GTI 5G Sub-6GHz Device Interoperability Test Specification

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Document History

Date	Meeting #	Version #	Revision Contents
02-11-2018	23rd GTI Workshop	V1.0	The first version of GTI 5G Sub-6GHz Device Interoperability Test Specification. This specification targets eMBB scenario for 5G Sub-6GHz Chipset, Module and Device products testing. It stipulates the 5G device interoperability test in lab for NSA Mode (Option 3/3a/3x) and SA (Option 2).

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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 interoperability 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 interoperability 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 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 References

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 Object

4.1 Hardware architecture

Table 4-1：Hardware for the test

Title	Number	Note
gNB	2	
test UE	more than 4	
NGC	1	
OMC	1	

4.2 Software architecture

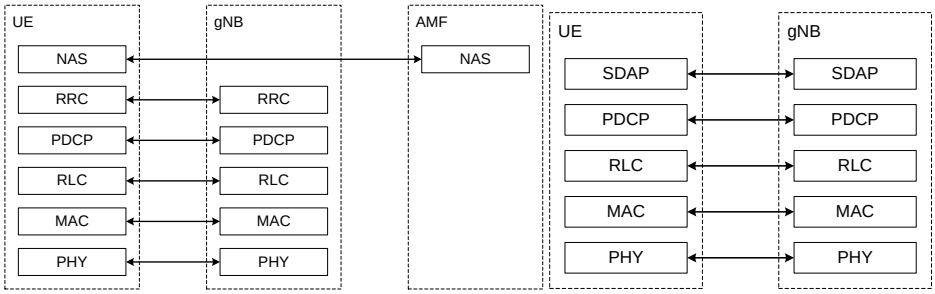


Fig4-1：Control surface and user surface architecture of SA

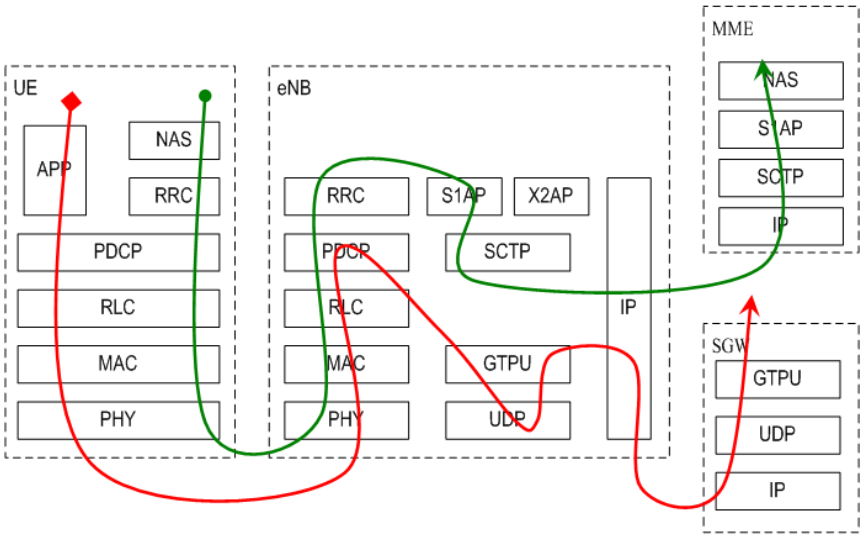


Fig 4-2：Architecture of NSA

4.3 Test network basic configuration

Table 4-2：NSAnetwork basic configuration

Item	Value	Remarks
NR frequency band	N41/N78/N79	NR frequency band
NR bandwidth	80 MHz /100MHz	NR bandwidth
LTE frequency used by cells in NSA mode	B3/B8/B40/B41	
LTE bandwidth used by cells in NSA mode	10MHz/20MHz	
SCS	15/30/60KHz	
NR frame structure	2ms: single-periodicity 2.5ms: single-/dual-periodicity 5ms：periodicity	Choose the supported periodicity.
CP length	normal	
GP in the special subframe	2-4 symbols	
PRACH format	Format0/Format B4/Format C2	Perform PRACH tests by modifying the timeslot configuration ratio.
PUCCH format	Format0/Format1+Format2/Format 3	Select at least one format between formats {0,1} and at least one format between format {2,3}.
PBCH sub-carrier spacing	30kHz	
PBCH SSB beam quantity	1~8	Fixed position, horizontal direction
PBCH period	20ms	
PDCCH beam quantity	Same as the SSB, narrow beam	Same as the SSB beam quantity.
Number of PDCCH symbols	1	
UL power control	Enabled	PUCCH, PUSCH, Sounding
HARQ	Enabled	
AMC	Enabled	
SRS	Transmission with antenna switching	NR：mandatory LTE：recommended
Terminal multi-antenna mode	NSA： NR: 1T4R LTE 1T4R or 1T2R	
Terminal Tx power	The total Tx power of the terminal supporting NSA is 26 dBm.	There are no power restrictions, and the terminal manufacturer needs to check whether 26dBm meets the requirement.

Table 4-3：NSA network basic configuration

Item	Value	Remarks
NR frequency band	N41/N78/N79	
NR bandwidth	80 MHz /100MHz	
NR frame structure	2ms: single-periodicity 2.5ms: single-/dual-periodicity 5ms：periodicity	Choose the supported periodicity.
SCS	15/30/60KHz	
CP length	normal	
GP in the special subframe	2-4 symbols	
PRACH format	Format0/Format B4/Format C2	Perform PRACH tests by modifying the timeslot configuration ratio.
PUCCH format	Format0/Format1+Format2/Form at 3	Select at least one format between formats {0,1} and at least one format between format {2,3}.
PBCH sub-carrier spacing	30kHz	
PBCH SSB beam quantity	1~ 8	Fixed position, horizontal direction
PBCH period	20ms	
PDCCH beam quantity	Same as the SSB, narrow beam	Same as the SSB beam quantity.
Number of PDCCH symbols	1	
UL power control	Enabled	PUCCH, PUSCH, Sounding
HARQ	Enabled	
AMC	Enabled	
SRS	Transmission with antenna switching	
Terminal multi-antenna mode	2T4R	
Terminal Tx power	The total Tx power of the terminal supporting SA system is 26 dBm.	

5 Testing environment

5.1 Network topology

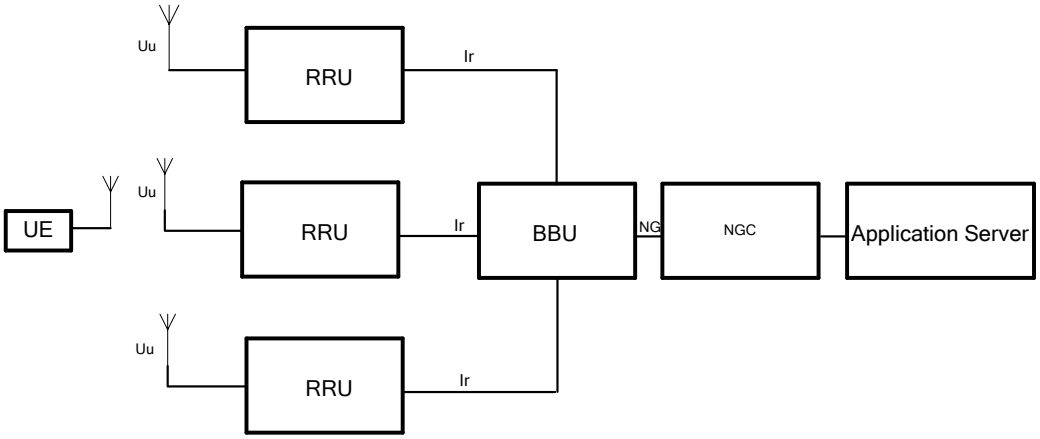


Fig 5-1: 3 Cell, 1 gNB

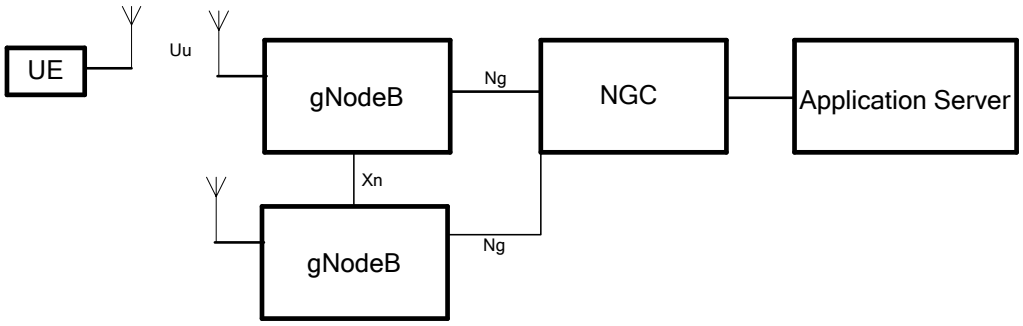


Fig 5-2: 2 Cell, 2gNB

5.2 Tested and matched Equipment

Before testing, the equipment model and software version of the under test must be registered. In the test, the tested equipment cannot be replaced in principle, Tester need to apply to test manager, if he wants to replace the hardware or software upgrade.

Table 5-1： NSA network basic configuration

Equipment Name	**Num**
LTE/NR-BS	1~3
EPC/NGC hardware and software	1
wireshark	1
Gigabit switches	1
application server	1

6 Test tools and test methods

6.1 Test tools

Message tracking tools of terminal self-provided signaling and log.

The tools can connect to a computer, and record and display the Signaling process of the sending and receiving by the UE.

6.2 Test methods

The actual base stations and terminals will be used in the lab test, which analyze and record signals and logs of base stations and terminals using protocol analyzer and terminal self-provided Message tracking tools.

6.2.1 Test procedure

Base station and terminal shall set up and connect the equipment in strict accordance with the preset conditions required by test cases in the specification, and strictly follow the steps in test cases to operate one by one, record in detail the important test information during and after the test, and compare and analyze. Test cases are independent and tested one by one.

6.2.2 Statistics and analysis of key indicators

The test process strictly conforms to the preset condition in the test case, and the test result is taken as the standard of passing or not. If the test result meets the requirements, the test cases can be passed; otherwise, it is not passed.

6.2.3 Others

If the tests need record results over a period of time, the test time will be at least 30s, the recorded results are the mean values of data sequences acquired in the test time, and the peak value can record the maximum in the test time. Some test cases need to be tested multiple times, and the average of the test results is recorded

If tests shall involve throughput, throughput of L1 and L3 both need be recorded, and how the throughput is recorded should be explained the statistical methods, including the reporting period、the statistical time , etc. Third-party statistical tools need to explain the specific statistical methods and configuration parameters adopted by the software.The download/upload files must be placed in the application server of the test network.In the test cases, unless otherwise specified, HARQ/AMC/UL power control should be active. Special requirements are explained separately in test cases.

The Ping configuration is set to Windows default and the Ping interval is 1s.

TCP/IP configuration during testing is shown in the following table.

Table 6-1：TCP/IP configuration

Recommended configuration parameters	On Server	On user laptop
PC operating system		Windows XP
TCP receiving window size (RWin)		1034816
Default sent window		Consistent with RWin
MTU size	1446	1446
Selective Acks		yes
Max duplicate Acks		2

6.2.4 Scope of application

NSA Option 3x and SA option 2 of terminals must both be tested in the lab test specification.

The NSA test focused on LTE controlplane and NR user plane.

The SA test focused on controlplane and user plane of NR.

7 Basic Functional Testing

7.1 UE Power On Network Search

7.1.1 Power On Cell Selection and Registration

Test Item	Cell Selection	Sub-Item	Single UE Power On Cell Selection and Registration
Reference		Network Configuration	No-Load Network Environment
Importance	Mandatory		
Test Purpose	To verify UE successrate of cell selection under various signal strength		
Test Conditions	（1） Network Configuration: NR system adopts the network basic configuration described in Section 4.3 （2） Test Area：Select a cell for main testing, and select excellent, good, moderate, and poor static test location in a single cell. In addition, to prevent UE from camping on non-main testing neighbor cell at moderate		

<table>
<tr><td></td><td>and poor test location, block the neighboring cell during the testing.
（3） Only one UE of same brand joins the testing.
（4） DUT is not allowed to use network frequency by default.</td></tr>
<tr><td>Test Steps：</td><td>（1） Find Choose a point with excellent signal quality, and boot the UE in a static environment. The UE performs initial cell searching.
<table>
<tr><th>UE –AMF</th><th>Message</th></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>--></td><td>REGISTRATION REQUEST</td></tr>
<tr><td><--</td><td>AUTHENTICATION REQUEST</td></tr>
<tr><td>--></td><td>AUTHENTICATION RESPONSE</td></tr>
<tr><td><--</td><td>SECURITY MODE COMMAND</td></tr>
<tr><td>--></td><td>SECURITY MODE COMPLETE</td></tr>
<tr><td><--</td><td>REGISTRATION ACCEPT</td></tr>
<tr><td>--></td><td>REGISTRATION COMPLETE</td></tr>
</table>
（2） Check if UE performs search and camp on cell successfully. Check UE’s log, and record (RSRP, RS-SINR) of camped cell and neighboring cells; in addition, record the time required for UE power on network registration (Tcell_in).Repeat Step 1~2 20 times and record the success rate.
（3） Repeat Step 1~3to search for good, moderate, and poor test locations.
Note: T_{cell_in} is the time required from UE receiving system information MIB to completing network registration</td></tr>
<tr><td>Expected Result：</td><td>（1） UE is able to complete cell selection under various signal strength, and the successful rate of cell selection is 100%</td></tr>
<tr><td>Data Statistics and Processing</td><td>（1） Record the time from UE first receives system information MIB to completing camp-on(T_1).
Record the time from UE initiated Msg1 to Registration complete (T_2)
（2） Calculate UE power on network registration(T_{cell_in})and the maximum (T_{max}),minimum (T_{min}), and average ($T_{average}$)of T_{cell_in}, where T_{cell_in} = T1 + T2.
（3） The success rate of cell selection and camp on cell = the number of UE completing cell selection and camp on cell / the total number of UE initiated cell selection and camp on cell</td></tr>
<tr><td>Note：</td><td>At poor signal test point, the relative relationship of signal strength between cells can vary constantly; therefore, it is required to record the measurement result of each initial access and perform analysis for each log.</td></tr>
</table>

7.1.2 Cell Search after Returning Coverage Area

Test Item	Cell Selection	Sub-Item	Cell Search after Returning Coverage Area
Reference		Network Configuration	No-Load Network Environment
Importance	Mandatory		
Purpose:	To verify the ability of UE to reinitiate cell search and camp on cellafter it is out of network service		
Test Condition	（1） NR system adopts the network basic configuration described in Section 4.3 （2） Select two cells (Cell 1 and Cell 2) for main testing Only one UE of same brand joinsthe testing. （3） DUT is set to auto network search mode and is not allowed to use network frequency by default.		
Test Steps：	（1） Power on the UE statically in Cell 1;the UE shall camp on and register Cell 1 and initiate service (e.g. FTP download) successfully. （2） Place UE in shielding box etc. to make it out of service. After confirming OOS, move it to Cell 2 and take UE out of the shielding box, the UE shallreinitiate network search.Record the result of UE network search and registration in Cell 2 and the time required (T_{cell_in}), and also record RSRP, RSRQ parameters etc. of camp on cell. （3） Repeat Step 1~2 10 times and record success rate. Note: T_{cell_in} is the time required from UE recovered from signal reception to completing network registration.		
Expected Result：	UE is able to complete cell search and camp on cell under various signal strength, and the success rate is 100%.		
Data Statistics and Processing	**（1）** Record the time required for UE to perform cell search in cell and calculate the average search time ($T_{average}$), the maximum search time (T_{max}), and the minimum search time (T_{min}). **（2）** If cell search is failed, analyze the cause of failure through network and UE signaling messages		
Note：			

7.1.3 Normal Registration

<table>
<tr><td>Test Item</td><td>Registration update</td><td>Sub-Item</td><td>Normal registration</td></tr>
<tr><td>Reference</td><td></td><td>Network Configuration</td><td>No-Load Network Environment</td></tr>
<tr><td>Importance</td><td colspan="3">Mandatory</td></tr>
<tr><td>Purpose：</td><td colspan="3">To verify the ability of UE tracking area update during mobility</td></tr>
<tr><td>Test Condition：</td><td colspan="3">（1） NR system adopts the network basic configuration described in Section 4.3
（2） Two different tracking areas (different TAI) should exist in the test area, and the test route should pass through these two different tracking areas.
（3） At least one UE of every brand joins the testing.
（4） UE is registered in CELL1, and in the state 5GMM-REGISTERED /5GMM-IDLE mode.</td></tr>
<tr><td>Test Steps：</td><td colspan="3">（1） Power on the UE at the starting point of test route, register on network in one tracking area, set up packet switched domain service (e.g. internet browsing), then end the service to verify that the UE operates properly.
（2） Move the UE to a new tracking area different from the original tracking area, check if UE successfully initiates and completes tracking area update by examining the log.
（3） In new tracking area, UE re-establishespacket switched domain service (e.g. internet browsing) to verify whether UE can operate properly. UE enters CELL2 from CELL1.
<table>
<tr><th>UE –MME</th><th>Messgae</th></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>--></td><td>REGISTRATION REQUEST</td></tr>
<tr><td><--</td><td>REGISTRATION ACCEPT</td></tr>
<tr><td>--></td><td>REGISTRATION COMPLETE</td></tr>
</table>
（4） Repeat Step 1~4 20 times and record success rate.</td></tr>
<tr><td>Expected Result：</td><td colspan="3">（1） UE is able to complete normal tracking area update without abnormality such as out-of-service network.
（2） UE is able to re-establish PS services successfully in new tracking area.
（3） The success rate of tracking area update is 100%.
（4） In the REGISTRATION REQUEST sent by UE, 5GS REGISTRATION type IE is "mobility REGISTRATION updating";</td></tr>
</table>

	（5） UE receives REGISTRATION ACCEPT with network assignment 5G-GUTI and TAI list. If there is a GUTI, UE sends REGISTRATION COMPLETE to AMF for confirmation.
Note：	

7.1.4 Periodic Registration

Test Item	Registration update	Sub-Item	Periodic registration
Reference		Network Configuration	No-Load Network Environment
Importance	Mandatory		
Purpose	To verify the ability of UE to update tracking area periodically		
Test Condition：	（1） Network Configuration:NR system adopts the network basic configuration described in Section 4.3 （2） Configure shorter T3412, e.g. 6 minutes. （3） Number of DUTs: At least one UE of every brand （4） Testing Method： Testing at a given point； （5） UE is registered in CELL1, and in the state 5GMM-REGISTERED /5GMM-IDLE mode.		
Test Steps：	（1） Power on UE, register for network, and enter the RRC IDLE state. （2） Wait for a while (until T3412 timer timer expires), and check the signal interacted between the UE and network.		

UE –MME	Messgae
…	…
-->	REGISTRATION REQUEST
<--	REGISTRATION ACCEPT
-->	REGISTRATION COMPLETE

（3） Check if UE successfully initiates and completes tracking area update by examining UE log.

（4） Repeat Step 2~3 20 times;observe whether all UEs are able to successfully complete tracking area update, and check if the interval of update time is identical to the time (6 minutes) set by network timer.

