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
n79	f1	100 MHz	4800M - 4900M

Table 4-2: 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

Table 4-3: 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 4-4: 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

Table 4-5: 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 4-4: Default Parameters

Parameters	Value	Note
MCC	460	
MNC	00	
NR Frame Structure	Uplink-Downlink Switch Period: 5ms	DD DD DD DS UU
	Uplink-Downlink Switch Period: 3ms+2ms	DD DS UU DD DD
Special Frame	DL : GP : UL = 6 : 4 : 4	
CP Length	Normal CP	
PRACH Format	Format 0	
PRACH Period	10ms	
PUCCH Format	Format 0 / Format 1	
	Format 2 / Format 3	
PBCH SCS	30kHz	
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	
MIMO	NSA: NR 1T4R, LTE 1T4R or 1T2R	
	SA: 2T4R	
UE Maximum TX Power	NSA: 26 dBm	
	SA: 26 dBm	
Waveform	Uplink : CP-OFDM	
	Downlink: CP-OFDM	

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	CMCC China (460, 00, NG-RAN), CMCC China (460, 00, EUTRAN),

		Technology)	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	
14	-->	NR RRC: ULInformationTransfer 5GMM: REGISTRATION COMPLETE	
15	-->	NR RRC: ULInformationTransfer 5GMM: UL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT REQUEST	
16	<--	NR RRC: RRCReconfiguration 5GMM: DL NAS TRANSPORT 5GSM: PDU SESSION ESTABLISHMENT ACCEPT	
17	-->	NR RRC: RRCReconfigurationComplete	
18	<--	NR RRC: RRCRelease	

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>UTRAN> GERAN. 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 is a NR cell,   Cell B is an E-UTRAN cell, Cell C is a GSM 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

GSM Cell C

Cell Id=4, LAC = 4

MCC = 460 MNC = 00

ARFCN = f1

NMO I

RF Signal level = - 125 dBm

[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.

GSM 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	NR Cell A	E-UTRAN Cell B	GSM Cell C	Remark
T0	-125	-125	-125	The cell selection criterion 'S' is not fulfilled for any cell. The UE will not try to camp on either of the cells
T1	-85	-85	-85	
T2	Not Active	-85	-85	
T3	Not Active	Not Active	-85	
T4	Not Active	Not Active	-85	

PREAMBLE

1. Activate NR Cell A, E-UTRAN Cell B, GSM 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 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).
8. The UE performs TAU procedure on E-UTRAN Cell B. 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.
10. Deactivate E-UTRAN Cell B. (Refer Table 5.1.1.5 -1: Time T3).
11. The UE performs combined procedure on GSM Cell C. SS releases the RRC connection. The UE transits to Idle state
12. The tag on the UI indicate that UE has registered on GSM network.

POSTAMBLE
13. The UE is powered OFF
14. The UE performs MO Detach procedure on GSM Cell D
15. Deactivate GSM Cell D.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			Message Sequence		
1	←	RRC	Activate NR Cell A, E-UTRAN Cell B, GSM Cell C		
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 E-UTRAN Cell B. (Refer Table 5.1.1.5 -1: Time T2)		
8	→ ←	RRC NAS	UE performs TAU procedure on E-UTRAN Cell B		PASS
9			The tag on the UI indicate that UE has registered on LTE network.		
10			Deactivate E-UTRAN Cell B. (Refer Table 5.1.1.5 -1: Time T3).		
11	→	RRC	UE performs combined procedure on GSM Cell C.		PASS

		NAS			
12			The tag on the UI indicate that UE has registered on GSM network.		
13		UE	Switch Off UE	AT Command	
14	→ ←	RRC NAS	UE performs MO Detach procedure on GSM Cell C		PASS
15			Deactivate GSM Cell C.		

5.1.1.6   Expected Result

When NR cell is unavailable, a NR-SA/E-UTRAN /GSM-capable UE can correctly camp on that RAT with the highest PLMN priority according to the priority list stored on the USIM irrespective of the RAT type.

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 the device that supports SA or SA+NSA

5.2.1.4   Test conditions

SS:
-   1 NR Cell1 and 1 E-UTRA Cell1.

UE:
-   The UE is in Automatic PLMN selection mode.
-   There is no RPLMN.

5.2.1.5   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 on Cell B (see 38.508, Table 4.5.2.2).

POSTAMBLE

4. The UE is powered OFF.
5. 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		UE	Switch On UE	AT Command	
3	→ ←	NAS RRC	The UE performs the registration procedure on Cell B (see 38.508, Table 4.5.2.2)		PASS
4		UE	Switch Off UE	AT Command	
5			Deactivate E-UTRAN Cell A and NR Cell B.		

5.2.1.6 Expected Result

- UE selects the NR cell and camps on the NR cell

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 TD-LTE cell when E-UTRAN cell available and no NR cell.

5.2.2.2 Reference specification

3GPP TS 36.304, clause 5.2.3.

5.2.2.3 Applicability

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

5.2.2.4 Test conditions

SS:
- 1 NR Cell1 and 1 E-UTRA Cell1.

UE:
- The UE is in Automatic PLMN selection mode.
- There is no RPLMN.

5.2.2.5 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).

POSTAMBLE

4. The UE is powered OFF.
5. 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		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 and NR Cell B.		

5.2.2.6 Expected Result

UE selects the E-UTRA cell and camps on the E-UTRA cell

5.2.3 Initial Cell Selection from Power-Up

5.2.3.1 Test Purpose

Verify that the UE will correctly select and camp on a NR cell based on channel quality from power-up using information saved to the USIM with an intra-frequency cell, an inter-frequency cell and an inter-band cell present simultaneously.

5.2.3.2 Reference specification

3GPP TS 38.304, clause 5.2.3.

