अनंतिम टेस्ट गाइड
टीईसी २१०६१:२०२५

PROVISIONAL TEST GUIDE
TEC 21061:2025

जीनोडबी
gNodeB

(**जीआर सं**: टीईसी २१०६०:२०२२)
(**GR No.:** TEC 21060:2022)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र
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TELECOMMUNICATION ENGINEERING CENTRE
DEPARTMENT OF TELECOMMUNICATIONS, MINISTRY OF COMMUNICATIONS
GOVERNMENT OF INDIA, KHURSHIDLAL BHAWAN, JANPATH, NEW DELHI-110001, INDIA
www.tec.gov.in

Release 1: September, 2025

FORWARD

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Issue of Standards for Generic Requirements (GR), Interface Requirements (IR) and Service Requirements (SR) as well as Test guides for Telecom Products and Services;
- Issue of Technical regulations in the form of essential Requirements (ER);
- Field evaluation of products and Systems;
- National Fundamental Plans;
- Support to DOT on technology issues;
- Testing & Certification of Telecom products; and
- Designation of Conformance Assessment Bodies (CABs) for testing.

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This document enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of gNodeB as per GR/IR/Applicant's spec. No GR No.: TEC: 21060:2022.

CONTENTS

A. HISTORY SHEET

Sl. No.	Standard No./Document No.	Equipment/Interface	Issue
1.	Provisional TEST GUIDE TEC 21061:2025	gNodeB	Release 1

B. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of gNodeB as per GR/IR/Applicant's spec. No GR No.: TEC: 21060:2022

C. General information:

Sn.	**General Information** [	**Details** *(to be filled by testing team)*	
1	Name and Address of the Applicant		
2	Date of Registration		
3	Name and No. of GR/IR/Applicant's Spec. against which the approval sought		
4	Details of Equipment		
	Type of Equipment	Model No.	Serial No.
(i)			
(ii)			
5	Any other relevant Information: -		

D. Testing team: *(to be filled by testing team)*

Sno.	Name	Designation	Organization	Signature
1.				
2.				

E. List of the Test Instruments:

Sno.	Name of the test instrument	Make /Model *(to be filled by testing team)*	Validity of calibration *(to be filled by testing team)*
1			dd/mm/yyy
2			
3			
4			
5			
6			
7			
8			

Note- The test instruments used for testing of EUT like Core/Core emulator, UE/UE Emulator, eNodeB/gNodeB etc. should have-

1. A valid calibration certificate OR
2. any other test certificate (like through TEC, ILAC/NABL labs etc.) OR
3. in case (1) and (2) above are negative, it may be checked that the test instruments are already being used/deployed in some functional network.

F. Equipment Configuration Offered: (to be filled by testing team)

(a) <Equipment/product name> Configuration:

S.No.	Item	Details	Remarks

Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product

(b) <Other equipment name> Configuration:

S.No.	Item	Details	Remarks

Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product

G. Equipment/System Manuals: *(to be filled by testing team)*

Availability of Maintenance manuals, Installation manual, Repair manual & User Manual etc. **(Y/N)**

H. Clause-wise Test Type and Test No.:

Clause No	Clause Description	Type of Test / Test No. etc. *
1.1	**Scope** This document contains the Standard for Generic Requirements (GR) for New Radio (NR) based gNB for deployment in the Indian mobile communication network. The NG-RAN (Next Generation Radio Access Network) consists of gNBs, providing the NR (air interface) user plane (PDCP/RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The document specifies Technical Requirements, General Requirements, Features and Functionality of the gNB System including NSA (Non-Stand Alone) and SA (Stand Alone) deployments. This GR is applicable for either FDD or TDD or both.	Submit datasheet of gNodeB 2. Network architecture indicating supported interfaces 3. Submit undertaking for type of gNodeB, viz., Macro, Micro, Pico, home gNodeB.
2.	**gNodeB**	
2.1	**Product Description**	
2.1.1	gNodeB (or gNB in short) is the NG-RAN node in the 5G network architecture that is responsible for radio transmission to and	Submit network diagram depicting placement of gNodeB in the system.

	reception from UEs in one or more cells. The NG-RAN consists of gNB (serving NR devices using the NR user-plane and control-plane protocols) and ng-eNodeB (serving LTE devices using the LTE user-plane and control-plane protocols), providing the E-UTRA user plane (PDCP/RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The gNB is connected to the 5G Core network by means of NG interface in standalone mode. The gNBs are also connected by means of the S1 interface to the EPC (Evolved Packet Core) in non-standalone mode. The gNBs may be interconnected with each other by means of the Xn interface in standalone mode and X2 interface in case of non-standalone mode..	2. Submit design architecture and functional split of the gNodeB: Subsystems along with their functional description, Hardware Functional Blocks, Sub-units
2.1.2	As mentioned above, the NG-RAN can connect not only to a 5G Core Network but also to the EPC (LTE Core Network). As such, the following deployment options have been considered:	Undertaking

a.	Non-Stand Alone" (NSA) Non-Standalone architecture, where the 5G Radio Access Network (RAN) and its New Radio (NR) interface is used in conjunction with the existing LTE and EPC infrastructure Core Network (respectively 4G Radio and 4G Core). The NSA is also known as "E-UTRA-NR Dual Connectivity (EN-DC)". The NSA offers dual connectivity, via both the 4G RAN (E-UTRA) and the 5G RAN (NR). It is thus also called "EN-DC", for "E-UTRA and NR Dual Connectivity". In EN-DC, the 4G's eNB is the Master Node (MN) while the 5G's en-gNB is the Secondary Node (SN).	Undertaking
b.	Stand-Alone" (SA) Standalone architecture, where the NR is connected to the 5G Core Network. The NR base station (logical node "gNB") connects with each other via the Xn interface, and the Access Network (called the "NG-RAN for SA architecture") connects to the 5GC network using the NG interface.	Undertaking
2.1.3	The gNB (or en-gNB) is responsible for all radio-related functions to and from UEs in one	Explanatory Only

	or several cells, for example radio resource management, admission control, connection establishment, routing of user-plane data to the UPF and control-plane information to the AMF, and quality-of-service (QoS) flow management. It is important to note that a gNB is a logical node and not a physical implementation. *(Note: One common implementation of a gNB is a three-sector site, where a base station is handling transmissions in three cells, although other implementations can be found as well, such as one baseband processing unit (Consisting of central unit/CU, distributed unit/DU or both) to which several remote radio units (Remote Radio Head/RRH) or Active Array Unit/AAU) are connected.)*	
2.1.4	The gNB design can be based on a distributed architecture or integrated architecture. This GR defines gNB functionality independent of implementation architecture. i) Integrated Architecture: Integrated architecture	Explanatory Only

	consists of single unit implementing all necessary functions of baseband subsystem and radio subsystem. ii) Distributed Architecture: The distributed architecture comprised of baseband unit (BBU) collocated with gNB Layer 2, Layer 3 functionality or split into DU and CU functionality and Remote radio head (RRH) connected via a CPRI/eCPRI or OBSAI interface or another interface. This also covers centralized/cloud RAN (C-RAN)/ vRAN/ O-RAN based architecture.	
2.2	**Interfaces**	Explanatory Only

2.2.1	Uu interface: The interface between the gNB and the device is known as the Uu interface. The scenario of a device connected to two cells is known as dual connectivity and is an important concept for NSA. In Option 3 NSA, the NR based secondary cell only handles user plane traffic and the control and user plane signalling is done through the LTE eNodeB.	GR_TSTP_2.2.1
2.2.2	Xn interface: Connecting gNBs to each other, is mainly used to support dual connectivity and lossless active-state mobility between cells by means of packet forwarding. It may also be used for multi-cell Radio Resource Management (RRM) functions.	GR_TSTP_2.2.2

2.2.3	F1 interface (As per tenderer requirement): There is also a standardized way to split the gNB into two parts, a central unit (gNB-CU) and one or more distributed units (gNB-DU) using the F1 interface. In case of a split gNB, the RRC, PDCP, and SDAP protocols, described in more detail later, reside in the gNB-CU and the remaining protocol entities (RLC, MAC, PHY) in the gNB-DU.	GR_TSTP_2.2.3
2.3	**gNB classes** 3GPP Specification (TS 38.104) defines the following gNB classes 1. Wide Area Base Station 2. Medium Range Base Station 3. Local Area Base Station Each class of gNB has different requirements in terms of output power, transmitter characteristics and receiver performance.	Submit undertaking stating class of gNodeB under testing: Wide Area, Medium Range, Local Area or Home gNodeB. Submit undertaking of maximum output power per port per carrier.

<table>
<tr>
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<tr><th>BS Class</th><th>Derivation from</th><th>Pout</th><th>Type</th><th>No of RRC connected users</th></tr>
<tr><td>Wide Area BS</td><td>Macro cell scenario</td><td>>38dBm(BS type 1-C, 1-H) >47dBm (BS type 1-O)</td><td>Type 1: Macro</td><td>For FR1: >=600 UE per cell (For FR2 >=200 UE per cell)</td></tr>
<tr><td>Medium Range BS</td><td>Micro cell scenario</td><td>≤38 dBm (BS type 1-C, 1-H) <47dBm (BS type 1-O)</td><td>Type 2: Micro</td><td>>=32 UE per cell</td></tr>
<tr><td>Local Area BS</td><td>Pico cell scenario</td><td>≤24 dBm (BS type 1-C, 1-H) <33dBm (BS type 1-O)</td><td>Type 3: Pico</td><td>>=8 UE per cell</td></tr>
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<tr>
<td>2.4</td>
<td>F1 interface - Split between DU and CU
(As per tenderer requirement)
The interface is between gNB-CU and gNB-DU. It is also separated into F1-C and F1-U based on control plane and user plane functionalities.</td>
<td>Submit document defining whether it is separated into F1-C and F1-U based on control plane and user plane functionalities.</td>
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<tr>
<td>2.4.1</td>
<td>-F1 interface defines inter-connection of a gNB-CU and a gNB-DU supplied by different manufacturers.

-It supports control plane and user plane separation.

-It separates Radio Network Layer and Transport Network Layer.

-F1 interface enables exchange of UE associated information and non-UE associated information.</td>
<td>Submit document defining F1 interface Interconnection of a gNB-CU and a gNB-DU supplied by different manufactures.</td>
</tr>
</table>

3.	**Functional Requirements** These Software functionalities requirements are applicable and cover for Low-band (NSA/SA), Mid-band (NSA/SA) and High-band (NSA/SA), until explicitly highlighted.	Explanatory Only
3.1	Radio Resource Control/ Radio Resource Management (RRC/RRM) Functionality	Explanatory Only
i).	Cell control and MME/AMF support: ng-eNB/gNB owns and controls the radio resources of its own cell or cells. Cell resources as requested by and granted to MME/AMFs shall be provided in an ordered fashion.	GR_TSTP_3.1_A
ii).	Measurements and reporting: The gNB shall support Event-triggered measurement reporting.	GR_TSTP_3.1_B
iii).	The gNB shall support System Information Broadcast (SIB).	GR_TSTP_3.1_C
iv).	RRC messages shall be transmitted to the device using signalling radio bearers (SRBs) including SRB0, SRB1and SRB2. additionally support SRB3 when UE in (NG)EN-DC or NR-DC.	GR_TSTP_3.1_D

v).	gNB shall support RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.	GR_TSTP_3.1_E
3.2	Service Data Adaptation Protocol (SDAP) for SA	Explanatory Only
i).	QoS Bearers: SDAP shall be responsible for mapping QoS bearers to radio bearers according to their quality-of-service requirements.	GR_TSTP_3.2_A
ii).	If the gNB is connected to the EPC (as in NSA), the SDAP is not required.	GR_TSTP_3.2_B
3.3	Packet Data Convergence Protocol (PDCP)	Explanatory Only
i).	Control and User Plane security: gNB shall support integrity protection and ciphering of RRC signalling.	GR_TSTP_3.3_A
ii).	RoHC shall be supported.	GR_TSTP_3.3_B
iii).	PDCP shall also handle retransmissions, in-sequence delivery, and duplicate removal in the case of handover.	GR_TSTP_3.3_C

iv).	For 5G NSA deployment: The gNB shall store one-to-one mapping between data radio bearers and S1 bearers to create the binding between a data radio bearer and an S1 bearer in both the uplink and downlink to enable Quality of Service (QoS) enforcement.	GR_TSTP_3.3_D
v).	The gNB shall perform data recovery.	GR_TSTP_3.3_E
vi).	For dual connectivity with split bearers, PDCP can provide routing and duplication. Duplication and transmission from different cells can be used to provide diversity for services requiring very high reliability. There is one PDCP entity per radio bearer configured for a device. (As per tenderer requirement)	GR_TSTP_3.3_F
3.4	Radio Link Control (RLC)	Explanatory Only
i).	RLC shall be responsible for segmentation and retransmission handling. The RLC shall provide services to the PDCP in the form of RLC channels. There shall be one RLC entity per RLC channel (and hence per radio bearer) configured for a device.	GR_TSTP_3.4_A

ii).	Segmentation/Concatenation: RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.	GR_TSTP_3.4_B
3.5	Medium Access Control (MAC)	Explanatory Only
i).	MAC shall handle multiplexing of logical channels, hybrid-ARQ retransmissions, and dynamic resource allocation (scheduling) and scheduling-related functions.	GR_TSTP_3.5_A
ii).	The MAC shall provide services to the RLC in the form of logical channels.	GR_TSTP_3.5_B
iii).	From the physical layer, the MAC layer shall use the services in the form of transport channels. The gNB shall support link adaptation and power control.	GR_TSTP_3.5_C
iv).	The gNB shall support Contention based Random Access (RA) procedure.	GR_TSTP_3.5_D
3.6	Physical Layer	Explanatory Only
i).	gNB shall support OFDM modulation in both DL and UL. When DFT-precoding is used, uplink transmissions are restricted to a single layer per UE only while uplink transmissions with multiple	GR_TSTP_3.6_A

	layers per UE are possible with OFDM.	
ii).	gNB shall support DFT-s-OFDM with pi/2 BPSK filtering (LMLC) in Uplink. (As per tenderer requirement)	GR_TSTP_3.6_B
iii).	gNB shall support Synchronization Signal Block (SSB).	GR_TSTP_3.6_C
iv).	The gNB shall support the following physical channel types: a. Physical Downlink Shared Channel (PDSCH) : Main physical channel used for unicast data transmission, but also for transmission of, for example, paging information, random-access response messages, and delivery of parts of the system information. b. Physical Broadcast Channel (PBCH): Carries system information, required by the device to access the network. c. Physical Downlink Control Channel (PDCCH): Used for	GR_TSTP_3.6_D1 GR_TSTP_3.6_D2 GR_TSTP_3.6_D3 GR_TSTP_3.6_D4 GR_TSTP_3.6_D5 GR_TSTP_3.6_D6

	downlink control information, mainly scheduling decisions, required for reception of PDSCH, and for scheduling grants enabling transmission on the PUSCH. d. Physical Uplink Shared Channel (PUSCH): the uplink counterpart to the PDSCH. There is at most one PUSCH per uplink component carrier per device. e. Physical Uplink Control Channel (PUCCH): Used by the device to send hybrid-ARQ acknowledgments, indicating to the gNB whether the downlink transport block(s) was successfully received or not, to send channel-state reports and for requesting resources to transmit uplink data upon. f. Physical Random-Access Channel (PRACH): Used for random access. The gNB shall support Contention based and Contention free Random Access (CBRA, CFRA) procedure.	

