Cell B	Step 20
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	723360	Step 14, Cell C
	721824	Step 20, Cell B

frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	
nrofUplinkSymbols	2	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		
}		

14.1.2.4.6 Expected Result

UE could support inter-frequency SCell removal and addtion with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.1.1.5-3: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n79A 100M+100M	Step 11	[TBD]
	Step 17	[TBD]

	Step 23	[TBD]

14.1.2.5 Intra-frequency Handover, PCell and SCell, CA_n41A-n79A

14.1.2.5.1 Test Purpose

Test to verify that UE could support intra-frequency handover with continuous downlink data transmission in NR Inter-band CA

14.1.2.5.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.5.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n79A

14.1.2.5.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.

Cell A (n41)				*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*
Cell B (n79)	*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*			

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.2.5.5 Test procedure

Table 14.1.2.5.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	NR Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active	Not Active
T1			-75	-75	Not Active	Not Active
T2			-95	-95	-75	-75
T3			-75	-75	-95	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.2.1.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.1.2.1.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.1.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin TCP download from the application server for 60 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
12. SS configures the cell power according to T2 in Table 14.1.2.5.5-1

13. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell A, Cell Band Cell C
14. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToReleaseList to release Cell B as the SCell. Refer to Table 14.1.2.5.5-2 for parameter configuration
15. Verify that UE sends RRCReconfigurationComplete message in Cell C to indicate the successful handover
16. Verify that UE sends MeasurementReport message in Cell C to report event A4 with the measured RSRP value for NR Cell D
17. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell D. Refer to Table 14.1.2.5.5-3 for parameter configuration
18. Verify that UE sends RRCReconfigurationComplete
19. SS activates Cell D as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
20. Verify the TCP data transmission is continued on Cell C and Cell D. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
21. SS configures the cell power according to T3 in Table 14.1.2.5.5-1
22. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell C, Cell D and Cell A
23. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToReleaseList to release Cell D as the SCell. Refer to Table 14.1.2.5.5-2 for parameter configuration
24. Verify that UE sends RRCReconfigurationComplete message in Cell A to indicate the successful handover
25. Verify that UE sends MeasurementReport message in Cell A to report event A4 with the measured RSRP value for NR Cell B
26. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell B. Refer to Table 14.1.2.5.5-3 for parameter configuration
27. Verify that UE sends RRCReconfigurationComplete
28. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
29. Verify the TCP data transmission is continued on Cell A and Cell B. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
30. Stop downlink data transmission.
31. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
32. UE transmit an RRCReconfigurationComplete

POSTAMBLE

33. Switch Off UE, UE initiates a Detach procedure.
34. Deactivate Cell A , Cell B, Cell C and Cell D.

Table 14.1.2.5.5-2: RRCReconfiguration in step 14 and step 23

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**

CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 23
}		
}		
}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.1.1.1.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 17 and Step 26

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell D	Step 17
	Physical cell id of Cell B	Step 26
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	721824	
frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms

nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	
nrofUplinkSymbols	2	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.1.2.5.6 Expected Result

UE could support intra-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.2.5.6-1: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n79A 100M+100M	Step 11	[TBD]
	Step 20	[TBD]
	Step 29	[TBD]

14.1.2.6 Inter-frequency Handover, PCell and SCell, CA_n41A-n79A

14.1.2.6.1 Test Purpose

Test to verify that UE could support inter-frequency handover with continuous downlink data transmission in NR Inter-band CA

14.1.2.6.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.6.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n79A

14.1.2.6.4 Test conditions

The same as 14.1.2.5.4 except the cell configuration as indicated below

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 721824
absoluteFrequencyPointA= 720048

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB = 504990
absoluteFrequencyPointA=503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n79

Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
Frame Structure= DDDSU DDSUU
Special Frame DL : GP : UL = 10 : 2 : 2
absoluteFrequencySSB= 723360
absoluteFrequencyPointA= 720048

14.1.2.6.5 Test procedure

The same as 14.1.2.5.5 except the parameter configuration as indicated below

Table 14.1.2.6.5-1: RRCReconfiguration in step 14 and step 23

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 23
downlinkConfigCommon {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	504990	Step 14, Cell C
	513150	Step 23, Cell A
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
}		
}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.1.1.1.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step17 and Step 26

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell D	Step 17
	Physical cell id of Cell B	Step 26
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	723360	Step 17, Cell D
	721824	Step 26, Cell B
frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	
nrofUplinkSymbols	2	
}		
}		

ss-PBCH-BlockPower	0	
}		
}		

14.1.2.6.6 Expected Result

UE could support inter-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.1.1.5-3: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n79A 100M+100M	Step 11	[TBD]
	Step 20	[TBD]
	Step 29	[TBD]

14.1.2.7 Intra-frequency PCell Handover, CA_n41A-n28A

14.1.2.7.1 Test Purpose

Test to verify that UE could support PCell intra-frequency handover meanwhile keep SCell unchanged with continuous downlink data transmission in NR Inter-band CA

14.1.2.7.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.7.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n28A

14.1.2.7.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell

Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 2x2MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.2.7.5 Test procedure

Table 14.1.2.7.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active
T1			-75	-75	Not Active
T2			-95	-75	-75
T3			-75	-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.2.1.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.1.2.7.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.2.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin TCP download from the application server for 60 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
12. SS configures the cell power according to T2 in Table 14.1.2.7.5-1
13. Verify tht UE sends MeasurementReport message to report event A3 with the measured RSRP value for NR Cell A and Cell B
14. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToAddModList to keep Cell B as SCell. Refer to Table 14.1.2.7.5-2 for parameter configuration
15. Verify that UE sends RRCReconfigurationComplete message in Cell C

16. Verify the TCP data transmission is continued on Cell C and Cell B. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
17. SS configures the cell power according to T3 in Table 14.1.2.5.5-1
18. Verify tht UE sends MeasurementReport message to report event A3 with the measured RSRP value for NR Cell A and Cell B
19. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToAddModList to keep Cell B as SCell. Refer to Table 14.1.2.7.5-2 for parameter configuration
20. Verify that UE sends RRCReconfigurationComplete message in Cell A
21. Verify the TCP data transmission is continued on Cell A and Cell B. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
22. Stop downlink data transmission.
23. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
24. UE transmit an RRCReconfigurationComplete

POSTAMBLE

25. Switch Off UE, UE initiates a Detach procedure.
26. Deactivate Cell A , Cell B and Cell C.

Table 14.1.2.7.5-2: RRCReconfiguration in step14 and Step19

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 19
}		
}		
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M

}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		
}		

14.1.2.7.6 Expected Result

UE could support PCell intra-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.1.1.5-3: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n28A 100M+30M	Step 11	[TBD]
	Step 16	[TBD]
	Step 21	[TBD]

14.1.2.8 Inter-frequency PCell Handover, CA_n41A-n28A

14.1.2.8.1 Test Purpose

Test to verify that UE could support PCell inter-frequency handover meanwhile keep SCell unchanged with continuous downlink data transmission in NR Inter-band CA

14.1.2.8.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.8.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n28A

14.1.2.8.4 Test conditions

The same as 14.1.2.7.4 except the cell configuration as indicated below

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41

Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 2x2MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=504990
absoluteFrequencyPointA=503172

14.1.2.8.5 Test procedure

The same as 14.1.2.5.5 except the parameter configuration as indicated below

Table 14.1.2.7.5-1: RRCReconfiguration in step14 and Step19

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		

physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 19
downlinkConfigCommon {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	504990	Step 14, Cell C
	513150	Step 19, Cell A
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
}		
}		
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		
}		

14.1.2.8.6 Expected Result

UE could support PCell inter-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.1.1.5-3: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n28A 100M+30M	Step 11	[TBD]
	Step 16	[TBD]
	Step 21	[TBD]

14.1.2.9 Intra-frequency Handover, PCell and SCell, CA_n41A-n28A

14.1.2.9.1 Test Purpose

Test to verify that UE could support intra-frequency handover with continuous downlink data transmission in NR Inter-band CA

14.1.2.9.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.1.2.9.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n28A

14.1.2.9.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 2x2MIMO = TRUE

DL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 2x2MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.1.1-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.
2. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

14.1.2.9.5 Test procedure

Table 14.1.2.5.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	NR Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active	Not Active
T1			-75	-75	Not Active	Not Active
T2			-95	-95	-75	-75
T3			-75	-75	-95	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.1.2.1.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.1.2.1.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.1.1.1.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin TCP download from the application server for 60 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
12. SS configures the cell power according to T2 in Table 14.1.2.5.5-1
13. Verify that UE sends MeasurementReport message to report event A2 and A3 with the

measured RSRP value for NR Cell A, Cell Band Cell C

14. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToReleaseList to release Cell B as the SCell. Refer to Table 14.1.2.5.5-2 for parameter configuration
15. Verify that UE sends RRCReconfigurationComplete message in Cell C to indicate the successful handover
16. Verify that UE sends MeasurementReport message in Cell C to report event A4 with the measured RSRP value for NR Cell D
17. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell D. Refer to Table 14.1.2.5.5-3 for parameter configuration
18. Verify that UE sends RRCReconfigurationComplete
19. SS activates Cell D as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
20. Verify the TCP data transmission is continued on Cell C and Cell D. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
21. SS configures the cell power according to T3 in Table 14.1.2.5.5-1
22. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell C, Cell D and Cell A
23. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToReleaseList to release Cell D as the SCell. Refer to Table 14.1.2.5.5-2 for parameter configuration
24. Verify that UE sends RRCReconfigurationComplete message in Cell A to indicate the successful handover
25. Verify that UE sends MeasurementReport message in Cell A to report event A4 with the measured RSRP value for NR Cell B
26. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell B. Refer to Table 14.1.2.5.5-3 for parameter configuration
27. Verify that UE sends RRCReconfigurationComplete
28. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
29. Verify the TCP data transmission is continued on Cell A and Cell B. Keep TCP download from the application server for 60 seconds and record TCP average throughput result.
30. Stop downlink data transmission.
31. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
32. UE transmit an RRCReconfigurationComplete

POSTAMBLE

33. Switch Off UE, UE initiates a Detach procedure.
34. Deactivate Cell A , Cell B, Cell C and Cell D.

Table 14.1.2.5.5-2: RRCReconfiguration in step 14 and step 23

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		

spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 14
	Physical Cell ID of Cell A	Step 23
}		
}		
}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.1.1.1.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 17 and Step 26

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell D	Step 17
	Physical cell id of Cell B	Step 26
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		
}		

14.1.2.9.6 Expected Result

UE could support intra-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.1.2.5.6-1: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41A+n79A 100M+100M	Step 11	[TBD]
	Step 20	[TBD]
	Step 29	[TBD]

14.2 Uplink NR Carrier Aggregation

14.2.1 Throughput with DL NR CA

14.2.1.1 UL Throughput under static channel, CA_n41C

14.2.1.1.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data in Conducted with NR Intra-band Contiguous CA in n41

14.2.1.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.1.1.3 Applicability

This test applies to Type2 UEs supporting NR UL CA_n41C

14.2.1.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01

MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table14.2.1.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE
UE is powered off

14.2.1.1.5 Test procedure

Table 14.2.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE
1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.1.1.5-1

3. Set the parameters of the propagation condition according to Table 14.2.1.1.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table 14.2.1.1.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.1.1.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin uplink TCP transmission for 90 seconds and record uplink TCP average throughput result. Verify data transmission on both PCC and SCC.
13. Stop uplink data transmission.
14. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
15. Repeat step 11-14 for one more iteration.
16. Calculate the average TCP throughput on the uplink channel during the file transfer over all iterations.
17. SS configures the cell power according to T2 in Table 14.2.1.1.5-1
18. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
19. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
20. UE transmit an RRCReconfigurationComplete

POSTAMBLE

21. Switch Off UE, UE initiates a Detach procedure.
22. Deactivate Cell A and Cell B.

Table 14.2.1.1.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	
frequencyBandList	n41	

absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon ::= SEQUENCE {		
frequencyInfoUL	Not Present	
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.2.1.1.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Table 14.2.1.1.6-1: Expected Result

Test band	Expected UL TCP Throughput
CA_n41C 100M+60M	[TBD]

14.2.1.2 UL Throughput under static channel, CA_n41A-n28A

14.2.1.2.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data in Conducted with NR Inter-band CA between n41 2Tx and n28 1Tx.