5.2.3.3 Applicability

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

5.2.3.4 Test conditions

SS:

- 4 NR Cells
- Cell A, Cell B Intra –frequency
- Cell C   Inter- frequency
- Cell D   Inter band

UE:

- The UE has stored information of frequencies.

5.2.3.5 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	"OFF"	"OFF"	"OFF"
T1	SS/PBCH SSS EPRE	dBm/SCS	-94	-88	-88	-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.
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.

MAIN BODY

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).

POSTAMBLE

9. The UE is powered OFF.
10. 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
9		UE	Switch Off UE	AT Command	
10			Deactivate NR CellA,NR CellB,NR CellC,NR CellD.		

5.2.3.6   Expected Result

UE selects the NR Cell B and camps on the NR Cell B

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, TS 38.304 clause 5.2.3

5.3.1.3   Applicability

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

5.3.1.4   Test conditions

SS:
- 2 NR cells

UE:
- None

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	"OFF"
T1	SS/PBCH SSS EPRE	dBm/SCS	"Off"	-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

UE is in NR RRC_CONNECTED state

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:
- 1 NR cell

UE:
- None

5.3.2.5   Test procedure

PREAMBLE

1. Activate NR CellA The SS configures the corresponding Master Information Block and System Information Block broadcast.
2. The UE is powered ON.
3. The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18).

MAIN BODY

4. SS sends RRCReconfiguration to UE on NR cell A.
5. Verify that UE sends RRCReconfigurationComplete message to SS on NR cell A.

POSTAMBLE

6. The UE is powered OFF.

7. Deactivate NR CellA.

Table 5.3.2.5-1: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			Message Sequence		**Verdict**
	U-S	Layer	Message	Specific Contents	
1	←	RRC	Activate NR CellA		
2		UE	The UE is powered ON.	AT Command	
3	→ ←	NAS RRC	The UE performs the registration procedure on Cell A (see 38.508, Table 4.5.2.2 till Step 18)		PASS
4	←		SS sends RRCReconfiguration to UE on NR cell A.		
5	→		Verify that UE sends RRCReconfigurationComplete message to SS on NR cell A.		PASS
6		UE	The UE is powered OFF.	AT Command	
7			Deactivate NR CellA.		

5.3.2.6 Expected Result

UE configures Bandwidth,Part for serving cell

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 5.1.1.5-1: 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	NR RRC: RRCSetupComplete		PASS
		NAS	5GMM: REGISTRATION REQUEST		
6	←	RRC	NR RRC: DLInformationTransfer		
		NAS	5GMM: AUTHENTICATION REQUEST		
7	→	RRC	NR RRC: ULInformationTransfer		PASS
		NAS	5GMM: AUTHENTICATION RESPONSE		
8	←	RRC	NR RRC: DLInformationTransfer		
		NAS	5GMM: SECURITY MODE COMMAND		
9	→	RRC	NR RRC: ULInformationTransfer		PASS
		NAS	5GMM: SECURITY MODE COMPLETE		
10	←	RRC	NR RRC: SecurityModeCommand		
11	→	RRC	NR RRC: SecurityModeComplete		PASS
12	←	RRC	NR RRC: UECapabilityEnquiry		
13	→	RRC	NR RRC: UECapabilityInformation		PASS
14	←	RRC	NR RRC: DLInformationTransfer		
		NAS	5GMM: REGISTRATION ACCEPT		
15	→	RRC	NR RRC: ULInformationTransfer		PASS
		NAS	5GMM: REGISTRATION COMPLETE		
16	→	RRC	NR RRC: ULInformationTransfer		PASS
		NAS	5GMM: UL NAS TRANSPORT		
			5GSM: PDU SESSION ESTABLISHMENT REQUEST, verify that PDU session type is IPv4v6.		
17	←	RRC	NR RRC: RRCReconfiguration		
		NAS	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 Cell selection

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 using information saved to the USIM.

5.5.1.2 Reference specification

3GPP TS 36.304, clause 5.2.3.

5.5.1.3 Applicability

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

5.5.1.4 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
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

5.5.1.5 Test procedure

PREAMBLE

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

7. The UE is powered ON.

MAIN BODY

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

9. The SS sends an ue-CapabilityRequest including the RAT type "eutra-nr".

10. Verify the UE sends UECapabilityInformation message including the RAT type "eutra-nr".

11. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PSCell 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. The RRC connection is released by the SS.

POSTAMBLE

15. The SS initiates a paging preocedure to establish RRC connection for DETACH.

16. The SS initiates a MT Detach procedure.

17. The SS initiates a RRC release procedure.

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

Table 5.1.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	

1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2		UE	Switch On UE	AT Command	
3	→	NAS	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
	←	RRC			
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	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PSCell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
		RRC			
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	←	RRC	The RRC connection is released.		
10	→	RRC	SS initiates a paging preocedure to establish RRC connection for DETACH.		PASS
	←				
11	→	NAS	SS initiates a MT Detach procedure.		PASS
	←				
12	←	RRC	SS initiates a RRC release procedure.		
13			Deactivate E-UTRAN Cell A and NR Cell B		

5.5.1.6   Expected Result

Verify that the UE will correctly select and camp on the E-UTRAN cell

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 PSCell after adding PSCell and SRB3 establishment.

5.5.2.2   Reference specification

3GPP TS 38.331, clause 5.3.5

5.5.2.3   Applicability

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

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 SRB3 and Cell B as NR PSCell 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 Cell B.

POSTAMBLE

11. The SS initiates a Detach procedure.

12. The SS initiates a RRC release procedure.

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

Table 5.1.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2		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 SRB3 and Cell B as NR PSCell 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 data transmission is performed successfully on Cell B.		
11	→ ←	NAS	SS initiates a Detach procedure.		PASS
12	←	RRC	SS initiates a RRC release procedure.		
13			Deactivate E-UTRAN Cell A and NR Cell B.		