v).	The gNB shall support UL Power Allocation for data channels. The gNB shall support both the open-loop power control and the closed-loop power control of the UE. (As per tenderer requirement)	GR_TSTP_3.6_E
vi).	The gNB shall be able to communicate timing advance value to UE.	GR_TSTP_3.6_F
vii).	The gNB shall support DL Power Allocation for data channels.	GR_TSTP_3.6_G
viii).	The gNB shall support DL Power setting for data channels.	GR_TSTP_3.6_H
ix).	The gNB shall support DL Power setting for signalling and control channels.	GR_TSTP_3.6_I
x).	The gNB shall support Normal cyclic prefix.	GR_TSTP_3.6_J
xi).	The gNB shall support Uplink and downlink demodulation reference signal.	GR_TSTP_3.6_K
xii).	The gNB shall support UL & DL Link Adaptation.	GR_TSTP_3.6_L
xiii).	The gNB shall support Short Buffer Status Report (BSR) and Long BSR.	GR_TSTP_3.6_M
xiv).	Support for Discontinuous Reception (DRX) to enable reasonable UE battery consumption.	GR_TSTP_3.6_N

xv).	The gNB shall support at least one Static TDD Mode with single Bandwidth Part.	GR_TSTP_3.6_O
3.6.1	NR Physical Layers – Low Band(LB)(<1GHz)	Explanatory Only
i).	The gNB shall support Cell Carrier Bandwidth of 5 MHz, 10 MHz, 15 MHz, 20 MHz on Low-Band.	GR_TSTP_3.6.1_A
ii).	The gNB shall support 15 kHz subcarrier spacing on Low-Band.	GR_TSTP_3.6.1_B
iii).	The gNB shall support Modulation schemes up to 256 QAM in downlink and uplink on Low-Band.	GR_TSTP_3.6.1_C
3.6.2	NR Physical Layers – Mid Band (MB)(1GHz- 6GHz)	Explanatory Only
i).	The gNB shall support 15kHz, 30 kHz and/ or 60 kHz subcarrier spacing on Mid-Band.	GR_TSTP_3.6.2_A
ii).	The gNB shall support Cell Carrier Bandwidth from a sub set of 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100MHz on Mid-Band. (Subject to valid combinations of SCS , Cell Carrier Bandwidth and cyclic prefix as specified by 3GPP)	GR_TSTP_3.6.2_B

iii).	The gNB shall support Modulation schemes up to 256 QAM in downlink and uplink on Mid-Band.	GR_TSTP_3.6.2_C
3.6.3	NR Physical Layers – High Band (HB)(24 GHz-52.5GHz)	Explanatory Only
i).	The gNB shall support 60kHz and 120 kHz subcarrier spacing on High-Band.	GR_TSTP_3.6.3_A
ii).	The gNB shall support Cell Carrier Bandwidth from a sub set of 50, 100, 200, 400MHz on High-Band. (Subject to valid combinations of SCS, Cell Carrier Bandwidth and cyclic prefix as specified by 3GPP)	GR_TSTP_3.6.3_B
iii).	The gNB shall support Modulation schemes up to 64 QAM in downlink and uplink on High-Band.	GR_TSTP_3.6.3_C
3.7	Interfaces	Explanatory Only
3.7.1	Interface between RAN and Device/ UE	
i).	gNB shall support Uu interface towards Device/UE.	GR_TSTP_3.7.1_A
3.7.2	Interface between RAN and Core	

i).	NR Standalone Deployment: The gNB is connected to the 5G Core Network (5GC) through the NG interface.	GR_TSTP_3.7.2_A
ii).	NR Non-Standalone (EN-DC) Deployment: The gNB is connected to the EPC through the S1 interface.	GR_TSTP_3.7.2_B
3.7.3	Interface between RAN and other RAN	Explanatory Only
i).	NR Standalone Deployment: The interconnection of gNBs is managed over the Xn interface.	GR_TSTP_3.7.3_A
ii).	NR Non-Standalone (EN-DC) Deployment: The interconnection of gNBs with eNodeBs is managed over the X2 interface.	GR_TSTP_3.7.3_B
3.8	Synchronization	Explanatory Only
i).	The gNB shall support Frequency Synchronization.	GR_TSTP_3.8_A
ii).	The gNB shall support Time and Phase Synchronization.	GR_TSTP_3.8_B
iii).	i) The gNB shall support at least one of following synchronization option	GR_TSTP_3.8_C

	a. GNSS (GPS or NAVIC) (to be specified by tenderer) b. IEEE 1588 V2 c. Sync E	
iv).	The gNB shall support at least 48 hr hold over mode in case of frequency synchronization loss and at least 1 hr hold over mode in case of phase synchronization loss.	GR_TSTP_3.8_D
3.9	MIMO requirements & Modulation Schemes (The tenderer may specify specific sub-clauses as per their requirements)	Explanatory Only
i).	The gNB shall support up to 4 DL MIMO layers in Low Band (as per tenderer requirement depending on deployment scenario)	GR_TSTP_3.9_A
ii).	The gNB shall support Downlink Single-User MIMO in Mid Band. The minimum configuration of Downlink Single-User MIMO may be specified by the tenderer.	GR_TSTP_3.9_B

iii).	The gNB shall support Downlink Multi-User MIMO in Mid Band to support minimum 8 layers;(applicable if tenderer requires 32T32R or higher)	GR_TSTP_3.9_C
iv).	The gNB shall support Uplink Multi-User MIMO in Mid Band to support minimum 4-layer UL MU-MIMO for PUSCH transmission; (applicable if tenderer requires 32T32R or higher)	GR_TSTP_3.9_D
v).	The gNB shall support DL modulation schemes: BPSK, QPSK, 16QAM, 64QAM and 256QAM	GR_TSTP_3.9_E
vi).	The gNB shall support UL modulation schemes: π/2-BPSK (As per tenderer requirement), QPSK, 16QAM, 64QAM and 256QAM (Low/Mid band)	GR_TSTP_3.9_F
3.10	5G QoS Requirements	Explanatory Only
i).	The gNB shall support Quality-of-Service Class Identifiers (QCIs) for NR-NSA mode (EN-DC mode).	GR_TSTP_3.10_A

ii).	The gNB shall support 5QI (5G QoS Identifiers) for NR-Standalone mode as per 3GPP TS 23.501 Table 5.7.4-1.	GR_TSTP_3.10_B
iii).	The gNB shall support multiple data radio bearers (DRBs).	GR_TSTP_3.10_C
iv).	The gNB shall support dynamic addition and deletion of dedicated bearers.	GR_TSTP_3.10_D
v).	The gNB shall support both UE initiated as well as Network Initiated dedicated bearer creation.	GR_TSTP_3.10_E
vi).	The gNB scheduler shall support prioritization of traffic in downlink as per the QCI/5QI priority value.	GR_TSTP_3.10_F
3.11	Mobility control	Explanatory Only
i).	Idle mode mobility (Re-selection): a. The gNB shall support NR intra-frequency cell re-selection. b. The gNB shall support NR inter-frequency cell re-selection. c. The gNB shall support IRAT inter-frequency cell re-selection towards EUTRAN.	GR_TSTP_3.11_A1 GR_TSTP_3.11_A2 GR_TSTP_3.11_A3

	(As per tenderer requirement in view of deployment)	
ii).	Connected mode mobility (Handover): a. The gNB shall support Connected mode mobility within NR frequency (Intra-frequency Handover). b. The gNB shall support Connected mode mobility within or between gNB (Inter-frequency Handover including same band and different band). c. The gNB shall support Connected mode mobility towards E-UTRAN in the form of release with redirection towards E-UTRAN frequency (only applicable to SA). (As per tenderer requirement in view of deployment) d. The gNB shall support interworking between FR1/FR2, including session continuity. e. The gNB shall support PS Handover to LTE for SA	GR_TSTP_3.11_B1 GR_TSTP_3.11_B2 GR_TSTP_3.11_B3 GR_TSTP_3.11_B4 GR_TSTP_3.11_B5 GR_TSTP_3.11_B6 GR_TSTP_3.11_B7 GR_TSTP_3.11_B8

	mode (In NSA Mobility control is governed by anchor LTE cell). (As per tenderer requirement in view of deployment) f. The gNB shall support inter technology handover i.e; FDD to TDD and vice versa. g. The gNB shall support X2(NSA) or Xn(SA) handover. h. The gNB shall support S1(NSA) or NG(SA) handover.	
iii).	The gNB shall support access class barring parameters	GR_TSTP_3.11_C
iv).	The gNB shall support inter PLMN reselection	GR_TSTP_3.11_D
v).	The gNB shall support “Connection re-establishment” procedure.	GR_TSTP_3.11_E
vi).	The system shall support data forwarding at intra-LTE/NR handover, both over X2/ Xn and S1 interfaces based on NSA or SA.	GR_TSTP_3.11_F

3.12	Fallback Support [For NSA mode, LTE anchor controls the voice call as normal LTE procedure] (As per tenderer requirement in view of deployment)	Explanatory Only
i).	The gNB shall support VoNR to VoLTE handover for Standalone mode.	GR_TSTP_3.12_A
ii).	The gNB shall support EPS Fallback from NR to LTE for IMS Voice in Standalone mode	GR_TSTP_3.12_B
iii).	If the NR-Standalone RAN is not able to provide voice services, then initiated or received voice calls shall be supported by moving the UE from NR RAN to LTE RAN to provide a seamless voice service.	GR_TSTP_3.12_C
iv).	The gNB shall support measurement-based release with redirection and measurement-based handover, to perform EPS fallback from NR to LTE for voice service in Standalone mode.	GR_TSTP_3.12_D
v).	If EPS fallback is opted for voice services, the gNB shall be able to handle Emergency Calls during Fallback. The gNB shall offer the	GR_TSTP_3.12_E

	operator the possibility to apply separate priorities for Fallback of emergency calls as compared to Fallback for ordinary voice calls in Standalone mode.	
3.13	Voice over NR (VoNR) (As per tenderer requirement in view of deployment)	Explanatory Only
i).	The gNB shall support Voice over NR (VoNR) functionality for Standalone mode	GR_TSTP_3.13_A
ii).	The gNB shall support Basic Voice over NR, which provides traffic functions and protocol procedures for establishing, maintaining, and releasing a voice call in NR Standalone mode.	GR_TSTP_3.13_B
iii).	The gNB shall support Voice over NR calls, which allow the handling of voice traffic directly in NR RAN instead of EPS Fallback to LTE for Standalone mode.	GR_TSTP_3.13_C
iv).	The gNB shall support intra frequency handover for voice services to be maintained in NR RAN for Standalone mode.	GR_TSTP_3.13_D
v).	The gNB shall support IP header compression	GR_TSTP_3.13_E

3.14	Carrier Aggregation (Optional – The tenderer may specify specific sub-clauses as per their requirements)	Explanatory Only
i).	The System shall support LTE-NR Downlink Carrier Aggregation for EN-DC mode	GR_TSTP_3.14_A
ii).	The System shall support LTE-NR Uplink Carrier Aggregation for EN-DC mode.	GR_TSTP_3.14_B
iii).	The gNB shall support NR DL Carrier Aggregation up to 2CC for Low-Band and Mid-Bands.	GR_TSTP_3.14_C
iv).	The gNB shall support up to 8CC DL Carrier Aggregation for High Bands, as per tendering authority requirements	GR_TSTP_3.14_D
v).	The gNB shall support Inter-Band CA between various standardized FDD bands (not applicable for TDD system)	GR_TSTP_3.14_E
vi).	The gNB shall support Intra-Band contiguous and non-contiguous CA	GR_TSTP_3.14_F
vii).	The gNB shall support CA between FDD and TDD	GR_TSTP_3.14_G

viii).	The gNB shall support Carrier Aggregation combinations for 3CC a. 1xFDD+2xTDD with FDD or TDD as PCell b. 2xFDD+ 1xTDD with FDD or TDD as PCell c. 3xFDD with FDD as PCell	GR_TSTP_3.14_H
ix).	The gNB shall support Uplink Carrier Aggregation	GR_TSTP_3.14_I
x).	The gNB shall support Dynamic selection of Secondary frequency when having multiple cell carriers for CA	GR_TSTP_3.14_J
xi).	The gNB shall consider CA users during Load Balancing to avoid losing CA capabilities and to avoid congestion because of CA activation.	GR_TSTP_3.14_K
3.15	Dual Connectivity (As per tenderer requirement in view of deployment)	Explanatory Only
i).	The system shall support LTE-NR Dual Connectivity to enable support for EN-DC in the gNB	GR_TSTP_3.15_A
ii).	The gNB shall support UE to be served simultaneously by multiple component carriers from 2 cell	GR_TSTP_3.15_B

	groups (Master eNodeB and Secondary gNB) scheduling resources independently for NR-NSA mode.	
iii).	Band combinations for end-to-end performance, standardization and ecosystem may be as per tenderer requirements.	GR_TSTP_3.15_C
iv).	System shall support periodic NR search thereby providing the UE multiple chances to establish EN-DC connection.	GR_TSTP_3.15_D
v).	EN-DC-Triggered Handover at incoming handover may be as per tenderer requirements.	GR_TSTP_3.15_E
vi).	Carrier aggregation features available to achieve high capacity may be as per tenderer requirements.	GR_TSTP_3.15_F
vii).	The LTE-NR Dual Connectivity system shall support addition, modification, and release of resources allocated in the Secondary Node for the EN-DC-capable UE.	GR_TSTP_3.15_G
3.16	Location Based Services	Explanatory Only

i).	System shall support Location Services for NR Standalone mode.	GR_TSTP_3.16_A
ii).	System shall support receiving a positioning request for a specific device from the AMF for NR Standalone mode.	GR_TSTP_3.16_B
3.17	Energy Efficiency & Power Savings (Optional – The tenderer may specify specific sub-clauses as per their requirements)	Explanatory Only
i).	gNB shall be power efficient and implement power saving functionality	GR_TSTP_3.17_A
ii).	The gNB shall support Energy Metering to provide a standardized way to observe power consumption and energy consumption measurements on a node or parts of a node.	GR_TSTP_3.17_B
iii).	The gNB shall support Micro Sleep Transmission, which reduces energy consumption by turning off certain radio hardware components when there is no traffic.	GR_TSTP_3.17_C

iv).	The gNB shall support discontinuous transmission (DTX) on downlink to save energy during low traffic.	GR_TSTP_3.17_D
v).	The gNB shall automatically enables and disables the main power amplifier (PA) in the radio-unit (as per tenderer requirements) The PA is turned off in the following cases: a. When no PDSCH traffic is scheduled on a subframe b. During symbols that do not carry mandatory information	GR_TSTP_3.17_E
vi).	The system shall support decrease of UE battery consumption by typical traffic patterns and reduces the risk of overheating.	GR_TSTP_3.17_F
vii).	The system shall support long cycle Discontinuous Reception (C-DRX)	GR_TSTP_3.17_G
3.18	Self-Organizing Network	Explanatory Only
i).	System shall provide support for Autointegration.	GR_TSTP_3.18_A

ii).	System shall provide support for Automatic Neighbour Relations or provide suitable API support for Automatic Neighbour Relations.	GR_TSTP_3.18_B
iii).	System shall provide suitable API support for minimization of drive test in NSA mode of operation. (Optional - As per tenderer requirement)	GR_TSTP_3.18_C
iv).	System shall provide support for autoconfiguration.	GR_TSTP_3.18_D
3.19	NR Public Warning System	Explanatory Only
i).	The gNB shall support Public Warning System (PWS).	GR_TSTP_3.19_A
ii).	The gNB shall supports the ETWS and CMAS (also known as WEA) cell broadcast functions.	GR_TSTP_3.19_B
3.20	**RAN Slicing** (Applicable for SA except point vi) which is applicable for NSA) / (Optional – The tenderer may specify specific sub-clauses as per their requirements)	Explanatory Only
i).	The gNB shall support network slices in NR RAN.	GR_TSTP_3.20_A
ii).	The gNB shall support slice-aware Quality of Service (QoS)	GR_TSTP_3.20_B

	mapping framework and support QoS differentiation within a slice.	
iii).	The gNB shall support Slice-aware NG-based handover.	GR_TSTP_3.20_C
iv).	The gNB shall support S-NSSAI (Single Network Slice Selection Assistance Information) of neighbouring gNB (received by the Xn interface) in order to avoid unnecessarily initiating NG-based handovers.	GR_TSTP_3.20_D
v).	The RAN Slicing Framework feature enables the mapping of PDU sessions to resource partitions based on PLMN and S-NSSAI.	GR_TSTP_3.20_E
vi).	For NSA mode: The EN-DC RAN Slicing extends QoS differentiation and dynamically sharing spectral resources to be applicable to EN-DC traffic.	GR_TSTP_3.20_F
3.21	RAN Sharing (Optional – The tenderer may specify specific sub-clauses as per their requirements)	Explanatory Only

i).	The gNB shall support MORAN (Multi-Operator RAN) functionality for both NR NSA and NR SA modes, which allows two operators to share the same Radio unit with dedicated spectrum per operator.	GR_TSTP_3.21_A
ii).	The gNB shall support MOCN (Multi-Operator Core Network) functionality, which allows shared NR RAN with Spectrum sharing for NR Cell among up to 12 operators for NR-SA mode.	GR_TSTP_3.21_B
iii).	The gNB shall support MOCN (Multi-Operator Core Network) functionality, which allows shared NR RAN with Spectrum sharing for NR Cell among up to 6 operators for NR-NSA (EN-DC) mode.	GR_TSTP_3.21_C
3.22	Satellite based backhaul system support (Optional – The tenderer may specify as per their requirements)	GR_TSTP_3.22_A GR_TSTP_3.22_B
3.23	Operating Frequency & Channel bandwidth	Explanatory Only
i).	Operating frequency and Channel bandwidth shall be as per the	GR_TSTP_3.23_A

	applicable National Frequency Allocation Plan.	
ii).	The Base Station shall be capable of operating in at least one of the frequency bands as per the applicable National Frequency Allocation Plan.	GR_TSTP_3.23_B
3.24	Transmitter Specification (Conducted)	Explanatory Only
01	Base station output power	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.2
02	RE Power control dynamic range	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.3.2
03	Total Power dynamic range	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.3.3
04	Transmitter OFF power	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.4
05	Frequency Error	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.5.1

06	Error Vector Magnitude	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.5.2
07	Time alignment error	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.5.3
08	Occupied Bandwidth	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.6.2
09	Adjacent Channel Leakage Power Ratio (ACLR)	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.6.3
10	Operating band unwanted emissions	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.6.4
11	Transmitter spurious emissions	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.6.5
12	Transmitter Intermodulation	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 6.7