14.2.1.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.1.2.3 Applicability

This test applies to Type2 UEs supporting NR UL CA_n41A-n28A

14.2.1.2.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140792

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

14.2.1.2.5 Test procedure

Table 14.2.1.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.1.2.5-1
3. Set the parameters of the propagation condition according to Table 14.2.1.2.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table 14.2.1.2.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.1.2.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.

12. Begin uplink TCP transmission. SS schedules UL data on PCC every UL slot and schedules UL data on SCC for the slots which is not collided with UL slots on PCC.
13. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
14. Stop uplink data transmission.
15. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
16. Repeat step 11-15for one more iteration.
17. Calculate the average TCP throughput on the uplink channel during the file transfer over all iterations.
18. SS configures the cell power according to T2 in Table 14.2.1.2.5-1
19. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
20. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
21. UE transmit an RRCReconfigurationComplete

POSTAMBLE

22. Switch Off UE, UE initiates a Detach procedure.
23. Deactivate Cell A and Cell B.

Table 14.2.1.2.5-2: *sCellToAddMod* in *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
}		
}		
uplinkConfigCommon::= SEQUENCE {		
frequencyInfoUL::= SEQUENCE {		
frequencyBandList	n28	
absoluteFrequencyPointA	140792	

}		
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		
}		

14.2.1.2.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Table 14.2.1.2.6-1: Expected Result

Test band	Expected UL TCP Throughput
CA_n41A-n28A 100M+30M	[TBD]

14.2.1.3 UL Throughput under static channel, CA_n28A-n41A

14.2.1.3.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data in Conducted with NR Inter-band CA between n28 1Tx and n41 2Tx.

14.2.1.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.1.3.3 Applicability

This test applies to Type2 UEs supporting NR UL CA_n28A-n41A

14.2.1.3.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n28

Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140792

NR Cell B, SCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TURE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.1.3.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE
UE is powered off

14.2.1.3.5 Test procedure

Table 14.2.1.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.1.3.5-1
3. Set the parameters of the propagation condition according to Table 14.2.1.3.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table14.2.1.3.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.1.3.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
24. Begin uplink TCP transmission. SS schedules UL data on SCC every UL slot and schedules UL data on PCC for the slots which is not collided with UL slots on SCC.
12. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. Stop uplink data transmission.
14. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
15. Repeat step 11-15for one more iteration.
16. Calculate the average TCP throughput on the uplink channel during the file transfer over all iterations.
17. SS configures the cell power according to T2 in Table 14.2.1.3.5-1
18. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
19. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
20. UE transmit an RRCReconfigurationComplete

POSTAMBLE

21. Switch Off UE, UE initiates a Detach procedure.
22. Deactivate Cell A and Cell B.

Table 14.2.1.3.5-2: *sCellToAddMod* in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	513150	
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
uplinkConfigCommon ::= SEQUENCE {		
frequencyInfoUL	Not Present	
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		

ss-PBCH-BlockPower	0	
}		
}		

14.2.1.3.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Table 14.2.1.3.6-1: Expected Result

Test band	Expected UL TCP Throughput
CA_n28A-n41A 30M+100M	[TBD]

14.2.1.4 UL Throughput under static channel, 2TX-1TX Switching, CA_n41A-n79A, Unaligned frame boundary

14.2.1.4.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data in Conducted with NR Inter-band CA between n41 2Tx and n79 1Tx.

Verify UE support the unaligned frame boundary with slot alignment for R16 inter-band CA.

14.2.1.4.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.1.4.3 Applicability

This test applies to Type2 UEs supporting NR UL CA_n41A-n79A

14.2.1.4.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell

Cell Id=02 TAC = 01

MCC = 460 MNC = 00

Test Band=n79

Test Frequency= f1

UL Modulation / Coding = 27

UL RB Allocation = Full

UL 2x2MIMO = FALSE

UL 256QAM = TRUE

absoluteFrequencySSB=721824

absoluteFrequencyPointA=720048

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.

Cell A (n41)				*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*
Cell B (n79)	*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*		

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.1.4.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

14.2.1.4.5 Test procedure

Table 14.2.1.4.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B

T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table14.2.1.4.5-1
3. Set the parameters of the propagation condition according to Table 14.2.1.4.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table14.2.1.4.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.1.4.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin uplink TCP transmission. SS schedules UL data on PCC and SCC respectively every UL slot. UL MIMO is enabled on PCC
13. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
14. Stop uplink data transmission.
15. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
16. Repeat step 11-15 for one more iteration.
17. Calculate the average TCP throughput on the uplink channel during the file transfer over all iterations.
18. SS configures the cell power according to T2 in Table 14.2.1.4.5-1
19. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
20. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
21. UE transmit an RRCReconfigurationComplete

POSTAMBLE

22. Switch Off UE, UE initiates a Detach procedure.
23. Deactivate Cell A and Cell B.

Table 14.2.1.4.5-2: *sCellToAddMod* in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	721824	
frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
uplinkConfigCommon ::= SEQUENCE {		
frequencyInfoUL	Not Present	
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	

nrofUplinkSymbols	2	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.2.1.4.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Table 14.2.1.4.6-1: Expected Result

Test band	Expected UL TCP Throughput
CA_n41A-n79A 100M+100M	[TBD]

14.2.1.5 UL Throughput under static channel, 2TX-1TX Switching, CA_n79A-n41A , Unaligned frame boundary

14.2.1.5.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data in Conducted with NR Inter-band CA between n79 2Tx and n41 1Tx.

To measure the UE uplink throughput performance while uploading TCP based data in Conducted with NR Inter-band CA between n79 2Tx and n41 1Tx .

Verify UE support the unaligned frame boundary with slot alignment for R16 inter-band CA.

14.2.1.5.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.1.5.3 Applicability

This test applies to Type2 UEs supporting NR UL CA_n41A-n79A

14.2.1.5.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE

UL 256QAM = TRUE
absoluteFrequencySSB=721824
absoluteFrequencyPointA= 720048

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.

Cell A (n79)				*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*
Cell B (n41)	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*			

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.1.5.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE
UE is powered off

14.2.1.5.5 Test procedure

Table 14.2.1.5.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active
T1			-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.1.5.5-1
3. Set the parameters of the propagation condition according to Table 14.2.1.5.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS activates Cell B and configures the cell power according to T1 in Table 14.2.1.5.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2 and A4.
8. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.1.5.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin uplink TCP transmission. SS schedules UL data on PCC and SCC respectively every UL slot. UL MIMO is enabled on PCC.
13. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
14. Stop uplink data transmission.
15. SS deactivates SCC by sending the deactivation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10).
16. Repeat step 11-15 for one more iteration.
17. Calculate the average TCP throughput on the uplink channel during the file transfer over all iterations.
18. SS configures the cell power according to T2 in Table 14.2.1.5.5-1
19. The UE sends MeasurementReport message to report event A2 with the measured RSRP value for NR Cell A and B
20. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
21. UE transmit an RRCReconfigurationComplete

POSTAMBLE

22. Switch Off UE, UE initiates a Detach procedure.
23. Deactivate Cell A and Cell B.

Table 14.2.1.5.5-2: *sCellToAddMod* in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	524910	
frequencyBandList	n41	
absoluteFrequencyPointA	523170	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon ::= SEQUENCE {		
frequencyInfoUL	Not Present	
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	

}		
}		

14.2.1.5.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Table 14.2.1.5.6-1: Expected Result

Test band	Expected UL TCP Throughput
CA_n79A-n41A 100M+100M	[TBD]

14.2.2 Mobility

14.2.2.1 Handover with uplink data transmission, CA_n41C

14.2.2.1.1 Test Purpose

Test to verify that UE handover with continuous uplink data transmission in NR Intra-band Contiguous CA

14.2.2.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.2.1.3 Applicability

This test applies to Type2 UEs supporting NR UL CA_n41C

14.2.2.1.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01

MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=524910
absoluteFrequencyPointA=523128

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=524910
absoluteFrequencyPointA=503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUEUL 256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

14.2.2.1.5 Test procedure

Table 14.2.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	NR Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active	Not Active
T1			-75	-75	Not Active	Not Active
T2			-95	-95	-75	-75
T3			-75	-75	-95	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.2.1.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.2.2.1.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.1.1.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin uplink TCP transmission. SS schedules UL data on PCC and SCC
12. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.

13. SS configures the cell power according to T2 in Table 14.2.2.1.5-1
14. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell A, Cell Band Cell C
15. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToReleaseList to release Cell B as the SCell. Refer to Table 14.2.2.1.5-2 for parameter configuration
16. Verify that UE sends RRCReconfigurationComplete message in Cell C to indicate the successful handover
17. Verify that UE sends MeasurementReport message in Cell C to report event A4 with the measured RSRP value for NR Cell D
18. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell D. Refer to Table 14.2.2.1.5-3 for parameter configuration
19. Verify that UE sends RRCReconfigurationComplete
20. SS activates Cell D as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
21. Verify the TCP data transmission is continued on Cell C and Cell D. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
22. SS configures the cell power according to T3 in Table 14.2.2.1.5-1
23. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell C, Cell D and Cell A
24. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToReleaseList to release Cell D as the SCell. Refer to Table 14.1.2.1.5-2 for parameter configuration
25. Verify that UE sends RRCReconfigurationComplete message in Cell A to indicate the successful handover
26. Verify that UE sends MeasurementReport message in Cell A to report event A4 with the measured RSRP value for NR Cell B
27. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell B. Refer to Table 14.2.2.1.5-3 for parameter configuration
28. Verify that UE sends RRCReconfigurationComplete
29. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
30. Verify the TCP data transmission is continued on Cell A and Cell B. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
31. Stop uplink data transmission.
32. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
33. UE transmit an RRCReconfigurationComplete

POSTAMBLE

34. Switch Off UE, UE initiates a Detach procedure.
35. Deactivate Cell A , Cell B, Cell C and Cell D.

Table 14.2.2.1.5-2: RRCReconfiguration in step 15 and step 24

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 15
	Physical Cell ID of Cell A	Step 20
downlinkConfigCommon {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	504990	Step 15, Cell C
	513150	Step 24, Cell A
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.2.2.1.5-3: *sCellToAddMod* in *RRCReconfiguration* Message in step 8, step 18 and step 27

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	Step 8 and Step 27
	Physical cell id of Cell D	Step 18
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	524910	Step 8 and Step 27
	528990	Step 18
frequencyBandList	n41	
absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	

subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon ::= SEQUENCE {		
frequencyInfoUL	Not Present	
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

14.2.2.1.6 Expected Result

UE could support intra-frequency handover with continuous uplink data transmission and record the throughput before and after handover

Table 14.2.2.1.6-1: Expected Result

Test band	Step	Expected DL TCP Throughput
CA_n41C 100M+60M	Step 12	[TBD]
	Step 21	[TBD]
	Step 30	[TBD]

14.2.2.2 PCell Handover with uplink data transmission, CA_n41A-n28A

14.2.2.2.1 Test Purpose

Test to verify that UE could support PCell handover meanwhile keep SCell unchanged with continuous uplink data transmission in NR Inter-band n41 2Tx and n28 1Tx.