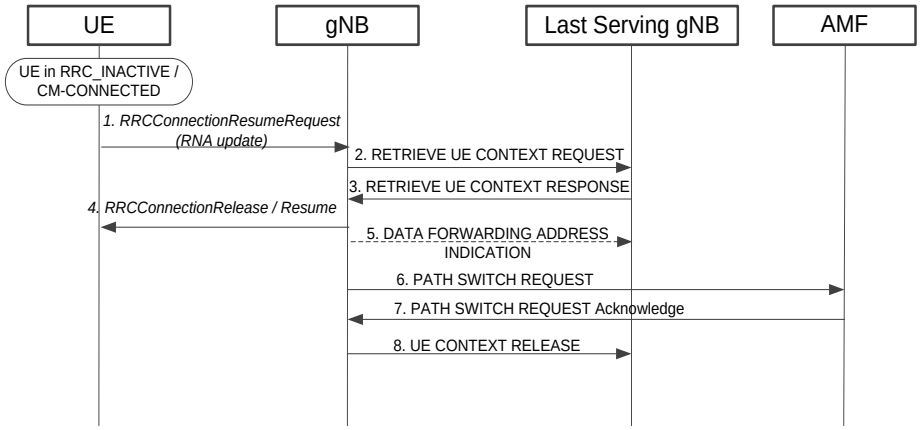
（5） Record the success result of each time and interval of TAU, calculate success rate, and analyze abnormal condition.

Expected	（1） UE is able to complete periodic tracking area update, and the interval

Result：	period of each update is identical to preset network period. （2） The success rate of tracking area update is 100%. （3） In the REGISTRATION REQUEST sent by UE, the 5GS REGISTRATION type IE is "cymat REGISTRATION updating"; （4） UE receives REGISTRATION ACCEPT with network assignment 5G-GUTI and TAI list. If there is a GUTI, UE sends REGISTRATION COMPLETE to AMF for confirmation.
Note：	UE should send registration update message after T3412 is expired; the message type should be set to periodic registration update, and the update period is identical to the period set by network timer.

7.1.5 RAN-based Notification Area Update

Test Item	Tracking area update	Sub-Item	RAN-based notification area update
Reference		Network Configuration	No-Load Network Environment
Importance	Mandatory		
Purpose：	To verify the ability of UE to perform RAN-based notification area update during mobility		
Test Condition	（1） Network Configuration:NR system adopts the network basic configuration described in Section 4.3 （2） Two different RAN-based notification areas should exist in the test area, and the test route should pass through these two different RAN-based notification areas. （3） Number of DUTs: At least one UE of every brand joins the testing.		
Test Steps	（1） Power on the UE at the starting point of test route, register on network in one RAN-based notification area, set up packet switched domain service (e.g. internet browsing), then end the service to verify that the UE operates properly. （2） Move the UE to a new RAN-based notification area different from the original RAN-based notification area, check if UE successfully initiates and completes RAN-based notification area update by examining the UE log.		

	（3） In the new RAN-based notification area, UE re-establishpacket switched domain service (e.g. internet browsing) to verify whether UE can operate properly. （4） Repeat Step 1~4 20 times and record success rate. 
Expected Result	（1） UE is able to complete normal RAN-based notification area update without abnormality such as out-of-servicefrom network. （2） UE is able to re-establishPS service successfully in new RAN-based notification area. （3） The success rate of RAN-based notification area update is 100%.
Note：	

7.2 System Configuration

7.2.1 Cell Bandwidth

Test Item	Cell Bandwidth	Sub-Item	Cell Bandwidth
Reference	TS38.401	Network Configuration:	A
Importance	Mandatory		
Purpose	To verify end-to-end supports for 100MHz cell bandwidth		
Preset Condition	1. gNB and DUT both support 100MHz carrier bandwidth configuration. 2. Test cell directly connects to UE and Spectrum/Vector Signal Analyzer through radio frequency.		

Test Steps	1. Configure cell with 100MHz bandwidth 2. Enable the configuration, and NR cell starts to operate properly. 3. DUT accesses NR cell 4. Use Vector Signal Analyzer to perform time domain analysis and frequency domain analysis on gNB transmission signal.
Expected Result	1. Cell can operate properly. 2. UE is able to properly establish Data Radio Bearer in this cell, and downlink service is normal. 3. Through the frequency domain analysis on gNB transmission signal,the power value within the 100MHz bandwidth in frequency domain matches the configured value.
Note：	

7.2.2 Frame Structure

7.2.2.1 SubcarrierSpacing

Test Item	Frame Struture Test	Sub-Item	Subcarrier Spacing 30KHz
Reference	TS38.401	Network Configuration	A
Importance	Mandatory		
Purpose:	To verify that end-to-endsubcarrier spacing is 30KHz		
Preset Condition:	**1.** gNB and DUT both support100MHz carrier bandwidth **2.** Connect UEto Spectrum/Vector Signal Analyzer in test environment.		
Test Steps:	**1.** Configure cell with100MHz bandwidth **2.** Enable the configuration, and NR cell starts to operate properly. 3. UE accessesNR cell **4.** Use Vector Signal Analyzer to perform time domain analysis and frequency domain analysis on gNB transmission signal.		
Expected Result	**1.** The configured cell can operate properly; UE can access cell properly and establish Radio Bearer. **2.** Observe UE high-level message “subCarrierSpacingCommon” **3.** Spectrum Analyzer shows that each subframe includes 28 symbols indicating corresponding energy in time domain.		
Note：			

7.2.2.2 Uplink and Downlink Resource Ratio

Test Item	Frame Structure	Sub-Item	X ms periodicity of frame structure
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports Xms periodicity of frame structure configuration in NR device		
Preset Condition:	1. gNB: 100MHz system bandwidth, configurable uplink and downlink resource ratio 2. UE: Adopt chipset vendor prototype 3. For RRU and antenna integratedgNB, it is required to remove antenna to connect radio frequency signal to Spectrum Analyzer with split signal.		
Test Steps:	1. Cell operates properly; the periodicity of frame structure configuration X ms 2. DUT accessesa cell of gNB **3.** DUT correctly receives signaling message and checks TDD-UL-DL-ConfigCommon IE 4. Initiate downlink UDP service, use Vector Signal Analyzer to perform time domain and frequency domain analysis on gNB transmission signal, and check that the scheduled downlink slot location of subframe is correct. 5. Initiate uplink UDP service, use Vector Signal Analyzer to perform time domain and frequency domain analysis on UEtransmission signal,and check that the scheduled slot location of uplink subframe is correct.		
Expected Result	1. Check that in TDD-UL-DL-ConfigCommon IE,the periodicity of uplink and downlink frame structure is 5ms; check quad bytes of subframe configuration. 2. The graph of time domain and frequency domain signal analysis is matched with configuration.		
Note：			

7.2.2.3 GP Configuration

Test Item	Frame Structure	Sub-Item	GP symbol number configuration (2,4)
Reference		Network Configuration	
Importance	Mandatory		
Purpose	1. To verify that UE supportsthe GP of NR device within one DL-unknown-UL period can be configured as 2 and 4 OFDM symbols respectively.		

Preset Condition:	1. gNB: 100MHz system bandwidth; support GP configurable OFDM symbol number within one DL-unknown-UL period. 2. UE: Adopt chipset vendor prototype 3. For RRU and antenna integrated gNB, it is required to remove antenna to connect radio frequency signal to Spectrum Analyzer with split signal.
Test Steps:	1. Cell operates properly; in the frame structure configuration, the GP within one DL-unknown-UL period are 2 OFDM symbols. 2. DUT accessesa cell ofgNB. 3. DUT correctly receives signaling message and checks TDD-UL-DL-ConfigCommon IE 4. Initiate uplink and downlink UDP service, use Vector Signal Analyzer to perform time domain and frequency domain analysis on combined uplink and downlink signal, and check that the scheduled uplink and downlink slot location of subframe and GP symbol number are correct. 5. Modify the GP within one DL-unknown-UL period to4 OFDM symbols. 6. Repeat Step 2～4.
Expected Result	1. Check the quad bytesin TDD-UL-DL-ConfigCommon IE,the GP within one DL-unknown-UL period can be configured as 2 and 4 OFDM symbols respectively. 2. The graph of time and frequency domain signal analysis is matched with configuration.
Note：	

7.2.2.4 Static Frame Structure Configuration

Test Item	Frame Structure	Sub-Item	Static Frame Structure Configuration
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports static frame structure configuration		
Preset Condition:	1. gNB: 100MHz system bandwidth; configurable uplink and downlink resource ratio; 2. UE: Adopt chipset vendor prototype 3. For RRU and antenna integrated gNB, it is required to remove antenna to connect radio frequency signal to Spectrum Analyzer with split signal.		
Test Steps:	1. Cell operates properly 2. DUT accessesa cell ofgNB 3. DUT correctly receives signaling message and checks TDD-UL-DL-ConfigCommon IE in SIB1.		

	4. Initiate uplink and downlink UDP service, use Vector Signal Analyzer to perform time and frequency domain analysis on combined signal of uplink and downlink, and check that the subframe time slot location of UE uplink and downlink scheduling and GP symbol number are correct. 5. Modify GP symbol number by RCC reconfiguration and check TDD-UL-DL-ConfigCommon IE according to UE signaling message . 6. Repeat Step 4.
Expected Result	1. Check that the quad bytes in TDD-UL-DL-ConfigCommon IEis updated according to configuration. 2. The graph of time and frequency domain signal analysis is matched with configuration.
Note：	

7.2.3 Bandwidth part(BWP)

7.2.3.1 Full Bandwidth BWP Configuration

Test Item	System parameter	Sub-Item	Support single user full bandwidth BWP configuration
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports single user full bandwidth BWP		
Test Conditions:	1. Channel bandwidth is100MHz; 2. NR cell operates properly.		
Test Steps:	1. System is configured by 1 BWP with full bandwidth. 2. Power on the DUT, performs random access, initiates uplink and downlink service, and check UE LOG.		
Expected Result:	1. System supports the configuration of a full bandwidth BWPfor user. Check BandwidthPart-Config configuration in RRCair interface configuration message, including the following content: downlinkBandwidthPartsToAddModList (including one BandwidthPart configuration), defaultDownlinkBwp-Id, uplinkBandwidthPartsToAddModList (including one BandwidthPart configuration), and bandwidthPartInactivityTimer, where BandwidthPart		

	includes parameters of DL-BWP-mu/ UL-BWP-mu, DL-BWP-CP/UL-BWP-CP, DL-BWP-BW/UL-BWP-BW (configured as full bandwidth), DL-BWP-index/UL-BWP-index, DL-BWP-loc/UL-BWP-loc, and etc. 2. DUT is able to camp on cell successfully with normal service.
Note：	

7.2.3.2 Multiple BWP Configuration and Activation

Test Item	System parameter	Sub-Item	Support 1~4 BWP configurations
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports 1~4 BWP, the starting position and bandwidth of each BWP are configurable.		
Test Conditions:	1. Channel bandwidth is100MHz; 2. NR cell operates properly.		
Test Steps:	1. System is configured by 1 BWP; configure the starting position and bandwidth parameter of each BWP. 2. Power on the DUT, performs random access, initiates uplink and downlink service, and check UE LOG. 3. Modify the configured BWPs to 2, 3, and 4 BWP in sequence, and modify the starting position and bandwidth parameter of each BWP; repeat Step 2. System is configured by 1 BWP; configure the starting position and bandwidth parameter of each BWP. 4. Through RRC reconfiguration, sequentially activate the BWP which is configured, and perform FTP service of uplink and downlink full BUFFER with activated BWP configuration. 5. Then, through DCI configuration, sequentially activate the BWP which is configured, and perform FTP service of uplink and downlink full BUFFER with activated BWP configuration. 6. Stop uplink and downlink service; when bwp-InactivityTimer expires, UE returns to default BWP; check UE LOG and record BWP information. 7. Modify the configuration to 3 and 4 BWP in sequence; repeat Step 2~6.		

Expected Result:	1. System supports 1~4 BWP for user, and the starting position and bandwidth of each BWP are configurable. Check BandwidthPart-Config configuration in RRC air interface configuration message, including the following content: downlinkBandwidthPartsToAddModList (including 1~4 BandwidthPart configuration),defaultDownlinkBwp-Id, uplinkBandwidthPartsToAddModList (including 1~4 BandwidthPart configuration), and bandwidthPartInactivityTimer, where BandwidthPart includes parameters of DL-BWP-mu/ UL-BWP-mu, DL-BWP-CP/UL-BWP-CP,DL-BWP-BW/UL-BWP-BW, DL-BWP-index/UL-BWP-index, DL-BWP-loc/UL-BWP-loc, and etc; the parameters of BWP starting position and bandwidth etc. are identical to configuration parameters. 2. DUT is able to camp on cell successfully with normal service. 3. Confirm that BWP configuration becomes effective through signaling and scheduled PRB.
Note：	

7.3 Physical Channel Configuration

7.3.1 Downlink Physical Channel

7.3.1.1 PBCH Configuration

Test Item	Downlink Physical Channel	Sub-Item	PBCH Configuration
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports 30kHz PBCH subcarrier spacing and period configuration.		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly.		

Test Steps:	1. Subcarieer spacing is 30kHz; PBCH signal period is 20ms. 2. DUT is powered on; perform random access. 3. Monitor if DUT can demodulate PBCH accurately. 4. Use Vector Signal Analyzer to perform time and frequency domain analysis on gNB trasmission signal. 5. Modify PBCH signal period to 5ms, 10ms, 40ms, 80ms, and160msin sequence; repeat Step 2~3.
Expected Result:	DUT can demodulate PBCH accurately and camp on cell successfully.
Note：	

7.3.1.2 PDCCH

7.3.1.2.1 PDCCH Symbol Number Configuration

Test Item	Downlink Physical Channel	Sub-Item	Configuration of PDCCH occupied symbol number
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports configurable PDCCH symbol number		
Test Conditions:	1. Channel bandwidth is100MHz; 2. NR cell operates properly.		
Test Steps:	1. Configure the PDCCH occupied symbol number as one. 2. DUT performs uplink or downlink data service after accessing network; gNB transmits PDCCH. 3. Monitor if DUT can demodulate PDCCH accurately. 4. By examining the LOG of DUT, confirm the PDCCH occupied symbol number, PDCCH occupied RB number, and the PDSCH occupied RB number. 5. Modify the PDCCH occupied symbol number to 2 and 3; repeat Step 2~4. 6. If adaptive modulation is supported, enable corresponding switch, and increase number of accessed DUT. Maintain service in each UE under test; repeat Step 2~4.		

Expected Result:	1. PDCCH occupied symbol number and RB number are configurable. 2. DUT can demodulate PDCCH sent by gNB accurately. 3. Check LOG to confirm that unoccupied wireless resource of PDCCH is allocated forPDSCH use.
Note：	

7.3.1.2.2 PDCCHDynamic Aggregation level

Test Item	Downlink physical channel	Sub-Item	Dynamic adjustment of PDCCH Aggregation Level
Reference		Network Configuration	
Importance	Mantatory		
Purpose	To verify that UE supportsdynamic adjustment of PDCCH occupied CCE number based on link quality.		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly.		
Test Steps:	1. DUT performs uplink or downlink data service after accessing network; gNB transmits PDCCH. 2. Adjust channel condition (based on UE received RSRP and SINR); trigger gNB adaptive modulation of PDCCH aggregation level. 3. Monitor if UE is able to demodulate PDCCH accurately; UE outputs related log.		
Expected Result:	1. DUT can demodulate PDCCH sent by gNB accurately. 2. gNB can perform adaptive selection of PDCCH aggregation level based on channel condition; go through CCE =1,2,4,8,16.		
Note：	Request for displaying CCE aggregation level on DUT.		

7.3.1.2.3 PDCCH beamforming

Test Item	Downlink physical channel	Sub-Item	PDCCH Beamforming
Reference		Network Configuration	

Importance	Mandatory
Purpose	To verify that DUT supportsPDCCH Beamforming
Test Conditions:	1. Channel bandwidth is100MHz; 2. NR device connects to channel emulator oramplitude/phase shifter; simulate different client positions (same distance to gNB but different positions, at least 8 different positions) in cell. 3. NR cell operates properly.
Test Steps:	1. System configures PDCCH sending method as beamforming. 2. After DUT is powered on toperform random accessof network, it performsuplink or downlink data service; gNB transmits PDCCH. 3. Monitor if UE is able to receive and demodulate PDCCH accurately; record signal strength of PDCCH . 4. Disable beamforming; repeat Step 2~3
Expected Result:	1. DUT is able to demodulate PDCCH accurately. 2. The UE received PDCCH envelope shows stronger UE signal strength afterenabling beamforming.
Note：	

7.3.1.2.4 PDCCH Transmission Format

Test Item	Downlink physical channel	Sub-Item	PDCCH Transmission Format 0/1
Reference		Network Configuration	
Importance	Mantatory		
Purpose	To verify that DUT supports PDCCH transmission format 0/1.		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly		
Test Steps:	1. DUT completes random access, establishes the RRC connection and radio bearers with gNB, and performs upload service. 2. DUT outputs PDCCH related log.		

	3. Stop uplink service; perform downlink service; UE outputs PDCCH related log. 4. Monitor if UE is able to demodulate PDCCH accurately.
Expected Result:	1. When performing uplink service, check LOG to confirm that the PDCCH transmission formats are Format0_0 and Format0_1. 2. When performing downlink service, check LOG to confirm that the PDCCH transmission formats are Format1_0 and Format1_1. 3. DUT is able to demodulate PDCCH accurately.
Note：	

7.3.2 Uplink Physical Channel

7.3.2.1 PRACH

7.3.2.1.1 PRACH Format

Test Item	Uplink physical channel	Sub-Item	Random access PRACH Format0
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that DUT supports all random access PRACH Format.		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly		
Test Steps:	1. Configure PRACH configuration Index of the cell based on PRACH preamble (refer to 3GPP TS38.211 Section 6.3.3.2). 2. DUT initiates random access; observe random access process signaling.		
Expected Result:	1. gNB broadcasts the configuration information of PRACH and RACH, open loop power control required parameter, PRACH root sequence number, and PRACH Configuration Index (prach-ConfigurationIndex) in system Information; the random access preamble code format meets expected result. 2. DUT performs random access successfully.		