3.25	Transmitter Specification (Radiated)	Explanatory Only
01	OTA Base Station Output Power	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.3
02	OTA RE power control dynamic range	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.4.2
03	OTA Total power dynamic range	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.4.3
04	OTA Transmitter OFF Power	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.5
05	OTA Frequency Error	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.6.1
06	Error Vector Magnitude	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.6.2
07	OTA Time alignment Error	Test procedure and limits are defined as per

		3GPP TS 38.104 Clause 9.6.3
08	OTA Occupied Bandwidth	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.7.2
09	OTA Adjacent Channel Leakage Power Ratio (ACLR)	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.7.3
10	OTA Operating band unwanted emissions	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.7.4
11	OTA Transmitter Spurious Emission	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 9.7.5
3.26	Receiver Specification (Conducted)	Explanatory Only
01	Receiver Spurious emissions	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.6
02	Blocking	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.6

03	Receiver intermodulation	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.4.2 & 7.5
04	Adjacent Channel Selectivity (ACS) and narrow-band blocking	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.7
05	Dynamic Range	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.3
06	In-channel selectivity	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.8
07	Reference sensitivity level	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.2
3.27	Receiver Specification (Radiated)	Explanatory Only
01	OTA Receiver Spurious Emissions	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 10.7
02	OTA Blocking	Test procedure and limits are defined as per 3GPP TS 38.104 Clause

		10.6
03	OTA Receiver Intermodulation	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 10.8
04	OTA Adjacent channel selectivity	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 10.5.1
05	OTA Dynamic Range	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 10.4
06	OTA In- Channel Selectivity	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 10.9
07	OTA Reference sensitivity level	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 10.3
3.28	AAS	Undertaking
3.29	Power Requirements	Explanatory Only
i).	gNB shall support DC power supply.	GR_TSTP_3.29_A GR_TSTP_3.29_B

ii).	gNB shall support nominal voltage of -48V DC supply voltage	GR_TSTP_3.29_C GR_TSTP_3.29_D GR_TSTP_3.29_E GR_TSTP_3.29_F
iii).	Protection on Power Input Ports.	
iv).	Reverse Polarity at the DC input.	
v).	Over voltage protection at the DC input.	
vi).	DC input under voltage cut-off. Limit of under voltage shall be indicated by the vendor.	
3.30	Operation & Maintenance	Explanatory Only
i).	O&M Interface: The gNB shall include an O&M interface for debugging, troubleshooting and for providing fault, configuration and performance data to an O&M server (EMS). The O&M interface shall be Ethernet.	GR_TSTP_3.30_A
ii).	gNB shall support at least one of the following interfaces towards EMS. a. XML b. TR.069 c. SNMP d. CLI e. NETCONF/YANG	GR_TSTP_3.30_B

iii).	The gNB control software shall interact with various hardware / software entities of the gNB and provide the health status/Alarms of the entire system on the EMS.	GR_TSTP_3.30_C
iv).	The gNB shall support remote Software/firmware updates via the EMS.	GR_TSTP_3.30_D
v).	The gNB control software shall be responsible for logging and sending the log file on the network to a designated syslog server.	GR_TSTP_3.30_E
vi).	The system shall maintain a system log and core dump logs.	GR_TSTP_3.30_F
vii).	The gNB shall support both local and remote software upgrade.	GR_TSTP_3.30_G GR_TSTP_3.30_D
viii).	The gNB shall support alarms, events to OMC for visual indicators of status and fault.	GR_TSTP_3.30_H
ix).	The gNB shall have reboot and shut-down capability.	GR_TSTP_3.30_I
x).	The gNB shall support built-in power-on diagnostics and system monitoring capabilities to detect hardware failures.	GR_TSTP_3.30_J

xi).	The gNB shall support Local Maintenance Ports for any debugging and troubleshooting.	GR_TSTP_3.30_K
xii).	The system shall provide the count for the total number of UEs connected to the gNB.	GR_TSTP_3.30_L
xiii).	The gNB shall be capable of providing the system configuration data to the Management Information Base (MIB) of the system (applicable with SNMP based management only).	GR_TSTP_3.30_M
xiv).	The gNB shall have the ability to detect and report any hardware fault within the equipment.	GR_TSTP_3.30_N
xv).	The system shall provide multiple level of recovery from software and hardware faults such that the impact on system operation shall be in accordance of the severity of the faults.	GR_TSTP_3.30_O
3.31	Transport features	Explanatory Only
i).	IP Transport: a. In case IPv4 is supported, the gNB hardware and software shall support IPv4 packet formats on all	GR_TSTP_3.31_A1 GR_TSTP_3.31_A2

	Ethernet transport interfaces in compliance with IETF RFC791. b. In case IPv6 is supported, the gNB hardware shall support IPv6 packet formats on all Ethernet transport interfaces in compliance with IETF RFC2460.	
ii).	Ethernet Transport:	Explanatory only
	a. The gNB shall support the operator configurable use of VLANs compliant to IEEE802.1Q on any Ethernet interfaces.	GR_TSTP_3.31_B1
	b. The gNB shall be able to flexibly map traffic onto one or more VLANs. The default SA mapping shall be User (NG_u), Control (NG_C, Xn) and O&M (PTP, Sync, Management)	GR_TSTP_3.31_B2
	c. The transport QoS is managed at layer 3 with the DSCP field of IP packets and at layer 2 with the “PCP” bits in the Ethernet frames.	GR_TSTP_3.31_B3

	d. DSCP values that are supported in the gNodeB shall be indicated in the technical document supplied with the equipment.	Undertaking
	e. Layer 2 QoS marking shall be supported when the backbone network supporting the gNodeB is a layer 2 switched network	GR_TSTP_3.31_B4
	f. DSCP-PCP mapping shall be configurable. Default DSCP-PCP to be provided.	GR_TSTP_3.31_B5
3.32	Security IPsec in Transport	Explanatory Only
i).	gNB shall support IPSec using Encapsulating Security Payload (ESP) tunnel mode for node terminated traffic, which is compliant to RFC 4301, RFC 4303 and RFC 7296.	GR_TSTP_3.32_A
ii).	gNB shall support IPSec solution where IKEv2 must be used as	GR_TSTP_3.32_B

	control and key exchange protocol.	
iii).	gNB shall support IKE initiator mode to initiate set up of IKE session.	GR_TSTP_3.32_C
iv).	gNB shall support Anti-replay protection.	GR_TSTP_3.32_D
v).	gNB shall support at least one of ESP encryption algorithm with 128- & 256-bit key length based on ciphers AES_GCM_16, AES-CBC and AES_GMAC.	GR_TSTP_3.32_E
vi).	gNB shall support DPD (Dead Peer Detection) mechanism at IPsec that can send out DPD messages in case no ESP traffic ongoing.	GR_TSTP_3.32_F
vii).	IPSec solution shall support IPv4 and IPv6.	GR_TSTP_3.32_G
4.	**3GPP Release 16 features** The features are given in the following clauses. The tenderer may specify which features from this section need to be supported based on eco-system development and use cases.	Explanatory Only
4.1	NR-based access to unlicensed spectrum	GR_TSTP_4.1

4.2	2-step RACH for NR	GR_TSTP_4.2_A GR_TSTP_4.2_B
4.3	UE Power Saving in NR	
i).	Power Saving Techniques in CONNECTED state	GR_TSTP_4.3_A
ii).	Cross slot scheduling	GR_TSTP_4.3_B
iii).	Maximum MIMO Layer Adaptation with characterisation of the Power saving impact of DRX adaptation	GR_TSTP_4.3_C
iv).	Power Saving Techniques in idle/inactive state	GR_TSTP_4.3_D
4.4	Integrated access and backhaul for NR	GR_TSTP_4.4_A GR_TSTP_4.4_B GR_TSTP_4.4_C
4.5	Dual Connectivity (EN-DC) with 3 bands DL and 3 bands UL	GR_TSTP_4.5
4.6	NR mobility enhancements	GR_TSTP_4.6_A GR_TSTP_4.6_B
4.7	Inter-band Carrier Aggregation (a) Rel-16 NR inter-band CA/Dual Connectivity for 2	GR_TSTP_4.7_A1 GR_TSTP_4.7_A2

	bands DL with x bands UL (x=1, 2) (b) Rel-16 NR inter-band Carrier Aggregation for 3 bands DL with 1 band UL	
4.8	Add support of NR DL 256QAM for frequency range 2 (FR2)	GR_TSTP_4.8
4.9	SON and MDT support SON (Self-Organising Networks) and MDT (Minimization of Drive Tests) support for NR	GR_TSTP_4.9
4.10	Introduction of NR FDD bands with variable duplex and corresponding framework	Undertaking
4.11	Cross Link Interference handling and Remote Interference Management for NR	GR_TSTP_4.11
4.12	RF requirements for NR frequency range 1 (FR1)	GR_TSTP_4.12
4.13	NR RF requirement enhancements for frequency range 2	GR_TSTP_4.13_A GR_TSTP_4.13_B GR_TSTP_4.13_C GR_TSTP_4.13_D GR_TSTP_4.13_E GR_TSTP_4.13_F GR_TSTP_4.13_G GR_TSTP_4.13_H
4.14	NR RRM enhancement	GR_TSTP_4.14_A GR_TSTP_4.14_B

		GR_TSTP_4.14_C GR_TSTP_4.14_D GR_TSTP_4.14_E GR_TSTP_4.14_F GR_TSTP_4.14_G GR_TSTP_4.14_H GR_TSTP_4.14_I
4.15	RRM requirement for CSI-RS based L3 measurement in NR	GR_TSTP_4.15
4.16	Enhancement on MIMO for NR (NR_eMIMO)	GR_TSTP_4.16_A GR_TSTP_4.16_B GR_TSTP_4.16_C GR_TSTP_4.16_D
4.17	Rel-16 pi/2 BPSK	GR_TSTP_4.17
5.	Operational, Reliability, Quality, EMI/ EMC, Safety Requirements	Explanatory Only
5.1	System Radio Operating Environments	Explanatory Only
5.1.1	System Radio Operating Environments a. Provision shall be made for continuous testing of the system to allow both system qualities check and fault indication as a fault arises. b. In case a fault is detected requiring reloading of the	GR_TSTP_5.1.1_A GR_TSTP_5.1.1_B

	program, this shall be carried out automatically. In case of manual re-loading, it shall be possible to stop and start at any particular point in the program.	
5.1.2	Relative UE speed The targeted relative speed between the gNB and the mobile stations may be chosen from the following categories: (Applicable for Low/Mid band) a. Stationary (0 km/h) b. Pedestrian (up to 10 km/h) c. Vehicular: 10 km/h to 120 km/h d. High speed vehicular: 120 km/h to 500 km/h For High band, the targeted relative speed between the gNB and the mobile station may be up to 100 km/h.	GR_TSTP_5.1.2
5.2	System and Network Management	Explanatory Only
5.2.1	Facility shall be available for introduction of centralized maintenance control (OMC).	GR_TSTP_5.2.1
5.2.2	The maintenance spares supplied shall take into account the MTBF and MTTR	GR_TSTP_5.2.2

5.3	Diagnostic capability	Explanatory Only
5.3.1	The diagnostic capability of the system shall be such as to minimize the human efforts required. The diagnostic programs which are normally resident in the on-line program shall be indicated. Details of the off-line diagnostic programs shall be given. The procedure for invoking such programs shall be described. The procedure for consulting fault dictionary for diagnostic programs shall be made available.	GR_TSTP_5.3.1
5.3.2	The system shall provide facility for automatic restart under severe fault conditions. Where automatic restart fails to restore system sanity, facility shall be provided for manual restart of the system.	GR_TSTP_5.3.2
5.4	Environmental Test Conditions: a. Indoor gNB / Indoor BBU : Category A SD: QM-333 b. Outdoor gNB BBU & RRH : Category D SD: QM-333 and IP65 c. Antenna & Feeders : Category E as per SD: QM-333	GR_TSTP_5.4
5.5	Qualitative Requirements (QR)	Explanatory Only

5.5.1	The supplier/manufacturer shall conform to ISO 9001:2015 certifications. A quality plan describing the quality assurance system followed by the manufacturer shall be required to be submitted.	GR_TSTP_5.5.1
5.5.2	For a distributed gNB, the failure of any component/ sub-system in the system shall not result in the failure of complete system.	GR_TSTP_5.5.2
5.6	gNB Safety Requirements	Explanatory Only
1.	The equipment shall conform to IS 13252 part 1:2010- "Information Technology Equipment – Safety- Part 1: General Requirements" [equivalent to IEC 60950-1 {2005} "Information Technology Equipment –Safety- Part 1: General Requirements"] OR IEC 62368-I:2014	GR_TSTP_5.6
2.	IEC 60215 (1987) Safety requirements of radio transmitting equipment's (for Radio equipment's only)	

5.7	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time)	Explanatory Only
1.	Conducted and Radiated Emission	GR_TSTP_5.7_1
2.	Immunity to Electrostatic discharge: Contact discharge level 2 {± 4 kV}	GR_TSTP_5.7_2
3.	Immunity to Electrostatic discharge: Air discharge level 3 {± 8 kV}	GR_TSTP_5.7_3
4.	Immunity to radiated RF: a) Radio Frequency: 80 MHz to 1 GHz, Electromagnetic field: 3V/m b) Radio Frequency: 800 MHz to 960 MHz, Electromagnetic field: 10V/m Radio Frequency: 1.4 GHz to 6 GHz, Electromagnetic field: 10V/m	GR_TSTP_5.7_4
5.	Immunity to fast transients (burst): Test Level 2: a) 1 kV for AC/DC power port 0. 5 kV for signal / control / data / telecom lines.	GR_TSTP_5.7_5

6.	Immunity to surges: AC/DC ports a) 2 kV peak open circuit voltage for line to ground 1kV peak open circuit voltage for line to line	GR_TSTP_5.7_6
7.	Immunity to surges: Telecom ports a) 2 kV peak open circuit voltage for line to ground coupling. 2 kV peak open circuit voltage for line-to-line coupling.	GR_TSTP_5.7_7
8.	Immunity to conducted disturbance induced by Radio frequency fields: Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.	GR_TSTP_5.7_8
9.	Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any): Limits: - a) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e., 70% supply voltage for 500ms) b) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e.,40% supply voltage for 200ms) c) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.	GR_TSTP_5.7_9

	a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.	
10.	Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any): a) Voltage Interruption with 0% of supply for 10ms. b) Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. c) Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. d) Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. Voltage variations corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29.	GR_TSTP_5.7_10
6.	**General Requirements**	Explanatory Only
6.1	General	Explanatory Only
6.1.1	5G provides users a facility for high-speed data & voice. The system shall have facilities for automatic roaming, locating and updating mobile subscribers.	GR_TSTP_6.1.1

6.1.2	The operation of the equipment shall be in the frequency band allotted.	Undertaking
6.2	Support of Multiple Equipment Vendors as per tender requirement	Undertaking
6.2.1	The system shall support the possibility of using equipment and sub-systems of different vendors as per defined industry standards, wherever relevant.	Undertaking
6.3	Hardware	Explanatory Only
6.3.1	The system hardware shall be modular in design and shall permit growth in steps. The arrangement shall be such that failure/ deterioration of service shall not occur when implementing the growth.	Undertaking
6.3.2	Design precautions shall be taken to minimize the possibility of equipment damage arising from the insertion of an electronic package into the wrong connector or the removal of any package from any connector.	GR_TSTP_6.3.2

6.3.3	The system hardware shall not pose any problem, due to changes in date and time caused by events such as changeover of leap year etc., in the normal functioning of the system.	GR_TSTP_6.3.3
6.4	Processors	Explanatory Only
6.4.1	Provision shall be made to prevent the loss/alteration of memory contents due to power failures, improper operating procedures and the procedure for restoring the system to its normal state, etc.	GR_TSTP_6.4.1
6.5	Input-Output devices	Explanatory Only
6.5.1	The communication facilities provided for exchange of information between the elements of 5G-RAN and the maintenance and operating personnel shall include facilities for a system test, control and alarm indication at OMC.	GR_TSTP_6.5.1

6.5.2	Input / output terminals shall be capable of transmitting/ receiving characters of a subset of the ITU-T T.50 alphabet. The printing/display device shall print/display different graphic symbols for the digit zero and the capital letter O. The input/output terminal shall have the English Keyboard.	GR_TSTP_6.5.2
6.5.3	Adequate number of man-machine interfaces shall be available.	GR_TSTP_6.5.3
6.5.4	If provision is made for monitoring from a remote terminal, it shall be ensured that the data links conform to the ITU-T Recommendation Q.513. Care shall be taken that the reliability of the data links towards remote terminal does not, in any way, affect the reliability of the 5G-RAN. Special provision shall also be made for storage of failure event even when the system is unable to transmit an output message.	GR_TSTP_6.5.4
6.5.5	A suitable alarm and display system at OMC shall be provided for a continuous indication of the system status.	GR_TSTP_6.5.5