14.2.2.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.2.2.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n28A

14.2.2.2.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FAILSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140792

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full

DL 4x4MIMO = TRUE

DL 256QAM = TRUE

absoluteFrequencySSB= 504990

absoluteFrequencyPointA= 503172

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.2.2.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

14.2.2.2.5 Test procedure

Table 14.2.2.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active
T1			-75	-75	Not Active
T2			-95	-75	-75
T3			-75	-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.2.2.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.2.2.2.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.2.2.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin uplink TCP transmission. SS schedules UL data on PCC every UL slot and schedules UL data on SCC for the slots which is not collided with UL slots on PCC. UL MIMO is enabled on PCC
12. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. SS configures the cell power according to T2 in Table 14.2.2.2.5-1
14. Verify tht UE sends MeasurementReport message to report event A3 with the measured RSRP value for NR Cell A and Cell B
15. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToAddModList to keep Cell B as SCell. Refer to Table 14.2.2.2.5-2 for parameter configuration
16. Verify that UE sends RRCReconfigurationComplete message in Cell C
17. Verify the TCP data transmission is continued on Cell C and Cell B. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
18. SS configures the cell power according to T3 in Table 14.2.2.2.5-1
19. Verify tht UE sends MeasurementReport message to report event A3 with the measured RSRP value for NR Cell A and Cell B
20. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToAddModList to keep Cell B as SCell. Refer to Table 14.2.2.2.5-2 for parameter configuration
21. Verify that UE sends RRCReconfigurationComplete message in Cell A
22. Verify the TCP data transmission is continued on Cell A and Cell B. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
23. Stop uplink data transmission.
24. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
25. UE transmit an RRCReconfigurationComplete

POSTAMBLE

26. Switch Off UE, UE initiates a Detach procedure.
27. Deactivate Cell A , Cell B and Cell C.

Table 14.2.2.2.5-2: RRCReconfiguration in step14 and Step19

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 15
	Physical Cell ID of Cell A	Step 20
downlinkConfigCommon {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	504990	Step 15, Cell C
	513150	Step 20, Cell A
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
}		
}		
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
}		
}		
uplinkConfigCommon::= SEQUENCE {		
frequencyInfoUL::= SEQUENCE {		
frequencyBandList	n28	

absoluteFrequencyPointA	140792	
}		
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		
}		

14.2.2.2.6 Expected Result

UE could support PCell intra-frequency handover with continuous uplink data transmission and record the throughput before and after handover

Table 14.2.2.2.6-1: Expected Result

Test band	Step	Expected UL TCP Throughput
CA_n41A+n28A 100M+30M	Step 12	[TBD]
	Step 17	[TBD]
	Step 22	[TBD]

14.2.2.3 Handover with uplink data transmission, PCell and SCell, CA_n41A-n28A

14.2.2.3.1 Test Purpose

Test to verify that UE could support handover on PCC and SCC with continuous uplink data transmission in NR Inter-band n41 2Tx and n28 1Tx .

14.2.2.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.2.3.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n28A

14.2.2.3.4 Test conditions

[SS configuration]

NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140792

NR Cell C, PCell
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=504990
absoluteFrequencyPointA=503172

NR Cell D, SCell
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full

UL 2x2MIMO = FALSE

UL 256QAM = TRUE

absoluteFrequencySSB=154570

DL absoluteFrequencyPointA= 151720

UL absoluteFrequencyPointA= 140792

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.2.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

14.2.2.3.5 Test procedure

Table 14.2.2.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	NR Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active	Not Active
T1			-75	-75	Not Active	Not Active
T2			-95	-95	-75	-75
T3			-75	-75	-95	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 14.2.2.3.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table 14.2.2.3.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table14.2.2.3.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin uplink TCP transmission. SS schedules UL data on PCC every UL slot and schedules UL data on SCC for the slots which is not collided with UL slots on PCC.
12. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. SS configures the cell power according to T2 in Table 14.2.2.3.5-1
14. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell A, Cell Band Cell C
15. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell C and sCellToReleaseList to release Cell B as the SCell. Refer to Table 14.2.2.3.5-2 for parameter configuration
16. Verify that UE sends RRCReconfigurationComplete message in Cell C to indicate the successful handover
17. Verify that UE sends MeasurementReport message in Cell C to report event A4 with the measured RSRP value for NR Cell D
18. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with SCell Cell D. Refer to Table 14.2.2.3.5-3 for parameter configuration
19. Verify that UE sends RRCReconfigurationComplete
20. SS activates Cell D as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
21. Verify the TCP data transmission is continued on Cell C and Cell D. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
22. SS configures the cell power according to T3 in Table 14.2.2.3.5-1
23. Verify that UE sends MeasurementReport message to report event A2 and A3 with the measured RSRP value for NR Cell C, Cell D and Cell A
24. The SS transmits an RRCReconfiguration message including a reconfigurationWithSync to change PCell to Cell A and sCellToReleaseList to release Cell D as the SCell. Refer to Table 14.2.2.3.5-2 for parameter configuration
25. Verify that UE sends RRCReconfigurationComplete message in Cell A to indicate the successful handover
26. Verify that UE sends MeasurementReport message in Cell A to report event A4 with the measured RSRP value for NR Cell B
27. The SS transmits an RRCReconfiguration message containing an sCellToAddModList with

SCell Cell B. Refer to Table 14.2.2.3.5-3 for parameter configuration

28. Verify that UE sends RRCReconfigurationComplete
29. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
30. Verify the TCP data transmission is continued on Cell A and Cell B. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
31. Stop uplink data transmission.
32. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
33. UE transmit an RRCReconfigurationComplete

POSTAMBLE

34. Switch Off UE, UE initiates a Detach procedure.
35. Deactivate Cell A , Cell B, Cell C and Cell D.

Table 14.2.2.3.5-2: RRCReconfiguration in step 15 and step 24

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	Step 15
	Physical Cell ID of Cell A	Step 24
downlinkConfigCommon {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	504990	Step 14, Cell C
	513150	Step 23, Cell A
frequencyBandList	n41	
absoluteFrequencyPointA	503172	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	100M
}		
}		
}		
}		
}		
sCellToReleaseList SEQUENCE {	1 entry	
sCellIndex[1]	1	
}		
}		

Table 14.2.2.3.5-3: *sCellToAddMod* in *RRCReconfiguration* Message in step 8, step 18 and step 27

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell D	Step 18
	Physical cell id of Cell B	Step 8 and Step 27
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	
}		
}		
}		
uplinkConfigCommon::= SEQUENCE {		
frequencyInfoUL::= SEQUENCE {		
frequencyBandList	n28	
absoluteFrequencyPointA	140792	
}		
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz15	
ss-PBCH-BlockPower	0	
}		

14.2.2.3.6 Expected Result

UE could support intra-frequency handover with continuous downlink data transmission and record the throughput before and after handover

Table 14.2.2.3.6-1: Expected Result

Test band	Step	Expected UL TCP Throughput
CA_n41A+n28A 100M+30M	Step 12	[TBD]
	Step 21	[TBD]
	Step 30	[TBD]

14.2.2.4 SCell Removal and Addition with uplink data transmission, CA_n41A-n79A

14.2.2.4.1 Test Purpose

Test to verify that UE could support SCell removal and addition with continuous uplink data transmission in NR Inter-band n41 2Tx and n79 1Tx with unaligned frame boundary for R16 inter-band CA.

14.2.2.4.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.321

14.2.2.4.3 Applicability

This test applies to Type2 UEs supporting NR DL CA _n41A-n79A

14.2.2.4.4 Test conditions

[SS configuration]
NR Cell A, PCell
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n79
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full

UL 2x2MIMO = FALSE

UL 256QAM = TRUE

absoluteFrequencySSB=721824

absoluteFrequencyPointA=720048

NR Cell C, SCell

Cell Id=03 TAC = 01

MCC = 460 MNC = 00

Test Band=n79

Test Frequency= f1

UL Modulation / Coding = 27

UL RB Allocation = Full

UL 2x2MIMO = FALSE

UL 256QAM = TRUE

absoluteFrequencySSB=723360

absoluteFrequencyPointA=720048

The frame boundary of n41 Cell A and n79 Cell B are unaligned as indicated below. The slot boundary are aligned.

Cell A (n41)				*D*	*D*	*D*	*D*	*D*	*D*	*D*	*S*	*U*	*U*
Cell B (n79)	*D*	*D*	*D*	*S*	*U*	*D*	*D*	*S*	*U*	*U*			

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.2.2.4.4-1: Test Points Configuration

Test Point	**Propagation Conditions**	**Correlation Matrices**
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.3 and A.3.2 for NR CA.

UE

UE is powered off

14.2.2.4.5 Test procedure

Table14.2.2.4.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	Not Active	Not Active
T1			-75	-75	Not Active
T2			-75	-95	-75
T3			-75	-75	-95

PREAMBLE

1. SS Activates Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table14.2.2.4.5-1
3. The UE is powered ON.

MAIN BODY

4. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
5. SS activates Cell B and configures the cell power according to T1 in Table14.2.2.4.5-1
6. The SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A2, A3 and A4.
7. The UE sends MeasurementReport message to report event A4 with the measured RSRP value for Cell B
8. The SS transmits an RRCReconfiguration message including sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.2.2.4.514.2.2.4.5-2 for parameter configuration
9. The UE transmits an RRCReconfigurationComplete message
10. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
11. Begin uplink TCP transmission. SS schedules UL data on PCC every UL slot and schedules UL data on SCC for the slots which is not collided with UL slots on PCC.
12. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result. Verify data transmission on both PCC and SCC.
13. SS configures the cell power according to T2 in Table14.2.2.4.5-1
14. Verify tht UE sends MeasurementReport message to report event A2 and A4 with the measured RSRP value for NR Cell A, Cell B and Cell C
15. The SS transmits an RRCReconfiguration message including sCellToReleaseList to release Cell B as the SCell an sCellToAddModList to add Cell C as the SCell. Refer to Table 14.2.2.4.5-2 for parameter configuration
16. Verify that UE sends RRCReconfigurationComplete message in Cell A
17. SS activates Cell C as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10

18. Verify the TCP data transmission is continued on Cell A and Cell C. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
19. SS configures the cell power according to T3 in Table 14.2.2.4.5-1
20. Verify that UE sends MeasurementReport message to report event A2 and A4 with the measured RSRP value for NR Cell A, Cell C and Cell B
21. The SS transmits an RRCReconfiguration message including sCellToReleaseList to release Cell C as the SCell an sCellToAddModList to add Cell B as the SCell. Refer to Table14.2.2.4.5-2 for parameter configuration
22. Verify that UE sends RRCReconfigurationComplete message in Cell A
23. SS activates Cell B as SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10
24. Verify the TCP data transmission is continued on Cell A and Cell B. Keep uplink TCP transmission for 90 seconds and record TCP average throughput result.
25. Stop uplink data transmission.
26. SS sends RRCReconfigurationmessage containing an sCellToReleaseList with SCell NR Cell B
27. UE transmit an RRCReconfigurationComplete

POSTAMBLE

28. Switch Off UE, UE initiates a Detach procedure.
29. Deactivate Cell A , Cell B and Cell C.

Table 14.2.2.4.5-2: *RRCReconfiguratio*n Message in step 8, step 15 and Step 21

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
CellGroupConfig ::= SEQUENCE {		
sCellToReleaseList {	1 entry	
sCellIndex[1]	1	
}		
sCellToAddModList {	1 entry	
sCellIndex	2	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell C	Step 15
	Physical cell id of Cell B	Step 8 and Step 21
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	723360	Step 15
	721824	Step 8 and Step 21
frequencyBandList	n79	
absoluteFrequencyPointA	720048	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	273	
}		

}		
}		
uplinkConfigCommon ::= SEQUENCE {		
frequencyInfoUL	Not Present	
initialUplinkBWP	Refer to Table 4.6.3-14 in TS 38.508-1	
}		
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	3	*DDDSU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	1	
nrofUplinkSymbols	2	
}		
pattern2 {		
dl-UL-TransmissionPeriodicity	ms2p5	2.5ms
nrofDownlinkSlots	2	*DDSUU*
nrofDownlinkSymbols	10	*DL : GP : UL = 10 : 2 : 2*
nrofUplinkSlots	2	
nrofUplinkSymbols	2	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		
}		

14.2.2.4.6 Expected Result

UE could support intra-frequency SCell removal and addtion with continuous uplink data transmission and record the throughput before and after handover

Table 14.2.2.4.6-1: Expected Result

Test band	Step	Expected UL TCP Throughput
CA_n41A+n79A 100M+100M	Step 12	[TBD]
	Step 18	[TBD]
	Step 24	[TBD]

14.3 SUL

14.3.1 Throughput

14.3.1.1 UL Throughput under static channel, SUL_n41A-n83A

14.3.1.1.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data on SUL band.

14.3.1.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508-1

14.3.1.1.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.1.1.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.1.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off

14.3.1.1.5 Test procedure

Table 14.3.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90
T1			-90	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. The SS configures the initial power according to T0 in Table 14.3.2.1.5-1
3. Set the parameters of the propagation condition according to Table 14.3.1.1.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS configures the cell power according to T1 in Table 14.3.1.1.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A5.
8. The UE sends MeasurementReport message to report event A5 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including supplementaryUplink to configure SUL band. Refer to Table 14.3.1.1.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message

11. Begin uplink TCP transmission. SS schedules UL data transmssion on SUL band.
12. Verify the uplink data transmission on SUL band. Keep uplink TCP transmission for 90 seconds and record uplink average TCP throughput result.
13. Stop uplink data transmission.
14. Repeat step 11-13 for one more iteration.
15. Calculate the average TCP throughput on the uplink channel over all iterations.