5.5.2.6 Expected Result

Verify the UE can support NSA, and the data transmission can be performed successfully on PSCell after adding PSCell and SRB3 establishment.

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 PSCell 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 5.1.1.5-1: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
1	←	RRC	SS Activates E-UTRAN Cell A and Cell B		
2		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 PSCell 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 RRCConnectionReconfigurationComplete		PASS

			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.

5.6   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 5.1.1.5-1: 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 PSCell 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 PSCell 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 5.1.1.5-1: 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 5.6.2.5-1.
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 PSCell 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 5.1.1.5-1: 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 PSCell 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 Scell to NR PScell 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 Scell

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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell with Split DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete		PASS

			message containing NR RRCReconfigurationComplete message.		
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 Scell to NR PSCell 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 5.1.1.5-1: 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 PSCell 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 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 PSCell 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 5.1.1.5-1: 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 PSCell 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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

5.8   Access Barring, Access Class

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= f1

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= f1

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

PRACH Configuration Index = 21(Preamble format 1)

NR Cell C

Cell Id=3 TAC = 3

MCC = 460 MNC = 00

NR-ARFCN= f2

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

PRACH Configuration Index = 61(Preamble format A1)

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 5.1.1.5-1: 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 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, 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 5.1.1.5-1: 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			Message Sequence		
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 measurement is configured in RRC CONNECTION RECONFIGURATION message.		PASS
5			Verify the data transmission is performed successfully on Cell A.		PASS
6			SS changes the cell power according to T1 in table 6.1.2.1.5-1.		
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 two 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 the UE 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

NR-ARFCN= f1

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

NR Cell B

Cell Id=2 TAC = 1

MCC = 460 MNC = 00

NR-ARFCN= f2

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 5.1.1.5-1: 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 6.1.2.2.5-1.
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. 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.

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 5.1.1.5-2: 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 6.1.2.2.5-1.		
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			Verify the data transmission is performed successfully on Cell A.		PASS
6			SS changes the cell power according to T1 in table 6.1.2.2.5-1.		
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			Verify the 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			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.		

6.1.2.2.6 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 5.1.1.5-1)

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 5.1.1.5-1)

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 5.1.1.5-1)

[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 5.1.1.5-1: 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 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 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.

6.2 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
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 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

6.2.1.1.5 Test procedure

Table 5.1.1.5-1: 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 5.1.1.5-2: 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	UE performs the registration procedure on Cell A according to subclause 5.4.1 step3-18.		PASS
	←	RRC			

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

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

MCC = 460 MNC = 00

EARFCN= f2

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

6.2.1.2.5 Test procedure

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

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	-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 5.1.1.5-2: 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 6.2.1.2.5-1.		
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 5.4.1 step3-18.		PASS
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.

6.2.2 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
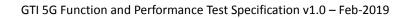3GPP TS 36.331 subclause 5.4 and 5.5

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
NR-ARFCN= f1
SS/PBCH SSS EPRE = -125 dBm/30kHz

E-UTRAN Cell B
Cell Id=2 TAC = 1
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

6.2.2.1.5 Test procedure

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

Time	NR Cell A	E-UTRAN Cell B	Remark
T0	-85	Not Active	
T1	-97	-85	
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 5.1.1.5-2: 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 6.2.2.1.5-1.		
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 5.1.1.5-1: 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 6.2.3.1.5-1.
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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			Message Sequence		
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 PCell 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
EARFCN= f1
rootSequenceIndex = 0
Reference Signal EPRE = -85 dBm/15kHz

NR Cell B
Cell Id=2 TAC = 2
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.
NR Cell B is not active.
The test shall be performed under ideal radio conditions.

UE
UE is powered off

6.2.3.2.5 Test procedure

Table 5.1.1.5-1: 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 5.1.1.5-2: 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 6.2.3.2.5-1.		
3		UE	Switch On UE	AT Command	
4	→ ←	NAS RRC	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
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	UE performs the registration procedure for		PASS

	←	RRC	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.		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 PCell.

6.3 NSA

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

6.3.1.1 Test Purpose

UE could reselect from NSA PCell 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 5.1.1.5-1: 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

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 6.3.1.5-1.
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 PSCell 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 RRC connection is released by the SS.

12. The SS changes cell power according to T1 in table 6.3.1.5-1.

13. The UE performs TRACKING AREA UPDATE on Cell B.

14. Verify the data transmission is performed 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 5.1.1.5-2: 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 RRC	SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell C as NR PSCell 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 PCell to E-UTRAN Cell.

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

6.3.2.1   Test Purpose

UE could reselect from E-UTRAN Cell to NSA PCell. Initial UL data trasfer, UE report NSA capability then SCG PSCell 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 5.1.1.5-1: 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 PSCell 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 5.1.1.5-2: 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 6.3.2.5-1.		
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			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 PSCell 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 PCell.

6.3.3   PCell Handover with SCG change, Data continuity

6.3.3.1   Test Purpose

Setup a real PS service (e.g. streaming).The UE perform Pcell-Pcell 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

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= -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

NR Cell D

Cell Id=04 TAC = 02

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 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 5.1.1.5-1: 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 PSCell 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	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 PSCell 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	The UE performs TRACKING AREA UPDATE on		PASS

15	←	RRC	Cell B.		
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 PCell Handover with SCG unchange, Data continuity

6.3.4.1 Test Purpose

Setup a real PS service (e.g. streaming).The UE perform Pcell-Pcell 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 5.1.1.5-1: 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	-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 PSCell 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 5.1.1.5-2: 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 6.3.4.5-1.		
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 PSCell 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 PSCell, UE can keep data transmission continuity after releasing of NSA PSCell and handover from NSA Pcell 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 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

6.3.5.5 Test procedure

Table 5.1.1.5-1: 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	-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 PSCell 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 5.1.1.5-2: 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 6.3.5.5-1.		
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		

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			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 PSCell 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 PSCell after handover from E-UTRAN cell to NSA Pcell and addition of NSA PSCell.