6.6	Equipment Practice	Explanatory Only
6.6.1	For a Distributed gNB, suitable test access points and displays shall be provided for facilitating maintenance. Test access points shall be located on the front side of the bay. All visual display devices shall be located in a position attracting immediate attention of the operation and maintenance personnel.	Undertaking
6.6.2	For a Distributed gNB, it shall be indicated whether printed board connectors are of edge-type or plug-and-socket type. They shall not be easily damaged during replacements and removals. The contact particulars as well as life test performance on contact resistance for each type of connector shall be supplied	Undertaking
6.6.3	All components and material used in the equipment shall be non-inflammable or in absence of it, self-extinguishable. They shall be fully tropicalised.	GR_TSTP_6.6.3
6.6.4	For a Distributed gNB, the method used for connection of permanent wiring outside the printed cards shall be indicated.	Undertaking

6.6.5	The buses, if any, shall be suitably protected against electrical and magnetic interference from neighbouring systems (like electromechanical systems, fluorescent tubes, motors, etc.).	Undertaking
6.6.6	For a Distributed gNB, the different plug-in cards shall have suitable mechanical safeguards to prevent damage due to accidental interchange of cards.	Undertaking
6.6.7	The requirement at the external interface against induced voltages and currents due to lightning, high power system, etc. shall be indicated.	Undertaking
6.6.8	The system shall provide for human isolation and protection from accidental high voltage power contact.	Undertaking
6.7	Quality Requirements	Explanatory Only

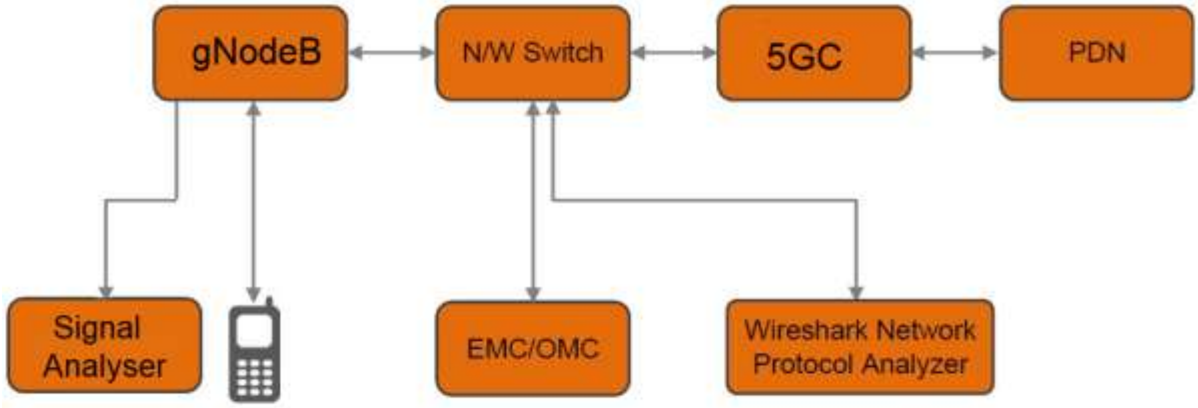
6.7.1	The components used shall be available from multiple sources with adequate qualification. Number of proprietary components used shall be minimum. List of such components shall be indicated.	GR_TSTP_6.7.1
6.7.2	All the equipment shall have a tropical finish and coated to protect against saline atmosphere.	GR_TSTP_6.7.2
6.8	Software	Explanatory Only
6.8.1	The software shall be written in a High-Level Language. The software shall be modular and structured.	Undertaking
6.8.2	The software shall include the following characteristics: a. The design of the software shall be such that the system is easy to handle both during installation and normal operations as well as during extensions.	GR_TSTP_6.8.2_A

	b. The functional modularity of the software shall permit introduction of changes wherever necessary with least impact on other modules.	Undertaking
	c. It shall be open-ended to allow addition of new features.	Undertaking
	d. Adequate flexibility shall be available to easily adopt changes in service features & facilities and technological evolution in hardware.	Undertaking
	e. The design shall be such that propagation of software faults is contained.	Undertaking
	f. Test programs shall include fault tracing for detection and localization of system faults.	GR_TSTP_6.8.2_B
6.9	Software Maintenance	Explanatory Only

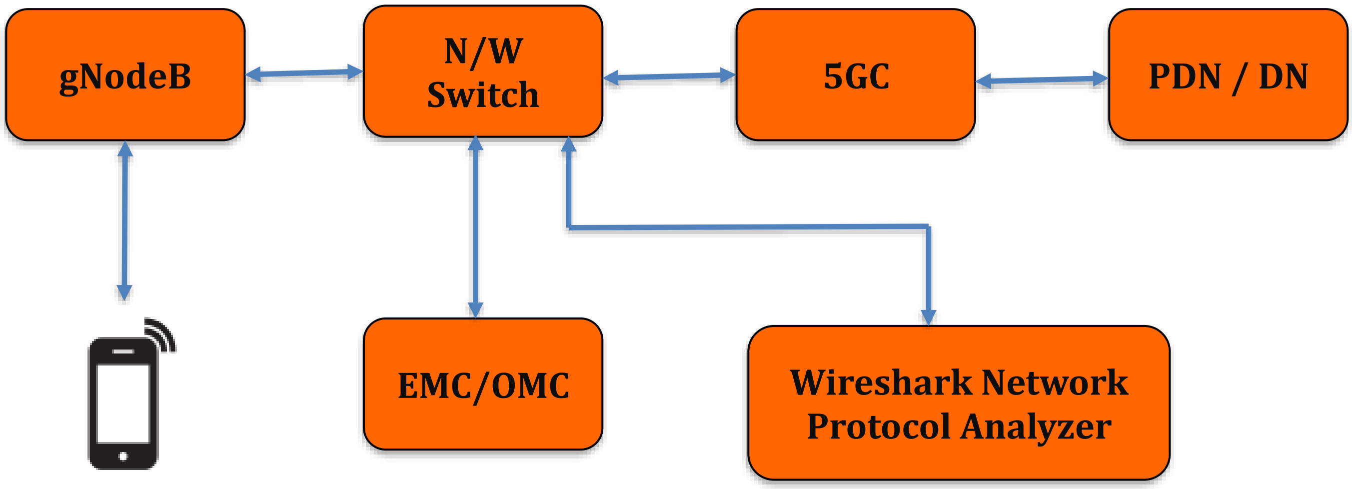
6.9.1	All software updates, for a period as specified, shall be supplied on continuing basis. These updates shall include new features and services and other maintenance updates.	Undertaking
6.9.2	Integration of software updates without posing any problem to the existing functionality shall be possible.	Undertaking
6.10	gNB DoS (Denial of Service) Attack Protection	Explanatory Only
6.10.1	The gNB shall provide the protection against DOS attack. The vendor shall describe how to protect against DOS attack in their system.	GR_TSTP_6.10.1

I. Test Setup & Procedures

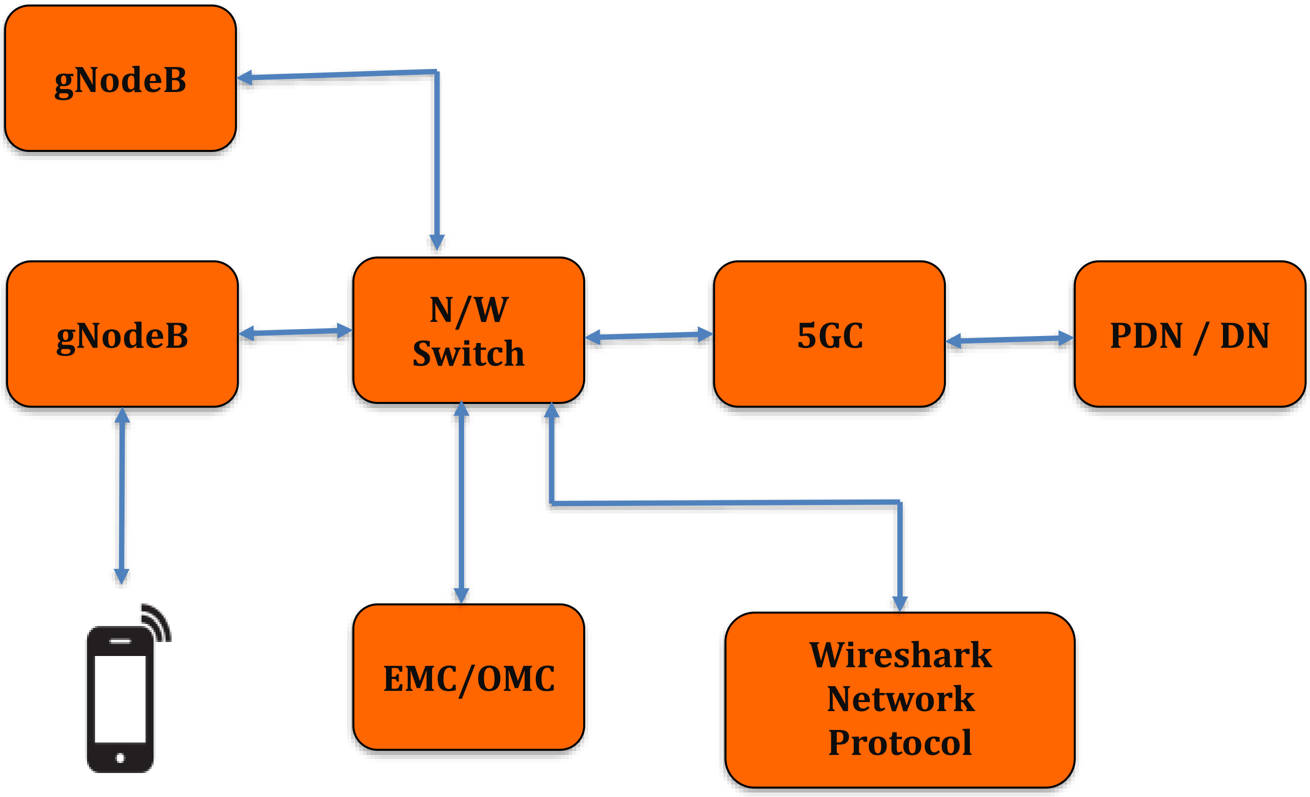
TEST SETUP 1



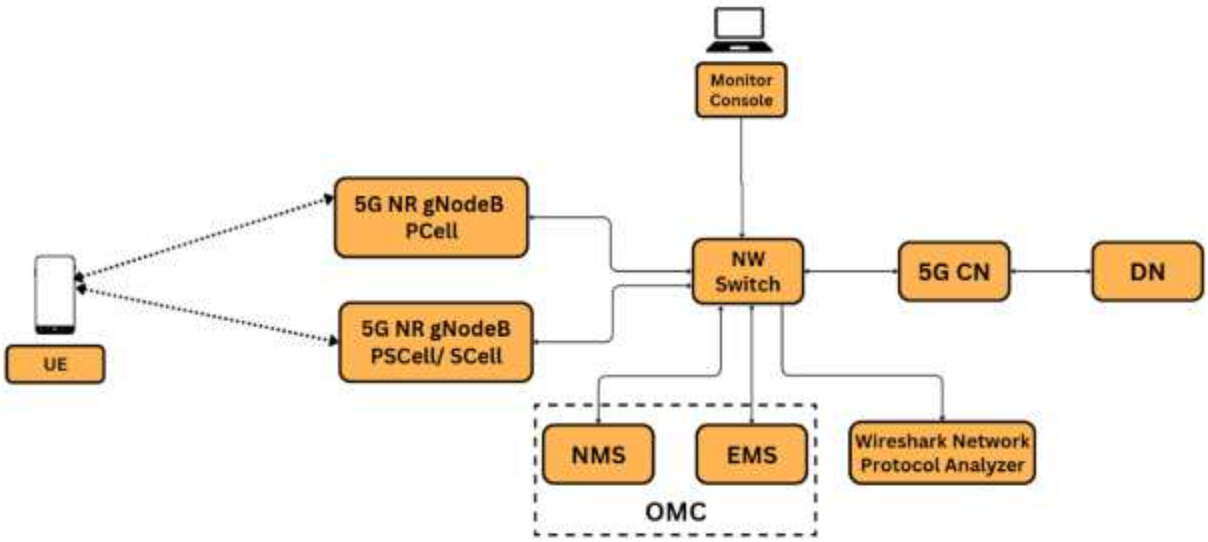
TEST SETUP 2



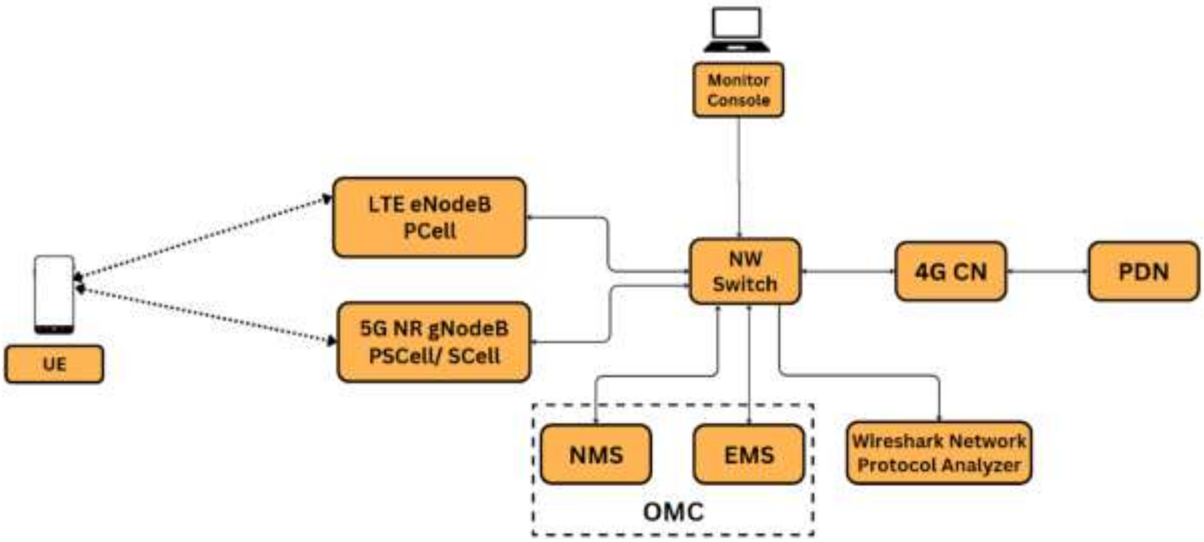
TEST SETUP 3


gNodeB
gNodeB
N/W
Switch
5GC
PDN / DN
EMC/OMC
Wireshark
Network
Protocol

TEST SETUP 4



TEST SETUP 5



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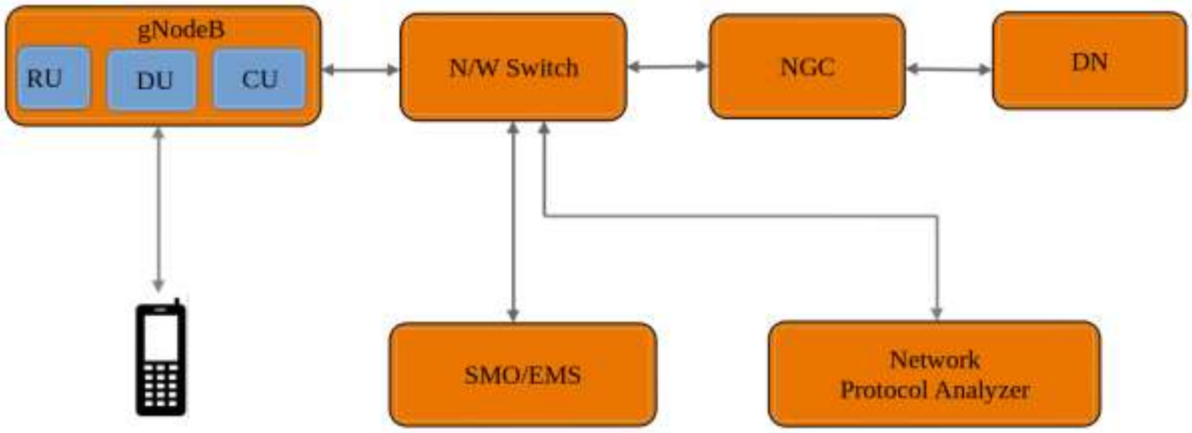