POSTAMBLE

16. Switch Off UE, UE initiates a Detach procedure.
17. Deactivate Cell A and Cell B.

Table 14.3.1.1.5-2: supplementaryUplink in *SIB1* Message in step 1

Information Element	Value/remark	Comments
supplementaryUplink SEQUENCE {	UplinkConfigCommonSIB	
FrequencyInfoUL::= SEQUENCE {		
frequencyBandList	n83	
absoluteFrequencyPointA	140720	
scs-SpecificCarriers SEQUENCE {	1 entry	
SCS-SpecificCarrier1{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
}		
}		
initialUplinkBWP ::= SEQUENCE {	BWP-UplinkCommon	
genericParameters {	BWP	
locationAndBandwidth	28875	
subcarrierSpacing	kHz15	
}		
}		
timeAlignmentTimerCommon	infinity	
}		

Table 14.3.1.1.5-2: *supplementaryUplink* in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
SpCellConfig{		
spCellConfigDedicated {		
supplementaryUplink SEQUENCE {	UplinkConfig	
uplinkBWP-ToAddModList{	BWP-uplink	
bwp-Id	1	
Bwp-Common{		

genericParameters {	BWP	
LocationAndBandwidth	32174	
subcarrierSpacing	kHz15	
}		
}		
Bwp-Dedicated{	For parameters not specified refer to TS 38.508-1 Table 4.6.3-15 with condition SUL_NUL	
pusch-Config{		
dataScramblingIdentityPUSCH	PUSCH Scrambling Identity of Cell B	
}		
}		
uplinkTxSwitching-r16	Not Present	
}		
}		
}		

14.3.1.1.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Editor Note: the expected throughput value may need to be further revised

Table 14.3.1.1.6-1: Expected Result

Test band	Expected UL TCP Throughput
sul_n41A-n83A	[160 Mbps]

14.3.1.2 UL Throughput under static channel, TX Switching, SUL_n41A-n83A

14.3.1.2.1 Test Purpose

To measure the UE uplink throughput performance while uploading TCP based data with TX switching on NUL and SUL band.

14.3.1.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508-1

14.3.1.2.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.1.2.4 Test conditions

[SS configuration]

NR Cell A, PCell

Cell Id=01 TAC = 01

MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B, SPCell
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE
UE is powered off

14.3.1.2.5 Test procedure

Table 14.3.1.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90
T1			-85	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. The SS configures the initial power according to T0 in Table 14.3.2.1.5-1
3. Set the parameters of the propagation condition according to Table 14.3.1.2.4-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS configures the cell power according to T1 in Table 14.3.1.2.5-1
7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A5.
8. The UE sends MeasurementReport message to report event A5 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including supplementaryUplink to configure SUL band with TX switching enabled. Refer to Table 14.3.1.2.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. Begin uplink TCP transmission. SS schedules UL data transmssion on NUL band and SUL band.
12. Verify the uplink data transmission on NUL and SUL band. Keep uplink TCP transmission for 90 seconds and record uplink average TCP throughput result.
13. Stop uplink data transmission.
14. Repeat step 11-13 for one more iteration.
15. Calculate the average TCP throughput on the uplink channel over all iterations.

POSTAMBLE

16. Switch Off UE, UE initiates a Detach procedure.
17. Deactivate Cell A and Cell B.

Table 14.3.1.2.5-2: *supplementaryUplink* in *RRCReconfiguration* Message in step 10

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
SpCellConfig{		
spCellConfigDedicated {		

supplementaryUplink SEQUENCE {	UplinkConfig	
uplinkBWP-ToAddModList{	BWP-uplink	
bwp-Id	1	
Bwp-Common{		
genericParameters {	BWP	
LocationAndBandwidth	32174	
subcarrierSpacing	kHz15	
}		
}		
Bwp-Dedicated{	For parameters not specified refer to TS 38.508-1 Table 4.6.3-15 with condition SUL_NUL	
pusch-Config{		
dataScramblingIdentityPUSCH	PUSCH Scrambling Identity of Cell B	
}		
}		
uplinkTxSwitching-r16{		
uplinkTxSwitchingPeriodLocation-r16	TRUE	
uplinkTxSwitchingCarrier-r16	Carrier1	
}		
}		
}		
}		

14.3.1.2.6 Expected Result

Calculate and record the average throughput on TCP layer. The average uplink TCP throughput shall meet or exceed the value in following table.

Editor Note: the expected throughput value may need to be further revised

Table 14.3.1.2.6-1: Expected Result

Test band	Expected UL TCP Throughput
sul_n41A-n83A	[380 Mbps]

14.3.1.3 Bidirectional Throughput under static channel, SUL_n41A-n83A

14.3.1.3.1 Test Purpose

To measure the UE uplink throughput and downlink throughput based UDP data transmission with SUL band.

14.3.1.3.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508-1

14.3.1.3.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.1.3.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4 MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.1.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off

14.3.1.3.5 Test procedure

Table 14.3.1.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90
T1			-90	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. The SS configures the initial power according to T0 in Table 14.3.1.3.5-1
3. Set the parameters of the propagation condition according to Table 14.3.1.3.4-1.

MAIN BODY

4. Execute test steps 4-10 in 14.3.1.1.5
5. Begin downlink and uplink UDP transmission simultaneous. For uplink transmission SS schedules UL data transmssion on SUL band.
6. Keep bidirection UDP transmission for 90 seconds and record downlink and uplink average UDP throughput result.
7. Stop bidirection data transmission.
8. Repeat step 5-7 for one more iteration.
9. Calculate the average UDP throughput on the uplink channel and downlink channel over all iterations.

POSTAMBLE

10. Switch Off UE, UE initiates a Detach procedure.
11. Deactivate Cell A and Cell B.

14.3.1.3.6 Expected Result

Calculate and record the average throughput on UDP layer. The average uplink and downlink UDP throughput shall meet or exceed the value in following table.

Editor Note: the expected throughput value may need to be further revised

Table 14.3.1.3.6-1: Expected Result

	Test band	**Expected UL TCP Throughput**
Uplink	sul_n41A-n83A	[380 Mbps]

Downlink	n41	[1.4 Gbps]

14.3.1.4 Bidirectional Throughput under static channel, SUL_n41A-n83A and DL CA_n41A-n28A

14.3.1.4.1 Test Purpose

To measure the UE uplink throughput and downlink throughput based UDP data transmission with downlink CA and TX switching between NUL and SUL bands.

14.3.1.4.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508-1

14.3.1.4.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.1.4.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
DL Modulation / Coding = 27
DL RB Allocation = Full
DL 4x4 MIMO = TRUE
DL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570

DL absoluteFrequencyPointA= 151720

UL absoluteFrequencyPointA= 140720

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.1.3.5-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off

14.3.1.4.5 Test procedure

Table 14.3.1.4.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90
T1			-85	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. The SS configures the initial power according to T0 in Table 14.3.1.4.5-1
3. Set the parameters of the propagation condition according to Table 14.3.1.3.5-1.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. SS configures the cell power according to T1 in Table 14.3.1.2.5-1

7. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A5.
8. The UE sends MeasurementReport message to report event A5 with the measured RSRP value for Cell B
9. The SS transmits an RRCReconfiguration message including supplementaryUplink to configure SUL band with TX switching enabled and sCellToAddModList with SCell addition to configure Cell B as SCC. Refer to Table 14.3.1.4.5-2 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message
11. SS activates SCC by sending the activation MAC CE. Refer TS 38.321 , clauses 5.9, 6.1.3.10.
12. Begin downlink and uplink UDP transmission simultaneous. For uplink transmission SS schedules UL data transmssion on NUL and SUL bands.
13. Keep bidirection UDP transmission for 90 seconds and record downlink and uplink average UDP throughput result.
14. Stop bidirection data transmission.
15. Repeat step 12-14 for one more iteration.
16. Calculate the average UDP throughput on the uplink channel and downlink channel over all iterations.

POSTAMBLE

17. Switch Off UE, UE initiates a Detach procedure.
18. Deactivate Cell A and Cell B.

Table 14.3.1.4.5-2: *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
CellGroupConfig{		
SpCellConfig	Refer to Table 14.3.1.2.5-2	Add SUL
sCellToAddModList	Refer to Table 错误！未找到引用源。-2	Add DL CA
}		

14.3.1.4.6 Expected Result

Calculate and record the average throughput on UDP layer. The average uplink and downlink UDP throughput shall meet or exceed the value in following table.

Editor Note: the expected throughput value may need to be further revised

Table 14.3.1.4.6-1: Expected Result

	Test Band	**Expected UL TCP Throughput**
Uplink	sul_n41A-n83A	[380 Mbps]
Downlink	CA_n41A-n28A	[1.7 Gbps]

14.3.2 Mobility

14.3.2.1 SUL addition and release with data transmission

14.3.2.1.1 Test Purpose

Verify that UE supports SUL addition and release with continuous uplink data transmission and uplink TX switching.

14.3.2.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508-1

14.3.2.1.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.2.1.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off

14.3.2.1.5 Test procedure

Table 14.3.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90
T1			-90	-75
T2			-85	-85

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block broadcast. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. SS configures the initial power of Cell A according to T0 in Table 14.3.2.1.5-1
3. SS activates Cell B and configures the cell power according to T0 in Table 14.3.2.1.5-1

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. Begin uplink TCP transmission. Verify data transmission on CellA NUL band.
7. SS configures the cell power according to T1 in Table 14.3.2.1.5-1
8. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A5.
9. The UE sends MeasurementReport message to report event A5 with the measured RSRP value for Cell B

10. The SS transmits an RRCReconfiguration message including supplementaryUplink to configure SUL band. Refer to Table 14.3.2.1.5-2 for parameter configuration
11. The UE transmits an RRCReconfigurationComplete message
12. SS schedules UL data transmssion on SUL band.
13. Verify that UE could keep data transmission on Cell A SUL band.
14. SS configures the cell power according to T2 in Table 14.3.2.1.5-1
15. SS schedules UL data transmssion on both NUL band and SUL band.
16. Verify that UE could keep data transmission on Cell A NUL band and SUL band simultaneously.
17. Stop uplink data transmission.
18. The SS transmits an RRCReconfiguration message to release SUL band. Refer to Table Table 14.3.2.1.5-3 for parameter configuration
19. UE transmit an RRCReconfigurationComplete

POSTAMBLE

20. Switch Off UE, UE initiates a Detach procedure.
21. Deactivate Cell A and Cell B.

Table 14.3.2.1.5-2: *supplementaryUplink* in *RRCReconfiguration* Message in step 10

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
SpCellConfig{		
spCellConfigDedicated {		
supplementaryUplink SEQUENCE {	UplinkConfig	
uplinkBWP-ToAddModList{	BWP-uplink	
bwp-Id	1	
Bwp-Common{		
genericParameters {	BWP	
LocationAndBandwidth	32174	
subcarrierSpacing	kHz15	
}		
}		
Bwp-Dedicated{	For parameters not specified refer to TS 38.508-1 Table 4.6.3-15 with condition SUL_NUL	
pusch-Config{		
dataScramblingIdentityPUSCH	PUSCH Scrambling Identity of Cell B	
}		
}		
uplinkTxSwitching-r16{		
uplinkTxSwitchingPeriodLocation-r16	TRUE	
uplinkTxSwitchingCarrier-r16	Carrier1	
}		

}		
}		
}		

Table 14.3.2.1.5-3: *supplementaryUplink* in *RRCReconfiguration* Message in step 18

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
ServingCellConfig {		
supplementaryUplinkRelease-r16	TRUE	
}		

14.3.2.1.6 Expected Result

At step 1, UE could select Cell A and initiate registration
At step 9, UE could sends MeasurementReport message to report event A5
At step 13, UE could transmit uplink data on SUL band
At step 16, UE could transmit uplink data on NUL and SUL bands simultaneously
At step 19, UE could sucessfully release SUL.