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 5.1.1.5-1: 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	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 PSCell 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
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 PSCell with Split DRB. RRCConnectionReconfiguration message contains the ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.		
13	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
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.

7 Service

7.1 Voice

7.2 Date Transmission

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 the device that supports SA or SA+NSA.

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 5.1.1.5-1: 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 and voltage 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 5.1.1.5-2: 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 and voltage 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 the device that supports SA or SA+NSA.

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 5.1.1.5-1: 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 and voltage 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 and voltage 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 the device that supports NSA or SA+NSA.

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 5.1.1.5-1: 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 9.1.3.5-1.
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 PSCell 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 and voltage 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 and voltage 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 the device that supports NSA or SA+NSA.

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 5.1.1.5-1: 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 PSCell 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 and voltage 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 and voltage 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 reslect 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 Cell.
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 and NR Cell B is not active

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.1.5.5 Test procedure

Table 5.1.1.5-1: 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

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 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 38.508, Table 4.5.2.2 till Step 20).

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 9.1.5.5-2
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 8 and 9

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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 9.1.5.5-1.		

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 20).		PASS
5			Start power consumption tester to record the changes of current and voltage of Handover procedure		
6			The SS changes the power level according to T1 in Table 9.1.5.5-2		
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 Handover between step 8 and 9		
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 reslect 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 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 = 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 is not active

      The test shall be performed under ideal radio conditions.

UE

      UE is powered off

9.1.6.5 Test procedure

Table 5.1.1.5-1: 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

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 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

38.508, Table 4.5.2.2 till Step 20).

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 9.1.6.5-2

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 8 and 9

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 5.1.1.5-2: 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 9.1.6.5-1.		
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 20).		PASS
5			Start power consumption tester to record the changes of current and voltage of Handover procedure		
6			The SS changes the power level according to T1 in Table 9.1.6.5-2		
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 Handover between step 8 and 9		
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, SA

9.2.1.1 Test Purpose

When UE is in RRC Connected State after Registering in NR cell, Measure the power consumption.

9.2.1.2 Reference specification

TS 38.304, TS 38.331, TS 38.300

9.2.1.3 Applicability

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

9.2.1.4 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

9.2.1.5 Test procedure

Table 5.1.1.5-1: 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 9.2.1.5-1.
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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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.		

9.2.1.6 Expected Result

The Current Should be less than [TBD]mA

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

Time	E-UTRAN Cell A	E-UTRAN Cell B	NR Cell C	Remark
T0	-85	-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 PSCell 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 PSCell(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 PSCell(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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 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

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 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

9.2.3.5 Test procedure

Table 5.1.1.5-1: 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

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 9.2.5.5-1.
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. SS reconfigures the cell power level according to T1 in Table 9.2.5.5-1

MAIN BODY

7. Start power consumption tester to record the changes of current and voltage of Handover procedure.

8. The SS Send RRC Reconfiguration message to make Handover from Cell A to Cell B

9. Verify that RACH procedure is successful and UE send RRC Reconfiguration complete in Cell B

10. Get the value of power consumption tester between step 8 and 9

11. The SS Send RRC Reconfiguration message to make Handover from Cell B to Cell A

12. Verify that RACH procedure is successful and UE send RRC Reconfiguration complete in Cell A

13. Get the value of power consumption tester between step 11 and 12

14. Repeat Step 8 to 13 for four times and calculate the overall average power consumption at the time of Handover procedure

POSTAMBLE

15. The SS initiates a Deregitration procedure.

16. The SS initiates a RRC release procedure.

17. Deactivate NR Cell A.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 9.2.5.5-1.		
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			SS reconfigures the cell power level according to T1 in Table 9.2.5.5-1		
7			Start power consumption tester to record the changes of current and voltage of Handover procedure		
8	←	RRC	The SS sends RRC Reconfiguration message to make Handover from Cell A to Cell B		
9	→	RRC	UE sends RRC Reconfiguration complete in Cell B		PASS
10			Get the power concumption tester values at the time of Handover between step 8 and 9		

11	←	RRC	The SS sends RRC Reconfiguration message to make Handover from Cell B to Cell A		PASS
12	→	RRC	UE sends RRC Reconfiguration complete in Cell A		
13			Get the power concumption tester values at the time of Handover between step 11 and 12		
14			Repeat steps between 8 to 13 for 4 times and Calculate the overall average power consumption value for Handover Procedure		PASS
15	→ ←	NAS	SS initiates a Deregitration procedure.		PASS
16	←	RRC	SS initiates a RRC release procedure.		
17			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 5.1.1.5-1: 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 9.3.1.5-1.
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 PSCell 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

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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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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		PASS

	←		Cell A		
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   VoLTE MT Call with E-UTRAN Cell, Power Consumption

9.3.2.1   Test Purpose

To measure the average current of MT VoLTE call procedure when call is ongoing in good coverage area.

9.3.2.2   Reference specification

TS 36.508, TS 24.299, RFC 4867

9.3.2.3   Applicability

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

This test applies to the device that supports VoLTE

9.3.2.4   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

9.3.2.5   Test procedure

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

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

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 9.3.3.5-1.