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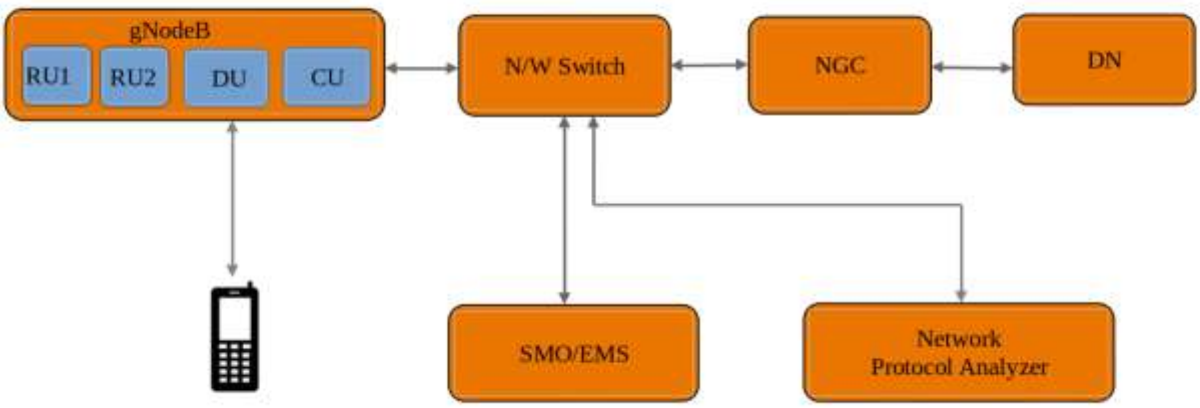
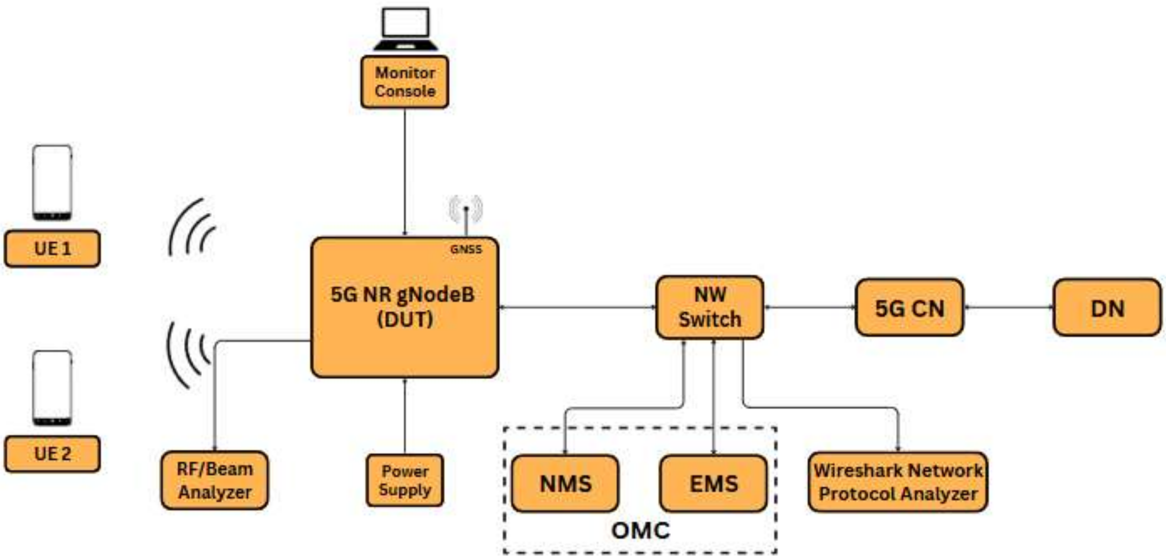


TEST SETUP 8



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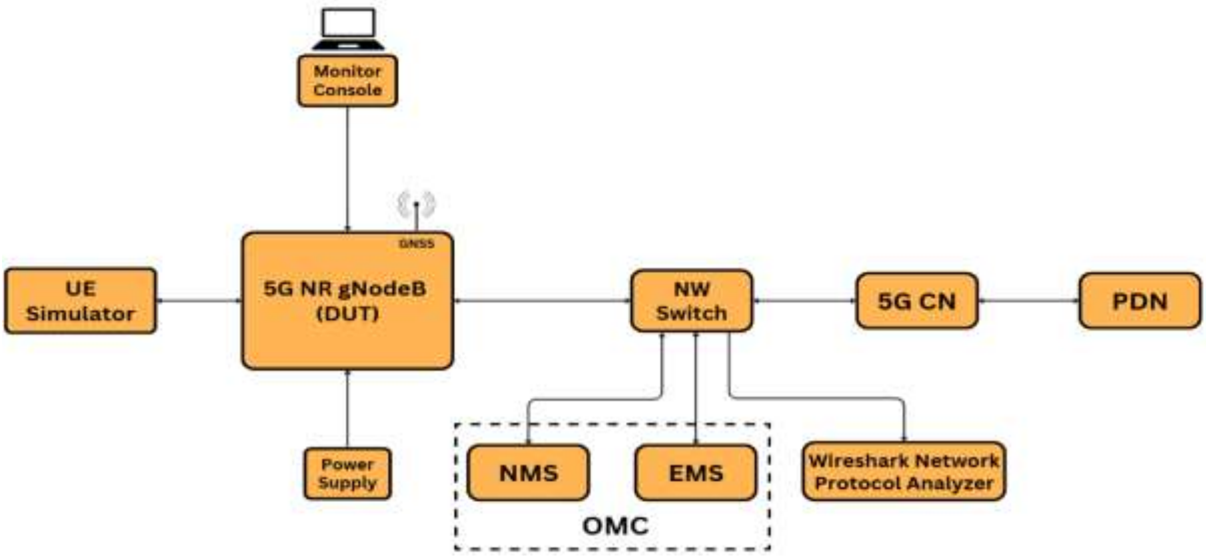
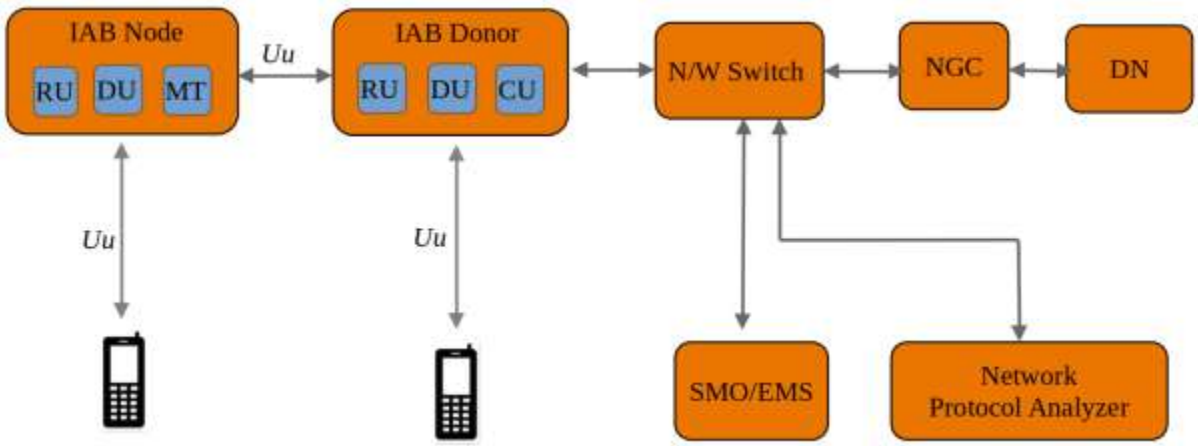
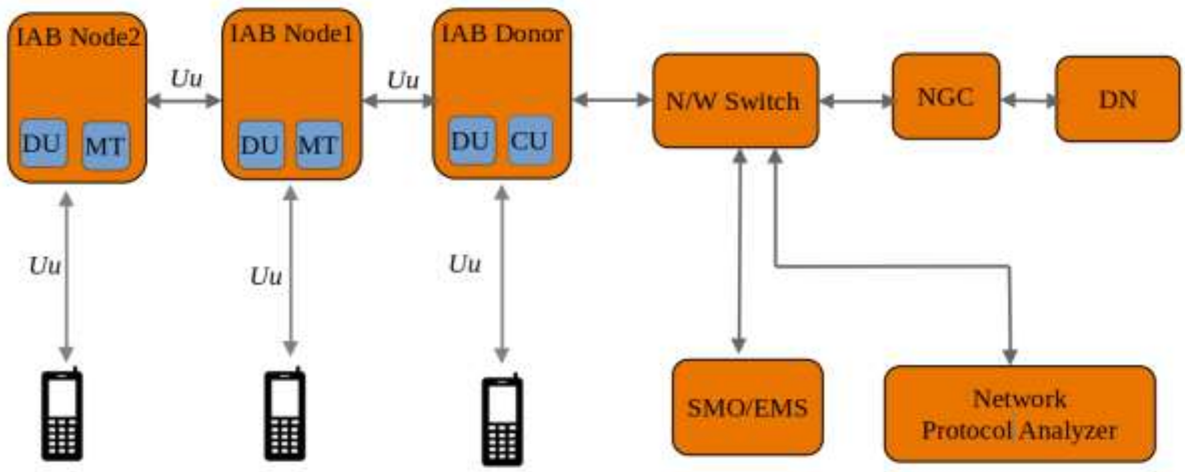


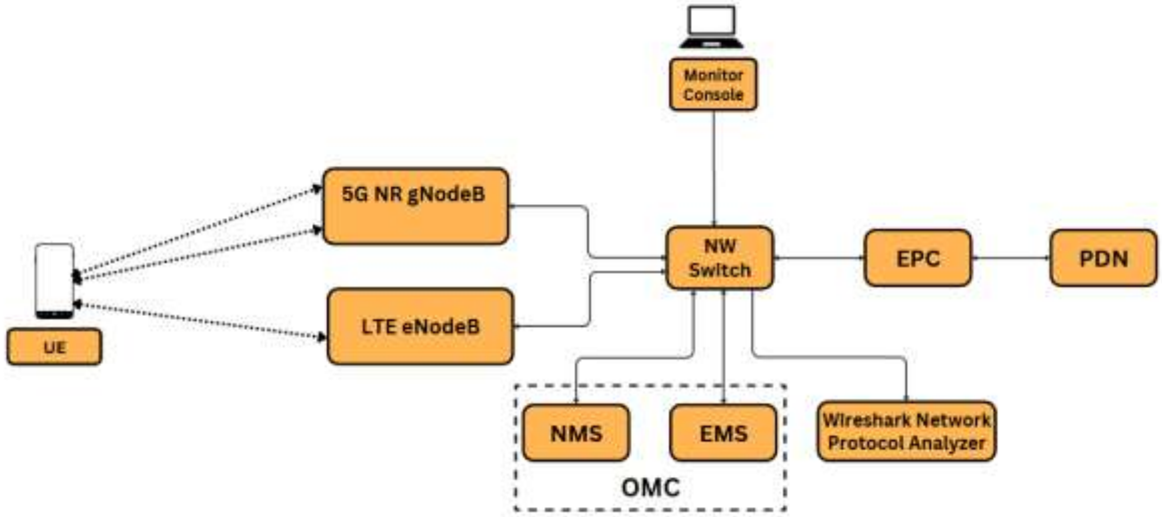
TEST SETUP 10



TEST SETUP 11



TEST SETUP 12-1



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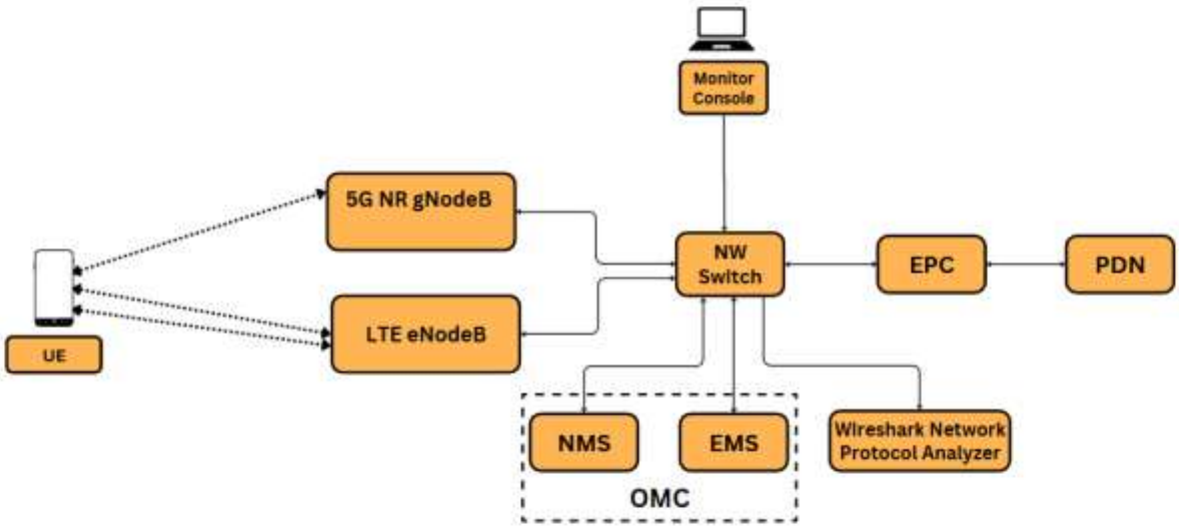

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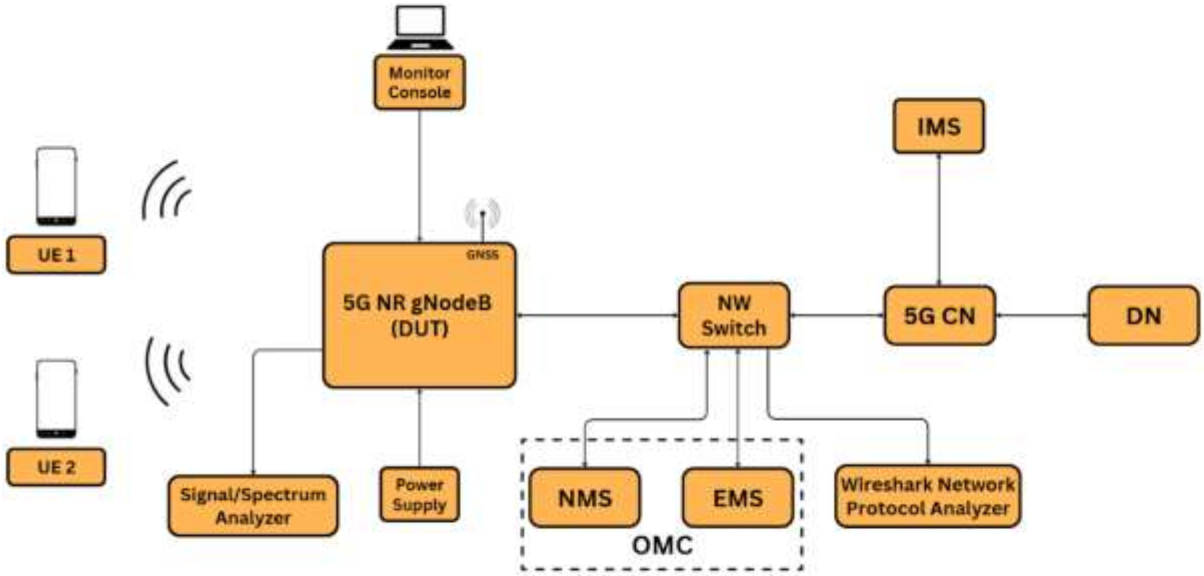
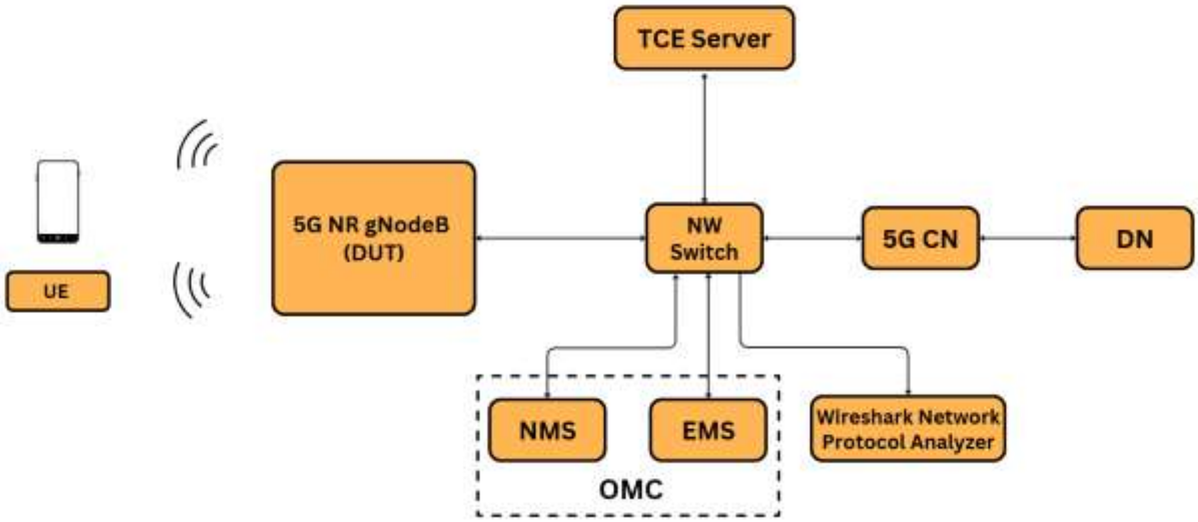