14.3.2.2 NUL handover with data transmission

14.3.2.2.1 Test Purpose

Verify that UE supports NUL handover with continuous uplink data transmission while SUL is unchanged.

14.3.2.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508-1

14.3.2.2.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.2.2.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE

absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB = 504990
absoluteFrequencyPointA=503172

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off.

14.3.2.2.5 Test procedure

Table 14.3.2.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90	Not Active
T1			-85	-75	Not Active
T2			-90	-75	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block broadcast. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. SS configures the initial power of Cell A according to T0 in Table 14.3.2.2.5-1
3. SS activates Cell B and configures the cell power according to T0 in Table 14.3.2.2.5-1

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR Cell A to register for PS services according to TS 38.508 subclause 4.5.2. UE is in state RRC_CONNECTED
6. Begin uplink TCP transmission. Verify data transmission on CellA NUL band.
7. SS configures the cell power according to T1 in Table 14.3.2.2.5-1
8. SS transmits an RRCReconfiguration message including measConfig to setup intra NR measurement and reporting for event A5.
9. The UE sends MeasurementReport message to report event A5 with the measured RSRP value for Cell B
10. The SS transmits an RRCReconfiguration message including supplementaryUplink to configure SUL band. Refer to Table 14.3.1.2.5-2 for parameter configuration
11. The UE transmits an RRCReconfigurationComplete message
12. SS schedules UL data transmssion on both NUL band and SUL band.
13. Verify that UE could keep data transmission on Cell A NUL band and SUL band simultaneously.
14. SS active Cell C and configures the MIB and System Informationt. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
15. SS configures the cell power of Cell A and Cell C according to T2 in Table 14.3.2.2.5-1
16. The SS transmits an RRCReconfiguration message including reconfigurationWithSync to trigger the handover from Cell A to Cell C and supplementaryUplink to keep SUL unchanged. Refer to Table 14.3.2.2.5-2 for parameter configuration
17. The UE transmits an RRCReconfigurationComplete message on Cell C
18. Verify that UE could continue the data transmission on Cell C NUL band and SUL band and

no throughout decline compared to the throughput at step 13.

19. Stop uplink data transmission.
20. The SS transmits an RRCReconfiguration message on Cell C to release SUL band. Refer to Table 14.3.2.1.5-3 for parameter configuration
21. UE transmit an RRCReconfigurationComplete

POSTAMBLE

22. Switch Off UE, UE initiates a Detach procedure.
23. Deactivate Cell C and Cell B.

14.3.2.2.6 Expected Result

At step 17, UE could successfully complete the handover from Cell A to Cell C
At step 18, UE could transmit uplink data on NUL and SUL bands simultaneously and there is no decrease in throughput

14.3.2.3 SUL change with data transmission

14.3.2.3.1 Test Purpose

Verify that UE supports SUL change with continuous uplink data transmission while NUL is unchanged.

14.3.2.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508-1

14.3.2.3.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.2.3.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B

Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB = 151720
absoluteFrequencyPointA= 140720

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off.

14.3.2.3.5 Test procedure

Table 14.3.2.3.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90	Not Active
T1			-85	-75	Not Active
T2			-85	-90	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block broadcast. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. SS configures the initial power of Cell A according to T0 in Table 14.3.2.3.5-1
3. SS activates Cell B and configures the cell power according to T0 in Table 14.3.2.3.5-1

MAIN BODY

4. Execute test steps 4-13 in 14.3.2.2.5
5. SS active Cell C. SS configures the cell power of Cell B and Cell C according to T2 in Table 14.3.2.3.5-1
6. The SS transmits an RRCReconfiguration message including supplementaryUplink to update the configuration of SUL band to Cell C. Refer to Table 14.3.2.3.5-2 for parameter configuration
7. The UE transmits an RRCReconfigurationComplete message on Cell A
8. Verify that UE could continue the data transmission on Cell A NUL band and Cell C SUL band and no throughout decline compared to the previous throughput on Cell A NUL band and Cell B SUL.
9. Stop uplink data transmission.
10. The SS transmits an RRCReconfiguration message on Cell A to release SUL band. Refer to Table 14.3.2.1.5-3 for parameter configuration
11. UE transmit an RRCReconfigurationComplete

POSTAMBLE

12. Switch Off UE, UE initiates a Detach procedure.
13. Deactivate Cell A and Cell C

Table 14.3.2.3.5-2: *supplementaryUplink* in *RRCReconfiguration* Message in step 6

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
SpCellConfig{		
spCellConfigDedicated {		
supplementaryUplink SEQUENCE {	UplinkConfig	
uplinkBWP-ToAddModList{	BWP-uplink	

bwp-Id	1	
Bwp-Common{		
genericParameters {	BWP	
LocationAndBandwidth	32174	
subcarrierSpacing	kHz15	
}		
}		
Bwp-Dedicated	For parameters not specified refer to TS 38.508-1 Table 4.6.3-15 with condition SUL_NUL	
pusch-Config{		
dataScramblingIdentityPUSCH	PUSCH Scrambling Identity of Cell C	
}		
}		
uplinkTxSwitching-r16{		
uplinkTxSwitchingPeriodLocation-r16	TRUE	
uplinkTxSwitchingCarrier-r16	Carrier1	
}		
}		
}		
}		

14.3.2.3.6 Expected Result

At step 7, UE could successfully complete the update of SUL band

At step 8, UE could transmit uplink data on NUL and SUL bands simultaneously and there is no decrease in throughput

14.3.2.4 NUL handover and SUL change with data transmission

14.3.2.4.1 Test Purpose

Verify that UE supports NUL handover and SUL change simultaneously with continuous uplink data transmission.

14.3.2.4.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508-1

14.3.2.4.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.2.4.4 Test conditions

[SS configuration]

NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB = 504990
absoluteFrequencyPointA=503172

NR Cell D
Cell Id=04 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full

UL 2x2MIMO = FALSE

UL 256QAM = TRUE

absoluteFrequencySSB = 151720

absoluteFrequencyPointA= 140720

[Common conditions]

Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off.

14.3.2.4.5 Test procedure

Table 14.3.2.4.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C	NR Cell D
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90	Not Active	Not Active
T1			-85	-75	Not Active	Not Active
T2			-90	-90	-75	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block broadcast. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. SS configures the initial power of Cell A according to T0 in Table 14.3.2.4.5-1
3. SS activates Cell B and configures the cell power according to T0 in Table 14.3.2.4.5-1

MAIN BODY

4. Execute test steps 4-13 in 14.3.2.2.5
5. SS active Cell C and Cell D. SS configures the MIB and System Informationt for Cell C. SUL

information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration

6. SS configures the cell power of Cel A, Cell B, Cell C and Cell D according to T2 in Table 14.3.2.4.5-1
7. The SS transmits an RRCReconfiguration message including reconfigurationWithSync to trigger the handover from Cell A to Cell C. Refer to Table 14.3.2.4.5-2 for parameter configuration
8. The UE transmits an RRCReconfigurationComplete message on Cell C
9. The SS transmits an RRCReconfiguration message including supplementaryUplink to add SUL band. Refer to Table 14.3.2.4.5-3 for parameter configuration
10. The UE transmits an RRCReconfigurationComplete message on Cell C
11. Verify that UE could continue the data transmission on Cell C NUL band and Cell D SUL band and no throughout decline compared to the previous throughput on Cell A NUL band and Cell B SUL.
12. Stop uplink data transmission.
13. The SS transmits an RRCReconfiguration message on Cell A to release SUL band. Refer to Table 14.3.2.1.5-3 for parameter configuration
14. UE transmit an RRCReconfigurationComplete

POSTAMBLE

15. Switch Off UE, UE initiates a Detach procedure.
16. Deactivate Cell A and Cell C

Table 14.3.2.4.5-2: RRCReconfiguration in step 7

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comment**
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	
}		
}		
}		
}		

Table 14.3.2.4.5-3:*supplementaryUplink* in *RRCReconfiguration* Message in step 9

Derivation Path: TS 38.508-1, Table 4.6.3-167		
Information Element	Value/remark	Comments
SpCellConfig{		
spCellConfigDedicated {		
supplementaryUplink SEQUENCE {	UplinkConfig	
uplinkBWP-ToAddModList{	BWP-uplink	
bwp-Id	1	
Bwp-Common{		

genericParameters {	BWP	
LocationAndBandwidth	32174	
subcarrierSpacing	kHz15	
}		
}		
Bwp-Dedicated	For parameters not specified refer to TS 38.508-1 Table 4.6.3-15 with condition SUL_NUL	
pusch-Config{		
dataScramblingIdentityPUSCH	PUSCH Scrambling Identity of Cell D	
}		
}		
uplinkTxSwitching-r16{		
uplinkTxSwitchingPeriodLocation-r16	TRUE	
uplinkTxSwitchingCarrier-r16	Carrier1	
}		
}		
}		
}		

14.3.2.4.6 Expected Result

At step 7, UE could successfully complete the update of SUL band
At step 11, UE could transmit uplink data on NUL and SUL bands simultaneously and there is no decrease in throughput

14.3.2.5 NUL handover to NR cell with data transmission

14.3.2.5.1 Test Purpose

Verify that UE supports NUL handover to NR FDD cell with continuous uplink data transmission.

14.3.2.5.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508-1

14.3.2.5.3 Applicability

This test applies to Type2 UEs supporting NR SUL

14.3.2.5.4 Test conditions

[SS configuration]
NR Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00

Test Band=n41
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = TRUE
UL 256QAM = TRUE
absoluteFrequencySSB=513150
absoluteFrequencyPointA=503172

NR Cell B
Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB=154570
DL absoluteFrequencyPointA= 151720
UL absoluteFrequencyPointA= 140720

NR Cell C
Cell Id=03 TAC = 01
MCC = 460 MNC = 00
Test Band=n28
Test Frequency= f1
UL Modulation / Coding = 27
UL RB Allocation = Full
UL 2x2MIMO = FALSE
UL 256QAM = TRUE
absoluteFrequencySSB = 151720
absoluteFrequencyPointA= 140720

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 14.3.2.5.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

[UE configuration]
The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.4 and A.3.2 for NR SUL.

UE

UE is powered off.

14.3.2.5.5 Test procedure

Table 14.3.2.5.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B	NR Cell C
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75	-90	Not Active
T1			-85	-75	Not Active
T2			-90	-90	-75

PREAMBLE

1. SS activates Cell A and configures the corresponding Master Information Block and System Information Block broadcast. SUL information is included in SIB1. Refer to Table 14.3.1.1.5-2 for parameter configuration
2. SS configures the initial power of Cell A according to T0 in Table 14.3.2.5.5-1
3. SS activates Cell B and configures the cell power according to T0 in Table 14.3.2.5.5-1

MAIN BODY

4. Execute test steps 4-13 in 14.3.2.2.5
5. SS active Cell C. SS configures the cell power of Cel A, Cell B and Cell C according to T2 in Table 14.3.2.5.5-1
6. The SS transmits an RRCReconfiguration message including reconfigurationWithSync to trigger the handover from Cell A to Cell C. Refer to Table 14.3.2.5.5-2 for parameter configuration
7. The UE transmits an RRCReconfigurationComplete message on Cell C
8. Verify that UE could continue the data transmission on Cell C and no throughout decline compared to the previous throughput on Cell B SUL.
9. Stop uplink data transmission.