Note：	

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7.3.2.2 PUCCH

7.3.2.2.1 PUCCH Format0/1/2/3

Test Item	Uplink physical channel	Sub-Item	PUCCHtransmission format Format0/1/2/3
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that DUT supports PUCCHtransmission format: Format 0, Format1, Format2, and Format3.		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly		
Test Steps:	1. DUT completes random access, establishes the RRC connection with base station, completes radio bearer process, performs continuous service upload and download, and triggers UE to send PUCCH with different formats. 2. Monitor if gNB is able to demodulate PUCCH accurately. 3. Go through different PUCCH formats: 0, 1, 2, 3.		
Expected Result:	1. gNB can configure at least one type of UE sent PUCCH format {0, 1} and at least one type of {2, 3}; check PUCCH-Config in air interface signaling, including parameter configuration of PUCCH-format0/PUCCH-format1/ PUCCH-format2/PUCCH-format3. 2. gNB is able to demodulate PUCCHformat 0, 1, 2, 3 accurately.		
Note：			

7.3.2.2.2 PUCCH Frequency-Hopping Transmission –Intra-Slot Frequency Hopping

Test Item	Uplink Physical Channel	Sub-Item	PUCCHFrequency-Hopping Transmission – Intra-Slot Frequency Hopping

Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports PUCCH intra-slot frequency hopping		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly		
Test Steps:	1. The PUCCH frequency-hopping mode in configured cell is intra-slot frequency hopping. 2. After DUT is powered on to complete random access, it establishes the RRC connection with gNB, completes radio bearer process, and performs continuous downloadservice. 3. DUT monitors air interface signaling and outputs related log.		
Expected Result:	1. Check PUCCH-Config in air interface signaling, including the following content: interslotFrequencyHopping is disabled in format1/ format3/ format4 configurations; intraSlotFrequencyHopping is enabled in PUCCH-Resource; parameters of PUCCH-starting-PRB, PUCCH-2nd-hop-PRB, etc. are identical to configured parameters. 2. gNB is able to configure UE to perform intra-slot PUCCH frequency hopping transmission and is able to receive PUCCH accurately.		
Note：			

7.3.2.2.3 PUCCH Frequency-Hopping Transmission – Inter-Slot Frequency Hopping

Test Item	Uplink physical channel	Sub-Item	PUCCH Frequency-Hopping Transmission – Inter-Slot Frequency Hopping
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports PUCCH inter-slot frequency hopping		

Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly
Test Steps:	1. The PUCCH frequency-hopping mode in configured cell is inter-slot frequency hopping. 2. DUT completes random access, establishes the RRC connection with base station and completes radio bearer process, and performs continuous downloadservice. 3. DUT monitors air interface signaling and outputs related log.
Expected Result:	1. Check PUCCH-Config in air interface signaling, including the following content: intraSlotFrequencyHopping is disabled in PUCCH-Resource; interslotFrequencyHopping is enabled in format1/format3/format4 configurations; parameters of number-of-slots, PUCCH-starting-PRB, PUCCH-2nd-hop-PRB, etc. are identical to configured parameters. 2. gNB is able to configure UE to perform inter-slot PUCCH frequency hopping transmission and is able to receive PUCCH accurately.
Note：	

7.3.2.2.4 PUCCH Periodic Feedback CQI/PMI/RI/ACK

Test Item	Uplink Physical Channel	Sub-Item	PUCCH Periodic Feedback CQI/PMI/RI
Reference		Network Configuration	
Importance	Mandatory		
Purpose	To verify that UE supports the periodic feedback of CQI/PMI/RI on PUCCH with various multi-antenna transmission modes.		
Test Conditions:	1. Channel bandwidth is100MHz; configurable uplink and downlink resource ratio; 2. NR cell operates properly		
Test Steps:	1. After DUT is powered on to complete random access, it establishes the RRC connection with gNB and completes radio bearer process. 2. The RRC signaling configured CSI reporting method of gNB is periodic RI/CQI reporting; the recommended port number of configured CSI-RS resources is greater than or equal to 4 ports; record the setting period. 3. DUT monitors air interface signaling and outputs related log.		

	4. Adjustattenuator (or channel emulators)to simulate the high-to-low variation of downlink channel quality. Observe and record the CSI report content of UE. 5. Modify CSI reporting method to periodic RI/PMI/CQI reporting;the recommended port number of configured CSI-RS resources is greater than or equal to 4 ports; record the setting period; repeat Step 3~4. Note: It is required to select one of two steps: Step 2 or Step 5.
Expected Result:	1. Check air interface signaling forCSI-MeasConfig configuration, including the following content: （一） One CSI-ResourceConfig configuration, including NZP-CSI-RS-Resource (recommended port number is greater than or equal to 4); resourceType is periodic. （二） One CSI-ResourceConfig configuration, including CSI-IM-ResourceConfigList 3) One csi-ReportConfig configuration in which reportConfigType is periodic with required pucch resource pucch-CSI-ResourceIndex for reporting; reportQuantity configuration is cRI-RI-PMI-CQI (corresponds to RI/PMI/CQI report), or reportQuantity configuration is cRI-RI-CQI (corresponds to RI/CQI report); codebookType configuration is typeI-SinglePanel. 4) One MeasLinkConfig configuration; relate the configuration to NZP-CSI-RS-Resourceand csi-ReportConfig mentioned above. 5) One MeasLinkConfig configuration; relate the configuration to CSI-IM interference measurement resource and csi-ReportConfig mentioned above. 2. UE performs periodic CSI reporting with configured PUCCH resources; the reporting period is identical to the configured period. 1) When the configuration is periodic RI/CQI reporting, the report content is RI/CQI. The reported CQI value increases with better channel quality. The RI reporting condition is identical to the channel condition. 2) When the configuration is periodic RI/PMI/CQI reporting, the report content is RI/CQI/PMI. The reported CQI value increases with better channel quality. The RI/PMI reporting condition is identical to the channel condition.
Note：	

7.3.3 Reference Signal

7.3.3.1 Synchronization Signal

7.3.3.1.1 PBCHSSB Synchronization

Test Item	Reference signal	Sub-Item	Synchronization
Reference	38.331	Network Configuration	A
Importance	Mandatory		
Purpose	To verify that DUT supports SSB and is able to perform Synchronization successfully.		
Preset Condition:	1. Configure 5G cell by 100MHz bandwidth. 2. UE works in SA mode 3. UE connects to cell by channel emulator or radio frequency		
Test Steps:	1. The cell ID of 5G cell is 100. 2. UE1 is powered on and is able to complete cell search process. It accurately demodulates cell ID, accesses cell successfully, and monitors UE air interface access signaling. 3. Modify 5G cell ID to 200; repeat Step 2.		
Expected Result	UE air interface monitor signaling, including L1 message. UE is able to accurately demodulate cell ID and access cell successfully.		
Note：			

7.3.3.2 CSI-RS

7.3.3.2.1 CSI-RS Port Configuration

Test Item	Reference signal	Sub-Item	CSI-RS Port Configuration
Reference	TS38,331	Network Configuration	A
Importance	Mandatory		
Purpose	DUT supportsthe receiving of 4-port CSI-RS for CQI/RI/PMI measurement.		
Preset Condition:	1. Configure 5G cell by 100MHz bandwidth 2. UE connects to cell with phase shifter or channel emulator		
Test Steps:	1. UE1 is powered on and accesses NR network, and it initiates 5G bearer and downlink UDP service. 2. Configure gNB to send 4-port CSI-RS withUE dedicated beamforming.		

	3. Configure link attenuation 4. Log CSI-RS measurement and CQI/RI/PMI reporting of UE. 5. Configure gNB to send 4-port CSI-RS based on SSB beam sweeping; repeat Step 3~4. 6. Configure gNB to send 4-port CSI-RS based on predefined direction of narrow beam (e.g. 32 beam); repeat the step. 7. Configure base station to send 4-port CSI-RS based on cell level wide beam; repeat Step 3~4. 8. Configure CSI-RS 8/16/32 port respectively; repeat Step 3~7.
Expected Result	1. UE is able to accurately demodulate the CSI-RS signal of each port and measure signal strength. 2. UE is able to accurately report CQI and RI/PMI based on the variation of CSI-RS signal. 3. Observe the differences between CQI/RI/PMI feedback reported from measurement taken using Step 2/5/6/7. 4. CSI-RS measurement reportand CQI/RI/PMI reporting of UE
Note：	Measuring and testing portion of CSI-RS 8/16/32 port and PMI

7.3.3.2.2 Single-Port CSI-RS Configuration

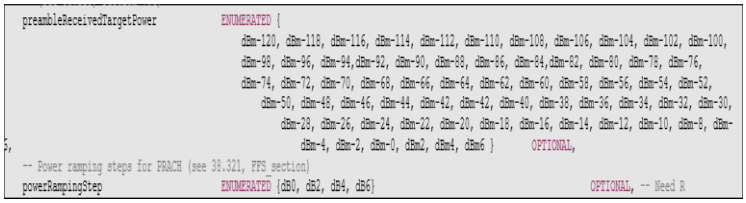
Test Item	Reference signal	Sub-Item	Support single-port CSI-RS configuration UE TRS
Reference	TS38.331	Network Configuration	A
Importance	Mandatory		
Purpose	DUT supports single-port CSI-RS configuration UE TRS		
Preset Condition:	1. Configure 5G cell by 100MHz bandwidth. 2. UE connects to cell with phase shifter or channel emulator.		
Test Steps:	1. UE1 is powered on and accesses NR network, and it initiates downlink UDP service. 2. Configure gNB to send single-port CSI-RS. 3. UE is able to accurately demodulate the port CSI-RS signal and measure signal strength.		
Expected Result	UE is able to accurately demodulate CSI-RS signal of each port and measure signal strength. CSI-RS measurement report of UE		
Note：			

7.4 Basic procedureof Air interface MSG

7.4.1 Power Control

7.4.1.1 Uplink Power Control

7.4.1.1.1 PRACH Open Loop Power Control

Item:	Power control	Sub Item:	PRACH open loop power control
Reference:	38.331	Network configuration:	
Importance:	Mandatory		
Purpose:	Verify that the uplink power control supports the operator to configure PRACH initial power and power adjustment by step size.		
Pre-condition:	1. The NR cell work on configuration of 100MHz bandwidth. 2. Collect UE's trace. 3. The terminal and the cell are connected with the RF of an amplitude control matrix or a channel simulator.		
Test steps:	1. Configure the PRACH initial access power value as default, and the power climbing step size is 3db.Then re-active the NR cell. 2. Observe the PRACH transmit power by adjusting the amplitude and phase control matrix or the channel simulator to simulate the terminal far away. 3. Configure the PRACH initial access power value as -3db,and the power climbing step size is 2db.Then re-active the NR cell. 4. Repeat step 2.		
Excepted results:	System information include the initial TX power value and adjustment step size, which is same as configured by NW.		
Note:			

7.4.1.1.2 Msg3 Power Control

Item:	Power control	Sub Item:	MSG3 Power control
Reference:	TS 38.213	Network configuration:	A
Importance	Mandatory		
Purpose	Verify NR support Msg3 power control when it's carried by PUSCH.		

Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. 2. Collect UE's trace. 3. The terminal and the cell are connected with the RF of an amplitude control matrix or a channel simulator.
Test steps	1. Active NR cell with the Preamble configuration of initial access power value as default. 2. UE attach to network. 3 Observe UE PUSCH to transmit preamble power by adjusting the amplitude and phase control matrix or the channel simulator to simulate the terminal far away.
Excepted results	1. The system message include the initial preamble TX power and adjustment step size. 2. PUSCH power value for Msg3 is correct.
Note	

7.4.1.1.3 SRS Open Loop Power Control

Item:	Power control	Sub Item:	UL Power control
Reference:	38.331	Network configuration:	
Importance	Mandatory		
Purpose	Verify BS support SRS open loop power control.		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth 2. Collect UE's trace.		
Test steps	1. Active the NR cell with the default value of P0 and Alpha parameter for SRS open loop power control. 2. UE attach to NW. 3. UE perform UL FTP service, adjust the attenuation to simulate UE moving far away. 4. Observe the SRS Tx power value from UE side. 5. Modify the SRS P0 and Alpha value then repeat step 1~4.		
Excepted results	The parameters of SRS open loop power control like PO&Alpha are configurable.		

Note	`UplinkPowerControlCommonPUSCH-LessCell-v1430 ::= SEQUENCE {`
	`p0-Nominal-PeriodicSRS-r14 INTEGER (-126..24) OPTIONAL, -- Need OR`
	`p0-Nominal-AperiodicSRS-r14 INTEGER (-126..24) OPTIONAL, -- Need OR`
	`alpha-SRS-r14 Alpha-r12 OPTIONAL -- Need OR`
	$P_{\mathrm{SRS},f,c}(i,q_s,l)=\min\left\{\begin{matrix}P_{\mathrm{CMAX},f,c}(i),\\ P_{\mathrm{O\_SRS},f,c}(q_s)+10\log_{10}(2^{\mu}\cdot M_{\mathrm{SRS},f,c}(i))+\alpha_{\mathrm{SRS},f,c}(q_s)\cdot PL_{f,c}(q_s)+h_{f,c}(i,l)\end{matrix}\right\}$			

7.4.1.1.4 PUSCH Open Loop Power Control

Item:	Power control	Sub Item:	UL Power control
Reference:	TS 38.331,38.213	Network configuration:	A
Importance	Mandatory		
Purpose	Verify BS support PUSCH open loop power control.		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. **2.** The terminal and the base station are connected by RF cable and attenuator.		
Test steps	1. Active the NR cell with the default value of P0 and Alpha parameter for PUSCH open loop power control(such as P0-nominal -87,P0-UE 0,Alpha 0.8). 2. UE attach to NW. 3. UE perform UL UDP service, adjust the attenuation to simulate UE moving far away. 4. Observe the PUSCH Tx power value from UE side. 5. Modify the PUSCH P0 and Alpha value then repeat step 1~4.		
Excepted results	The parameters of PUSCH open loop power control like PO&Alpha are configurable. If the relevant parameters are supported to distinguish j values for configuration, multiple sets of values should be verified.		

Note	– *UplinkPowerControl*
	The IE *UplinkPowerControlCommon* and IE *UplinkPowerControlDedicated* are used t power control in the system information and in the dedicated signalling, respectively.
	***UplinkPowerControl* information elements**
	`-- ASN1START`
	`UplinkPowerControlCommon ::= SEQUENCE {`
	`p0-NominalPUSCH INTEGER (-126..24),`
	`alpha Alpha-r12,`
	`p0-NominalPUCCH INTEGER (-127..-96),`
	`deltaFList-PUCCH DeltaFList-PUCCH,`
	`deltaPreambleMsg3 INTEGER (-1..6)`
	`}`
	$P_{\text{PUSCH},f,c}(i,j,q_d,l)=\min\left\{\begin{matrix}P_{\text{CMAX},f,c}(i),\\ P_{\text{O\_PUSCH},f,c}(j)+10\log_{10}(2^{\mu}\cdot M^{\text{PUSCH}}_{\text{RB},f,c}(i))+\alpha_{f,c}(j)\cdot PL_{f,c}(q_d)+\Delta_{\text{TF},f,c}(i)+f_{f,c}(i,l)\end{matrix}\right\}$		

7.4.1.1.5 PUCCH Open Loop Power Control

Item:	Power control	Sub Item:	UL Power control
Reference:	TS 38.331,38.213	Network configuration:	A
Importance	Mandatory		

Purpose	Verify BS support PUCCH open loop power control.
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. **2.** The terminal and the base station are connected by RF cable and attenuator.
Test steps	1. Active the NR cell with the default value of P0 and Alpha parameter for PUCCH open loop power control. 2. UE attach to NW. 3. UE perform UL FTP service, adjust the attenuation to simulate UE moving far away. 4. Observe the PUCCH Tx power value and formats from UE side. 5. Modify related parameters' value then repeat step 1~4.
Excepted results	The parameters of PUCCH open loop power control like PO is configurable. If the relevant parameters are supported to distinguish q values for configuration, multiple sets of values should be verified.

Note	– *UplinkPowerControl*
	The IE *UplinkPowerControlCommon* and IE *UplinkPowerControlDedicated* are used t power control in the system information and in the dedicated signalling, respectively.
	***UplinkPowerControl* information elements**
	`-- ASN1START`
	`UplinkPowerControlCommon ::= SEQUENCE {`
	`p0-NominalPUSCH INTEGER (-126..24),`
	`alpha Alpha-r12,`
	`p0-NominalPUCCH INTEGER (-127..-96),`
	`deltaFList-PUCCH DeltaFList-PUCCH,`
	`deltaPreambleMsg3 INTEGER (-1..6)`
	`}`
	$P_{\mathrm{PUCCH},f,c}(i,q_u,q_d,l)=\min\begin{Bmatrix}P_{\mathrm{CMAX},f,c}(i),\\ P_{\mathrm{O\_PUCCH},f,c}(q_u)+PL_{f,c}(q_d)+\Delta_{\mathrm{F\_PUCCH}}(F)+\Delta_{\mathrm{TF},f,c}(i)+g_{f,c}(i,l)\end{Bmatrix}$

7.4.1.1.6 PUSCH Close Loop Power Control

Item:	Power control	Sub Item:	UL close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	Verify BS support PUSCH accumulated close loop power control.		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. 2. Connect the DUT and BS with RF cable.		

Test steps	1. BS enable UL PUSCH accumulated close loop power control. 2. UE attach to NW. 3. UE perfrom UL FTP service. 4. Simulate the moving distance and channel quality jitter of the UE by adjusting the attenuation, etc. 5. The UE side observes the PUSCH transmit power, and the base station side tracks the TPC command word and the power control target value through TTI level signaling.
Output	1、
Excepted results	1. PUSCH TX power will rasie as the signal quality deteriorates. 2. 2. The base station adjusts the terminal PUSCH transmit power through TPC when the attenuation is suddenly increased. 3. Air interface signaling tracking of NR cell. 4. UE’s trace（Could decode PDCCH message at the TTI level）.
Note	If UE support absolute close loop power control mode, UE also need to be verified.

7.4.1.1.7 PUCCH Close Loop Power Control

Item:	Power control	Sub Item:	UL close loop power control
Reference:		Network configuration:	A
Importance	Recommend		
Purpose	Verify BS support PUCCH close loop power control		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. 2. Connect the DUT and BS with RF cable.		
Test steps	1. BS enable UL PUCCH close loop power control.； 2. UE attach to NW. 3. UE perfrom DL FTP service. 4. Simulate the moving distance and channel quality jitter of the UE by adjusting the attenuation, etc. 5. The UE side observes the PUCCH transmit power, and the base station side tracks the TPC command word and the power control target value through TTI level signaling.		
Excepted results	1. PUCCH TX power will rasie as the signal quality deteriorates. 2. The base station adjusts the terminal PUCCH transmit power through TPC when the attenuation is suddenly increased. 3. Air interface signaling tracking of NR cell. 4. UE’s trace（PDCCH information at the TTI level）.		
Note			

7.4.1.1.8 SRS Close Loop Power Control

Item:	Power control	Sub Item:	UL Power control
Reference:		Network configuration:	
Importance	Recommend		
Purpose	Verify BS support SRS close loop power control.		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth，enable SRS close loop power control function. 2. Collect UE's trace.		
Test steps	1. The SRS closed loop power control is configured to multiplex the power control command word with the PUSCH, and the PUSCH is an accumulated value close loop power control. 2. UE attach to NW. 3. UE perform UL FTP service, Simulate the moving distance and channel quality jitter of the UE by adjusting the attenuation, etc. 4. The UE side observes the SRS transmit power, and the base station side tracks the TPC command word and the power control target value through TTI level signaling.		
Excepted results	1. SRS TX power will raise as the signal quality deteriorates. 2. The base station adjusts the terminal SRS transmit power through TPC when the attenuation is suddenly increased. 3. Air interface signaling tracing of NR cell. 4. BS TTI tracking. 5. UE's trace.		
Note	If SRS and PUSCH independent closed loop power control are supported, verification is also performed (DCI format2_3). If SRS absolute value closed-loop power control is supported, verification is also performed.		