TEST SETUP 14



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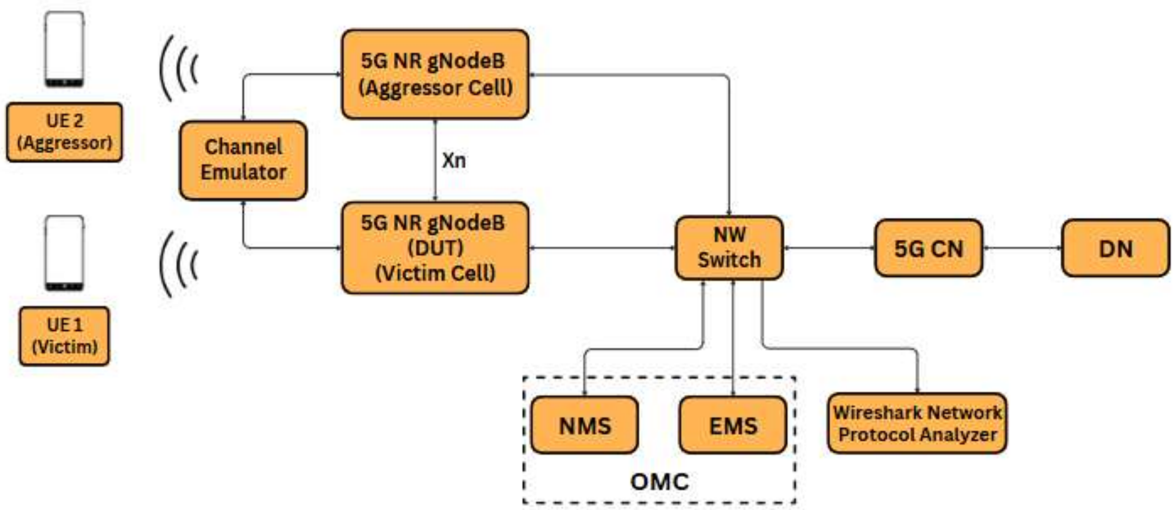
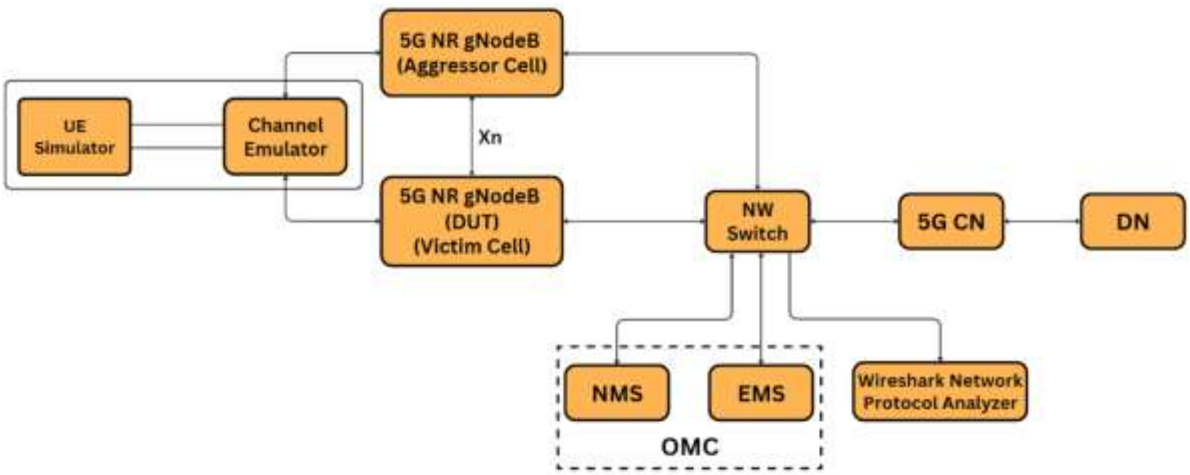


TEST SETUP 16



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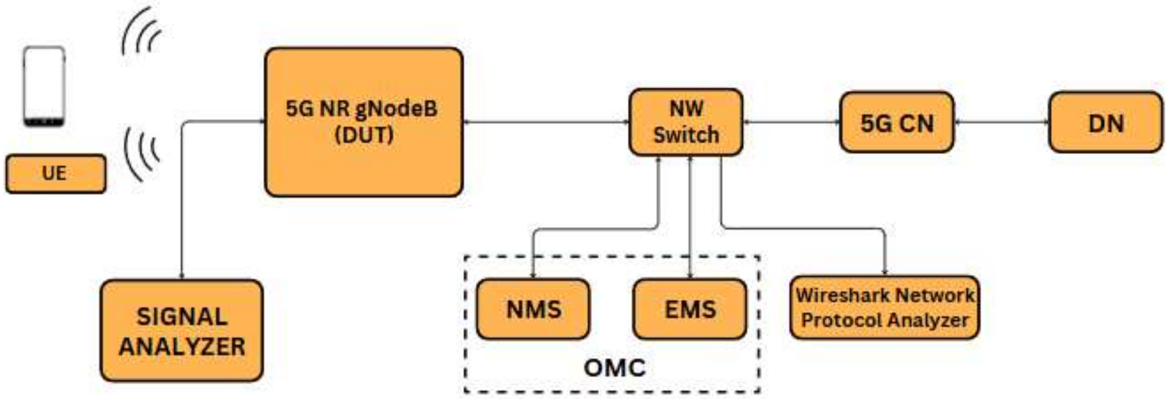

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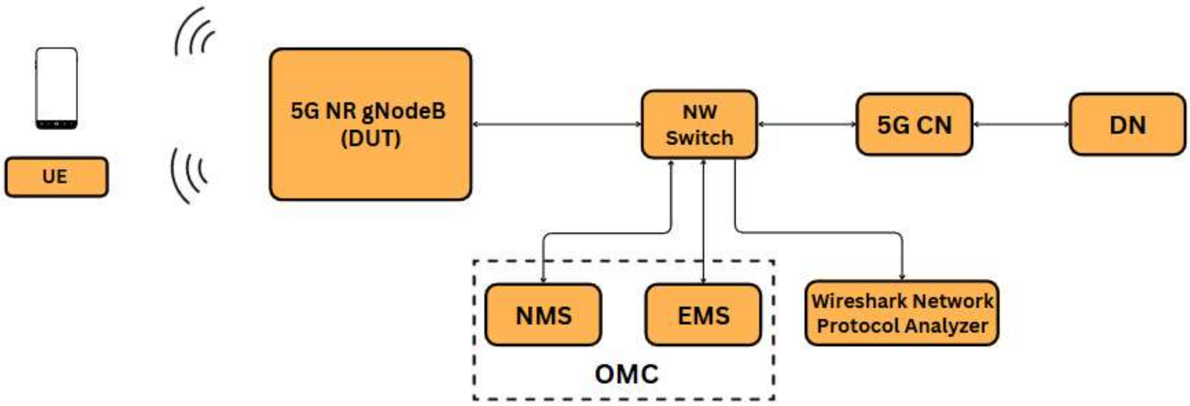
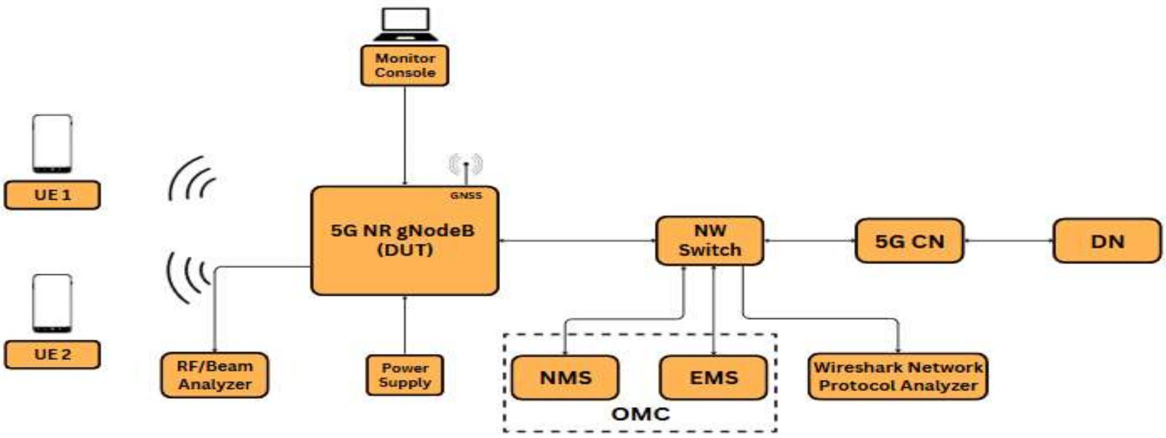
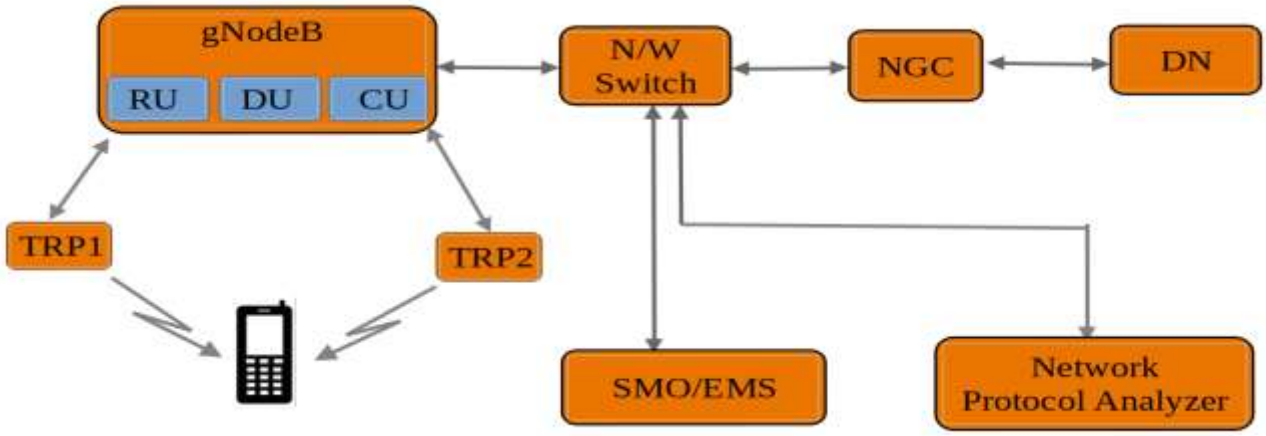


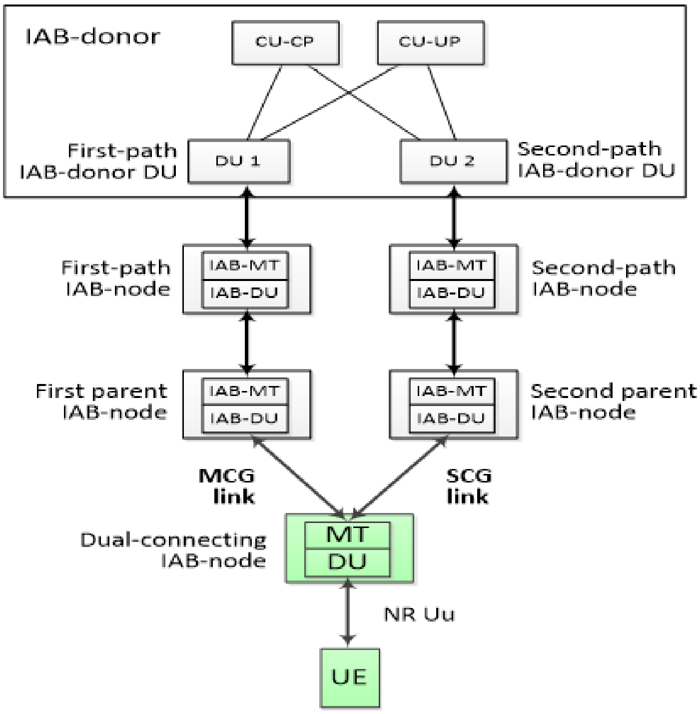
TEST SETUP 19



TEST SETUP 20



TEST SETUP 21



Test No.	**GR_TSTP_2.2.1**
Test Details	Uu interface: The interface between the gNB and the device is known as the Uu interface. The scenario of a device connected to two cells is known as dual connectivity and is an important concept for NSA. In Option 3 NSA, the NR based secondary cell only handles user plane traffic and the control and user plane signalling is done through the LTE eNodeB.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. UE supports NSA Dual Connectivity. 2. LTE eNodeB and NR gNB are connected and configured. 3. UE is in RRC Connected state via LTE. 4. Establish LTE connection between UE and eNodeB (Master Cell). 5. Configure NR gNB as Secondary Node (SgNB). 6. Activate dual connectivity; forward user-plane data via NR Uu. 7. Monitor data flow and signaling paths.
Test Limits	NA
Expected Results	User-plane traffic flows over NR gNB Uu interface. Control signaling remains on LTE.

Test No.	**GR_TSTP_2.2.2**
Test Details	Xn interface: Connecting gNBs to each other, is mainly used to support dual connectivity and lossless active-state mobility between cells by means of packet forwarding. It may also be used for multi-cell Radio Resource Management (RRM) functions.
Test Instruments Required	Two gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 3
Test Procedure	1. Two gNBs (gNB-A and gNB-B) are Xn-connected. 2. UE is in RRC Connected state under gNB-A. 3. Move UE toward gNB-B coverage while maintaining an active data session. 4. Trigger handover from gNB-A to gNB-B using Xn interface. 5. gNB-A forwards in-transit packets to gNB-B during handover. 6. gNB-B completes handover and resumes data transmission to UE.
Test Limits	NA
Expected Results	UE completes handover without session drop.

Test No.	**GR_TSTP_2.2.3**
Test Details	F1 interface (As per tenderer requirement): There is also a standardized way to split the gNB into two parts, a central unit (gNB-CU) and one or more distributed units (gNB-DU) using the F1 interface. In case of a split gNB, the RRC, PDCP, and SDAP protocols, described in more detail later, reside in the gNB-CU and the remaining protocol entities (RLC, MAC, PHY) in the gNB-DU.
Test Instruments Required	Two gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 3
Test Procedure	1.Bring the gNB to the operational **Enabled** state. 2.Connect the UE to the gNB. 2.Observe the initial messages like F1 setup request & F1 set up response between CU &DU or CU & multiple DU's. 3.In wireshark observe the F1AP message flow between CU & DU or CU & multiple DU's .
Test Limits	NA
Expected Results	The F1AP protocol is required to successfully establish the connection and manage message flow between the CU and DU

Test No.	**GR_TSTP_3.1_A**
Test Details	Verify that ng-eNB/gNB owns and controls the radio resources of its own cell or cells. Cell resources as requested by and granted to MME/AMFs shall be provided in an ordered fashion.
Test Instruments Required	gNodeB, MME/AMF, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure two N2 interfaces towards AMFs from gNodeB. 2. Configure Relative AMF Capacity for both AMFs. 3. Verify Relative AMF Capacity from the NGSetupResponse message. 4. Perform UE registration (attach) from two UEs. 5. Verify UE logs for allocation of radio resources. 6. UEs shall be registered as per the Relative AMF Capacity. 7. Verify through Wireshark logs that resources are allocated in an ordered fashion.
Test Limits	NA
Expected Results	gNodeB shall allocate resources as in the order requested by UE and MME/AMF

Test No.	**GR_TSTP_3.1_B**
Test Details	Verify that the gNB shall support Event-triggered measurement reporting.
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure event triggered measurement reporting parameters at gNodeB. Ensure that the 2 gNodeBs are in operationally enabled state. 2. Perform UE attach on first gNodeB. Through UE logs, verify the RRC connection reconfiguration message sent after the completion of security procedure. Check that the gNodeB configures different events A1, A2, A3, A4 etc 3. Move the UE from first gNodeB towards the second gNodeB such that the UE gets better coverage from the potential target gNodeB 4. Verify from UE logs that the UE sends measurement report on encountering different types of events. Verify that the additional/deleted/modified measurement control information is sent to the UE in RRC connection reconfiguration message sent upon the receipt of various measurement reports.
Test Limits	NA
Expected Results	gNodeB shall configure UE with different events for measurement reporting.

Test No.	**GR_TSTP_3.1_C**
Test Details	Verify that gNB shall support System Information Broadcast (SIB).
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure gNodeB with system information Broadcast parameters. Ensure that the gNodeB is operationally enabled. 2. Power on a user equipment 3. Verify through UE's reception of System Information (SIB). 4. Capture the control plane signaling using a tool like Wireshark to analyze the broadcast of SIBs that the gNodeB is transmitting configured system information.
Test Limits	NA
Expected Results	The gNodeB shall broadcast system information as per configuration.

Test No.	**GR_TSTP_3.1_D**
Test Details	Verify that RRC messages shall be transmitted to the device using signalling radio bearers (SRBs) including SRB0, SRB1and SRB2. additionally support SRB3 when UE in (NG)EN-DC or NR-DC.
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Perform UE attach. 2. Verify from UE logs that SRB0, SRB1, and SRB2 are established successfully, and additionally, SRB3 when the UE is in (NG)EN-DC or NR-DC. NOTE: a. SRB0 is mapped to CCCH in UL and DL. (RRC Connection Request and RRC Connection setup) b. SRB1 is mapped to DCCH in UL and DL. RRC messages and RRC with NAS piggybacked messages prior to the establishment of SRB2 will be transmitted in SRB1. (RRC Connection Setup Complete, RRC Connection Reconfiguration, RRC Connection Reconfiguration Complete, Security mode command, Security mode complete, UE capability enquiry, UE capability information, DL/UL Information Transfer when no SRB2 is established.) c. SRB2 is mapped to the DCCH in UL and DL, but after completion of security procedure. UL Information Transfer and DL Information Transfer messages are transmitted in SRB2. d. SRB3 is mapped to DCCH in UL and DL and is established when the Secondary Node (SN) is added in (NG)EN-DC or NR-DC.
Test Limits	NA

Expected Results	UE logs shall indicate allocation of signaling bears SRB0, SRB1, SRB2 and SRB3.