POSTAMBLE

10. Switch Off UE, UE initiates a Detach procedure.
11. Deactivate Cell A and Cell C

Table 14.3.2.5.5-2: RRCReconfiguration in step 6

Derivation Path: TS 38.331 [6], clause 6.3.2

Information Element	Value/remark	Comment
CellGroupConfig ::= SEQUENCE {		
spCellConfig SEQUENCE {		
reconfigurationWithSync SEQUENCE {		
spCellConfigCommon{		
physCellId	Physical Cell ID of Cell C	
downlinkConfigCommon::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	154570	
frequencyBandList	n28	
absoluteFrequencyPointA	151720	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	
}		
initialDownlinkBWP ::= SEQUENCE {	BWP-UplinkCommon	
genericParameters {		
locationAndBandwidth	28875	
subcarrierSpacing	kHz15	
}		
}		
}		
}		
uplinkConfigCommon{		
FrequencyInfoUL::= SEQUENCE {		
frequencyBandList	n28	
absoluteFrequencyPointA	140720	
scs-SpecificCarriers SEQUENCE {	1 entry	
SCS-SpecificCarrier1{		
offsetToCarrier	0	
subcarrierSpacing	kHz15	
carrierBandwidth	160	30M
}		
}		
}		
initialUplinkBWP ::= SEQUENCE {	BWP-UplinkCommon	
genericParameters {	BWP	
locationAndBandwidth	28875	
subcarrierSpacing	kHz15	
}		
}		
timeAlignmentTimerCommon	infinity	

}		
}		
}		
}		
}		

14.3.2.5.6 Expected Result

At step 7, UE could successfully handover to Cell C
At step 11, UE could transmit uplink data on Cell C and there is no decrease in throughput compared to the throughput on previous SUL band

15 URLLC

15.1 Mini-slot

15.1.1 Functional test of Mini -slot

15.1.1.1 Mini-slot Scheduling with 2 symbols

15.1.1.1.1 Test Purpose

Verify UE could support the functionality of mini-slot scheduling with 2 symbols.

15.1.1.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.1.1.1.3 Applicability

This test applies to Type2 UEs

15.1.1.1.4 Test conditions

[SS configuration]
Cell A is a NR cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

Table15.1.1.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.1.1.1.4-2: Test band configuration

Test Point	Cell	Test Band	Test Frequency	NR Frame Structure	Special Frame
1	Cell A	n79	f1	DDDSU DDSUU	DDDDDDDDDDGGUU

Table 15.1.1.1.4-3: *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
pdsch-TimeDomainAllocationList{		
pdsch-TimeResourceAllocation{		
K0	0	
Mapping type	TypeB	
startSymbolAndLength	15(TBC)	
}		
}		
pusch-TimeDomainAllocationList{		
pusch-TimeResourceAllocation{		
K2	1	
Mapping type	TypeB	
startSymbolAndLength	14(TBC)	
}		
}		

15.1.1.1.5 Test procedure

Table 15.1.1.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH,SSS EPRE	dBm/SCS	-75

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 15.1.1.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).

MAIN BODY

5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with pdsch-MappingTypeB and pusch-MappingTypeB supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
9. SS Transmits RRC Reconfiguration including pdsch-TimeDomainAllocationList and pusch-TimeDomainAllocationList. Refer to Table 15.1.1.1.4-3 for parameter configuration.
10. UE sends RRC Reconfiguration Complete to the SS.
11. SS Transmits an ICMP Echo Request packet (PING) set the length of PING package size to 80 bytes.
12. UE replies with an ICMP Echo Reply packet.
13. Repeat step 11-12 9 times.

POSTAMBLE

14. The SS initiates a De-registration procedure.
15. Deactivate NR Cell A.

15.1.1.1.6 Expected Result

Verify that UE could transmit data successfully by mini-slot scheduling with 2 symbols.

15.1.1.2 Mini-slot Scheduling with 7 symbols

15.1.1.2.1 Test Purpose

Verify UE could support the functionality of mini-slot scheduling with 7 symbols.

15.1.1.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.1.1.2.3 Applicability

This test applies to Type2 UEs

15.1.1.2.4 Test conditions

[SS configuration]
Cell A is a NR cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

Table15.1.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.1.1.2.4-2: Test band configuration

Test Point	Cell	Test Band	Test Frequency	NR Frame Structure	Special Frame
1	Cell A	n79	f1	DDDSU DDSUU	DDDDDDDDDDGGUU

Table 15.1.1.2.4-3: *RRCReconfiguratio*n Message in step 9

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
pdsch-TimeDomainAllocationList{		
pdsch-TimeResourceAllocation{		
K0	0	
Mapping type	TypeB	
startSymbolAndLength	85(TBC)	
}		
}		
pusch-TimeDomainAllocationList{		
pusch-TimeResourceAllocation{		
K2	1	
Mapping type	TypeB	
startSymbolAndLength	84(TBC)	

}		
}		

15.1.1.2.5 Test procedure

Table 15.1.1.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 15.1.1.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).

MAIN BODY

5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with pdsch-Mapping Type B / pusch-Mapping Type B supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
9. SS Transmits RRC Reconfiguration including pdsch-TimeDomainAllocationList and pusch-TimeDomainAllocationList configure refer to Table 15.1.1.2.4-3 for parameter configuration.
10. UE sends RRC Reconfiguration Complete to the SS.
11. SS Transmits an ICMP Echo Request packet (PING), set the length of PING package size to 80 bytes.
12. UE replies with an ICMP Echo Reply packet.
13. Repeat step 11-12 9 times.

POSTAMBLE

14. The SS initiates a De-registration procedure.
15. Deactivate NR Cell A.

15.1.1.2.6 Expected Result

Verify UE could transmit data successfully by mini-slot scheduling with 7 symbols.

15.1.2 Performance test of Mini-Slot

15.1.2.1 Latency when data transfer by mini-slot Scheduling with 2 symbols

15.1.2.1.1 Test Purpose

To measure the latency performance while UE transmitting data by mini-slot scheduling with 2 symbols.

15.1.2.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.1.2.1.3 Applicability

This test applies to Type2 UEs

15.1.2.1.4 Test conditions

[SS configuration]
Cell A is a NR cell.

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

Table15.1.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.1.2.1.4-2: Test band configuration

Test Point	Cell	Test Band	Test Frequency	NR Frame Structure	Special Frame
1	Cell A	n79	f1	DDDSU DDSUU	DDDDDDDDDDGGUU

Table 15.1.2.1.4-3: *RRCReconfiguratio*n Message in step 16

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**

pdsch-TimeDomainAllocationList{		
pdsch-TimeResourceAllocation{		
K0	0	
Mapping type	TypeB	
startSymbolAndLength	15(TBC)	
}		
}		
pusch-TimeDomainAllocationList{		
pusch-TimeResourceAllocation{		
K2	1	
Mapping type	TypeB	
startSymbolAndLength	14(TBC)	
}		
}		

15.1.2.1.5 Test procedure

Table 15.1.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH,SSS EPRE	dBm/SCS	-75

Note: If the RTT time without mini-slot has been measured and recorded in TC.15.1.2.2 step 9-14, step 9-15 in following main body could be skipped.

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 15.1.2.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).

MAIN BODY

5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with pdsch-Mapping Type A and pdsch-Mapping Type B supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
9. SS transmits RRC Reconfiguration to UE
10. UE sends RRC Reconfiguration Complete to the SS.
11. SS Transmits an ICMP Echo Request packet (PING), set the length of PING package size to 80 bytes.

12. UE replies with an ICMP Echo Reply packet.
13. Repeat ping 1000 [TBD] times.
14. Record and calculates the RTT time for step 11-13.
15. SS transmits RRCRelease to UE.
16. SS Transmits RRC Reconfiguration including pdsch-TimeDomainAllocationList and pusch-TimeDomainAllocationList configure. Refer to Table 15.1.2.1.4-3 for parameter configuration.
17. UE sends RRC Reconfiguration Complete to the SS.
18. SS Transmits an ICMP Echo Request packet (PING), set the length of PING package size to 80 bytes.
19. UE replies with an ICMP Echo Reply packet.
20. Repeat ping 1000 [TBD] times.
21. Record and calculates the RTT time for step 18-20.
22. Compare the RTT time in step 14 and step 21.

POSTAMBLE

23. The SS initiates a De-registration procedure.
24. Deactivate NR Cell A.

15.1.2.1.6 Expected Result

1. Record the average, maximum and minimum RTT time in step 14 and step 21. Verify the fluctuation is no more than 50% of the average RTT time.
2. Verify the latency of step 21 is less than step 14.

15.1.2.2 Latency when data transfer by mini-slot Scheduling with 7 symbols

15.1.2.2.1 Test Purpose

To measure the latency performance while UE transmitting data by mini-slot scheduling with 2 symbols.

15.1.2.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.1.2.2.3 Applicability

This test applies to Type2 UEs

15.1.2.2.4 Test conditions

[SS configuration]
Cell A is a NR cell.

NR Cell A

Cell Id=1 TAC = 1

MCC = 460 MNC = 00

[UE configuration]

The test UICC with USIM should be inserted.

The UE is in AUTOMATIC network selection mode.

UE works in SA mode.

[Initial conditions]

SS

NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

Table15.1.2.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.1.2.2.4-2: Test band configuration

Test Point	Cell	Test Band	Test Frequency	NR Frame Structure	Special Frame
1	Cell A	n79	f1	DDDSU DDSUU	DDDDDDDDDDGGUU

Table 15.1.2.2.4-3: *RRCReconfiguratio*n Message in step 16

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**
pdsch-TimeDomainAllocationList{		
pdsch-TimeResourceAllocation{		
K0	0	
Mapping type	TypeB	
startSymbolAndLength	85(TBC)	
}		
}		
pusch-TimeDomainAllocationList{		
pusch-TimeResourceAllocation{		
K2	1	
Mapping type	TypeB	
startSymbolAndLength	84(TBC)	
}		
}		

15.1.2.2.5 Test procedure

Table 15.1.2.2.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

Note: If the RTT time without mini-slot has been measured and recorded in TC.15.1.2.1 step 9-14, step 9-15 in following main body could be skipped.

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 15.1.2.2.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).

MAIN BODY

5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with pdsch-Mapping Type A and pdsch-Mapping Type B supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
9. SS transmits RRC Reconfiguration to UE
10. UE sends RRC Reconfiguration Complete to the SS.
11. SS Transmits an ICMP Echo Request packet (PING), set the length of PING package size to 80 bytes.
12. UE replies with an ICMP Echo Reply packet.
13. Repeat ping 1000 [TBD] times.
14. Record and calculates the RTT time for step 11-13.
15. SS transmits RRCRelease to UE.
16. SS Transmits RRC Reconfiguration including pdsch-TimeDomainAllocationList and pusch-TimeDomainAllocationList configure. Refer to Table 15.1.2.2.4-3 for parameter configuration.
17. UE sends RRC Reconfiguration Complete to the SS.
18. SS Transmits an ICMP Echo Request packet (PING), set the length of PING package size to 80 bytes.
19. UE replies with an ICMP Echo Reply packet.
20. Repeat ping 1000 [TBD] times.
21. Record and calculates the RTT time for step 18-20.
22. Compare the RTT time in step 14 and step 21.

POSTAMBLE

23. The SS initiates a De-registration procedure.
24. Deactivate NR Cell A.

15.1.2.2.6 Expected Result

1. Record the average, maximum and minimum RTT time in step 14 and step 21. Verify the fluctuation is no more than 50% of the average RTT time.
2. Verify the latency of step 21 is less than step 14.

15.2 Low code rate

15.2.1 Low code rate with data transfer, 64QAM

15.2.1.1 Test Purpose

To measure the UE could support the data transmission with MCS table of qam64LowSE, MCS=28, BAND=n79.

15.2.1.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.2.1.3 Applicability

This test applies to Type2 UEs

15.2.1.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
mcs-Table = qam64LowSE
DL Modulation / Coding = 28
UL Modulation / Coding = 28
RB Allocation UL= Full
RB Allocation DL = Full
enable4x4MIMO = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

Table15.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.2.1.4-2: Test band configuration

Test Point	Cell	Test Band	Test Frequency	NR Frame Structure	Special Frame
1	Cell A	n79	f1	DDDSU DDSUU	DDDDDDDDDDGGUU

15.2.1.5 Test procedure

Table 15.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The SS configures the initial power according to T0 in Table 15.2.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).

MAIN BODY

5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message including PHY-parameters configuration with dl-64QAM-MCS-TableAlt and ul-64QAM-MCS-TableAlt supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
9. SS Transmits RRC Reconfiguration including PDSCH-Config with mcs-Table = qam64LowSE and PUSCH-Config with mcs-Table = qam64LowSE.
10. UE sends RRC Reconfiguration Complete to the SS.
11. SS start bidirectional UDP data transmission with DL MCS=28 and UL MCS=28
12. Verify the data transmission is performed successfully on NR Cell A.