7.4.1.1.9 PUSCH Accumulated Close Loop Power Control

Item:	Power control	Sub Item:	PUSCH accumulated close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	Verify UL power control of NR support PUSCH accumulated close loop power control.		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. 2. The terminal and the cell are connected with the RF of an amplitude		

	control matrix or a channel simulator.
Test steps	1. Enable PUSCH accumulated close loop power control function. 2. UE attach to NW. 3. Observing the air interface signaling and PUSCH transmit power of the UE. 4. UE perfrom UL UDP service. Simulate UE moveing distance by modifying the amplitude and phase control matrix channel simulator configuration.
Excepted results	1. PUSCH TX power will rise as UE faring away. 2. The Accumulation-enabled field of the Power control in RRC_CONN_SETUP is TRUE. 3. Analyze UE log,to check UE adjuest the TX power as the TPC command.
Note	

7.4.1.1.10 PUSCH Close Loop Power Control-absolute Value

Item:	Power control	Sub Item:	PUSCH absolute value close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	Verify NR support PUSCH absolute value close loop power control.		
Pre-condition	1. The NR cell work on configuration of 100MHz bandwidth. 2. The terminal and the cell are connected with the RF of an amplitude control matrix or a channel simulator.		
Test steps	1. Enable PUSCH absolute close loop power control function. 2. UE1 attach to NW. 3. Observing the air interface signaling and PUSCH transmit power of the UE. 4. UE perfrom UL UDP service. Simulate UE moveing distance by modifying the amplitude and phase control matrix channel simulator configuration.		
Excepted results	1. PUSCH TX power will rise as UE faring away . 2. The Accumulation-enabled field of the Power control in RRC_CONN_SETUP is FALSE. 3. Analyze UE log,to check UE adjuest the TX power as the TPC command. 4. Air interface signaling tracking of NR cell. 5. UE’s trace.		
Note			

7.4.1.1.11 SRS Accumulated Close Loop Power Control

Item:	Power control	Sub Item:	SRS accumulated close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	Verify BS support SRS accumulated close loop power control.		
Pre-condition	1. NR BS is noramal, cell is avaliable. 2. The UE supports NR. In the scenario of NSA networking, the UE supports NSA. 3. NR cell configure P0 and Alpha as default value. 4. Eable SRS close loop power control function. 5. Track the UU interface signaling.		
Test steps	1. Active NR cell. 2. UE1 attach to NW. 3. UE perfrom UL UDP service. 4. Adjuest the anntenuator to simulate UE moving far away. 5. Observe SRS TX power value from UE side.		
Excepted results	1. SRS TX power will rise as UE faring away. 2. The Accumulation-enabled-srs field of the Power control in RRC_CONN_SETUP is TURE. 3. Analyze UE log,to check UE adjuest the TX power as the TPC command. 4. Air interface signaling tracking of NR cell. 5. UE’s trace.		
Note			

7.4.1.1.12 SRS Close Loop Power Control- absolute Value

Item:	Power control	Sub Item:	UL close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	Verify NR support SRS absolute value close loop power control.		
Pre-condition	1. BS is normal, cell is avaliable. 2. The UE supports NR. In the scenario of NSA networking, the UE supports NSA. 3. Enable SRS absolute close loop power control function. 4. Track the UU interface signaling.		

Test steps	1. Active NR cell. 2. UE attach to NW. 3. UE perfrom UL UDP service. 4. Adjuest the anntenuator to simulate UE moving far away. 5. Observe SRS TX power value from UE side.
Excepted results	1. SRS TX power will rise as UE faring away. 2. The Accumulation-enabled-srs field of the Power control in RRC_CONN_SETUP is FALSE. 3. Analyze UE log,to check UE adjuest the TX power as the TPC command. 4. Air interface signaling tracking of NR cell. 5. UE's trace.
Note	

7.4.1.1.13 SRS Multiplexing PUSCH Power Control Status

Item:	Power control	Sub Item:	UL close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	Verify NR support SRS multiplexing PUSCH power control status.		
Pre-condition	1. BS is normal, cell is avaliable. 2. Enable NR support SRS multiplexing PUSCH power control status function. 3. Track the UU interface signaling.		
Test steps	1. Active NR cell. 2. UE attach to NW. 3. UE perfrom UL UDP service. 4. Adjuest the anntenuator to simulate UE moving far away. 5. Observe SRS TX power value from UE side.		
Excepted results	1. SRS TX power will rise as UE faring away. 2. RRC_CONN_SETUP indicate SRS multiplexing PUSCH power control status function. 3. Analyze UE log,to check UE adjuest the TX power as the TPC command. 4. Air interface signaling tracking of NR cell. 5. UE's trace.		
Note			

7.4.1.1.14 NR Support Periodic Report for Power Headroom

Item:	Power control	Sub Item:	UL close loop power control

Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	NR supports event triggering and periodic two ways to trigger PHR reporting, and supports different trigger period and threshold settings.		
Pre-condition	1. BS is normal, cell is avaliable. 2. Configure PUSCH、PUCCH and SRS as close loop power control. 3. Configure the period of PHR as default value. 4. Track the UU interface signaling.		
Test steps	1. Active NR cell. 2. UE attach to NW. 3. UE perfrom UL UDP service. 4. Adjuest the anntenuator to simulate UE moving far away. 5. Observe PUSCH,PUCCH and SRS TX power value from UE side. 6. UE power off. 7. Modify PHR reporting period. 8. Repeat setps 2~5.		
Excepted results	1. PHR reporting period is carried in RRC_CONN_SET message. 2. Analyze the BS log to chcek the period of UE report PHR is the sam as configured. 3. Air interface signaling tracking of NR cell. 4. UE’s trace. 5. Base station’s trace.		
Note			

7.4.1.1.15 NR Support Event Trigger Reporting for Power Headroom

Item:	Power control	Sub Item:	UL close loop power control
Reference:		Network configuration:	A
Importance	Mandatory		
Purpose	NR supports event triggering and periodic two ways to trigger PHR reporting, and supports different trigger period and threshold settings.		
Pre-condition	1. BS is normal and cell is available. 2. Configure PUSCH、PUCC and SRS as close loop power control. 3. Configure the period and threshold of PHR as default value. 4. Track the UU interface signaling.		
Test steps	1. Active NR cell. 2. UE attach to NW. 3. UE perfrom UL UDP service. 4. PHR reporting triggered by quickly adjusting the path loss. 5. Observe PUSCH,PUCCH and SRS TX power value from UE side.		

	6. UE power off. 7. Modify PHR reporting threshold. 8. repeat setps 2~5.
Excepted results	1. PHR reporting threshold is carried in RRC_CONN_SET message. 2. Analyze the BS log to chcek the event trigger UE report PHR. 3. Air interface signaling tracking of NR cell. 4. UE's trace.
Note	

7.4.2 Scheduling

7.4.2.1 Basic Scheduling

7.4.2.1.1 Scheduling of QoS parameters

Item:	Scheduling	Sub-item:	Scheduling based on QoS parameters
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	1. Support MBR in downlink, and support UE-AMBR scheduling in uplink.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally. 3. The downlink maximum bit rate of the UE is set to 100 Mbps in the core network, and the uplink UE-AMBR is set to 20 Mbps in the core network.		
Test steps:	1. UE performs attach. 2. Perform downlink UDP data transmission with a data rate of 200Mbps. 3. Perform uplink UDP data transmission with a data rate of 50Mbps.		
Expected result	1. The UE RRC connection is successful. Check the AMBR parameters in the NG message. The Maximum Bit Rate is 100 Mbps and the UE-AMBR is 20 Mbps. 2. The actual downlink throughput of the UE is 100Mbps. 3. The actual uplink throughput of the UE is 20Mbps.		
Note			

7.4.2.1.2 Scheduling Based on QCI Parameters

Item:	Scheduling	Sub-item:	Scheduling based on QoS parameters
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	Support for scheduling based on QCI parameters.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally. 3. The default bearer of UE1 is QCI6, and the default bearer of UE2 is QCI9.		
Test steps:	1. UE1/UE2 attach in order. 2. Perform uplink and downlink UDP data transmission, and the data amount need to fill the full bandwidth.		
Expected result	1. UE1 and UE2 access successfully, and the QCI parameters in the NAS message are checked. UE1/UE2 are QCI6/QCI9 respectively. 2. The UE1/UE2 services are normal. Under the same channel conditions (good channel quality, no BLER), the throughputs of UE1 and UE2 are allocated according to the relative scheduling priority weights of the respective QCI configurations, such as the weights of QCI6 and QCI9 are 4:1, the rate ratio of UE1 and UE2 is 4:1.		
Note			

7.4.2.2 SR/BSR

7.4.2.2.1 SR/BSR Supports LCG

Item:	Scheduling	Sub-item:	SR/BSR
Reference:	38.331	Network configuration:	A
Importance:			
Purpose:	BSR supports 8 LCGs and rationally divides LCG.		
Pre-condition:	1. The cell is active. 2. Tested UE is ready, enable BSR report. 3. Install UDP test tool Iperf on the server and terminal.		

Test steps:	1. The UE boots up and attaches to the network. 2. The UE initiates a small uplink packet and a full-fill packet service, and tracks through the base station TTI. 3. The UE initiates an uplink ping service, and observes through the base station TTI and UE TTI.
Expected result	1、It can be seen that 8 LCGs are supported from the base station TTI trace. 2、Track the air interface signaling of the NR cell. 3、Base station TTI tracking. 4、Track the log in UE side.

Note	– *LogicalChannelConfig*
	The IE *LogicalChannelConfig* is used to configure the logical channel parameters.
	***LogicalChannelConfig* information element**
	`-- ASN1START`
	`-- TAG-LOGICAL-CHANNEL-CONFIG-START`
	`LogicalChannelConfig ::= SEQUENCE {`
	`ul-SpecificParameters SEQUENCE {`
	`priority INTEGER (1..16),`
	`prioritisedBitRate ENUMERATED {kBps0, kBps8, kBps16, kBps32, kBps64, kBps128, kBps256, kBps512, kBps1024, kBps2048, kBps4096, kBps8192, kBps16384, kBps32768, kBps65536, infinity},`
	`bucketSizeDuration ENUMERATED {ms50, ms100, ms150, ms300, ms500, ms1000, spare2, spare1},`
	`-- FFS: Detailed handling of restrictions (UP email discussion)`
	`-- Defined in L1 parameters but the value range must be checked.`
	`allowedSubCarrierSpacing SubcarrierSpacing OPTIONAL,`
	`allowedTiming TYPE_FFS OPTIONAL,`
	`logicalChannelGroup INTEGER (0..maxLCid) OPTIONAL,`
	`logicalChannelSR-Mask BOOLEAN,`
	`logicalChannelSR-DelayTimerApplied BOOLEAN`
	`} OPTIONAL, -- Cond UL`
	`-- other parameters`
	`}`
	`-- TAG-LOGICAL-CHANNEL-CONFIG-STOP`
	`-- ASN1STOP`

7.4.2.2.2 SR/BSR Supports SR Resources Configuration

Item:	Scheduling	Sub-item:	SR/BSR
Reference:	38.331	Network configuration:	A
Importance:			
Purpose:	The BSR supports the proper configuration of SR resources for each LCG. The allocation algorithm should consider at least the system capacity, the priority of different LCGs, and the delay requirements.		
Pre-condition:	1. The cell is active. 2. Tested UE is ready, enable BSR report. 3. The base station has configured different LCG priorities and delay requirements. 4. Install UDP test tool Iperf on the server and terminal.		
Test steps:	1. The UE boots up and attaches to the network. 2. The UE initiates a small uplink packet and a full-fill packet service, and tracks through the base station TTI and UE TTI. 3. The UE initiates an uplink ping service, and observes through the base station TTI and UE TTI.		

Expected result	1、 BSR supports configuring SR resources for each LCG, different LCG priorities and delays. 2、 Track the air interface signaling of the NR cell. 3、 Base station TTI tracking. 4、 Track the log in UE side.

Note	– *LogicalChannelConfig*
	The IE *LogicalChannelConfig* is used to configure the logical channel parameters.
	***LogicalChannelConfig* information element**
	`-- ASN1START`
	`-- TAG-LOGICAL-CHANNEL-CONFIG-START`
	`LogicalChannelConfig ::= SEQUENCE {`
	`ul-SpecificParameters SEQUENCE {`
	`priority INTEGER (1..16),`
	`prioritisedBitRate ENUMERATED {kBps0, kBps8, kBps16, kBps32, kBps64, kBps128, kBps256, kBps512, kBps1024, kBps2048, kBps4096, kBps8192, kBps16384, kBps32768, kBps65536, infinity},`
	`bucketSizeDuration ENUMERATED {ms50, ms100, ms150, ms300, ms500, ms1000, spare2, spare1},`
	`-- FFS: Detailed handling of restrictions (UP email discussion)`
	`-- Defined in L1 parameters but the value range must be checked.`
	`allowedSubCarrierSpacing SubcarrierSpacing OPTIONAL,`
	`allowedTiming TYPE_FFS OPTIONAL,`
	`logicalChannelGroup INTEGER (0..maxLCid) OPTIONAL,`
	`logicalChannelSR-Mask BOOLEAN,`
	`logicalChannelSR-DelayTimerApplied BOOLEAN`
	`} OPTIONAL, -- Cond UL`
	`-- other parameters`
	`}`
	`-- TAG-LOGICAL-CHANNEL-CONFIG-STOP`
	`-- ASN1STOP`

7.4.2.2.3 SR/BSR Terminal Supports Reporting SR/BSR According to The Terminal Cache Status

Item:	Scheduling	Sub-item:	SR/BSR
Reference:		Network configuration:	A
Importance:	Mandatory		
Purpose:	Supports uplink scheduling based on buffer status report (BSR).		
Pre-condition:	1. The cell is active. 2. Tested UE is ready.Tested UE is ready. 3. Install UDP test tool Iperf on the server and terminal.		
Test steps:	1. The UE boots up and attaches to the network. 2. The UE initiates a small uplink packet and a full-fill packet service,observe SR and BSR size through base station TTI tracking and UE TTI tracking.		
Expected result	1、 In the UE TTI and the base station TTI, it can be seen that when the amount of data to be transmitted is different, the BSR size is different, and the UE has a corresponding SR scheduling request when there is a transmission request. 2、 Track the air interface signaling of the NR cell. 3、 Base station TTI tracking. 4、 Track the log in UE side.		

Note	

7.4.2.2.4 NR-supported Uplink Scheduling Algorithm

Item:	Scheduling	Sub-item:	SR/BSR
Reference:	38.321	Network configuration:	A
Importance:	Mandatory		
Purpose:	SR/BSR supports adaptive adjustment of the amount of estimated uplink data corresponding to each SR resource based on historical data transmission. The amount of uplink estimated data refers to the amount of uplink pending data in the LCG that triggers the SR predicted by the base station.		
Pre-condition:	1. The cell is active. 2. Tested UE is ready, enable BSR report. 3. The base station has configured different LCG priorities and delay requirements. 4. The base station SR/BSR parameters are configured as default values. 5. The uplink scheduling algorithm is recommended algorithm. 6. Enable UU interface tracking.		
Test steps:	1. UE1 and UE2 are powered on to access the NR network. 2. The UE initiates an uplink UDP service.		
Expected result	1、NR scheduling algorithm predicts the amount of uplink data according to historical data transmission when scheduling priority ranking and resource allocation. 2、Track the air interface signaling of the NR cell. 3、NR base station log. 4、Track the log in UE side.		
Note			

7.4.2.2.5 NR Supports BSR Control Parameter Configuration

Item:	Scheduling	Sub-item:	SR/BSR
Reference:	38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	SR/BSR supports configuration of periodic timers and parameters such as periodicBSR-Timer and retxBSR-Timer.		
Pre-condition:	1. The cell is active. 2. Tested UE is ready, enable BSR report. 3. The base station has configured different LCG priorities and delay requirements. 4. The base station SR/BSR parameters are configured as default values. 5. Enable UU interface tracking.		

Test steps:	1. UE is powered on to access the NR network. 2. The UE initiates an uplink UDP service. 3. UE detaches the network. 4. Modify BSR periodicBSR-Timer、retxBSR-Timer. 5. Repeat step 1~2
Expected result	1、 The RRC_CONN_SETUP message carries BSR control parameters such as BSR periodicBSR-Timer and retxBSR-Timer. 2、 After the BSR control parameters are modified, the terminal re-accesses, and RRC_CONN_SETUP is the new parameter. 3、 UU interface message of NR base station. 4、 Track the log in UE side.
Note	

7.4.2.3 Resource Allocation

7.4.2.3.1 Uplink and Downlink Resource Indication Mode type0 and Localized Type1

Item:	Scheduling	Sub-item:	Resource indication
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	1. Verify that the system supports the resource indication mode type0 and localized type1.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally.		
Test steps:	1. Use type0 to configure the uplink and downlink resource allocation mode. 2. The gNB performs downlink service transmission to the tested UE. PDSCH adopts type0 resource allocation indication mode. 3. The gNB performs uplink service transmission to the tested UE. PUSCH adopts type0 resource allocation indication mode. 4. Monitor the corresponding allocation information in the DCI, including the allocated RBGbitmap and related signalings. 5. Configure the uplink and downlink resource allocation mode by using localized type1. 6. The gNB performs downlink service transmission to the tested UE. PDSCH adopts localized type1 resource allocation indication mode. The gNB performs uplink service transmission to the tested UE. PUSCH adopts		

	localized type1 resource allocation indication mode. 7. Monitor the corresponding allocation information in the DCI, including the RB start position and RB length.
Expected result	1. The uplink and downlink services are normal in various configurations, and the resource indication mode matches configuration in the PDCCH.
Note	If the condition is met, it can be checked that the resources allocated by the PDCCH are consistent with the resources actually used by the PDSCH/PUSCH by the third-party instrument such as the vector signal analyzer.

7.4.2.3.2 Uplink and Downlink Resource Indication Mode Distributed Type1

Item:	Scheduling	Sub-item:	Resource indication
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	Verify that the system supports the resource indication mode distributed type1.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally.		
Test steps:	1. Use distributed type1 to configure the uplink and downlink resource allocation mode. 2. The gNB performs downlink service transmission to the tested UE. PDSCH adopts distributed type1 resource allocation indication mode. 3. The gNB performs uplink service transmission to the tested UE PUSCH adopts distributed type1 resource allocation indication mode. 4. Monitor the corresponding allocation information in the DCI, including the VRB start position and VRB length.		
Expected result	1. The uplink and downlink services are normal in various configurations, and the resource indication mode matches configuration in the PDCCH.		
Note	If the condition is met, it can be checked that the resources allocated by the PDCCH are consisitent with the resources actually used by the PDSCH/PUSCH by the third-party instrument such as the vector signal analyzer.		

7.4.2.3.3 Adaptive Uplink and Downlink Resource Indication Mode

Item:	Scheduling	Sub-item:	Resource Indication
Reference:		Network	

		configuration:	
Importance:	Mandatory		
Purpose:	Verify that the uplink and downlink resources support adaptive indication.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally.		
Test steps:	1. Configure adaptive uplink and downlink resource allocation mode. 2. The UE performs uplink and downlink services and maintains, gradually reducing traffic from large to small, triggering system adaptive resource allocation. 3. Monitor the corresponding allocation information in the DCI, check the PDSCH and PUSCH resource allocation mode and signaling.		
Expected result	1. The system supports uplink and downlink resources to support adaptive changes in type0 and type1. 2. When the amount of data is very small, the gNB can allocate 1 PRB resource to the UE for uplink and downlink.		
Note			

7.4.2.3.4 PDSCHstaticconfigurationPRB BundleSize

Item:	Scheduling	Sub-item:	PRB BundleSize
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	Test system supporting PDSCH static configuration PRB BundleSize.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally.		
Test steps:	1. Set the PDSCH static configuration as PDSCH Bundling. The default value of the Bundle Size is 2. 2. The terminal initiates downlink service from the Idle state and maintains it. Observe PDSCH allocation resources and RPB bundling conditions.		
Expected result	1. Check PDSCH-Config in the RRC reconfiguration message, including the following content: prbBundlingEnabled = FALSE，pdsch-BundleSize=2.		
Note			

7.4.2.4 Scheduling Delay

7.4.2.4.1 The Minimum Slot Interval from PDCCH to PUSCH is 1

Item:	Scheduling	Sub-item:	Uplink basic scheduling
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	Verify system supporting uplink basic scheduling.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally.		
Test steps:	1. The terminal initiates service in the Idle state and maintains it, and observes the PDCCH to PUSCH scheduling interval. 2. The minimum slot interval from PDCCH to PUSCH is 1.		
Expected result	1. Scheduling delay is supported in UL Grant, the minimum slot interval from PDCCH to PUSCH is 1.		
Note			

7.4.2.4.2 The Minimum Slot Interval from PDCCH to PDSCH is 0

Item:	Scheduling	Sub-item:	Downlink basic scheduling
Reference:		Network configuration:	
Importance:	Mandatory		
Purpose:	Verify system supporting downlink basic scheduling.		
Pre-condition:	1. System bandwidth 100MHz 2. NR cell works normally.		
Test steps:	1. The terminal initiates service in the Idle state and maintains it, and observes the PDCCH to PDSCH scheduling interval. 2. The minimum slot interval from PDCCH to PDSCH is 0		
Expected result	1. Scheduling delay is supported in DL Grant, the minimum slot interval from PDCCH to PDSCH is 0.		
Note			

7.4.3 Link adaption

7.4.3.1 Downlink Modulation

Item:	Link adaption	Sub-item:	Modulation
Reference:	TS 38.211	Network configuration:	
Importance:	Mandatory		
Purpose:	Support DL Modulation:QPSK, 16QAM, 64QAM,256QAM.		
Pre-condition: Pre-condition	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE support 256QAM,and registered.		
Test steps:Test steps	1. UE attach to NW and trigger full traffic, frequency resource assign no less than 30 PRB. 2. Decreasing DL SINR and check MCS change from high to low.		
Expected result	Traffic normal, 256QAM->QPSK comply with SINR decreasing.		
Note:	Using vector signal analysis instrument to read PDSCH constellation if possible.		