20. The UE is powered ON.

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

22. The SS sends an ue-CapabilityRequest including the RAT type "eutra-nr".

23. Verify the UE sends UECapabilityInformation message including the RAT type "eutra-nr".

24. The SS sends an RRCConnectionReconfiguration message containing NR RRCReconfiguration message to add Cell B as NR PSCell with Split DRB.

25. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

26. UE inititaes the PDN connectivity procedure for the IMS PDN and Default EPS procedure for IMS PDN is completed in Cell A.

27. IMS Registration is successful in Cell A

28. Verify that Data tranfer(Ping) perofrmed on NR cell B

MAIN BODY

29. start power consumption tester records the changes of current and voltage and start the MT VoLTE call from tester

30. Verify the RTP packet flow between UE and SS in both directions and stop the VoLTE call after 3 minutes

31. Stop the power consumption measurement and calculate the average current for VoLTE call

POSTAMBLE

32. The SS initiates a Detach procedure.

33. The SS initiates a RRC release procedure.

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

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 PSCell 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.		

9.3.2.6   Expected Result

Record the test results of the current9.4   Data Transmission, Power Consumption

9.4   Data Transmission, Power Consumtpion

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 3 dBm

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 the device that supports SA or SA+NSA.

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

RB Allocation DL = Full

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 5.1.1.5-1: 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 and voltage.
6. Setup a FTP session and verify that UE uploads data correctly. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.1.1.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports SA or SA+NSA.

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

RB Allocation DL = Full

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

    UL MCS = 18

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.1.2.5 Test procedure

Table 5.1.1.5-1: 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 9.4.1.2.5-1.
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 and voltage.
6. Setup a FTP session and verify that UE uploads data correctly. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer

8. Repeat Step 6 and 7 for four more time

9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.

11. The SS initiates a RRC release procedure.

12. Deactivate NR Cell A.

Table 5.1.1.5-2: 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 9.4.1.2.5-1.		
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 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.1.2.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 3 dBm

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 the device that supports SA or SA+NSA.

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
RB Allocation DL = Full
P_Max = 26 dBm
UL 256 QAM MCS Table = true

[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 = 27
    The test shall be performed under ideal radio conditions.
UE
    UE is powered off

9.4.1.3.5 Test procedure

Table 5.1.1.5-1: 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 9.4.1.3.5-1.
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 and voltage.
6. Setup a FTP session and verify that UE uploads data correctly. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 5.1.1.5-2: 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 9.4.1.3.5-1.		
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 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		

10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.1.3.6 Expected Result

The Current Should be less than [TBD]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. Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports SA or SA+NSA.

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
RB Allocation DL = Full
P_Max = 23 dBm
UL MIMO = 2X2
UL 256 QAM MCS Table = true

[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 = 27

   The test shall be performed under ideal radio conditions.

UE

   UE is powered off

9.4.1.4.5 Test procedure

Table 5.1.1.5-1: 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 9.4.1.4.5-1.

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 FTP session and verify that UE uploads data correctly. Keep the service for 2 minutes

7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer

8. Repeat Step 6 and 7 for four more time

9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.

11. The SS initiates a RRC release procedure.

12. Deactivate NR Cell A.

Table 5.1.1.5-2: 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 9.4.1.4.5-1.		
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 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.1.4.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports SA or SA+NSA.

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 UL = Full

RB Allocation DL = Full

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

    DL MCS = 22

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.2.1.5 Test procedure

Table 5.1.1.5-1: 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 9.4.2.1.5-1.
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 and voltage.
6. Setup a FTP session and verify that UE downloads data correctly. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.

11. The SS initiates a RRC release procedure.

12. Deactivate NR Cell A.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 and voltage		
6	←	UE	UE downloads the data correctly in NR Cell A. Keep services for 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.2.1.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports SA or SA+NSA.

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 UL = Full

RB Allocation DL = Full

P_Max = 0 dBm

DL MIMO = 4X4

DL 256 QAM MCS Table = true

[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

     DL MCS = 27

     The test shall be performed under ideal radio conditions.

UE

     UE is powered off

9.4.2.2.5 Test procedure

Table 5.1.1.5-1: 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 9.4.2.2.5-1.
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 and voltage.
6. Setup a FTP session and verify that UE downloads data correctly. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 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 downloads the data correctly in NR Cell A. Keep services for 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		

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

9.4.2.2.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 3 dBm

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 the device that supports SA or SA+NSA.

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
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
    UL MCS = 18

140

DL MCS = 22

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.3.1.5 Test procedure

Table 5.1.1.5-1: 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 9.4.3.1.5-1.
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 and voltage.
6. Setup a FTP session and verify that UE downloads and uploads the data simultaneously. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 5.1.1.5-2: 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 9.4.3.1.5-1.		
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 and voltage		
6	←	UE	UE donwloads/uploads the data correctly in NR Cell A. Keep services for 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.3.1.6 Expected Result

The Current Should be less than [TBD]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 data with a power of 0 dBm

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 the device that supports SA or SA+NSA.

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

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

    UL MCS = 18

    DL MCS = 22

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.3.2.5 Test procedure

Table 5.1.1.5-1: 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 9.4.3.2.5-1.
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 and voltage.
6. Setup a FTP session and verify that UE downloads and uploads data simultaneously. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 and voltage		
6	←	UE	UE downloads/uploads the data correctly in NR Cell A. Keep services for 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.3.2.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 3 dBm

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 the device that supports SA or SA+NSA.

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

P_Max = 26 dBm

DL MIMO = 4X4

DL 256 QAM MCS Table = true

UL 256 QAM MCS Table = true

[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 = 27

    DL MCS = 27

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.3.3.5 Test procedure

Table 5.1.1.5-1: 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 9.4.3.3.5-1.

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 and voltage.

6. Setup a FTP session and verify that UE downloads and uploads the data simultaneously. Keep the service for 2 minutes

7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer

8. Repeat Step 6 and 7 for four more time

9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.