POSTAMBLE

13. Switch Off UE, UE initiates a Detach procedure

15.2.1.6 Expected Result

1. Verify the UE could support low MCS-Table (TS 38.214, Table 5.1.3.1-3 and Table 6.1.4.1-2).

2. Verify the data transmission is performed successfully in Step12, both DL BLER and UL BLER are not higher than [5%].

15.2.2 Low code rate with data transfer, 16QAM

15.2.2.1 Test Purpose

To measure the UE IP transfer performance with MCS table of qam64LowSE, MCS=20, BAND=n79

15.2.2.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.2.2.3 Applicability

This test applies to Type2 UEs

15.2.2.4 Test conditions

The same as 15.2.1.4 except the cell configuration as indicated below

[SS configuration]
NR-RAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
mcs-Table = qam64LowSE
DL Modulation / Coding = 20
UL Modulation / Coding = 20
RB Allocation UL= Full
RB Allocation DL = Full
enable4x4MIMO = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz

15.2.2.5 Test procedure

The same as 15.2.1.5 except the configuration of step 11 as indicated below.
Step 11: SS start bidirectional UDP data transmission with DL MCS=20 and UL MCS=20

15.2.2.6 Expected Result

1. Verify the UE could support low MCS-Table (TS.38.214, Table 5.1.3.1-3 and Table 6.1.4.1-2）.
2. Verify the data transmission is performed successfully in Step12, both DL BLER and UL BLER are not higher than [5%].

15.2.3 Low code rate with data transfer, QPSK

15.2.3.1 Test Purpose

To measure the UE could support the data transmission with MCS table of qam64LowSE, MCS=14, BAND=n79

15.2.3.2 Reference specification

3GPP TS 38.101,3GPP TS 38.331, 3GPP TS 38.508

15.2.3.3 Applicability

This test applies to Type2 UEs

15.2.3.4 Test conditions

The same as 15.2.1.4 except the cell configuration as indicated below

[SS configuration]
NR-RAN Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00
mcs-Table = qam64LowSE
DL Modulation / Coding = 14
UL Modulation / Coding = 14
RB Allocation UL= Full
RB Allocation DL = Full
enable4x4MIMO = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz

15.2.3.5 Test procedure

The same as 15.2.1.5 except the configuration of step 11 as indicated below.
Step 11: SS start bidirectional UDP data transmission with DL MCS=14 and UL MCS=14.

15.2.3.6 Expected Result

1. Verify the UE could support low MCS-Table (TS.38.214, Table 5.1.3.1-3 and Table 6.1.4.1-2).
2. Verify the data transmission is performed successfully in Step12, both DL BLER and UL BLER are not higher than [5%].

15.3 Slot Repetition

15.3.1 Functional test of slot repetition

15.3.1.1 Slot Repetition for 2/4/8 times

15.3.1.1.1 Test Purpose

Verify that UE can support Slot repetition with different repetition times.

15.3.1.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.3.1.1.3 Applicability

This test applies to Type 2 UEs.

15.3.1.1.4 Test conditions

NR Cell A
Cell Id=1 TAC = 1
MCC = 460 MNC = 00

[UE configuration]
The test UICC with USIM should be inserted.
The UE is in AUTOMATIC network selection mode.
UE works in SA mode.

[Initial conditions]
SS
NR Cell A is not active
The test shall be performed under ideal radio conditions.
UE
UE is powered off

Table15.1.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices	SINR
NR-1	Static	N/A	[20] dB

Table 15.1.2.4-2: Test band configuration

Test Point	Cell	Test Band	Test Frequency
1	Cell A	n79	f1

15.3.1.1.5 Test procedure

Table 15.3.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. Activate NR Cell A.The SS configures the corresponding Master Information Block and System Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 15.1.1.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).

MAIN BODY

5. The SS transmits a UECapabilityEnquiry message.
6. The UE transmits a UECapabilityInformation message with with pusch-RepetitionMultiSlots and pdsch-RepetitionMultiSlot supported.
7. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
8. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
9. SS Transmits RRC Reconfiguration includingRRCReconfiguration including pdsch-aggregationFactor=n2 and pusch-AggregationFactor=n2.
10. UE sends RRC Reconfiguration Complete to the SS.
11. SS start bidirectional UDP data transmission for 30s
12. Verify the data transmission is performed successfully on NR Cell A.
13. Stop UDP data transmission
14. SS transmits RrcReconfiguration including pdsch-aggregationFactor=n4 and pusch-AggregationFactor=n4.
15. UE sends RRC Reconfiguration Complete to the SS.
16. SS start bidirectional UDP data transmission for 30s
17. Verify the data transmission is performed successfully on NR Cell A.
18. Stop UDP data transmission
19. SS transmits RrcReconfiguration including pdsch-aggregationFactor=n8 and pusch-AggregationFactor=n8.
20. UE sends RRC Reconfiguration Complete to the SS.
21. SS start bidirectional UDP data transmission for 30s
22. Verify the data transmission is performed successfully on NR Cell A
23. Stop UDP data transmission

POSTAMBLE

24. The SS initiates a Deregitration procedure.
25. The SS initiates a RRC release procedure.

15.3.1.1.6 Expected Result

1. Verify that UE can support Slot repetition configuration in step 6.

2. Verify that UE transfer data successful in step 12, 17, and 22. Both DL BLER and UL BLER are not higher than [5%]

15.3.2 Performance test of slot repetition

15.3.2.1 DL Throughput under AWGN channel with 2 slot repetition

15.3.2.1.1 Test Purpose

To measure the performance enhancement of DL TCP data transfer under AGWN channel when SINR=5 dB[TBC] with 2 slot repetition.

15.3.2.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.3.2.1.3 Applicability

This test applies to Type 2 UEs.

15.3.2.1.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
SSB SINR=5dB
enable4x4MIMO = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
pdsch-aggregationFactor=n2
pusch-AggregationFactor=n2

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 15.3.2.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices	SINR
NR-1	Static	N/A	[5] dB

Table 15.3.2.1.4-2 Test band configuration

Test Point	Cell	Test Band	Test Frequency	NR Frame Structure	Special Frame
1	Cell A	n79	f1	DDDSU DDSUU	DDDDDDDDDDGGUU

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

15.3.2.1.5 Test procedure

Table 15.3.2.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	[-85]

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 15.3.2.4-1 & Table 15.3.2.4-2.

MAIN BODY

4. The UE is powered ON.
5. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
6. The SS transmits a UECapabilityEnquiry message.
7. The UE transmits a UECapabilityInformation with pusch-RepetitionMultiSlots and pdsch-RepetitionMultiSlot supported.
8. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
9. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
10. The SS transmits an RRC Connection Reconfiguration.
11. UE transmit an RRC Connection Reconfiguration Complete message to SS.
12. Using the TCP client, begin TCP download from the application server for [90] seconds and record Throughput and BLER results.
13. Stop data transmission.
14. Repeat step 12-step 13 for one more iteration.
15. Calculate and record the average throughput and BLER without slot repetition

16. SS transmits RRC Reconfiguration includingRRCReconfiguration including pdsch-aggregationFactor=n2 and pusch-AggregationFactor=n2.
17. UE sends RRC Reconfiguration Complete to the SS.
18. Repeat step 12- step 14
19. Calculate and record the average DL TCP throughput and BLER with slot repetition .
20. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

21. Deactivate Cell.

15.3.2.1.6 Expected Result

1. Calculate and record the average throughput and BLER in step 15 and 19.
2. Verify that BLER in step 19 is lower than step 15.

15.3.2.2 DL Throughput under AWGN channel with 8 slot repetition

15.3.2.2.1 Test Purpose

To measure the performance enhancement of DL TCP data transfer under AGWN channel when SINR=5dB with 2 slot repetition.

15.3.2.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.3.2.2.3 Applicability

This test applies to Type 2 UEs.

15.3.2.2.4 Test conditions

The same as 15.3.2.1.4 except the cell configuration as indicated below

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
SSB SINR=5dB
enable4x4MIMO = TRUE
enable256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz

pdsch-aggregationFactor=n2

pusch-AggregationFactor=n2

15.3.2.2.5 Test procedure

The same as 15.3.2.1.5 except the configuration of step 16 as indicated below.

Step 16: SS transmits RRC Reconfiguration includingRRCReconfiguration including pdsch-aggregationFactor=n8 and pusch-AggregationFactor=n8.

15.3.2.2.6 Expected Result

1. Calculate and record the average throughput and BLER in step 15 and 19.
2. Verify that BLER in step 19 is less than step 15.

15.4 PDCP Duplication

15.4.1 DL Throughput under AWGN channel with PDCP duplication

15.4.1.1 Test Purpose

To measure the performance enhancement of DL TCP data transfer under AGWN channel with PDCP duplication.

15.4.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.4.1.3 Applicability

This test applies to Type 2 UEs.

15.4.1.4 Test conditions

[SS configuration]

NR Cell A, PCell

Cell Id=01 TAC = 01

MCC = 460 MNC = 00

DL Modulation / Coding = 27

Test Band=n41

RB Allocation UL= Full

RB Allocation DL = Full

enable4x4MIMO = TRUE

enable256QAM = TRUE

absoluteFrequencySSB=513150

absoluteFrequencyPointA=503172

NR Cell B, SCell

Cell Id=02 TAC = 01
MCC = 460 MNC = 00
Test Band=n41
Test Frequency= f5
RB Allocation UL= Full
RB Allocation DL = Full
enable4x4MIMO = TRUE
enable256QAM = TRUE
absoluteFrequencySSB=528990
absoluteFrequencyPointA=523128

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 15.4.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	Low

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.2.1.5 for antenna configuration 4x4.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

15.4.1.5 Test procedure

Table 15.4.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A	NR Cell B
T0	SS/PBCH,	dBm/SCS	-75	Not Active

T1	SSS EPRE		-75	-75
T2			-75	-95

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.
3. The SS configures the initial power according to T0 in Table 15.4.1.5-1
4. Set the parameters of the propagation condition, the correlation matrix, antenna configuration according to Table 15.4.1.4-1

MAIN BODY

5. The UE is powered ON.
6. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 12).
7. The SS transmits a UECapabilityEnquiry message.
8. The UE transmits a UECapabilityInformation with pdcp-DuplicationMCG-OrSCG-DRB supported.
9. The SS transmits a DLInformationTransfer message and a REGISTRATION ACCEPT message.
10. The UE transmits an ULInformationTransfer message and a REGISTRATION COMPLETE message.
11. SS add Cell B as a Scell and activates SCC refer to TC.14.1.1.1.5 step6- step11
12. Using TCP client, begin TCP downloads from the application server for [90] seconds and record Throughput and BLER results. Verify data transmission on both PCC and SCC.
13. Stop data transmission.
14. Repeat step 12-step 13 for one more iteration.
15. Calculate and record the average DL TCP throughput and BLER with PDCP duplication
16. SS transmits an RRCReconfiguration message including PDCP duplication=Ture.
17. The UE sends RRC Reconfiguration Complete to the SS.
18. Using TCP client, begin TCP downloads from the application server for [90] seconds and record Throughput and BLER results. Verify data transmission on both PCC and SCC.
19. Stop data transmission.
20. Repeat step 18 -step 19 for one more iteration.
21. Calculate and record the average DL TCP throughput and BLER with PDCP duplication
22. SS deactivates SCC and release NR cell B refer to TC.14.1.1.1.5 step14- step21

POSTAMBLE

23. Switch Off UE, UE initiates a Detach procedure.
24. Deactivate Cell A and Cell B.

Table 15.4.1.5-1: *sCellToAddMod* in *RRCReconfiguratio*n Message in step

Derivation Path: TS 38.331 [6], clause 6.3.2		
Information Element	**Value/remark**	**Comments**

sCellToAddModList {	1 entry	
sCellIndex	1	
sCellConfigCommon ::= SEQUENCE {		
physCellId	Physical cell id of Cell B	
downlinkConfigCommon ::= SEQUENCE {		
frequencyInfoDL::= SEQUENCE {		
absoluteFrequencySSB	528990	
frequencyBandList	n41	
absoluteFrequencyPointA	523128	
scs-SpecificCarrier{		
offsetToCarrier	0	
subcarrierSpacing	kHz30	
carrierBandwidth	162	60M
}		
}		
}		
uplinkConfigCommon	Not present	
ssb-periodicityServingCell	ms20	
dmrs-TypeA-Position	pos2	
ssbSubcarrierSpacing	kHz30	
tdd-UL-DL-ConfigurationCommon = {		
referenceSubcarrierSpacing	kHz30	
pattern1 {		
dl-UL-TransmissionPeriodicity	ms5	
nrofDownlinkSlots	7	*DD DD DD DS UU*
nrofDownlinkSymbols	6	*DL : GP : UL = 6 : 4 : 4*
nrofUplinkSlots	2	
nrofUplinkSymbols	4	
}		
}		
ss-PBCH-BlockPower	0	
}		
}		

15.4.1.6 Expected Result

1. Calculate and record the average throughput and BLER in step 15 and 21.
2. Verify that BLER in step 21 is less than step 15.