7.4.3.2 Uplink Modulation

Item:	Link adaption	Sub-item:	Modulation
Reference:	TS 38.211	Network configuration:	
Importance:	Mandatory		
Purpose:	Support UL modulation：π/2-BPSK ,QPSK, 16QAM, 64QAM, 256QAM.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	Testing UE make successive UL transmission. change UL pathloss,go through all π/2-BPSK ,QPSK, 16QAM, 64QAM, 256QAM Modulation .		
Expected result	UL traffic normal.		
Note			

7.4.3.3 Link Adaption

Item:	Link adaption	Sub-item:	Link adaption
Reference:	TS 38.211	Network configuration:	
Importance:	Mandatory		

Purpose:	1. Support reasonable parameters configuration,choosing UL/DL TBSIZE according to channel condition and data buffer,make sure Padding rate(（Traffic in physical layer-Traffic in MAC layer）/Traffic in physical layer)less than10%.
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz;; 3. UE registered.
Test steps:	1. UE in the strong field,ping 100 bytes、300 bytes、1000 bytes、500 bytes、800 bytes、32 bytes、1500 bytes one by one ,20 times for each. 2. Record UL/DL resource allocation(MCS,PRB,etc.)and Tputinformation(Tput in physical layer,Tput in MAC Layer,Tput in PDCP layer). 3. UE do UL/DL full buffer traffic（at least 2 mins）,repeat step2. 4. UE in middle and weak field respectively,repeat step 1~3.
Expected result	1. UL/DL traffic normal,ping 100% successful. 2. Strong/middle/weak point full buffer traffice, padding rate(（Traffic in physical layer-Traffic in MAC layer）/Traffic in physical layer)less than 10%. 3. Strong/middle/weak point ping traffic, padding rate less than 10%.
Note	

7.4.3.4 CSI（Periodic Wideband CQI/PMI/RI）

Item:	Link adaption	Sub-item:	CSI
Reference:	38.214	Network configuration:	
Importance:	First grade priority		
Purpose:	Support receive periodic wideband CQI/PMI/RI on PUCCH or PUSCH.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	1. Configure periodic wideband CQI/PMI/RI, CSI reporting period set to 20. 2. UE RRC connected. 3. Make DL UDP data transmission. 4. Adjust attenuation(or channel emulation) to emulate DL channel condition from good to poor, adjustment step 5dB. 5. Observe & record the CSI report from UE side. 6. Change CSI reporting period 5、10、40、80、160、320 respectively,repeat step 3~6.		
Expected result	1. Record periodic of CQI/PMI/RI on PUCCH or PUSCH,check periodic is configuable. 2. Observing CQI/PMI/RI. 3. UE report CQI correctly,CQI increasing with channel condition get		

	better.UE log can display CQI reporting procedure. 4. In the mode needed PMI/RI report, can report PMI/RI correctly.
Note	

7.4.3.5 CSI（Periodic Narrowband CQI/PMI/RI）

Item:	Link adaption	Sub-item:	CSI
Reference:	TS 38.214	Network configuration:	
Importance:	First grade priority		
Purpose:	Support receive periodic narrowband CQI/PMI/RI on PUCCH or PUSCH.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	1. Configure periodic narrowband CQI/PMI/RI,CSI reporting periodic set as 20. 2. CSI bandwidth set to subband size = 4. 3. UE RRC connected. 4. Make DL UDP data transmission. 5. Adjust attenuation(or channel emulation) to emulate DL channel condition from good to poor, adjustment step 5dB. 6. Observe & record the CSI report from UE side. 7. Change CSI bandwidth set to 8、16,repeat step 3-6. 8. Change CSI reporting period 5、10、40、80、160、320,repeat step2~7.		
Expected result	1. Record periodic of CQI/PMI/RI on PUCCH or PUSCH,check periodic is configuable. 2. Observing CSI using correct subband bandwidth according to configuration. 3. Observing CQI/PMI/RI. 4. UE report CQI correctly,CQI increasing with channel condition get better.UE log can display CQI reporting procedure. 5. In the mode needed PMI/RI report, can report PMI/RI correctly.		
Note			

7.4.4 HARQProcedure

7.4.4.1 Common

7.4.4.1.1 HARQ Supports UL/DL IR Algorithm

Item:	MAC layer function&Key technology	Sub-item:	HARQ Supports UL/DL IR Algorithm
Reference:	TS 38.321, 38.212,38.213	Network configuration:	A

Importance:	Mandatory
Purpose:	1. Support IR algorithm DL transmission,and at least support 4 IR Version. 2. Support UL IR algorithm,and at least support 4 IR Version.
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.
Test steps:	1. gNB typical configuration（recommend configuration：UL：single codeword;DL：single codeword）maximun HARQ transimission times set to 3 for PDSCH and PUSCH,check system can transmit on PDSCH and PUSCH normally; 2. UE do DL transmission normally, adjust attenuation to get down signal strength,make DL signal weak and weak until DL traffic stop; 3. Stop and save UE log, check NDI and RV infomation in PDCCH; 4. UL transmission, adjust attenuation to get down signal strength, make UL signal weak and weak until UL traffic stop; 5. Stop and save UE log, check NDI and RV infomation in PDCCH.
Expected result	1. In step 3: Check DL retransmission UE log,NDI not changed, and RV change go through all versions in PDCCH; 2. In step 5：Check UL retransmission UE log, NDI not changed, and RV change go through all versions in PDCCH.
Note	

7.4.4.1.2 Single User Multiple HARQ Processes

Item:	MAC layer function&Key technology	Sub-item:	Single User multiple HARQ processes
Reference:	TS 38.321, 38.213,38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	1. To verify gNb can support DL HARQ processes 16 as spec; 2. To verify gNb can support UL HARQ processes 16 as spec.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	1. gNB typical configuration（recommend configuration：UL：single codeword,DL：single codeword）fro PDSCH transmission, Maximun HARQ re-transmission as 3,check system can transmit on PDSCH and PUSCH normally; 2. gNB configure DL HARQ processes as 16; 3. Save UE log,to check the value of nrofHARQ-processesForPDSCH in PDSCH-Config and nrofHARQ- processesForPUSCH in PUSCH-Config from receive RRC signaling.		

Expected result	1. To verify UL HARQ processes number is 16 in RRC signaling; 2. To verify DL HARQ processes number is 16 in RRC signaling.
Note	nrofHARQ- processesForPUSCH not defined in PUSCH-Config, but [6.1 38.214] indicate this value configured by high layer.

7.4.4.1.3 CBG HARQ Processing

Item:	MAC layer function&Key technology	Sub-item:	Support CBG HARQ processing
Reference:	TS 38.321, 38.212,38.213	Network configuration:	A
Importance:	Recommend		
Purpose:	To verify gNB can support CBG based HARQ processing as SPEC.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	1. gNB typical configuration（recommend configuration：UL：single codeword;DL：single codeword）maximun HARQ transimission times set to 3 for PDSCH and PUSCH,check system can transmit on PDSCH and PUSCH normally;eNB enable UL/DL CBG HARQ function; 2. UE do normal DL transmission,adjust attenuation to get down signal strength,make DL signal weak and weak until DL traffic stop; 3. Stop and save UE log, to check NDI and CBGTI in DCI Format1_1, and check corresponding ARQ-ACK infomation also; 4. UL transmission, adjust attenuation to get down signal strength, make UL signal weak and weak until UL traffic stop; 5. Stop and save UE log, to check NDI and CBGTI in DCI Format1_1.		
Expected result	1. In Step 4: to check the DCI Format1_1 for DL re-transimission, NDI not change, CBFTI changed comply with HARQ-ACK infomation; 2. In step 6: to check the DCI Format0_1 for DL re-transimission, NDI not change, CBFTI changed comply with HARQ-ACK infomation; 3. CBG configured correctly in signaling.		
Note			

7.4.4.1.4 UL/DL HARQ Re-transmission Min Slot Interval

Item:	MAC layer function&Key technology	Sub-item:	UL/DL HARQ re-transmission min slot interval
Reference:	TS 38.213,38.321,38.331	Network configuration:	A
Importance:	Recommend		

Purpose:	1. Verify gNB Support the min slot interval from DL HARQ ACK feedback to corresponding DL re-transmission. 2. Verify gNB Support the min slot interval from UL PUSCH transmisson to corresponding PDCCH re-transmission.
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz. 3. UE registered, the min slot interval from DL HARQ ACK feedback to corresponding DL re-transmision is 2.
Test steps:	1. UE RRC connected, UL/DL UDP traffic simultaneously; 2. Adjust attenuation to change channel status, make high BLER in both UL and DL, observe interval of one DL HARQ process from NACK received to re-transmission; Observe interval of same UL HARQ process from intial PUSCH to corresponding re-transmission PDCCH; Record the min value.
Expected result	1. To verify gNB can be configured to support the min slot interval of DL HARQ ACK to corresponding DL re-transmission is 2 or 1. 2. To verify gNB can be configured to support the min slot interval of initial UL PUSCH transmission to corresponding re-transmission PDCCH is 2 or 1.
Note	

7.4.4.2 DL HARQ

7.4.4.2.1 PUCCH HARQ-ACK

Item:	MAC layer function&Key technology	Sub-item:	DL HARQ-ACK feedback on PUCCH
Reference:	TS 38.321,38.213	Network configuration:	A
Importance:	Mandatory		
Purpose:	DL HARQ Support feedback on PUCCH.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	1. UE RRC connected; 2. DL data transmission, observe PUCCH ACK/NAK and UL decoding in gNB side; 3. Stop and save UE log, observe UE side HARQ-ACK reporting.		
Expected result	HARQ-ACK report on PUCCH in gNB side comply with UE side.		

Note	

7.4.4.2.2 PUSCH HARQ-ACK

Item:	MAC layer function&Key technology	Sub-item:	DL HARQ-ACK feedback on PUSCH
Reference:	TS 38.213,38.321	Network configuration:	A
Importance:	Mandatory		
Purpose:	DL HARQ Support feedback on PUSCH.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered.		
Test steps:	1. UE RRC connected; 2. Make UL and DL data transmission simultaneously,UE will report ACK/NAK on PUSCH,observe number of ACK/NAK on PUSCH in gNB side; 3. Stop and save UE log, observe UE side HARQ-ACK reporting.		
Expected result	1. HARQ-ACK report on PUSCH in gNB side comply with UE side.		
Note			

7.4.4.2.3 DL HARQ ACK-spatial-bundling

Item:	MAC layer function&Key technology	Sub-item:	DL HARQ-ACK-spatial-bundling feedback mode
Reference:	TS 38.213,38.321,38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	HARQ-ACK-spatial-bundling feedback mode.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz; 3. UE registered,DL HARQ-ACK-spatial-bundling feedback mode configurable,DL transmission use 2 TBs.		

Test steps:	1. UE RRC connected; 2. gNB set DL HARQ-ACK-Spatial-Bundling feedback mode as False; 3. Make DL UDP data transmission; 4. Stop and save UE log, observe number of PUCCH ACK/NAK bit in UE side; 5. gNB reset DL HARQ-ACK-Spatial-Bundling feedback mode as True; 6. Repeat step3, 4.
Expected result	1. IE “harq-ACK-Spatial-Bundling” configured correctly in RRC signaling. 2. Number of UE feedback bit for non harq-ACK-Spatial-Bundling mode comply with protocol, gNB can decoding HARQ-ACK properly. 3. Number of UE feedback bit for harq-ACK-Spatial-Bundling mode comply with protocol, gNB can decoding HARQ-ACK properly.
Note	

7.4.4.2.4 DL HARQ Codebook Mode as Dynamic

Item:	MAC layer function&Key technology	Sub-item:	DL HARQ dynamic codebook mode
Reference:	TS 38.213,38.321,38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	DL HARQSupportdynamic codebook mode.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz. 3. UE registered,DL HARQ codebook mode set as dynamic.		
Test steps:	1. UE RRC connected; 2. gNB DL HARQ codebook mode setting as dynamic; 3. Make DL UDP data transmission; 4. Make full buffer traffic, save UE log,observe the length of UE feedback ACK on PUCCH; 5. Make non-full buffer traffic, save UE log,observe the length of UE feedback ACK on PUCCH;		
Expected result	1. IE “harq-ACK-Codebook” setting as dynamic in RRC configuration. 2. DAI in DL DCI1_1 comply with protocol requirement. 3. DL full buffer traffic, considering current sub-frame configuration and number of TBs, every DL sub-frames should have feedback, bits of HARQ-ACK feedback comply with protocol and gNB can decode		

	correctly. 4. DL non full buffer traffic, considering current sub-frame configuration and number of TBs, every DL sub-frames should have feedback, bits of HARQ-ACK feedback comply with protocol and gNB can decode correctly.
Note	

7.4.4.2.5 DL HARQ ACK on PUSCH Code Rate Offset as Dynamic

Item:	MAC layer function&Key technology	Sub-item:	Configure DL HARQ ACK on PUSCH code rate offset dramatically
Reference:	TS 38.213,38.321,38.331	Network configuration:	A
Importance:	Recommend		
Purpose:	DL HARQ support PDCCH indicate HARQ ACK on PUSCH using code rate offset.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz. 3. UE registered,DL HARQ on PUSCH code rate offset as dynamic,configure long PUCCH.		
Test steps:	1. UE RRC connected; 2. gNB configure DL HARQ ACK on PUSCH code rate offset as dynamic; 3. Configure PUCCH, HARQ-ACK on PUSCH, UL/DL UDP traffic simultaneously; 4. Full buffer traffic, save UE log,observe the usage of betaOffsetACK on PUSCH from UE side; 5. Non full buffer traffic, save UE log, observe the usage of betaOffsetACK on PUSCH from UE side.		
Expected result	1. Configure IE “uci-On-PUSCH” in RRC as dynamic, record the sets of BetaOffsets configuration (1~4 sets). 2. DL full buffer traffic, observe betaOffsetACK-Index in DCI indication comply with protocol, and betaOffsetACK-Index used by UE comply with DCI indicated. 3. DL non full buffer traffic, observe betaOffsetACK-Index in DCI indication comply with protocol, and betaOffsetACK-Index used by UE comply with DCI indicated.		
Note			

7.4.4.2.6 Slot Interval of PDSCH to HARQ ACK Feedback as 1~8

Item:	MAC layer function&Key technology	Sub-item:	Slot interval of PDSCH to HARQ ACK feedbak as 1~8 adaptive
Reference:	TS 38.213,38.321,38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	DL HARQ support the min slot interval of PDSCH to HARQ ACK feedbackK1=1~8,and support dynimic adjust interval according to frame structure, UE capability, PUCCH resource.		
Pre-condition:	1. gNB and UE HW/SW work well; 2. gNB works on system bandwidth 100MHz. 3. UE registered, the min slot interval of PDSCH to HARQ ACK feedback adaptive.		
Test steps:	1. UE RRC connected; 2. Make DL UDP data transmission; 3. Save UE log, observe UE received min slot interval in DCI with different frame structure, DL HARQ codebook mode, PUCCH resource.		
Expected result	When the min slot interval of PDSCH to HARQ ACK feedback adaptive, record and observe different configuration, PDSCH-to-HARQ-timing-indicator in DCI1_1 how to change（need observe the min slot interval is 1）,to check the HARQ-ACK feedback timing after UE received DCI indicator,gNB can decode UE feedback HARQ-ACK correctly.		
Note			

7.4.5 RLC Transmission Mode

7.4.5.1 AM Transmission Mode

Item:	RLC Transmission mode	Sub-item:	AM Transmission mode
Reference:		Network configuration:	A
Importance:	Mandatory		
Purpose:	This case to verify single User Tput performance with AM.		
Pre-condition:	1. The cell is activated. 2. DUT UE is ready. 3. TCP/UDP tool such as Iperf already install in both server and client sides.		
Test steps:	1. Configure RLC Transmission mode as AM; 2. UE power on initiate attach procedure; 3. To initiate TCP traffic by using Iperf tool.		

Expected result	Record the average Tput for single User during 5 minutes.
Note	

7.4.5.2 UM Transmission Mode

Item:	RLC Transmission mode	Sub-item:	UM Transmission mode
Reference:		Network configuration:	A
Importance:	Mandatory		
Purpose:	This case to verify single User Tput performance with UM.		
Pre-condition:	1. The cell is activated. 2. DUT UE is ready. 3. UDP tool such as Iperf already install in both server and client sides.		
Test steps:	1. Configure RLC Transmission mode as UM; 2. UE power on initiate attach procedure; 3. To initiate UDP traffic by using Iperf tool.		
Expected result	Record the average Tput for single User during 5 minutes.		
Note			

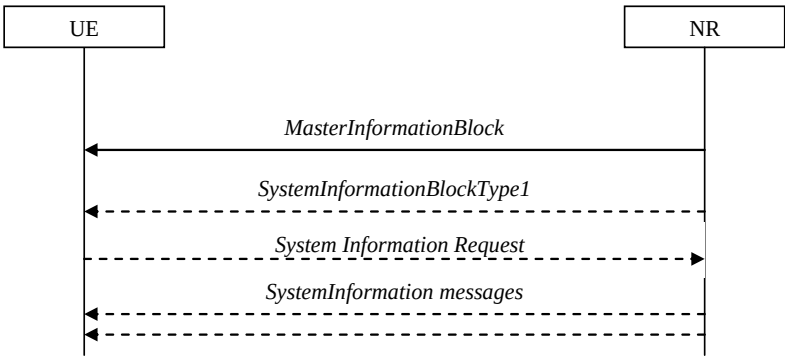
7.5 RRC

7.5.1 MSIBroadcast

Item:	RRC functionality and key technology	Sub-item:	System broadcast message
References:	TS 38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that UE can acquire and udpate MSI broadcast message correctly.		
Pre-condition:	1. cell bandwidth :100MHZ. 2. UE supports SA protocol, and is a valid subscriber in core network.		
Test steps:	1. NR sends MIB、SIB1 message **UE – NR** | **Message** <-- | *MasterInformationBlock* <-- | SystemInformationBlockType1 2. UE acquires MSI system message; 3. Modify system broadcast snformaiton,UE acquires updated System		

	broadcast message.
Expected result	1. gNodeB shall send MIB and SIB1 according to specification and network configuration. 2. UE in RRC_IDLE state shall acquire MIB in PBCH & SIB1 in PDSCH; 3. UE shall acquire MSI message when MSI updates.
Note	Refer to 3GPP 38.331 5.2

7.5.2 OSI Broadcast

Item:	RRC functionality and key technology	Sub-item:	System broadcast message
References:	TS 38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that UE can acquire and udpate OSI（SIB2~SIBn）broadcast message correctly. UE shall be able to request ODOSI (on demand system information) according to need.		
Pre-condition:	1. cell bandwidth :100MHZ. 2. UE supports SA protocol, and is a valid subscriber in core network.		
Test steps:	1. ODOSI function shall be enabled。If there is Msg1 assigned by SIB1, then Msg1 shall beused. 2. UE registers in the network,and enters into IDLE or INACTIVE state； 3. UE can use Msg1 or Msg3 to request OSI，and acquire the requested SI message(s) in the next boardcast period. ODOSI procedure：  4. Modify System broadcast Informaiton,UE acquires updated System broadcast message.		
Expected result	1. gNodeB shall send OSI according to specification and network configuration. 2. UE shall acquire OSI message when OSI updates.		