11. The SS initiates a RRC release procedure.

12. Deactivate NR Cell A.

Table 5.1.1.5-2: 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 9.4.3.3.5-1.		
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 and voltage		
6	←	UE	UE downloads/uploads the data correctly in NR Cell A. Keep services for 2 minutes		PASS
7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.3.3.6 Expected Result

The Current Should be less than [TBD]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. Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports SA or SA+NSA.

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
P_Max = 23 dBm
DL MIMO = 4X4
UL MIMO = 2X2
DL 256 QAM MCS Table = true
UL 256 QAM MCS Table = true

[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 = 27
      DL MCS = 27
      The test shall be performed under ideal radio conditions.

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UE

 UE is powered off

9.4.3.4.5 Test procedure

Table 5.1.1.5-1: 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 9.4.3.4.5-1.
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 FTP session and verify that UE uploads data correctly. Keep the service for 2 minutes
7. Get the value of power consumption tester during step 6 and calculate the average throughput at application layer
8. Repeat Step 6 and 7 for four more time
9. Calculate the overall average power consumption and throughput at the application level

POSTAMBLE

10. The SS initiates a Deregistration procedure.
11. The SS initiates a RRC release procedure.
12. Deactivate NR Cell A.

Table 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 and voltage		
6	←	UE	UE uploads the data correctly in NR Cell A. Keep services for 2 minutes		PASS

7			Get the power concumption tester values and note down the throughput put value at application layer level		
8			Repeat step 6 and 7 for four times		
9			Calculate the overall average power consumption value and Application Data throughput value		
10	→ ←	NAS	SS initiates a Deregistration procedure.		PASS
11	←	RRC	SS initiates a RRC release procedure.		
12			Deactivate E-UTRAN Cell A and NR Cell B.		

9.4.3.4.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a 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 the device that supports NSA or SA+NSA.

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

RB Allocation DL = Full

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

UL MCS = 18

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.4.1.5 Test procedure

Table 5.1.1.5-1: 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 9.4.4.1.5-1.
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 PSCell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current and voltage.

10. Setup a FTP session and verify that UE uploads data correcctly. Verify that data transfer happening in NR data path. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step			Message Sequence		Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 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 PSCell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the chnages of current and voltage		
10	←	UE	UE uploads the data correctly in NR data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values		

			and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.4.1.6 Expected Result

The Current Should be less than [TBD]mA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a 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 the device that supports NSA or SA+NSA.

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
RB Allocation DL = Full
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

RB Allocation DL = Full

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

     UL MCS = 18

     The test shall be performed under ideal radio conditions.

UE

     UE is powered off

9.4.4.2.5 Test procedure

Table 5.1.1.5-1: 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 9.4.4.2.5-1.
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 PSCell 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 and voltage.

10. Setup a FTP session and verify that UE uploads data correcctly. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step			Message Sequence		Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 and voltage		
10	←	UE	UE uploads the data correctly in both MCG		PASS

			and SCG data path. Keep services for 2 minutes		
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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

The Current Should be less than [TBD]mA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits 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 the device that supports NSA or SA+NSA.

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

RB Allocation DL = Full

P_Max = 23 dBm

UL 256 QAM(MCS Table) = true

[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

    UL MCS = 27

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.4.3.5 Test procedure

Table 5.1.1.5-1: 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 9.4.4.3.5-1.
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 PSCell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current and voltage.

10. Setup a FTP session and verify that UE uploads data correcctly. Verify that data transfer happening in NR data path. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the chnages of current and voltage		
10	←	UE	UE uploads the data correctly in NR data path. Keep services for 2 minutes		PASS

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11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.4.3.6 Expected Result

The Current Should be less than [TBD]mA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 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
RB Allocation DL = Full
P_Max = 23 dBm

UL MCS 256 QAM = 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

RB Allocation DL = Full

P_Max = 23 dBm

UL 256 QAM(MCS Table) = true

[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

    UL MCS = 27

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.4.4.5 Test procedure

Table 5.1.1.5-1: 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 9.4.4.4.5-1.
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 PSCell 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 and voltage.

10. Setup a FTP session and verify that UE uploads data correcctly. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 and voltage		
10	←	UE	UE uploads the data correctly in both MCG		PASS

			and SCG data path. Keep services for 2 minutes		
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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

The Current Should be less than [TBD]mA

9.4.5 DL Data Transmission, Power Consumption, SA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports NSA or SA+NSA.

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 UL = Full

RB Allocation DL = Full

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

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.5.1.5 Test procedure

Table 5.1.1.5-1: 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 9.4.5.1.5-1.
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 PSCell with SCG DRB.
8. The UE sends an RRCConnectionReconfigurationComplete message containing NR

RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current and voltage.

10. Setup a FTP session and verify that UE downloads data correcctly. Verify that data transfer happening in NR data path. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the chnages of current and voltage		
10	←	UE	UE downloads the data correctly in NR data		PASS

			path. Keep services for 2 minutes		
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.5.1.6 Expected Result

The Current Should be less than [TBD]mA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm for both LTE and NR cell

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 the device that supports NSA or SA+NSA.

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 UL = Full
RB Allocation DL = Full

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

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

      The test shall be performed under ideal radio conditions.

UE

      UE is powered off

9.4.5.2.5 Test procedure

Table 5.1.1.5-1: 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 9.4.5.2.5-1.
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 PSCell 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 and voltage.

10. Setup a FTP session and verify that UE downloads data correctly. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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		

10	←	UE	UE downloads the data correctly in both MCG and SCG data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.5.2.6 Expected Result

The Current Should be less than [TBD]mA

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. Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm

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 the device that supports NSA or SA+NSA.