Test No.	**GR_TSTP_3.1_E**
Test Details	Verify that gNB shall support RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure Inactive state parameters. 2. Camp the UE to the network (ensure the UE is in Connected mode)and Keep device in no-data transition so that based on configuration device will move to inactive state. 3. UE is in Inactive mode, where it can receive paging and control messages but doesn't actively exchange data. 4. Once the Inactive timer expires, the UE moves to Idle mode.
Test Limits	NA
Expected Results	gNB shall support RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.

Test No.	GR_TSTP_3.2_A
Test Details	Verify that SDAP shall be responsible for mapping QoS bearers to radio bearers according to their quality-of-service requirements.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the operational **Enabled** state. 2.Perform a UE attach procedure. 3.In the UE logs, verify the rrcReconfiguration message contains sdap-Config with PDU session and QoS Flow Identifier to DRB Identity mapping information. 4.Verify the sdap-HeaderDL and sdap-HeaderUL status, and confirm QFI-to-DRB mapping for different PDU sessions (e.g., Internet and IMS), based on their QoS requirements.
Test Limits	NA
Expected Results	SDAP needs to successfully perform QFI-to-DRB mapping and the SDAP downlink and uplink headers are enabled or disabled based on the DRB requirement.

Test No.	GR_TSTP_3.2_B
Test Details	Verify If the gNB is connected to the EPC (as in NSA), the SDAP is not required.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Bring the gNB to operationally Enabled state. 2.Perform a UE attach procedure. 3.In the UE logs, verify that the RRCReconfiguration message does not include sdap-Config or QFI-to-DRB mapping, as SDAP is not required when the gNB is connected to the EPC in NSA mode
Test Limits	NA
Expected Results	gNB successfully need to connect to the EPC without SDAP.

Test No.	GR_TSTP_3.3_A
Test Details	Verify that the gNB shall support integrity protection and ciphering of RRC signalling.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Observe the Security Mode Command message sent from gNB to UE. 4. UE responds with Security Mode Complete message.
Test Limits	NA
Expected Results	The gNodeB shall support ciphering and integrity protection procedures on radio interface.

Test No.	GR_TSTP_3.3_B
Test Details	Verify that RoHC shall be supported.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally with ROHC enabled. 2. Perform UE Attach. 3. Initiate VoNR call or perform data test 4. Verify through UE logs that RoHC is used.
Test Limits	NA
Expected Results	gNodeB shall use RoHC during VoNR call or data test.

Test No.	GR_TSTP_3.3_C
Test Details	Verify that PDCP shall also handle retransmissions, in-sequence delivery, and duplicate removal in the case of handover.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE Attach. 3. Trigger inter-DU handover with data transfer in progress. 4. Capture the pdcp layers logs on both gNB and UE sides. 5. Verify the PDCP behaviour for re-transmission, in-sequence delivery, and duplicate removal post-handover.
Test Limits	NA
Expected Results	The gNB shall ensure in-sequence transmission of data. In the event out-of-sequence data is detected, the gNB shall initiate retransmission procedures to recover the missing data. Furthermore, upon detection of duplicate packets with the same sequence number, the gNB shall perform duplicate removal to maintain data integrity.

Test No.	GR_TSTP_3.3_D
Test Details	Verify that For 5G NSA deployment: The gNB shall store one-to-one mapping between data radio bearers and S1 bearers to create the binding between a data radio bearer and an S1 bearer in both the uplink and downlink to enable Quality of Service (QoS) enforcement.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. Bring gNodeB to an operationally enabled state in NSA mode. 2. Attach the UE and establish data radio bearers. 3. Initiate end-to-end data transfer. 4. Use Wireshark to trace bearer mapping. 5. Confirm the binding between gNB DRB and S1 bearer with matching QoS parameters.
Test Limits	NA
Expected Results	gNodeB shall maintain one-to-one mapping between gNB DRB and S1 bearer to support proper QoS enforcement in uplink and downlink.

Test No.	GR_TSTP_3.3_E
Test Details	Verify that the gNB shall perform data recovery.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB to an operationally enabled state in SA mode. 2. Attach the UE and establish a data session. 3. Trigger RRC Reestablishment. 4. Observe PDCP and RLC logs or Wireshark captures to verify data recovery mechanisms.
Test Limits	NA
Expected Results	The gNB shall re-transmit the data to ensure lossless data transmission

Test No.	GR_TSTP_3.3_F
Test Details	Verify that for dual connectivity with split bearers, PDCP can provide routing and duplication. Duplication and transmission from different cells can be used to provide diversity for services requiring very high reliability. There is one PDCP entity per radio bearer configured for a device.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB and secondary node to operational state in dual connectivity configuration (EN-DC or NR-DC). 2. Attach UE with split bearer configured at PDCP layer. 3. Initiate data transfer and verify traffic routing over both master and secondary paths. 4. Simulate one link failure or packet drop scenario. 5. Verify PDCP duplication and successful data delivery via alternate path. 6. Confirm that one PDCP entity handles the split bearer routing and duplication.
Test Limits	NA
Expected Results	PDCP shall provide routing and duplication for split bearers across different cells. Data shall be delivered with high reliability, and one PDCP entity shall be associated per configured radio bearer.

Test No.	GR_TSTP_3.4_A
Test Details	Verify that RLC shall be responsible for segmentation and retransmission handling. The RLC shall provide services to the PDCP in the form of RLC channels. There shall be one RLC entity per RLC channel (and hence per radio bearer) configured for a device.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure DRB with RLC AM/UM for checking segmentation and only AM mode for verifying retransmission. 2. Bring gNodeB in operationally enabled state. 3. Perform UE attach. 4. Perform Downlink and uplink data traffic. 5. Verify the procedures in gNodeB RLC transmitter logs. 6. Verify segmentation and retransmission meets all RLC mode requirements from UE analyser tool.
Test Limits	NA
Expected Results	The RLC layer shall support segmentation and retransmission functionality.

Test No.	GR_TSTP_3.4_B
Test Details	Verify that RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure DRB with RLC AM/UM for checking segmentation and concatenation. 2. Bring gNodeB in operationally enabled state. 3. Perform UE attach. 4. Perform Downlink data traffic test. 5. Verify the procedures in gNodeB RLC transmitter and receiver logs. 6. Verify concatenation and segmentation meets all RLC mode requirements from UE analyser tool.
Test Limits	NA
Expected Results	The RLC layer shall support segmentation and concatenation functionality.

Test No.	GR_TSTP_3.5_A
Test Details	Verify that MAC shall handle multiplexing of logical channels, hybrid-ARQ retransmissions, and dynamic resource allocation (scheduling) and scheduling-related functions.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Ensure gNB is loaded with correct configurations. 2. Camp the UE and ensure RRC and NAS connections are established. 3. Perform data transfers along with video streaming, along with some mobility. 4. Collect UE logs when test is performed
Test Limits	
Expected Results	Different Logical channel multiplexing with multiple MAC CE For few of the HARQ process re-transmission will happen. Dynamic resource allocation can be seen based on demand.

Test No.	GR_TSTP_3.5_B
Test Details	Verify that the MAC shall provide services to the RLC in the form of logical channels.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Ensure gNB is loaded with correct configurations 2. Perform UE attach and data transfer in both UL & DL 3. Collect Logs & PCAP
Test Limits	
Expected Results	Various Logical channels can be observed

Test No.	GR_TSTP_3.5_C
Test Details	Verify that from the physical layer, the MAC layer shall use the services in the form of transport channels. The gNB shall support link adaptation and power control
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	**Procedures for Link adaptation** 1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL and UL data 4. Attenuate the radio link 5. Verify through UE logs that MCS is modified.
Test Limits	NA
Expected Results	MCS shall change as per link condition in both UL and DL.

Test No.	GR_TSTP_3.5_D
Test Details	Verify that the gNB shall support Contention based Random Access (RA) procedure
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify from UE logs that contention resolution procedure is executed.
Test Limits	NA
Expected Results	gNodeB shall support both contentions based and contention free RA procedures.

Test No.	GR_TSTP_3.6_A
Test Details	Verify that gNB shall support OFDM modulation in both DL and UL. When DFT-precoding is used, uplink transmissions are restricted to a single layer per UE only while uplink transmissions with multiple layers per UE are possible with OFDM.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure Transform Precoding as Enabled and set the UL maximum MIMO layer to 1. 2.Bring the gNB to the operational (enabled) state. 3.Perform the UE attach procedure. 4.Capture UE logs and verify that Transform Precoding is enabled and the PUSCH is able to transmit successfully.
Test Limits	NA
Expected Results	The gNB is successfully able to configure Transform Precoding, and the UE is able to decode and schedule transmissions accordingly.

Test No.	GR_TSTP_3.6_B
Test Details	Verify that gNB shall support DFT-s-OFDM with pi/2 BPSK filtering (LMLC) in Uplink. (As per tenderer requirement)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure Transform Precoding as Enabled and set the UL maximum MIMO layer to 1. 2.Bring the gNB to the operational (enabled) state. 3.Perform the UE attach procedure. 4.Capture UE logs and verify that Transform Precoding is enabled, the MCS index corresponds to π/2-BPSK, and the PUSCH is able to transmit successfully
Test Limits	NA
Expected Results	The gNB is successfully able to configure Transform Precoding with π/2-BPSK, and the UE is able to decode and schedule transmissions accordingly.

Test No.	GR_TSTP_3.6_C
Test Details	Verify that gNB shall support Synchronization Signal Block (SSB).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture a PCAP to verify whether the gNB is broadcasting the SSB. 4.Capture UE logs to confirm that the UE successfully decodes the SSB.
Test Limits	NA
Expected Results	UE needs to successfully decode the SSB and be able to decode SIB1.

Test No.	GR_TSTP_3.6_D1
Test Details	Verify that the gNB shall support the Physical Downlink Shared Channel (PDSCH): Main physical channel used for unicast data transmission, but also for transmission of, for example, paging information, random-access response messages, and delivery of parts of the system information.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture UE logs to confirm that the UE successfully decodes the PDSCH carrying different types of information w.r.t RNTI, such as SIB1 (via SI-RNTI) and RACH responses (via RA-RNTI).
Test Limits	NA
Expected Results	UE needs to successfully decode the PDSCH Payload.

Test No.	GR_TSTP_3.6_D2
Test Details	Verify that the gNB shall support the Physical Broadcast Channel (PBCH): Carries system information, required by the device to access the network.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture UE side logs and check for successful decoding of the MIB. Within the MIB content, verify parameters such as SFN, SCS, and other information required to decode SIB1.
Test Limits	NA
Expected Results	UE needs to successfully decode the PBCH Payload.

Test No.	GR_TSTP_3.6_D3
Test Details	Verify that the gNB shall support the Physical Downlink Control Channel (PDCCH): Used for downlink control information, mainly scheduling decisions, required for reception of PDSCH, and for scheduling grants enabling transmission on the PUSCH.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture UE side logs and verify that DL-DCI is decoded for PDSCH and UL-DCI for PUSCH.
Test Limits	NA
Expected Results	UE needs to successfully decode both DL-DCI for PDSCH and UL-DCI for PUSCH

Test No.	GR_TSTP_3.6_D4
Test Details	Verify that the gNB shall support the Physical Uplink Shared Channel (PUSCH): the uplink counterpart to the PDSCH. There is at most one PUSCH per uplink component carrier per device.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture gNB side logs to verify successful decoding of PUSCH. 4.Capture UE logs to confirm that PUSCH is successfully established and utilized for uplink transmission.
Test Limits	NA
Expected Results	gNB needs to successfully decode the PUSCH

Test No.	GR_TSTP_3.6_D5
Test Details	Verify that the gNB shall support the Physical Uplink Control Channel (PUCCH): Used by the device to send hybrid-ARQ acknowledgments, indicating to the gNB whether the downlink transport block(s) was successfully received or not, to send channel-state reports and for requesting resources to transmit uplink data upon.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL data. 4. Verify HARQ ACK/NACK is received every 4 sub frames in FDD or in next available UL transmission in TDD. 5. Verify HARQ process ID and RV is allocated in PDCCH for DL. 6. Start UL data. Verify HARQ ACK/NACK for UL data is received after 4 sub frames on PHICH channel for FDD or in next available UL transmission in TDD. 7. Verify RV and MCS used in UL re-transmissions is as per UL HARQ mode applicable. Also verify from UE analyser tool. 8. Verify at max, 8 HARQ processes are used FDD. 9. Verify appropriate number of HARQ processes are used according to the TDD configuration used for TDD.
Test Limits	NA
Expected Results	HARQ ACK/NACK is received every 4 sub frames in FDD or in next available UL transmission in TDD. HARQ process ID and RV is allocated in PDCCH for DL. RV is allocated in UL Grant for UL. at max, 8 HARQ processes are used FDD.

	appropriate number of HARQ processes are used according to the TDD configuration used for TDD.

Test No.	GR_TSTP_3.6_D6
Test Details	Verify that the gNB shall support the Physical Random-Access Channel (PRACH): Used for random access. The gNB shall support Contention based and Contention free Random Access (CBRA, CFRA) procedure.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify from UE logs that contention resolution procedure is executed. 4. Perform UE handover 5. Verify from UE logs that contention free procedure is executed.
Test Limits	NA
Expected Results	gNodeB shall support both contentions based and contention free RA procedures.

Test No.	GR_TSTP_3.6_E
Test Details	Verify that the gNB shall support UL Power Allocation for data channels. The gNB shall support both the open-loop power control and the closed-loop power control of the UE.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL and UL data. 4. Open loop power control (TPC disabled) 5. Attenuate the radio link. 6. Verify through UE logs, the UE Tx power is modified 7. Close loop power control (TPC enabled) 8. Attenuate the radio link. 9. Verify through UE logs that gNodeB sends TPC command 10. Verify through UE logs, the UE Tx power is modified
Test Limits	NA
Expected Results	The Tx power of UE shall be modified in both cases.

Test No.	GR_TSTP_3.6_F
Test Details	Verify that the gNB shall be able to communicate timing advance value to UE.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNodeB to the operationally enabled state. 2.Perform UE attach. 3.Capture UE side logs and check for the RACH Response message, which provides the TA (Timing Advance) value to the gNB.
Test Limits	NA
Expected Results	gNB needs to send the TA (Timing Advance) value, and the UE must successfully decode the TA value and schedule UL transmission based on the TA

Test No.	GR_TSTP_3.6_G
Test Details	Verify that the gNB shall support DL Power Allocation for data channels.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. From OMC/ Console configure P-A, P-B
Test Limits	NA
Expected Results	The gNodeB shall allow configuration of P-A, P-B parameters from OMC / Console

Test No.	GR_TSTP_3.6_H
Test Details	Verify that the gNB shall support DL Power setting for data channels.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. From EMS/Console , configure PCFICH power offset, PHICH power offset, PBCH power offset, PDCCH Power offset
Test Limits	NA
Expected Results	gNodeB shall configuration of PCFICH power offset, PHICH power offset, PBCH power offset, PDCCH Power offset from OMC/Console

Test No.	GR_TSTP_3.6_I
Test Details	Verify that the gNB shall support DL Power setting for signalling and control channels.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. From EMS/Console, configure PCFICH power offset, PHICH power offset, PBCH power offset, PDCCH Power offset
Test Limits	NA
Expected Results	gNodeB shall configuration of PCFICH power offset, PHICH power offset, PBCH power offset, PDCCH Power offset from OMC/Console

Test No.	GR_TSTP_3.6_J
Test Details	Verify that the gNB shall support Normal cyclic prefix.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. Bring gNodeB up and radiating with Normal and extended cyclic prefix as applicable. 2. Verify the S1AP link is up. 3. Verify UE is attached successfully. 4. Verify via UE logs, gNodeB shall support Normal cyclic prefix.
Test Limits	NA
Expected Results	gNodeB shall support Normal cyclic prefix.

Test No.	GR_TSTP_3.6_K
Test Details	Verify that the gNB shall support Uplink and downlink demodulation reference signal.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify that uplink data transfer is successful.
Test Limits	NA
Expected Results	The gNodeB shall be able to decode uplink data. This will verify uplink DMRS.

Test No.	GR_TSTP_3.6_L
Test Details	Verify that the gNB shall support UL & DL Link Adaptation.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL and UL data. 4. Attenuate the radio link 5. Verify through UE logs that MCS is modified
Test Limits	NA
Expected Results	MCS shall change as per link condition in both UL and DL.

Test No.	GR_TSTP_3.6_M
Test Details	Verify that the gNB shall support Short Buffer Status Report (BSR) and Long BSR.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Start UL data. 4. Verify through UE logs that long and short BSR is supported in gNodeB
Test Limits	NA
Expected Results	The gNodeB shall allocate resources considering short BSR and long BSR.