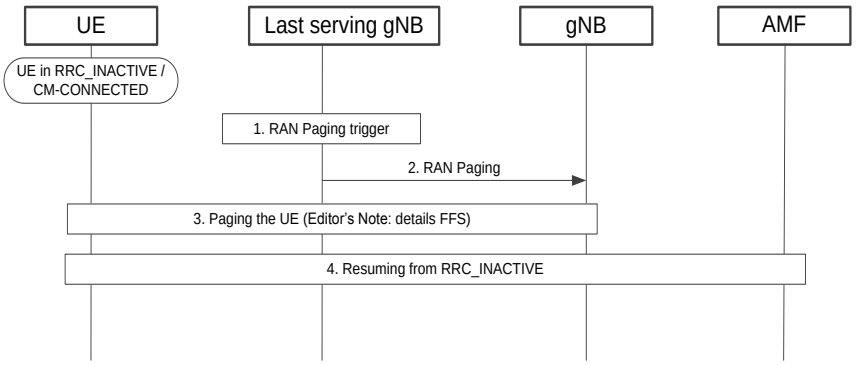
Note	Refer to 3GPP 38.331 5.2

7.5.3 5GCPaging

Item:	RRC functionality and key technology	Sub-item:	Paging
References:	TS 38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that SS can paging UE which is in RRC_IDLE state.		
Pre-condition:	UE has registered in the network, and in RRC_IDLE state.		
Test steps:	1. UE registers in the network and enters RRC-IDLE, network sends 5GC paging which triggered by downlink service. 2. Message flow is not defined yet due to core specification is not available in 3gpp.		
Expected result	1. Paging message elements are not defined yet. 2. UE shall receive paging message successfully and initiate RRC connection request procedure and enter RRC_CONNECTED state.		
Note	Refer to 3GPP 38.331 5.3.2		

7.5.4 NG-RANPaging

Item:	RRC functionality and key technology	Sub-item:	Paging
References:	TS 38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that SS can paging UE which is in RRC_INACTIVE state.		
Pre-condition:	UE has registered in the network, and in RRC_INACTIVE state.		
Test steps:	Downlink data arrives, triggers gNB to paging UE。Paging messages are sent in all gNB cells of the RNA area that UE's last serving gNB belongs to. Meanwhile, paging messages are also sent in the neighbour gNBs of RNA area that UE's last serving gNB belongs to。 Message Flow :		

	
Expected result	1. Paging message IEs are not defined yet. 2. Network can paging UE successfullly and UE shall initiate RRC connection setup procedure and enter RRC_CONNECTED state.
Note	Refer to 3GPP 38.300 9.2.2, It is not clearly difined yet in TS38.331

7.5.5 RRC Connection Setup

Item:	RRC	Sub-item:	RRC connection setup
References:	TS 38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that UE in RRC-Idle state can setup RRC connection correctly(Includings SRB1)		
Pre-condition:	1. cell bandwidth :100MHZ. 2. UE supports SA protocol, and is a valid subscriber in core network.		
Test steps:	1. UE registers in the network and initiates service 2. Message flow： UE – NR-RAN | Message | | --> | RRCConnectionRequest（ue-Identity ,establishmentCause..） <-- | RRCConnectionSetup --> | RRCConnectionSetupComplete		
Expected result	RRC connection is successfully established, UE is in RRC_CONNECTED state ，and SRB1 is established successfully.		
Note			

7.5.6 RRC Connection Release

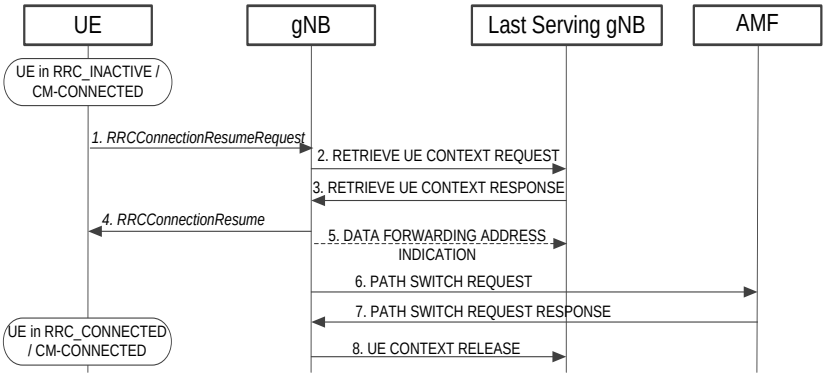
Item:	RRC functionality and key technology	Sub-item:	RRC connection release

<table>
<tr><td>References:</td><td>TS 38.331</td><td>Network configuration:</td><td>A</td></tr>
<tr><td>Importance:</td><td colspan="3">Mandatory</td></tr>
<tr><td>Purpose:</td><td colspan="3">To verify that UE in RRC_CONNECTED state can release RRC connection and all radio resources correctly.</td></tr>
<tr><td>Pre-condition:</td><td colspan="3">1. cell bandwidth :100MHZ.
2. UE supports SA protocol, and is a valid subscriber in core network.</td></tr>
<tr><td>Test steps:</td><td colspan="3">1. Terminate call to make NR-RAN trigger RRC connection release
Message Flow：<table><tr><td>UE – NR-RAN</td><td>Message</td></tr><tr><td><--</td><td>RRCConnectionRelease</td></tr></table></td></tr>
<tr><td>Expected result</td><td colspan="3">RRC connection can be released correctly and UE shall enter RRC_IDLE state.</td></tr>
<tr><td>Note</td><td colspan="3"></td></tr>
</table>

7.5.7 RRC Connection Re-establishment

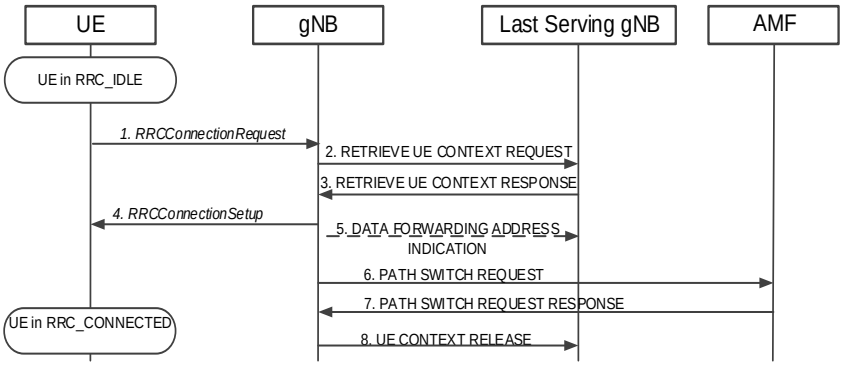
<table>
<tr><td>Item:</td><td>RRC functionality and key technology</td><td>Sub-item:</td><td>RRC connection re-establishment</td></tr>
<tr><td>References:</td><td>TS 38.331</td><td>Network configuration:</td><td></td></tr>
<tr><td>Importance:</td><td colspan="3">Mandatory</td></tr>
<tr><td>Purpose:</td><td colspan="3">To verify that UE in RRC_CONNECTED state can initiate RRC connection re-establishment.</td></tr>
<tr><td>Pre-condition:</td><td colspan="3">UE in RRC_CONNECTED state.
Initial AS security has been activated.</td></tr>
<tr><td>Test steps:</td><td colspan="3">UE triggers RRC connection re-establishment when UE detects Radio link failure or handover failure.
Message flow：<table><tr><td>UE – NR-RAN</td><td>Message</td></tr><tr><td>--></td><td>RRCConnectionReestablishmentRequest</td></tr><tr><td><--</td><td>RRCConnectionReestablishment</td></tr><tr><td>--></td><td>RRCConnectionReestablishmentComplete</td></tr></table></td></tr>
<tr><td>Expected result</td><td colspan="3">1. SRB1 shall be reconfigured and SRB1 data transfer resume.
2. AS securityshall be re-activated.</td></tr>
<tr><td>Note</td><td colspan="3"></td></tr>
</table>

7.5.8 RRC State Change-Inactive-Connected

Item:	RRC functionality and key technology	Sub-item:	RRC state change
References:	TS 36.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that UE can change state correctly between RRC_INACTIVE and RRC_CONNECTED		
Pre-condition:	1. cell bandwidth :100MHZ. 2. UE supports SA protocol, and is a valid subscriber in core network.		
Test steps:	1. UE registers in the cell and enter RRC_CONNECTED state，after timer expires, UE enters RRC_INACTIVE。 2. UE initiates service and triggers RRC conncetion establishment，enters RRC_CONNECTED state. 		
Expected result	UE shall switch between RRC_INACTIVE and RRC_CONNECTED correctly.		
Note			

7.5.9 RRC State Change-idle -Connected

Item:	RRC functionality and key technology	Sub-item:	RRC state change
References:	TS 36.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify that UE can change state correctly between RRC_IDLE and RRC_CONNECTED.		

Pre-condition:	1. cell bandwidth :100MHZ. 2. UE supports SA protocol,and is a valid subscriber in core network.
Test steps:	1. UE registers in the cell and enters RRC_CONNECTED state,after timer expires, UE enters RRC_IDLE. 2. UE initiates service and triggers RRC conncetion setup,enters RRC_CONNECTED. 
Expected result	UE shall switch between RRC_IDLE and RRC_CONNECTED correctly.
Note	

7.5.10 Data Radio Bearer Setup

Item:	RRC functionality and key technology	Sub-item:	DRB setup and release
References:	TS 38.331	Network configuration:	A
Importance:	Mandatory		
Purpose:	To verify UE can setup DRB with NG-RAN correctly.		
Pre-condition:	1. cell bandwidth :100MHZ. 2. UE supports SA protocol,and is a valid subscriber in core network.		
Test steps:	1. UE registers in the network and initiates service **UE – NG-RAN** | **Message** <-- | *RRCConnectionReconfiguration（drb-ToAddModLists）* --> | *RRCConnectionReconfigurationComplete*		
Expected result	1. NG-RAN sends RRCConnectionReconfiguration message in which includes radioBearerConfig ->DRB-ToAddModList ->drb-Identity&dedicatedInfoNASList; 2. UE shall setup DRB correctly according to the information in IE radioBearerConfig		
Note			

7.5.11 Data Radio Bearer Release

<table>
<tr><td>Item:</td><td>RRC functionality and key technology</td><td>Sub-item:</td><td>DRB setup and release</td></tr>
<tr><td>References:</td><td>TS 36.331</td><td>Network configuration:</td><td>A</td></tr>
<tr><td>Importance:</td><td colspan="3">Mandatory</td></tr>
<tr><td>Purpose:</td><td colspan="3">1. To verify UE can release DRB correctly.</td></tr>
<tr><td>Pre-condition:</td><td colspan="3">1. cell bandwidth :100MHZ.
2. UE supports SA protocol,and is a valid subscriber in core network.</td></tr>
<tr><td>Test steps:</td><td colspan="3">1. UE attaches to network and start UL UDP service, DRB is established..
2. UE execute detach procedure and trigger DRB releasement.
<table>
<tr><th>UE – NR-RAN</th><th>Message</th></tr>
<tr><td><--</td><td>RRCConnectionReconfiguration（drb-ToReleaseList）</td></tr>
<tr><td>--></td><td>RRCConnectionReconfigurationComplete</td></tr>
</table></td></tr>
<tr><td>Expected result</td><td colspan="3">1. NG-RAN send RRCConnectionReconfiguration message which includes radioBearerConfig -> DRB-ToReleaseList information to indicate UE which DRB should be released.
DRB-ToReleaseList ::= SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity</td></tr>
<tr><td>Note</td><td colspan="3"></td></tr>
</table>

7.5.12 Data Bearer Mapping

<table>
<tr><td>Item:</td><td>RRC functionality and key technology</td><td>Sub-item:</td><td>DRB setup and release</td></tr>
<tr><td>References:</td><td>TS 38.331</td><td>Network configuration:</td><td>A</td></tr>
<tr><td>Importance:</td><td colspan="3">Mandatory</td></tr>
<tr><td>Purpose:</td><td colspan="3">1. To verify that gNB supports extended 5QI and QoS parameter configuration.</td></tr>
<tr><td>Pre-condition:</td><td colspan="3">1. cell bandwidth :100MHZ.
2. UE supports SA protocol,and is a valid subscriber in core network.
3. Core network or UE side has the ability to configure dedicated Bearer QoS</td></tr>
<tr><td>Test steps:</td><td colspan="3">1. UE registers in the network and initiates service, set up dedicated DRB.
<table>
<tr><th>UE – NG-RAN</th><th>Message</th></tr>
<tr><td><--</td><td>RRCConnectionReconfiguration（drb-ToAddModLists）</td></tr>
<tr><td>--></td><td>RRCConnectionReconfigurationComplete</td></tr>
</table></td></tr>
</table>

Expected result result：	1. NG-RAN sends RRCConnectionReconfiguration message，which includes radioBearerConfig -> DRB-ToAddMod，including IE sdap-Config, sdap-Config includes QoSflow information：
	SDAP-Config ::= SEQUENCE {
	-- FFS / TODO: Definition of PDUsessionID to be added
	pduSession PDUsessionID,
	
	-- FFS: separate configuration for UL and DL
	sdap-Header-DL ENUMERATED {present, absent},
	sdap-Header-UL ENUMERATED {present, absent}
	defaultDRB BOOLEAN,
	reflectiveQoS BOOLEAN, -- It is FFS whether this field is needed
	
	-- FFS: Is the simple list sufficient? Replace by add/mod/release list? Or bitmap?
	mappedQoSflows SEQUENCE (SIZE (0..maxNrofQFIs)) OF QFI
	...
	}
	
	QFI :: = INTEGER (0..maxQFI)

Note	Message flow and messge format are not defined yet.

7.6 Measurement and mobility management

7.6.1 Measurement based on SSB/CSI-RS

Item	RRM	Sub-item	Measurement and mobility management
References		Configuration	
Importance	Mandatory		
Target	Verify whether UE supportsRSRP/RSRQ measurement and reporting based on RSRP/RSRQ		
Pre-condition	1. UE has registered and enter RRC_IDLE state 2. gNB supports SSB beam measurement		
Test procedures	1. UE initiates a normal service in cell 1. Complete the State transition to RRC_CONNECTED 2. In cell 1, configure the UE to report RSRP measurement results based on SSB. 3. Configure the 5G cell Cell2 as the intra-frequency neighbor cell of Cell1. 4. Increase the signal strength of Cell2 to trigger the UE to report the		

	intra-frequency RSRP measurement results, then log the corresponding measurement Report 5. Configure the 5G Cell3 as the inter-frequency neighbor cell of Cell1 6. Increase the signal strength of Cell3 to trigger the UE to report the inter-frequency RSRP measurement results, then log the corresponding measurement Report 7. In cell 1, configure the UE to report RSRQ measurement results based on SSB. 8. increase the signal strength of Cell2 to trigger the UE to report the intra-frequency RSRQ measurement results, then log the corresponding measurement Report 9. In cell 1, configure the UE to report RSRQ measurement results based on CSI-RS, repeat the test as step3~step 6
Expected result	1. The UE can normally trigger the RSRP measurement reports based on SSB, and the reported values can correctly represent the RSRP measurements reports based on SSB when the RSRP measurements based on SSB are configured. 2. The UE can normally trigger RSRQ measurement reports based on SSB, and the reported values can correctly represent the RSRQ measurements reports based on SSB when the RSRQ measurements based on SSB are configured. 3. The UE can trigger the measurement reports of the Intra-frequency and inter-frequency RSRP measurement based on SSB and the reported values can correctly represent the RSRP measurement results based onSSB.4The UE can trigger the measurement reports of the Intra-frequency and inter-frequency RSRQ measurement based on CSI-RS and the reported values can correctly represent the RSRQ measurement results based on CSI-RS.
Note	

7.6.2 Event measurement

Item	RRM	Sub-item	Measurement and mobility management
References		Configuration	
Importance	Mandatory		
Target	Verify whether UE supports different measurement events.		
Pre-condition	1.UE has registered and enter RRC_IDLE state 2.UE camp on NR Cell1, and Cell2is the NR neighbor cell of Cell1		
Test procedures	UE initiates a normal service in cell 1. Complete the State transition to RRC_CONNECTED 1. Configure the UE with measurement report event A1. 2. To trigger transaction in Cell1 and increase the signal strength of Cell1, monitor the measurement reporting when A1 is triggered 3.Configure the UE with measurement report event A2. 4. To trigger transaction in Cell1 and decrease the signal strength of Cell1, monitor the measurement reporting when A2 is triggered 5. Configure the UE with measurement report event A3.		