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 UL = Full

RB Allocation DL = Full

P_Max = 0 dBm

DL 256 QAM(MCS Table) = true

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 = 27

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.5.3.5 Test procedure

Table 5.1.1.5-1: 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 9.4.5.3.5-1.
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 PSCell with SCG DRB.

8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current and voltage.

10. Setup a FTP session and verify that UE downloads data correctly. Verify that data transfer happening in NR data path. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the		

10	←	UE	UE downloads the data correctly in NR data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.5.3.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm for both LTE and NR cell

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 the device that supports NSA or SA+NSA.

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 UL = Full

RB Allocation DL = Full

P_Max = 0 dBm

DL MCS 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 UL = Full

RB Allocation DL = Full

P_Max = 0 dBm

DL 256 QAM(MCS Table) = true

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 = 27

The test shall be performed under ideal radio conditions.

UE

UE is powered off

9.4.5.4.5 Test procedure

Table 5.1.1.5-1: 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 9.4.5.4.5-1.
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 PSCell 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 and voltage.

10. Setup a FTP session and verify that UE uploads data correcctly. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step			Message Sequence		Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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 PSCell 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 and voltage		
10	←	UE	UE downloads the data correctly in both MCG and SCG data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.5.4.6 Expected Result

The Current Should be less than [TBD]mA

9.4.6 Bi-direction Data Transmission, Power Consumption, SA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 3 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 the device that supports NSA or SA+NSA.

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

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 NSA mode.

[Initial conditions]

SS

    E-UTRAN Cell A is not active

    NR Cell B is not active

    DL MCS = 22

    UL MCS = 17

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.6.1.5 Test procedure

Table 5.1.1.5-1: 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.

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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 PSCell with SCG DRB.

8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current and voltage.

10. Setup a FTP session and verify that UE downloads/uploads data simultaneously. Verify that data transfer happening in NR data path. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 PSCell with SCG DRB.		

8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the chnages of current and voltage		
10	←	UE	UE downloads/uploads the data correctly in NR data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.6.1.6 Expected Result

The Current Should be less than [TBD]mA

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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 dBm for both LTE and NR cell
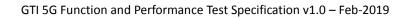
9.4.6.2.2 Reference specification

TS 36.508, TS 38.331, TS 38.300

9.4.6.2.3 Applicability

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

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

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

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 5.1.1.5-1: 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 9.4.6.2.5-1.
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 PSCell 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 and voltage.
10. Setup a FTP session and verify that UE downloads/uploads data simultaneously. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 2 minutes
11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer
12. Repeat Step 9 to 11 for four more time
13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	U-S	Layer	Message	Specific Contents	Verdict
			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 PSCell 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 and voltage		
10	←	UE	UE downloads/uploads the data correctly in both MCG and SCG data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.6.2.6 Expected Result

The Current Should be less than [TBD]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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 26 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 the device that supports NSA or SA+NSA.

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

P_Max = 26 dBm

DL 256 QAM(MCS Table) = true

UL 256 QAM(MCS Table) = true

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 = 27

     UL MCS = 27

     The test shall be performed under ideal radio conditions.

UE

     UE is powered off

9.4.6.3.5 Test procedure

Table 5.1.1.5-1: 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 9.4.6.3.5-1.

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 PSCell with SCG DRB.

8. The UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.

MAIN BODY

9. The power consumption tester records the changes of current and voltage.

10. Setup a FTP session and verify that UE downloads and uploads data simultaneously. Verify that data transfer happening in NR data path. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
	←	RRC			
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 PSCell with SCG DRB.		
8	→	RRC	UE sends an RRCConnectionReconfigurationComplete message containing NR RRCReconfigurationComplete message.		PASS
9			Power consumption tester records the chnages of current and voltage		
10	←	UE	UE downloads/uploads the data correctly in NR data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.6.3.6 Expected Result

The Current Should be less than [TBD]mA

9.4.6.4 Power Consumption with UL 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.Keep the FTP services for 2 minutes. Measure the power consumption when UE transmits data with a power of 0 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 the device that supports NSA or SA+NSA.

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

P_Max = 23 dBm

DL MCS 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 UL = Full

RB Allocation DL = Full

P_Max = 23 dBm

DL 256 QAM(MCS Table) = true

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 = 27

    UL MCS = 27

    The test shall be performed under ideal radio conditions.

UE

    UE is powered off

9.4.6.4.5 Test procedure

Table 5.1.1.5-1: 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 9.4.6.4.5-1.

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 PSCell 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 and voltage.

10. Setup a FTP session and verify that UE downloads and uploads data simultaneously. Verify that data transfer happening in both MCG and SCG bearers. Keep the service for 2 minutes

11. Get the value of power consumption tester during step 10 and calculate the average throughput at application layer

12. Repeat Step 9 to 11 for four more time

13. Calculate the overall average power consumption and throughput at the application 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 5.1.1.5-2: Message Sequence

Step	Message Sequence				Verdict
	U-S	Layer	Message	Specific Contents	
			Connect the power consumption tester to the UE		
1	←	RRC	Activate 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	UE performs the registration procedure with activation of the initial default EPS bearer on Cell A (see 36.508, 4.5.2).		PASS
	←	RRC			
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 PSCell 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 and voltage		
10	←	UE	UE downloads/uploads the data correctly in both MCG and SCG data path. Keep services for 2 minutes		PASS
11			Get the power concumption tester values and note down the throughput put value at application layer level		
12			Repeat step 9 to 11 for four times		
13			Calculate the overall average power consumption value and Application 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.		