15.5 DS 1ms frame structure

15.5.1 Latency of IP data transfer with 1ms frame structure

15.5.1.1 Test Purpose

To measure the latency performance while UE transmitting data with 1ms frame structure.

15.5.1.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.5.1.3 Applicability

This test applies to Type 2 UEs.

15.5.1.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC =00
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=1ms
nrofDownlinkSlots=1
nrofUplinkSlot=0
nrofDownlinkSymbols=0
nrofUplinkSymbols=12

Table15.5.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.5.1.4-2: Test band configuration

Test Points	Test band	Test Frequency	NR Frame Structure	Special Frame
1	n79	f1	DS	GGUUUUUUUUUUU

15.5.1.5 Test procedure

Table 15.5.1.5-1: Time of cell power level and parameter changes

Time	Parameter	Unit	NR Cell A
T0	SS/PBCH, SSS EPRE	dBm/SCS	-75

PREAMBLE

1. Activate NR Cell A. The SS configures the corresponding Master Information Block and System Information Block broadcast.

2. The SS configures the initial power according to T0 in Table 15.5.1.5-1.
3. The UE is powered ON.
4. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2-2 till Step 18).

MAIN BODY

5. Set the length of PING package to 32 bytes.
6. SS Transmits an ICMP Echo Request packet(PING) to the UE
7. UE replies with an ICMP Echo Reply packet to SS
8. SS calculates the RTT time from ICMP Echo Request to ICMP Echo Reply
9. Repeat steps 6 to 8 for 1000 times and calculate the average RTT time
10. Set the length of PING package to 1000 bytes, repeat steps 6 to 9
11. Set the length of PING package to 1500 bytes, repeat steps 6 to 9

POSTAMBLE

12. The SS initiates a D-registration procedure.
13. The SS initiates a RRC release procedure.
14. Deactivate NR Cell A.

15.5.1.6 Expected Result

Calculate the RTT at step 9, step 10 and step 11.

15.5.2 R15 UL Throughput under static channel with 1ms frame structure

15.5.2.1 Test Purpose

To measure the throughput performance while UE uploading TCP based data with DS 1ms frame structure in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, UL 256QAM, UL2*2 MIMO.

15.5.2.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.5.2.3 Applicability

This test applies to Type 2 UEs.

15.5.2.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
rootSequenceIndex = 0

UL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=1ms
nrofDownlinkSlots=1
nrofUplinkSlot=0
nrofDownlinkSymbols=0
nrofUplinkSymbols=12

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 15.5.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.5.2.4-2: Test band configuration

Test Points	Test band	Test Frequency	NR Frame Structure	Special Frame
1	n79	f1	DS	GGUUUUUUUUUUU

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS
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.
Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.
Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.
Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.2 for NR UL MIMO.
2. Connect an application server to the IP output of the SS configured with a FTP server.

3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.

UE

UE is powered off

15.5.2.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PUSCH via PUCCH DCI format 0_0 for C_RNTI to transmit the UL data using the fixed transport format and transport block size.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmits an RRC Connection Reconfiguration Complete message to SS.
8. Using the TCP client, begin TCP upload from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the uplink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

15.5.2.6 Expected Result

Calculate and record the average TCP throughput. The average downlink TCP throughput shall meet the value in following table.

Table 15.5.2.6-1: Expected result

Test Point	Test band	Expected UL TCP Throughput
1	n79	[535]Mbps

15.5.3 R15 DL Throughput under static channel with 1ms frame structure

15.5.3.1 Test Purpose

To measure the throughput performance while UE downloading TCP based data with DS 1ms frame structure in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, DL

256QAM, DL4*4 MIMO.

15.5.3.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.5.3.3 Applicability

This test applies to Type 2 UEs.

15.5.3.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=1ms
nrofDownlinkSlots=1
nrofUplinkSlot=0
nrofDownlinkSymbols=0
nrofUplinkSymbols=12

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 15.5.3.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.5.3.4-2: Test band configuration

Test Points	Test band	Test frequency	NR Frame Structure	Special Frame
1	n79	f1	DS	GGUUUUUUUUUUU

[UE configuration]

The test USIM shall be inserted.

The UE is in AUTOMATIC network selection mode.

[Initial conditions]

SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.2 for NR UL MIMO.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

15.5.3.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits an RRC Connection Reconfiguration.
7. UE transmits an RRC Connection Reconfiguration Complete message to SS.
8. Using the TCP client, begin TCP download from the application server for [90] seconds and record Throughput result.
9. Repeat step 8 for one more iteration.
10. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
11. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

12. Deactivate Cell.

15.5.3.6 Expected Result

Calculate and record the average TCP throughput. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 15.5.3.6-1: Expected result

Test Point	Test band	Expected DL TCP Throughput
1	n79	[1.1]Gbps

15.5.4 DL Throughput under static channel with 1ms frame structure with TRS configured

15.5.4.1 Test Purpose

To measure the throughput performance while UE downloading TCP based data with DS 1ms frame structure with TRS configured in Conducted, Static Channel, SA Option2, 100 MHz BW, Full Resource Allocation, DL 256QAM, DL4*4 MIMO.

15.5.4.2 Reference specification

3GPP TS 38.331, 3GPP TS 38.508, 3GPP TS 38.521-1

15.5.4.3 Applicability

This test applies to Type 2 UEs.

15.5.4.4 Test conditions

[SS configuration]
NR-RAN Cell A
Cell Id=01 TAC = 01
MCC = 460 MNC = 00
NR-ARFCN= f1
NR Band n79
rootSequenceIndex = 0
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUL256QAM = TRUE
CPConfig = UL: Normal CP/DL: Normal CP
subcarrierSpacing=30kHz
Dl/UL switch period=1ms

nrofDownlinkSlots=1
nrofUplinkSlot=0
nrofDownlinkSymbols=0
nrofUplinkSymbols=12

[Common conditions]
Common conditions include a set of test points the UE needs to be tested in and the common test parameters for each transmission mode.

Table 15.5.4.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NR-1	Static	N/A

Table 15.5.4.4-2: Test band configuration

Test Points	Test band	Test frequency	NR Frame Structure	Special Frame
1	n79	f1	DS	GGUUUUUUUUUUU

[UE configuration]
The test USIM shall be inserted.
The UE is in AUTOMATIC network selection mode.

[Initial conditions]
SS

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.

Configurations of PUSCH and PUCCH before measurement are specified in Annex G.2 of TS 38.521-1.

Test Environment: Normal, as defined in TS 38.508-1 clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 Annex A, Figure A.3.1.1.2 for NR UL MIMO.
2. Connect an application server to the IP output of the SS configured with a FTP server.
3. Downlink signals are initially set up according to Annex C0, C.1 and Annex C.3.1 in TS 38.521-1 and uplink signals according to Annex G.1 and G.3.2 in TS 38.521-1.
4. Propagation conditions are set according to Annex B.0 in TS 38.521-1.

UE

UE is powered off

15.5.4.5 Test procedure

PREAMBLE

1. SS Activates NR-RAN Cell A configures the corresponding Master Information Block and System Information Block broadcast.
2. SS transmits PDSCH via PDCCH DCI format 1_0 for C_RNTI to transmit the DL data using the fixed transport format and transport block size.

MAIN BODY

4. The UE is powered ON.
5. UE performs a Registration procedure on NR-RAN Cell A to register for PS services. The UE establishes the default MCG bearer during the registration according to TS 38.508 subclause 4.5.2.
6. The SS transmits a UECapabilityEnquiry message.
7. The UE transmits a UECapabilityInformation message with oneSlotPeriodicTRS-r16 supported.
8. The SS transmits an RRC Connection Reconfiguration.
9. UE transmit an RRC Connection Reconfiguration Complete message to SS.
10. SS starts data transmission with TRS configured. Using the TCP client, begin TCP download from the application server for [90] seconds and record Throughput result.
11. Repeat step 8 for one more iteration.
12. Calculate the average throughput at the application layer on the downlink channel during the file transfer over all iterations.
13. Switch Off UE, UE initiates a Detach procedure.

POSTAMBLE

14. Deactivate Cell.

15.5.4.6 Expected Result

Calculate and record the average TCP throughput. The average downlink throughput at the application layer shall meet or exceed the value in following table.

Table 15.5.4.6-1: expected result

Test Point	Test band	Expected DL TCP Throughput
1	n79	[1.1]Gbps

Appendix A Test Channel Parameters

Appendix B Document Change Record

Date	Version	Revision Contents
27-Nov-2018	0.1	First draft release to task members to be used as starting template.
04-Jan-2019	0.2	Incorporated the following CRs:- Anritsu-20181221-01 Anritsu-20181221-02 CMCC-20181217-01 DTG-20190101-01 Keysight-20181223-01-NSA Keysight-20181223-02-SA RNS-20181217-01 RNS-20181217-02 RNS-20181217-03 RNS-20181224-01 RNS-20181224-02 RNS-20181224-03
23-Jan-2019	0.3	CMCC-20190120-01
23-Jan-2019	0.4	Anritsu-20190115-01 Anritsu-20190115-02 Anritsu-20190115-03 Anritsu-20190115-04 DTG-20190115-01 Keysight-20190116-01
31-Jan-2019	0.5	Anritsu-20190130-01 Anritsu-20190131-01 CMCC-20190130-02 DTG-20190129-01 Keysight-20190129-01
12-Feb-2019	1.0	Anritsu-20190201-01 Anritsu-20190208-01 RNS-20190212-01
08-Mar-2019	1.0.1	CMCC-20190304-01 DTG-20190304-01 DTG-20190306-01
22-Mar-2019	1.0.2	CMCC-20190321-01 R&S-20190311-01 DTG-20190308-01 DTG-20190320-01
08-Apr-2019	1.5.0	DTG-20190329-01 Keysight-20190402-01 StarPoint-20190401-01
6-May-2019	1.5.1	CMCC-20190422-01 RS-20190410-01 RS-20190410-02r1

		RS-20190412-03
30-May-2019	1.5.2	CMCC-20190426-01 CMCC-20190510-01r2 CMCC-20190513-01 CMCC-20190522-01
16-Jun-2019	2.0	Post GTI members review. Updated document version number only.
23-Aug-2019	2.0.1	CMCC-20190731-01 CMCC-20190731-02 CMCC-20190731-03 CMCC-20190802-01 CMCC-20190805-01 CMCC-20190805-02 RS-20190621-02 Keysight-20190820-01
30-October-2019	2.5	Updated document version number only For GTI members review
11-November-2019	3.0	CMCC-20190830-01
8-June-2020	3.0.1	DTG-20200323-01 CMCC-20200515-01 CMCC-20200515-02 CMCC-20200515-03 CMCC-20200515-04 CMCC-20200528-01 CMCC-20200604-01
18-June-2020	3.5	Updated document version number only
12-Novermber-2020	4.0	DTG-20200323-02 R&S-20200707-01 R&S-20200707-02 DTG-20200628-02 CMCC-20200911-01 CMCC-20200921-01 CMCC-20201026-01 R&S-20201102-01 CMCC-20201105-01 Keysight-20201105-02 Keysight-20201105-03
25-March-2021	4.1	Keysight-20201210-01 Keysight-20201210-02 MTK-20201210-01 MTK-20201210-02 CMCC-20201230-01 DTG-20210113-02 CMCC-20210223-01r1

		Keysight-20210125-01r1 Keysight-20210310-01
21-September-2021	4.2	DTG-20210301-02 DTG-20210820-01 DTG-20210820-03 CMCC-20210604-01 Keysight-20210323-BWP_switch_by_DCI Keysight-20210524-01 CMCC-20210910-01
14-April-2022	4.3	CMCC-20211209-01r1 CMCC-20220114-01 CMCC-20220222-01 DTG-20220318-04