	6. To trigger transaction in Cell1 and decrease the signal strength of Cell2, monitor the measurement reporting when A3 is triggered 7. Configure the UE with measurement report event A4. 8. To trigger transaction in Cell1 and decrease the signal strength of Cell2, monitor the measurement reporting when A4 is triggered 9. Configure the UE with measurement report event A5. 10. To trigger transaction in Cell1 and decrease the signal strength of Cell2 and increase the signal strength of Cell2,.monitor the measurement reporting when A5 is triggered 11. The Cell1 configures the measurement event A6, Cell1 configures the primary and secondary two-carrier cell, and configures the neighbor CELL2, starting the measurement report via the event A6 12. To trigger transaction in Cell1 and decrease the signal strength of Cell1‘s secondary carrier and increase the signal strength of Cell2,.monitor the measurement reporting when A6 is triggered
Expected result	1. UE can trigger the measurement report of measurement events, and the measurement report value is correct. 2. Both RSRP measurement and RSRQ measurement can be used in the test.
Note	

7.6.3 Cell Re-selection

Item	Mobility management	Sub-item	Intra-rat cell re-selection
References		Configuration	
Importance	Mandatory		
Target	Verify intra-rat cell selection and cell reselection based on RSRP		
Pre-condition	1. UE has registered and enter RRC_IDLE state 2. Cell1 and Cell2 are NR cells and the Cell2 is the intra-frequency neighbor cell of Cell1		
Test procedures	1. UE camp onCell1. 2. Increase the signal strength of Cell2 while decreasing the signal strength of Cell1. 3.Continue the step2 operation until the difference of the signal strength of the two cells will trigger the UE to re-select to Cell2. 4.UE initiates a normal service in cell 2. 5. UE can show the measurement signal strength change on its displayer.		
Expected result	1. UE can re-select to the new cell correctly. 2.UE can initiate service normally in cell 2.		
Note			

7.7 Basic performance (high/middle priority)

7.7.1 Peak data rate (SA)

7.7.1.1 DL Peak rate (4 Streams)

Item	Basic performance	Sub-item	DL peak data rate
References		Configuration	
Importance	Mandatory		
Target	Verify the downlink peak rate of standalone user terminal		
Pre-condition	1.Base station：Cell configured with 100MHz Carrier Bandwidth ,the percentage of UL/DL timing resource is configurable and can be set to 7:2 2. UE: support at least DL 4 streams and 256QAM. RSRP\SINR\throughput etc. parameters can be recorded. 3. The terminal connects to the 5G NR gNB via channel simulator 4. RF signal connects to channel simulator		
Test procedures	1. The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2. UE accesses the cell via channel simulator 3. To send UDP to UE with 4 streams and monitor the downlink date rate for at least 1 minute. Record the DL RSRP\SINR\DL MCS\DL BLER and DL physical layer throughput in the terminal.		
Expected result	1. DL RSRP\SINR\DL MCS\DL BLER and physical layer throughput in UE 2. DL physical layer data rate in base station 3. To record the maximum peak data rate of FTP Download for each full buffer data, DL transmission data rate reaches the theoretical rate with 4 streams and256 QAM , and the average BLER is less than 1% in the terminal.		
Note			

7.7.1.2 UL peak data rate (2 streams-64QAM)

Item	Basic performance	Sub-item	UL peak data rate
References		Configuration	
Importance	Mandatory		
Target	Verify the uplink peak rate of single standalone user		
Pre-condition	1.Base station：Cell configured with 100MHz Carrier Bandwidth ,the percentage of UL/DL timing resource is configurable and can be set to 7:2 2. UE: support uplink 2 streams and 64 QAM. RSRP\SINR\throughput etc. parameters can be recorded.		

	3. The terminal connects to the 5G gNB via channel simulator. 4. RF signal connects to channel simulator.
Test procedures	1. The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2. UE accesses one cell via channel simulator. 3. UE sends uplink UDP to gNB with 2 streams and 64QAM. Monitor the UL data rate for at least 1 minute. Record the UL RSRP\SINR\UL MCS\UL BLER and UL physical layer throughput in UE.
Output data requirement and expected result	1. UL RSRP\SINR\UL MCS\UL BLER and UL physical layer throughput in UE. 2. UL physical layer data rate in base station 3. To record the maximum peak data rate of FTP upload for each full buffer data. UL data rate reaches the theoretical rate with 2 streams and 64QAM, and the average BLER in the terminal is less than 1%.
Note	

7.7.1.3 UL peak data rate (2 streams-256QAM)

Item	Basic performance	Sub-item	UL peak data rate
References		Configuration	
Importance	Mandatory		
Target	Verify the uplink peak data rate of single standalone user		
Pre-condition	1. Base station：Cell configured with 100MHz Carrier Bandwidth, the percentage of UL/DL timing resource is configurable and can be set to 7:2 2. UT supports uplink 2 stream and 256 QAM. RSRP\SINR\throughput etc. parameters can be recorded. 3. The terminal connects to the 5G cell via channel simulator 4. RF output connects to channel simulator		
Test procedures	1. The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2. DUT access to the cell via channel simulator 3. To trigger the uplink UL 2 streams by UDP data service and monitor the UL speed at least 1 minute. Record the UL RSRP\SINR\MCS\BLER and physical level throughput.		
Output data requirement and expected result	1. UL RSRP\SINR\MCS\BLER and physical level throughput of UE 2. UL physical level throughput of base station 3. To record the maximum peak rate of uplink traffic for each full buffer data when UL transmission rate reaches the theoretical rate of 2 streams/256 QAM condition under the premise that the average BLER of the terminal is less than 1%		
Note			

7.7.1.4 DL/UL peak data rate (DL:4 streams, UL 2 streams-64QAM)

Item	Basic performance	Sub-item	DL/UL peak data rate
References		Configuration	
Importance	Mandatory		
Target	Verify the DL/UL simultaneous peak data rate of single user for SA terminals		
Pre-condition	1.Base station：Cell configured with 100MHz Carrier Bandwidth ,the percentage of UL/DL timing resource is configurable and can be set to 7:2 2. DUT downlink support 4 stream and 256 QAM and uplink 2 stream and 64 QAM. RSRP\SINR\throughput etc. parameter can be recorded. 3. The terminal connect to the 5G cell via channel simulator 4. RF output connects to channel simulator		
Test procedures	1. The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2. DUT accesses the cell via channel simulator. 3. To trigger the upload and download services and monitor the DL/UL speed at least 30 minutes. Record the DL RSRP\SINR\MCS\BLER\physical level throughput and UL MCS\BLER and physical level throughput.		
Output data requirement and expected result	1. DL RSRP\SINR\MCS\BLER\physical level throughput and UL MCS\BLER and physical level throughput of UE 2. DL/UL physical level throughputs of base station. 3. To record the maximum peak rate of FTP Upload/Download for each full buffer data when DL/UL transmission rate reaches the current max rate under the premise that the average BLER of the terminal is less than 1%.		
Note			

7.7.1.5 DL/UL peak data rate (DL:4 streams, UL 2 streams-256QAM)

Item	Basic performance	Sub-item	DL/UL peak data rate
References		Configuration	
Importance	Mandatory		
Target	Verify the uplink and downlink simultaneous peak dat rate of single standalone user		
Pre-condition	1. Base station：Cell configured with 100MHz Carrier Bandwidth, the percentage of UL/DL radio resource is configurable and can be set to 7:2. 2. UT support downlink4 streams and 256QAM, and uplink2 streams and 256QAM. The RSRP\SINR\throughput etc. parameters can be recorded. 3. The terminal connects to the 5G cell via channel simulator. 4. RF output connects to channel simulator.		
Test procedures	1. The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%;		

	2. DUT access to the cell via channel simulator. 3. To trigger the upload and download services and monitor the DL/UL speed at least 30 minutes. Record the DL RSRP\SINR\MCS\BLER\physical level throughput and UL MCS\BLER and physical throughput.
Output data requirement and expected result	1. DL RSRP\SINR\MCS\BLER\physical level throughput and UL MCS\BLER and physical level throughput of UE. 2. DL/UL physical level throughput of base station. 3. To record the maximum peak rate of FTP Upload/Download for each full buffer data when DL/UL transmission rate reaches the current max rate under the premise that the average BLER of the terminal is less than 1%.
Note	

7.7.2 Latency

7.7.2.1 User plane latency

Item	Basic performance	Sub-item	User plane latency
References		Configuration	
Importance:	Mandatory		
Target	Verify the latency in user plane of 5G terminal		
Pre-condition	1. Cell configured with 100MHz Carrier Bandwidth, the percentage of UL/DL radio resource is configurable and can be set to 7:2 2. Test terminal is from chip manufacturer 3. For 5G base station with integrated RRU and antenna, tear down the antenna at first, then the test terminal connects to RF signal 4. The test instruments are connected to the 5GNR base station and the test terminal respectively		
Test procedures	1. The cell works normally, the frame structure configuration is recommended to 70% for downlink, and the percentage of UL radio resource is around 30%; 2. UE accesses one NR cell and is in RRC_CONNECTED state 3. To send the downlink UDP to UE. The parameters of packets are configured by test instrument. For each packet, test instrument records the time of PDCP entry point at the base station as T1, the time of PDCP exit point at test terminal as T2, and the downlink unidirectional user plane latency as T = T2-T1. (The test instrument sends the data packet with GPS time stamp to the base station through port A. The base station forwards the data packet to the terminal. The terminal sends the recovered data packet to port B of the network test instrument. The network test instrument calculates the downlink latency according to the difference between the receiving time of the data packet and the time stamp in the data packet.) 4. To send the uplink UDP packet to the base station. The parameters of packets are configured via test instrumentation. Test instrumentation records the time of PDCP entry point at the UE as T1, the time of PDCP exit point at		

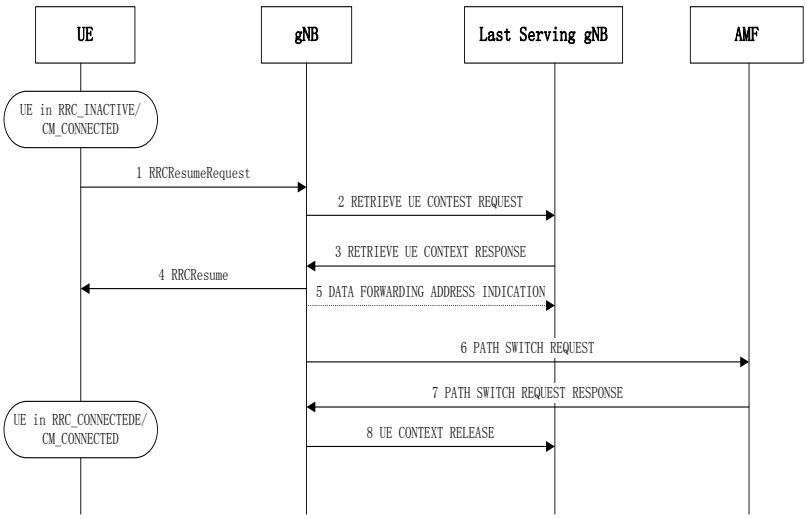
	the base station as T2, and the radio uplink unidirectional user plane latency as T = T2-T1 5. To repeat 10 times from step2 to step4
Output data requirement and expected result	Record the T1 and T2, calculate the user plane latency(T= T2 – T1) Both the uplink latency and downlink latency are not greater than 4ms
Note	<table><tr><td></td><td>Ave-latency</td><td>Max-latency</td><td>Min-latency</td></tr><tr><td>Uplink</td><td></td><td></td><td></td></tr><tr><td>Downlink</td><td></td><td></td><td></td></tr></table>

7.7.2.2 Control plane latency—Idle state(SA)

Item	Basic performance	Sub-item	Control plane latency
References		Configuration	
Importance:	Mandatory		
Target	Verify the latency of 5G control plane in SA mode		
Pre-condition	1. Cell configured with 100MHz Carrier Bandwidth, the percentage of UL/DL radio resource is configurable and can be set to 7:2 2. Test terminal from chip manufacturer 3. For 5G base station with integrated RRU and antenna, tear down the antenna at first, then the test terminal connects to RF signal		
Test procedures	1. The cell works normally, the frame structure configuration is recommended to 70% for downlink, and the percentage of UL subframe is around 30%; 2. UE camps on the 5G NR cell and is in RRC_IDLE state 3. The UE starts UL UDP data service, and record the latency from msg1 to msg5 as the transition latency from idle state to RRC_CONNECTED state. 4. Repeat 10 times for access procedure and record the access latency each time.		
Output data requirement and expected result	The average access latency of UE in 5G SA mode		
Note			

7.7.2.3 Control plane latency—Inactive state(SA)

Item	State transition and latency testing	Sub-item	Control plane latency—Inactive state
References:		Network Configuration:	No load
Importance:	Mandatory		
Target	Verify the control plane latency of UE in Lab static point		
Pre-condition	1:NR basic network configuration		

	2: Test is performed in 4 static points within one cell, very good\good\middle\bad channel condition 3: Test terminal: one brand terminal in one test loop; different brand terminals in different test loops.
Test procedures	1. At first, the system is configured as required, no loading and no interference 2.At the very good point in the cell 3. UE power on, record the time 4. UE access the network, enter RRC_Inactive state. 5. UE initiates Preamble from Inactive state, record the time from RACH preamble to RRC Connection Resume of UE side as control plane latency. 6. Repeat 20 times from step4 to step 5. 7. To do the test respectively at the static good point\middle point\bad point from step 3 to step 6. 
Output data requirement and expected result	Record maximum, minimum and average access latency at each test point.
Note	Control plane latency—from inactive to connected state, the time from the 1st random preamble to RRC Resume.

7.7.2.4 Paging performance test

Item	State transition and latency testing	Sub-item	Paging on fix point
References		Configuration	
Importance	Mandatory		
Target	Verify paging latency and paging successful rate of UE		
Pre-condition	1.NR basic network configuration 2. Select one NR cell 3. Test is performed in 4 static points within one cell, very good\good\middle\bad channelcondition. There is only one test NR cell		

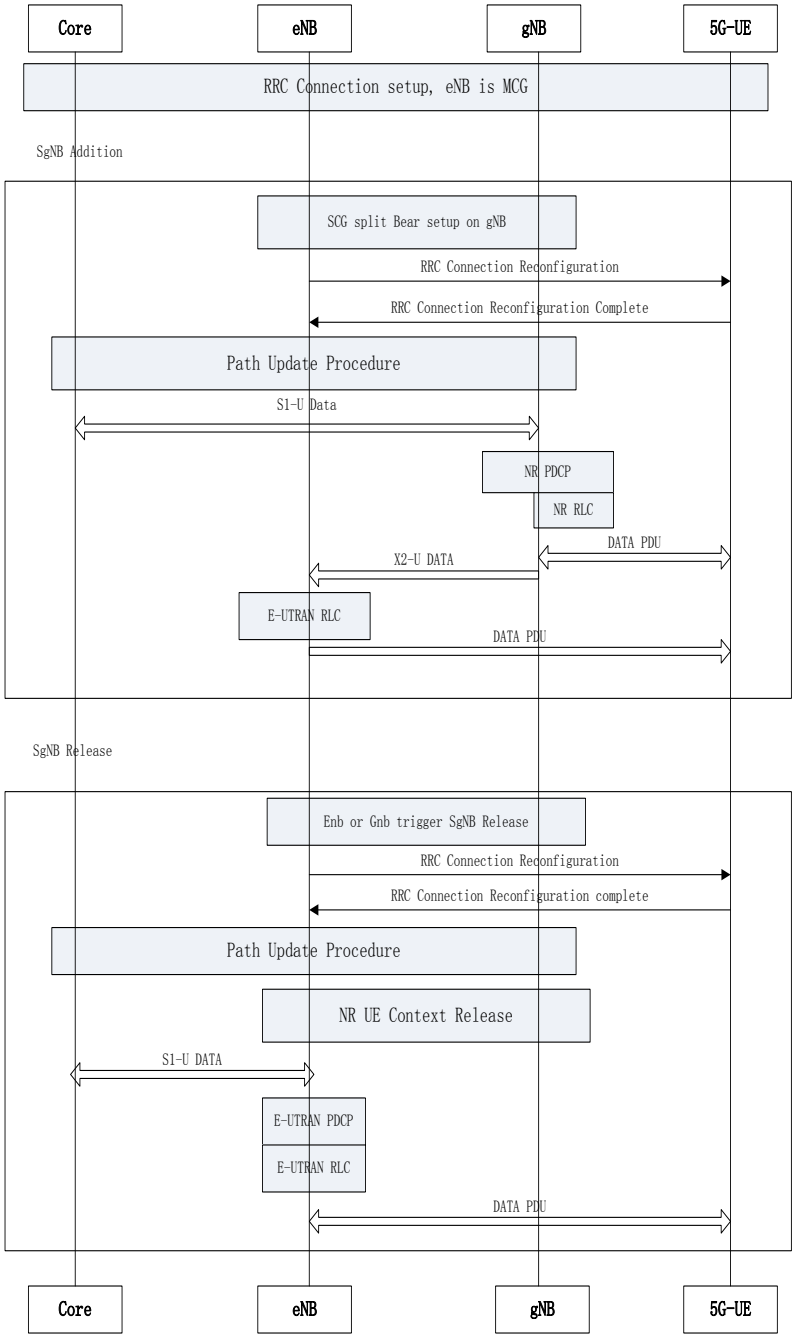
	without any neighbor cell. 4.one same brand UE at one test loop
Test procedures	1. At first, the NR system is configured as required. 2. At the very good point in the cell 3. UE power on and select cell to access, then enter to RRC_IDLE state 4. To trigger the paging from 5GC 5. UE initiates the RRC setup procedure after UE received the paging message. Check the establishment Cause in RRCRequest is “mt-Access”. 6. UE enters to RRC_Idle state after UE received the release message from gNB. 7. Repeat 15 times from step3 to step 6, then record the successful ratio of paging and paging latency. 8.Do the test respectively at good point、middle point and bad point from step 3 to step 7.
Output data requirement and expected result	Record paging successful rate and paging latency
Note	1. paging latency includes both gNB side and UE side 2. paging latency of gNB: from paging initiated by gNB to RRC setup complete received by the gNB. 3. paging latency of UE side：from paging received by UE to RRC setup complete sent by the UE. DRX is set as 64ms.

7.8 NSA

7.8.1 Option 3X EN DC

7.8.1.1 Data plane split anchor point

Item	NSA	Sub-item	Data plane split anchor point
References		Configuration	
Importance	Mandatory		
Target	Verify the supporting of option 3x EN-DC and the data plane split anchor point is located in PDCP layer of gNB		
Pre-condition	1. base station: Cell1 with 100MHz Carrier Bandwidth is NR Cell, Cell2 is LTE cell 2.UE: one UE supporting NSA option 3x 3. eNB connects to NR base station via X2 interface, eNB connects to SGW via S1-U and MME via S1-C, gNB connects to SGW via S1-U 4. UE connect toNR/LTE cells via RF line		

Test procedures	1. UE establishesthe RRC connection setup in LTE cell, and establishes EN-DC with NR cell. One SCG split bearer is configured for this UE. 2. UE starts to receive downlink data such as UDP 3.To monitor the RRC signaling、X2 interfacesignaling and user data , monitor the user data between Core Network and LTE cell, between core network and NR cell 
Output data requirement and expected result	1. Test terminal successfully establishes EN-DC. 2. User plane data is transmitted through S1-U interface between core network and NR cell. 3. Theuser plane data is splitfrom NR PDCP entity located in gNB to LTE RLC layer through X2 interface.

Note	SgNB Release is used in this test.

7.8.1.2 SCG split bearer

Item	NSA	Sub-item	SCG split bearer
References		Configuration	
Importance	Mandatory		
Target	Verify the supporting of SCG split bearer in EN-DC		
Pre-condition	1. base station: Cell1 with 100MHz Carrier Bandwidth is NR Cell, Cell2 is LTE cell. 2. DUT: one UE supporting NSA option 3x 3. eNB connects to NR base station via X2 interface, eNB connects to SGW via S1-U and MME via S1-C. gNB connects to SGW via S1-U. 4. UE connects toNR/LTE cells via RF line		
Test procedures	1. UE establishes the RRC connection setup in LTE cell, then EN-DC is configured. One SCG split bearer is configured for this UE. 2.UE initiates the data transmission (DL UDP services) and the transmission continues at least 2 minutes. 3. To monitor the RRC signaling、X2 signaling and user dataand monitor the user data respectively between core network and LTE cell, between core network and NR cell. Monitor the transmission status through two radio links. 4. To record the throughput		
Expected result	1. DUT successfully establishes EN-DC. 2.User plane data is transmitted through S1-U interface between core network and NR. 3. The distribution of date from PDCP entity located in NR cell to RLC layer of LTE cell can be monitored in X2 interface. User plane data is transmitted through two radio links. 4. The throughput of useris higher than the expected throughput of a single NR station.		
Note			

7.8.1.3 MCG bearer

Item	NSA	Sub-item	MCG bearer
References		Configuration	
Importance	Second Priority		
Target	Verify the supporting of MCG bearer		
Pre-condition	1. base station: Cell1 with 100MHz Carrier Bandwidth is NR Cell, Cell2 is LTE cell 2. DUT: one UE supporting NSA option 3x 3. eNB connects NR base station via X2 interface, eNB connects to SGW via S1-U and MME via S1-C, gNB connects to SGW via S1-U.		