9.4.6.4.6 Expected Result

The Current Should be less than [TBD]mA

9.5 Power Consumption - Inactive Mode

9.6 BWP, Power Consumption

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: $P_B = 1$		

[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 10 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		
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 FTP Client begin FTP Download		PASS
10			Repeat Step 10		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.1.1.6 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 10.1.1.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]
NR-1	FFS

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 : FFS	FFS

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 10 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	U-S	Layer	Message	Specific Contents	Verdict
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 FTP Client begin FTP Download		PASS
10			Repeat Step 10		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	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

10.2 Uplink TCP Throughput

10.2.1   UL Throughput under static channel, UL 64QAM, DL2*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 = 27
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: $\quad P_B = 1$			

[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 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 FTP client, begin FTP upload from the application server for [90] seconds and record Throughput result.

9. Repeat step 10 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		
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 FTP Client begin FTP Upload		PASS

10			Repeat Step 10		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.2.1.6 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 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	Expected UL Result [Mbit/s]
NR-1	FFS

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, 100 MHz BW, 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
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 10.2.2.4-1: 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: $P_B = 1$			

[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 FTP client, begin FTP upload from the application server for [90] seconds and record Throughput result.
9. Repeat step 10 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		
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 FTP Client begin FTP Upload		PASS
10			Repeat Step 10		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.2.2.6 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 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	Expected UL Result [Mbit/s]
NR-1	FFS

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: $P_B = 1$			

[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 FTP client, begin FTP upload from the application server for [90] seconds and record Throughput result.

9. Repeat step 10 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		
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 FTP Client begin FTP Upload		PASS
10			Repeat Step 10		
11	SS		Calculate Average Throughput		PASS
12			Switch Off UE	AT Command	
13	SS		Deactivate Cell A		

10.2.3.6 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 10.2.3.6-1: expected result

Test Point	Expected UL Result [Mbit/s]
NR-1	FFS

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

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 10.3.1.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation 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: $P_B = 1$			

[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 FTP client, begin FTP download from the application server for [90] seconds and record Throughput result.

9. Repeat step 10 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 10.3.1.5-1: 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 FTP Client begin FTP Download		PASS
10			Repeat Step 10		
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 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	Expected DL Result [Mbit/s]
NR-1	FFS

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 : FFA	FFA

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.

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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 10 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 10.3.2.5-1: 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 FTP Client begin FTP Download		PASS
10			Repeat Step 10		
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

Test Point	Expected DL Result [Mbit/s]
NR-1	FFS

10.4 Downlink TCP Throughput, NSA

10.4.1 DL Throughput under static channel, DL 256QAM, DL4*4 MIMO, 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 3 UEs.

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

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 10.4.1.4-1: 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
NSA 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 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 Propagation 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 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 10.4.1.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]
NSA-1	FFS

10.4.2 DL Throughput under fading channel, DL 256QAM, 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, 256QAM, DL NR 4*4 MIMO + LTE 2*2 MIMO, 2*2 MIMO, 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 3 UEs.

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
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

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 10.4.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	LTE Fading Profile : FFS , NR Fading Profile : FFS	N/A

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
NSA 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 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 10.4.2.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]
NSA-1	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 3 UEs.

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
DL Modulation / Coding = 27
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

DL Modulation / Coding = 27

RB Allocation UL= Full

RB Allocation DL = Full

simultaneousAckNackAndCQI = 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 10.5.1.4-1: 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
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 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 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 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 10.5.1.4-1, 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 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 10.5.1.5-1: 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 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 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 10.5.1.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]
NSA-1	FFS

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 256QAM,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 3 UEs.

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
DL Modulation / Coding = 27
RB Allocation UL= Full
RB Allocation DL = Full
simultaneousAckNackAndCQI = TRUE
enableUl256QAM = 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
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 10.5.2.4-1: 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 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 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 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 10.5.2.4-1, 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	U-S	Layer	Message	Specific Contents	Verdict
			Message Sequence		
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 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 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 10.5.2.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]
NSA-1	FFS

10.6 Bidirectional UDP Throughput, NSA

10.6.1 Bidirectional Throughput under static channel,256QAM, DL 4*4 and UL 2*2 MIMO, 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, 256QAM, DL NR 4*4 MIMO+ LTE2*2 MIMO, 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 3 UEs.

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
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
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 10.6.1.4-1: 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 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 and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.1.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]	Expected UL Result [Mbit/s]
NSA-1	FFS	FFS

10.6.2 Bidirectional Throughput under fading channel,256QAM, DL 4*4 and UL 2*2 MIMO,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, 256QAM, DL NR 4*4 MIMO+ LTE2*2 MIMO, 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 3 UEs.

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
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
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 10.6.2.4-1: Test Points Configuration

Test Point	Propagation Conditions	Correlation Matrices
NSA-1	Fading Profile : FFS	N/A

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
NSA 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 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 and uplink throughput at the application layer shall meet or exceed the value in following table.

Table 10.6.2.6-1: Expected Result

Test Point	Expected DL Result [Mbit/s]	Expected UL Result [Mbit/s]
NSA-1	FFS	FFS

11 Latency

12 High Speed Train

13 Beam Management

Appendix A Test Channel Parameters

Appendix B Document Change Record

Date	Meeting #	Version	Revision Contents
27-Nov-2018	NA	0.1	First draft release to task members to be used as starting template.
04-Jan-2019	NA	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	NA	0.3	CMCC-20190120-01
23-Jan-2019	NA	0.4	Anritsu-20190115-01 Anritsu-20190115-02 Anritsu-20190115-03 Anritsu-20190115-04 DTG-20190115-01 Keysight-20190116-01
31-Jan-2019	NA	0.5	Anritsu-20190130-01 Anritsu-20190131-01 CMCC-20190130-02 DTG-20190129-01 Keysight-20190129-01
12-Feb-2019			Anritsu-20190201-01 Anritsu-20190208-01 RNS-20190212-01