	4. UE connects toNR/LTE cell via radio line
Test procedures	1. To monitor the establishment of X2 between NR base station and LTE base station. 2. UE establishes the RRC connection in LTE cell, the EN-DC is not configured and MCG bearer is configured in LTE cell. 3. UE initiates the data transaction(UDP services) 4. To record the peak throughput of user, the signaling and user data in air interface, X2 interface and S1 interface.
Output data requirement and expected result	1. UE successfully establishes bearer in LTE cell 2. User-level data is transmitted through the core network-LTE cell-terminal link, and the peak throughput reaches the theoretical peak of LTE cell configuration
Note	

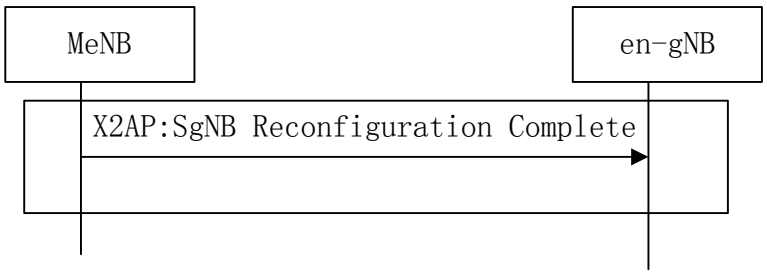
7.8.2 EN DC Mobility management based on Option3X

7.8.2.1 SgNB configuration

Item	NSA	Sub-item	SgNB Configuration
References		Configuration	
Importance	Mandatory		
Target	Verify the additionof NR secondary cell for UE viaSgNB configuration procedure		
Pre-condition	1. base station: Cell1 with 100MHz is NR Cell, Cell2 is LTE cell 2. DUT: one UE supporting NSA option 3x 3. eNB connects to NR base station via X2 interface,eNB connects to SGW via S1-U and MME via S1-C, gNB connects to SGW via S1-U. 4. UE connects to NR/LTE cells via RF line		
Test procedures	1. UE establishes the RRC connection setup in LTE cell, the SCG NR cell is added and at least one radio bearer is setup in NR cell. EN-DC is established. 2. UE initiates the data transmission. 3. To monitor the RRC signaling、X2 signaling and user data, and monitor the user data respectively between Core Network and LTE cell, between Core Network and NR cell.		
Output data requirement and expected result	1. The NR PSCell is configured successfully via the SgNB configuration procedure. 2. The signaling procedure conforms to the SgNB addition procedure of 3GPP standard.		
Note			

7.8.2.2 SgNB re-configuration

Item	NSA	Sub-item	SgNB re-configuration

References		Configuration	
Importance	Mandatory		
Target	Verify the SgNB re-configuration procedure of EN-DC		
Pre-condition	1 base station: Cell1 with 100MHz is NR Cell, Cell2 is LTE cell 2 DUT: one UE supporting NSA option 3x 3 The eNB connects to NR base station via X2 interface，eNB connects to SGW via S1-U and MME via S1-C 4 UE connects toNR/LTE cell via Radio line		
Test procedures	1. UE initiates RRC connection setup in LTE cell 2. Network triggers the SgNB re-configuration procedure 3. UE initiates the data transmission. 4. To monitor the RRC signaling、X2 signaling and user data and monitor the user data respectively between Core and LTE cell, between core and NR cell		
Expected result	The SgNB Re-configuration Complete message can be monitored in X2 interface while SgNB is re-configured. 		
Note			

7.8.2.3 SgNB release

Item	NSA	Sub-item	SgNB release
References		Configuration	
Importance	1 level		
Target	Verify the SgNB release process and the resource release about SgNB of UE		
Pre-condition	1. base station: Cell1 with 100MHz is NR Cell, Cell2 is LTE cell 2. DUT: one UE supporting NSA option 3x 3. The eNB connects NR base station via X2 interface，eNB connects to SGW via S1-U and MME via S1-C 4. UE connects toNR/LTE cell via Radio line		
Test procedures	1.To monitor the RRC signaling、X2 signaling and user data and monitor the user data respectively between Core and LTE cell, between core and NR cell 2. UE initiates RRC connection setup in LTE cell, and the NR cell is configured the SgNB. The RB is setup in NR cell. 3. UE initiates the data transaction 4. To trigger the SgNB release process via MCG or SCG station		
Expected result	1. The connection between LTE cell and NR cell is released 2. The resource about NR cell is released 3. The connection between UE and LTE cell continues and the data traffic is		

	normal. 4. The signal flow about SgNB release conforms to the 3GPP standard
Note	

7.8.2.4 EN DC HO

Item	NSA	Sub-item	LTE/NR DC HO
References		Configuration	
Importance	1 level		
Target	Verify the HO process of LTE/NR DC		
Pre-condition	1. base station: Cell1 with 100MHz is NR Cell, Cell2 is LTE cell 2. DUT: one UE supporting NSA option 3x 3. The eNB connects to NR base station via X2 interface，the eNB connect to SGW via S1-U and MME via S1-C 4. UE connects toNR/LTE cell via Radio line		
Test procedures	1. To monitor the RRC signaling、X2 signaling and user data and monitor the user data respectively between Core and LTE cell, between core and NR cell 2. UE establishes the RRC connection setup in LTE cell2, the SCG NR cell1 is added and radio bearer is setup in NR cell 3. UE initiates the data transaction and monitor the throughput 4. To trigger the PSCell change from Cell1 to Cell3 by adjusting the signal strengths of Cell1 and Cell3		
Expected result	1. The source cell Cell1 initiates the measurement control and initiates the PScell change according to the measurement report. 2. UEperforms handover to the target cell Cell3, and the services keep continuous. 3. the resources about source cell are released.		
Note			

7.9 4G/5G interoperation

7.9.1 Inter-RAT HO from 5G to 4G (SA)

Item	Mobility management	Sub-item	Inter-RAT HO
References		Configuration	
Importance	Mandatory		
Target	Verify the Inter-RAT HO		
Pre-condition	1.UE has registered and is in RRC_IDLE state 2.UE resides NR cell1 and the LTE cell2 is the neighbor cell of cell1		
Test procedures	1. UE initiates data traffic to enter RRC_CONNECTED state in cell1 2. To change the signal strengths of Cell1 and cell2 to trigger the UE HO from NR Cell1 to LTE cell2		

Expected result	1. UE can successfully HO to the target cell and the traffic keeps continuous. 2. The related resource of source cell can be released successfully
Note	

7.9.2 Data service

7.9.2.1 Re-selection of data service

Item	Interoperation test of data service	Sub-item	5G<>LTE cell reselection in idle state
References		Configuration	E
Importance	Mandatory		
Target	Verify the cell re-selection between 5G and 4G		
Pre-condition	1. hardware and software of 4/5G base station and UE for test is normal 2.5G cell is configured the inter-rat re-selection parameters and the LTE Cell is the neighbor cell of 5G cell. 3. LTE Cell is configured the inter-rat re-selection parameters and 5G cell is the neighbor cell of LTE cell 4. DUT initially resides in the 5G cell in the RRC_IDLE state.		
Test procedures	1.To record the LTE neighbor frequency in 5G cell broadcast messages 2.To decrease the 5G cell signal to trigger the UE to re-select from 5G to LTE cell, and UE initiates the data service after UE resides the LTE Cell successfully 3. UE enter idle state in LTE Cell after the traffic stopped then recovery the 5G cell signal slowly until UE re-select the cell from LTE to 5G and UE initiates the data service in 5G cell		
Expected result	1. To record the inter-rat neighborhood frequency configuration information in 5G cell. 2. UE can be trigger the measurement of LTE neighbor cell and re-select from 5G to LTE cell according to the re-selection parameters, the data services is successfully setup in LTE cell. 3. UE can be trigger the measurement of 5G neighbor cell and re-select from LTE to 5G cell according to the re-selection parameters, the data services is successfully setupin 5G cell.		
Note			

7.9.2.2 Data service HO-across EPC and 5GC

Item	Interoperation of data service	Sub-item	5G<>LTE data service Interoperation in connected state
References		Configuration	E
Importance	Mandatory		
Target	1.Verify that 5G system supports 5G/LTE data service interoperability based		

	on redirection 2. Verify that the base station can send the measurement and HO command correctly according to the UE capability.
Pre-condition	1. hardware and software of 4/5G base station and UE for test is normal2.5G cell can configure the measurement parameters and the LTE Cell is the neighbor cell of 5G cell. 3. LTE Cell is normal and 5G cell is the neighbor cell of LTE cell 4. DUT initially resides in the 5G cell and initiates data traffic and in the RRC_CONNECTED state.
Test procedures	1. To decrease the 5G cell signal until RSRP is low to trigger the UE reports A2 event measurement reporting. 2.To record the measurement control command from base station 3. To decrease the 5G cell signal until base station send the Ho command 4. To record the signaling and service recovery process of UE after receiving the HO command
Expected result	1.5G base station can send A2 measurement control correctly, and UE can report A2 measurement report correctly 2. 5G base station can configure the inter-rat measurement control for LTE cell 3. 5G base station will send the Ho command with LTE target cell and frequency information to UE after receiving the measurement reporting from UE 4. UE access the LTE cell according to the network command and traffic recovery is successful
Note	

7.9.2.3 Data service in DC

Item	HO latency	Sub-item	carrier management latency of NSA mobility
References		Configuration	
Importance	Mandatory		
Target	To test the latency of 5G carrier change during Ho of NSA DUT		
Pre-condition	1. Base station: NR system, 100M bandwidth, LTE system,20M system bandwidth, time slot ratio is 3DL:1UL, special time slot is 10:2:2. LCell1 and LCell2 are neighbor LTE cells each other bellowing different BBU. 2. UE: 5G UE which can record the RSRP、SINR、throughput etc. 3.UE connects to NR Cell1/Cell2 and LTE base station directly via the attenuator and feeder.		
Test procedures	1.To set NCell1 and Ncell2 with different BBU 2. DUT initiates the access to LCell1 via channel simulator; and access the NCell1 with 5G DRB bearers. DUT is in connected state. 3. test the downlink and uplink UDP traffic of UE		

	4.To increase the attenuation between the UE and LCell1 and decrease the attenuation between the UE and LCell2 to trigger the UE HO from LCell1 to LCell2. The SCG update from NCell1 to NCell2 at same time as HO, record the control plane and user plane latency of SCG update. 5. To set the NCell1 and NCell2 to belong same CU and different BBU 6. To repeat the step2 to step4 7. To configure NCell1 and NCell2 belong to different CU and different BBU. 8. Do repeat test from the step2 to step4 9.Connect the network damage instrument between CU and DU interface, and configure network damage meter delay XXms, repeat step 2~6.
Expected result	1. data output: record the control plane latency of SCG update and user plane interrupt latency 2.expected results: HO performance of CU/DU separated is basically same as that of CU/DU together without network fade. The SCG update latency and user plane latency will increase and UDP throughput is no changed when network fade increase.
Note	The scrambling of transmission delay is recommended in 0~10ms.

7.9.3 Voice service

7.9.3.1 Interoperation of voice service(voice call)

Item	Inter-operation test of voice service	Sub-item	Voice call switch to VoLTE via PSHO during setup
References		Configuration	
Importance	Mandatory		
Target	To test the voice HO process in idle state		
Pre-condition	1. The hardware and software of 4G/5G base station and DUT UE1、UE2 are normal 2.5G cell has the same coverage with 4G cell, and configured voice service PSHO VoLTE 3.5G cell and LTE cell have mutual neighborhood relationship and handover parameters. 4.UE1 and UE2 is in IDLE-state after registered in 5G cell		
Test procedures	1.To make a voice call from UE1 to UE2, and record the call process information 2. DUTs return back to 5G after the call and initiates the data service, then make the call from UE1 to UE2 while data service is running, record the process flow and voice call establishment information 3. Hang up the voice call after 30s, and end the data service, observe the DUTs		
Expected result	1. UE1 and UE2 PSHO to LTE cell successfully and the VoLTE call setup successfully, and the relevant processes comfort to the according standard 2. Both UE1 and UE2 return back to 5G successfully after the call finished, data service is setup successfully in 5G, the relevant processes comfort to the		

	according standard 3. Both UE1 and UE2 fall back to LTE cell and call setup successfully, data traffic is normal, the relevant processes comfort to the according standard 4. Both UE1 and UE2 return back to 5G after the call and data service finished, the relevant processes comfort to the according standard
Note	

7.9.3.2 Interoperation of voice service (HO)

Item	Inter-operation of voice service	Sub-item	VoRN PSHO to VoLTE
References		Configuration	
Importance	Mandatory		
Target	To test the voice call HO process in connected state		
Pre-condition	1. The hardware and software of 4G/5G base station and DUT UE1、UE2 are normal. 2.5G cell has the same coverage with 4G cell, and configured VoRN PSHO to VoLTE 3.5G cell and LTE cell have mutual neighborhood relationship and handover parameters. 4.UE1 and UE2 is in IDLE-state after registered in 5G cell		
Test procedures	1.To make a voice call from UE1 to UE2, and record the call process information 2.To decrease the signal strength of 5G CELL to trigger the A2 measurement reporting, then 5G base station configure the LTE measurement to UE after receiving the measurement report Step3 To continue to decrease the signal strength of 5G cell to trigger the LTE measurement reporting from UE, 5G station determines the PSHO threshold is met and initiates the PSHO procedure. Record the following procedure and voice service establishment information. Step4 To hang up the call after 30s		
Expected result	1.The VoNR call between UE1 and UE2 is established successfully, and the relevant processes is up to the according standard 2. The A2 event measurement reporting is triggered from both UEs 3. The call is kept after the two UEs ho to LTE and the process is up to the according standard 4. UEs return to 5G cell after Call and process is up to according standard		
Note			

7.10 Key Tech of Terminal

7.10.1 SRS

7.10.1.1 SRS antenna switching

Item	Reference signal	Sub-item	SRS antenna switching
References	TS38.331	Configuration	A
Importance	Mandatory		
Target	Measure the UE SRS signal when 4 antenna switching enabled		
Pre-condition	1, Cell configured with 100MHz Carrier Bandwidth 2, The terminal connect the 5G cell with a phase shifter or channel simulator		
Test procedures	1, Set the cell configuration parameter with 100MHz carrier bandwidth, SRS resource per DL/UL switch period 2,Turn on the UE1, access to NR cell, set up the uplink UDP service 3,The base station configures the SRS ports parameter to UE 4,UE tracks the signals from the connected base station, watch the RRC reconfiguration signal 5, The base station measures the SRS signal quality 6, If multi-UE exist, the base station can configure the FDM and CDM for multi-UEs, and the wide-band SRS or narrow band SRS according to UE path loss		
Expected result	Output: L3 message signal of UE side , SRS single measurement from base station Expected result: There is SRS ports number from L3 message； RRC_ CONN_RECFG ->rrcConnectionRecoufigurationsrs-ResourceMapping ->srs-AntSwitching:tx4 The base station can correctly measure the power and SINR of the 4 ports SRS		
Note	The 4 antenna switching should be supported in both 1TX and 2TX		

7.10.2 PUCCH high power class (SA)

The UE should support PUCCH with total output power of 26dBm, two options can be chosen: 26dBm on single TX or 23dBm on each TX with 2TX enable.

7.10.2.1 PUCCH 26dBm with single TX

Item	Important feature	Sub-item	26dBm PUCCH
References		Configuration	
Importance	Mandatory		
Target	Test the SA UE about PUCCHsingle TX 26dBm output power In condition		

	with downlink peak throughput
Pre-condition	1, Cell configured with 100MHz Carrier Bandwidth ,thepercentage of UL/DL timing resource is configurable and can be set to 7:2 2,The terminal connect the 5G cell with a phase shifter or channel simulator 3, RF output connect to channel simulator
Test procedures	1, The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2, The UE connected to the cell via the channel simulator; 3,The UE starts DL UDP data service, adjust the channel attenuation, make sure of the UE PUCCH max output power is 26dBm via terminal log.
Expected result	Output: UE log shows the PUCCH output power
Note	

7.10.2.2 PUCCH 26dBm with dual TX

Item	Important feature	Sub-item	26dBm PUCCH
References		Configuration	
Importance	Mandatory		
Target	Test the SA UE about PUCCH dual TX of total 26dBm output power In condition with downlink peak throughput		
Pre-condition	1, Cell configured with 100MHz Carrier Bandwidth ,the percentage of UL/DL timing resource is configurable and can be set to 7:2 2, The terminal connect the 5G cell with a phase shifter or channel simulator 3, RF output connect to channel simulator		
Test procedures	1, The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2, The UE connected to the cell via the channel simulator; 3, The UE starts DL UDP data service, adjust the channel attenuation, make sure of the UE PUCCH max output power is 23dBm per antenna via terminal log. 4, Make sure of the antenna power via the instrument		
Expected result	Output: UE log shows the PUCCH output power		
Note			

7.10.3 PUSCH high power class (SA)

7.10.3.1 UE data service test of 23dBm

This chapter is the SA scenario, the UE transmit power is defined as NR TX output power of 23dBm, and the TX antenna number is 2, and 20dBm per TX antenna. The max output power is the sum of the two antenna output power.

Item	Important feature	Sub-item	PUSCH of high power

References		Configuration	
Importance	Mandatory		
Target	Test the SA UE about the PUSCH dual TX of total 23dBm output power In condition with uplink peak throughput		
Pre-condition	1, Cell configured with 100MHz Carrier Bandwidth ,the percentage of UL/DL timing resource is configurable and can be set to 7:2 2, Configure the UE max power of 23dBm(2TX , 20dBm per TX) 3, The terminal connect the 5G cell with a phase shifter or channel simulator 4, RF output connect to channel simulator		
Test procedures	1, The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2, The UE connected to the cell via the channel simulator; 3, The UE starts UL UDP data service, adjust the channel attenuation, make sure of the UE PUSCH max total output power is 23dBm, and 20dBm per antenna via terminal log. 4, Make sure of the antenna power via the instrument		
Expected result	Output: UE log shows the PUSCH output power		
Note			

7.10.3.2 UE data service test of 26dBm

This chapter is the SA scenario, the UE transmit power is defined as NR TX output power of 26dBm, and the TX antenna number is 2, and 23dBm per TX antenna. The max output power is the sum of the two antenna output power.

Item	Important feature	Sub-item	PUSCH of high power
References		Configuration	
Importance	Mandatory		
Target	Test the SA UE about the PUSCH dual TX of total 26dBm output power In condition with uplink peak throughput		
Pre-condition	1, Cell configured with 100MHz Carrier Bandwidth ,the percentage of UL/DL timing resource is configurable and can be set to 7:2 2, Configure the UE max power of 26dBm(2TX , 23dBm per TX) 3, The terminal connect the 5G cell with a phase shifter or channel simulator 4, RF output connect to channel simulator		
Test procedures	1, The cell works normally, the percentage of DL timing resource is recommended to 70%, and the percentage of UL timing resource is around 30%; 2, The UE connected to the cell via the channel simulator; 3, The UE starts UL UDP data service, adjust the channel attenuation, make sure of the UE PUSCH max total output power is 26dBm, and 23dBm per antenna via terminal log. 4, Make sure of the antenna power via the instrument		

Expected result	Output: UE log shows the PUSCH output power
Note	