Test No.	GR_TSTP_3.6_N
Test Details	Verify that Support for Discontinuous Reception (DRX) to enable reasonable UE battery consumption
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure DRX and UE inactivity timers. 2. Bring gNodeB in operationally enabled state. 3. Perform UE attach 4. Verify through UE logs DRX and UE inactivity parameters
Test Limits	NA
Expected Results	gNodeB shall indicate configured DRX and UE inactivity timers to the UE.

Test No.	GR_TSTP_3.6_O
Test Details	Verify that the gNB shall support at least one Static TDD Mode with single Bandwidth Part.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure TDD pattern and BWP. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check for the SIB1 message to verify if the TDD pattern and BWP are configured correctly. 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB should be able to schedule the TDD pattern and BWP, and the UE should successfully decode them

Test No.	GR_TSTP_3.6.1_A
Test Details	Verify that the gNB shall support Cell Carrier Bandwidth of 5 MHz, 10 MHz, 15 MHz, 20 MHz on Low-Band.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure BWP according to the cell carrier bandwidth. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check the SIB1 message to verify the "NumRb" as per the configured bandwidth. 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB must successfully schedule according to the bandwidth, and the UE must be able to decode it correctly

Test No.	GR_TSTP_3.6.1_B
Test Details	Verify that the gNB shall support 15 kHz subcarrier spacing on Low-Band.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure SCS according to the cell. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check the SIB1 message to verify the "Subcarrier Spacing." 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB must successfully schedule at 15 kHz, and the UE must be able to decode it correctly.

Test No.	GR_TSTP_3.6.1_C
Test Details	Verify that the gNB shall support Modulation schemes up to 256 QAM in downlink and uplink on Low-Band.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure link adaptation. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Run data and perform mobility from good RSRP to bad RSRP. 5.Capture UE logs and check the PDSCH and PUSCH to verify the varying "MCS" based on channel conditions. 6.Validate that all MCS are triggering correctly according to the MCS index table
Test Limits	NA
Expected Results	gNB must successfully schedule up to 256 QAM for both DL and UL.

Test No.	GR_TSTP_3.6.2_A
Test Details	Verify that the gNB shall support 15kHz, 30 kHz and/ or 60 kHz subcarrier spacing on Mid-Band.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure SCS according to the cell. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check the SIB1 message to verify the "Subcarrier Spacing." 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB must successfully schedule at 15 kHz, 30 kHz, and 60 kHz, and the UE must be able to decode them correctly

Test No.	GR_TSTP_3.6.2_B
Test Details	Verify that the gNB shall support Cell Carrier Bandwidth from a sub set of 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100MHz on Mid-Band. (Subject to valid combinations of SCS, Cell Carrier Bandwidth and cyclic prefix as specified by 3GPP)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure BWP according to the cell carrier bandwidth. 2.Bring the gNodeB t the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check the SIB1 message to verify the "NumRb" as per the configured bandwidth. 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB must successfully schedule according to the bandwidth, and the UE must be able to decode it correctly

Test No.	GR_TSTP_3.6.2_C
Test Details	Verify that the gNB shall support Modulation schemes up to 256 QAM in downlink and uplink on Mid-Band
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure link adaptation. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Run data and perform mobility from good RSRP to bad RSRP. 5.Capture UE logs and check the PDSCH and PUSCH to verify the varying "MCS" based on channel conditions. 6.Validate that all MCS are triggering correctly according to the MCS index table
Test Limits	NA
Expected Results	gNB must successfully schedule up to 256 QAM for both DL and UL.

Test No.	GR_TSTP_3.6.3_A
Test Details	Verify that the gNB shall support 60kHz and 120 kHz subcarrier spacing on High-Band.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure SCS according to the cell. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check the SIB1 message to verify the "Subcarrier Spacing." 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB must successfully schedule at 60 Khz and 120 kHz, and the UE must be able to decode them correctly

Test No.	GR_TSTP_3.6.3_B
Test Details	Verify that the gNB shall support Cell Carrier Bandwidth from a sub set of 50, 100, 200, 400MHz on High-Band. (Subject to valid combinations of SCS, Cell Carrier Bandwidth and cyclic prefix as specified by 3GPP)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure BWP according to the cell carrier bandwidth. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Capture UE logs and check the SIB1 message to verify the "NumRb" as per the configured bandwidth. 5.Capture gNB side logs to validate whether the UE is decoding correctly.
Test Limits	NA
Expected Results	gNB must successfully schedule according to the bandwidth, and the UE must be able to decode it correctly.

Test No.	GR_TSTP_3.6.3_C
Test Details	Verify that the gNB shall support Modulation schemes up to 64 QAM in downlink and uplink on High-Band.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure link adaptation. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Run data and perform mobility from good RSRP to bad RSRP. 5.Capture UE logs and check the PDSCH and PUSCH to verify the varying "MCS" based on channel conditions. 6.Validate that all MCS are triggering correctly according to the MCS index table
Test Limits	NA
Expected Results	gNB must successfully schedule up to 64 QAM for both DL and UL.

Test No.	GR_TSTP_3.7.1_A
Test Details	Verify that Interface between RAN and Device / UE gNB shall support Uu interface towards Device/UE.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is powered on and configured correctly. 2. UE is powered on and within gNB coverage area. 3. UE sends RRC Connection Request to gNB over Uu. 4. gNB responds with RRC Connection Setup. 5. UE sends RRC Connection Setup Complete.
Test Limits	NA
Expected Results	RRC connection is established successfully. UE transitions to RRC Connected state. PDU session is established successfully.

Test No.	GR_TSTP_3.7.2_A
Test Details	Verify that NR Standalone Deployment: The gNB is connected to the 5G Core Network (5GC) through the NG interface.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is in Standalone mode and properly configured. 2. 5GC components (AMF, SMF) are operational. 3. Power on and initialize gNB. 4. gNB initiates NG setup procedure with AMF over NG-C. 5. Establish NG-U for user-plane path. 6. Attach UE and verify registration and data flow.
Test Limits	NA
Expected Results	NG setup successful between gNB and 5GC. UE registers and establishes PDU session. Data flows through NG-U to UPF.

Test No.	GR_TSTP_3.7.2_B
Test Details	Verify that NR Non-Standalone (EN-DC) Deployment: The gNB is connected to the EPC through the S1 interface
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. Configure and Bring up the NSA setup. 2. Run the data through attached UE and capture pcap on gNB 3. In wireshark, observe S1 GTP Tunnel End Point.
Test Limits	NA
Expected Results	gNB should be able to route data between UE and EPC.

Test No.	GR_TSTP_3.7.3_A
Test Details	Verify that NR Standalone Deployment: The interconnection of gNBs is managed over the Xn interface.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 3
Test Procedure	1. Two gNBs are deployed in NR Standalone mode. 2. Xn interface connectivity is configured. 3. Power on both gNBs. 4. Initiate Xn Setup procedure. 5. Exchange XnAP messages.
Test Limits	Required Two gNBs
Expected Results	Xn interface is successfully established. gNBs can communicate via XnAP signaling.

Test No.	GR_TSTP_3.7.3_B
Test Details	Verify that NR Non-Standalone (EN-DC) Deployment: The interconnection of gNBs with eNodeBs is managed over the X2 interface.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring up the NSA setup. 2. Capture pcap on gNB. 3. In wireshark, observe X2 Setup Request and Response.
Test Limits	NA
Expected Results	X2 connections should be properly established.

Test No.	GR_TSTP_3.8_A
Test Details	Verify that the gNB shall support Frequency Synchronization.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Run the SyncE in gNB server with GPS signal
Test Limits	NA
Expected Results	SyncE status gets locked in RU Observing the QL(Quality level) logs in gNB, it should be equal to 0x20

Test No.	GR_TSTP_3.8_B
Test Details	Verify that the gNB shall support Time and Phase Synchronization.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Run Ts2phc synchronize System to the PHC 2. Run phc2sys for updating system clock with hardware clock 3. Run Ptp4l for synchronization PHC to PTP master clock on the network 4. Run the SyncE in gNB server with GPS signal
Test Limits	NA
Expected Results	PTP status got locked Offset values should be <10 ns SyncE status gets locked in RU Observe the QL(Quality level) logs in gNB, it should be equal to 0x20

Test No.	GR_TSTP_3.8_C
Test Details	Verify that the gNB shall support at least one of following synchronization option GNSS (GPS or NAVIC) (to be specified by tenderer) IEEE 1588 V2 Sync E
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Vendor to specify the supported synchronization options. Test Procedure for GNSS (GPS or NAVIC) 1. Prepare the Test setup and position gNodeB such that GPS satellite signal is receivable by it. 2. Power ON gNodeB and give it some time to acquire the GPS satellite signals. 3. Verify through EMS / OMC about the synchronization status. 4. Test Procedure for IEEE 1588v2: 5. Prepare setup as per Test setup 2. 6. Additionally connect a IEEE1588 PTP Grandmaster (GM) on Ethernet Switch. 7. Configure the GM and gNodeB appropriately. 8. gNodeB should recover timing from GM using IEEE 1588v2 protocol 9. Verify through EMS / OMC about the synchronization status Test Procedure for SynchE: 1. Prepare setup as per Test setup 2. 2. Additionally, connect a SynchE PTP Grandmaster (GM) on

	Ethernet Switch. The Ethernet Switch shall also support SyncE 3. Configure the GM and gNodeB appropriately. 4. gNodeB should recover timing from GM using SynchE 5. Verify through EMS / OMC about the synchronization status
Test Limits	NA
Expected Results	gNodeB shall support vendor specified synchronization options.

Test No.	GR_TSTP_3.8_D
Test Details	Verify that the gNB shall support at least 48 hr hold over mode in case of frequency synchronization loss and at least 1 hr hold over mode in case of phase synchronization loss.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Forcefully disable the GPS service on gNB server for Phase and Frequency synchronization loss
Test Limits	NA
Expected Results	Observe the QL(Quality level) logs in gNB, it should be equal to 0xFF Observer the GPS logs in ts2phc service

Test No.	GR_TSTP_3.9_A
Test Details	Verify that the gNB shall support up to 4 DL MIMO layers in Low Band (as per tenderer requirement depending on deployment scenario)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure link adaptation and set the DL maximum MIMO layers to 4. 2.Bring the gNodeB to an operationally enabled state. 3.Perform UE attachment. 4.Run data traffic and perform mobility. 5.Capture UE logs and check the DCI and PDSCH to verify the variation in "Number of layers."
Test Limits	NA
Expected Results	gNB must successfully schedule all 4 layers, and the UE must be able to decode.

Test No.	GR_TSTP_3.9_B
Test Details	Verify that the gNB shall support Downlink Single-User MIMO in Mid Band. The minimum configuration of Downlink Single-User MIMO may be specified by the tenderer.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure the gNB for SU-MIMO. 2.Bring the gNB to an operationally enabled state. 3.Perform UE attachment. 4.Run data traffic and perform mobility. 5.Capture UE logs to verify SU-MIMO.
Test Limits	NA
Expected Results	The gNB is able to schedule SU-MIMO, and the UE is able to decode it successfully

Test No.	GR_TSTP_3.9_C
Test Details	Verify that the gNB shall support Downlink Multi-User MIMO in Mid Band to support minimum 8 layers;(applicable if tenderer requires 32T32R or higher)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator,, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure the gNB for SU-MIMO and set Max MIMO layers in DL to 8 and 16 as per the tender requirements. 2. Bring the gNB to an operationally enabled state. 3. Perform UE attachment. 4. Run data traffic and perform mobility. 5. Capture UE logs to verify that two or more UEs are multiplexed in both time and frequency domains, and check DCI and PDSCH able to decode the "Number of layers" as per the gNB configuration
Test Limits	NA
Expected Results	gNB is successfully able to configure MU-MIMO and the maximum layer, and the UE is able to decode them

Test No.	GR_TSTP_3.9_D
Test Details	Verify that the gNB shall support Uplink Multi-User MIMO in Mid Band to support minimum 4-layer UL MU-MIMO for PUSCH transmission; (applicable if tenderer requires 32T32R or higher)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator,, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure the gNB for SU-MIMO and set the maximum MIMO layers in UL to 4 or 8, as per the tender requirements. 2.Bring the gNB to an operationally enabled state. 3.Perform UE attachment. 4.Run data traffic and perform mobility. 5.Capture UE logs to verify that two or more UEs are multiplexed in both time and frequency domains, and check that the PUSCH transmits the 'Number of layers' as per the gNB configuration.
Test Limits	NA
Expected Results	The gNB is successfully able to configure MU-MIMO and the maximum number of layers, and the UE is able to transmit accordingly

Test No.	GR_TSTP_3.9_E
Test Details	Verify that the gNB shall support DL modulation schemes: BPSK, QPSK, 16QAM, 64QAM and 256QAM
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure link adaptation. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Run data and perform mobility from good RSRP to bad RSRP. 5.Capture UE logs and check the PDSCH to verify the varying "MCS" based on channel conditions. 6.Validate that all MCS are triggering correctly according to the MCS index table
Test Limits	NA
Expected Results	gNB must successfully schedule up to 256 QAM for DL.

Test No.	GR_TSTP_3.9_F
Test Details	Verify that the gNB shall support UL modulation schemes: π/2-BPSK (As per tenderer requirement), QPSK, 16QAM, 64QAM and 256QAM (Low/Mid band)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure link adaptation. 2.Bring the gNodeB to the operationally enabled state. 3.Perform UE attach. 4.Run data and perform mobility from good RSRP to bad RSRP. 5.Capture UE logs and check the PUSCH to verify the varying "MCS" based on channel conditions. 6.Validate that all MCS are triggering correctly according to the MCS index table
Test Limits	NA
Expected Results	gNB must successfully schedule up to 256 QAM for UL.

Test No.	GR_TSTP_3.10_A
Test Details	Verify that the gNB shall support Quality-of-Service Class Identifiers (QCIs) for NR-NSA mode (EN-DC mode).)
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Bring the gNB and eNB (in case of NSA deployment) are correctly configured and operational.. 2.Power on UE and ensure it attaches to the network in EN-DC (NR-NSA) mode. 3.In Wireshark, observe the eUTRANQoS QCI value within the X2AP SgNB Addition Request message. 4.Verify that the X2AP SgNB Addition Request Acknowledge message indicates successful acceptance.
Test Limits	NA
Expected Results	gNB need to successfully establish QCI for camped UE in NSA mode.

Test No.	GR_TSTP_3.10_B
Test Details	Verify that the gNB shall support 5QI (5G QoS Identifiers) for NR-Standalone mode as per 3GPP TS 23.501 Table 5.7.4-1.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the operational Enabled state. 2.Perform a UE attach procedure between two UEs. 3.Perform data testing, as well as IMS voice and video call testing. 4.In the UE logs, observe the 5QI values in the PDU Session Establishment Request and PDU Session Modification Command messages for DNNs like internet and IMS during data, voice, and video call testing. 5.Verify that the 5QI values used for data, voice, and video match the values defined in 3GPP TS 23.501 Table 5.7.4-1. 6.Check the PDU Session Establishment Accept and PDU Session Modification Complete messages to confirm successful acceptance.
Test Limits	NA
Expected Results	gNB need to allocate defined 5QI values based on the services like data,voice & video

Test No.	GR_TSTP_3.10_C
Test Details	Verify that the gNB shall support multiple data radio bearers (DRBs).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the operational Enabled state. 2.Perform a UE attach procedure between two UEs. 3.Perform data testing, as well as IMS voice and video call testing. 4.In the UE logs, observe the 5QI values in the PDU Session Establishment Request and PDU Session Modification Command messages for DNNs such as internet and IMS, during data, voice, and video call testing. 5.Verify that the gNB supports multiple Data Radio Bearers (DRBs) by checking the DRB ID values in the rrcReconfiguration message for each PDU session corresponding to QFI values for voice, video, and data.
Test Limits	NA
Expected Results	Multiple DRBs need to be established for corresponding QFI values through gNB.

Test No.	GR_TSTP_3.10_D
Test Details	Verify that the gNB shall support dynamic addition and deletion of dedicated bearers.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the operational Enabled state. 2.Perform a UE attach procedure with two UEs. 3.Perform IMS voice and video call testing. 4.During voice or video call initiation, verify that the gNB supports dynamic addition of dedicated bearers by checking the rrcReconfiguration message for DRB IDs with flag defaultDRB:false. 5.Also, ensure that these dedicated bearers are released upon call termination in rrcreconfiguration message with DRB to release list confirming the gNB supports dynamic deletion of dedicated bearers.
Test Limits	NA
Expected Results	gNB need to do dynamic addition and deletion of dedicated bearers while performing services like voice or video call

Test No.	GR_TSTP_3.10_E
Test Details	Verify that the gNB shall support both UE initiated as well as Network Initiated dedicated bearer creation.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1 Bring the gNB to the Operational Enabled state. 2 Perform a UE attach procedure with two UEs. 3 Perform IMS voice and video call testing. 4 Check the NAS message flow—specifically the PDU Session Establishment Request or PDU Session Modification Command—to determine whether it was initiated by the UE or the core network. 5 Check the Successful PDU Session Establishment Accept and PDU Session Modification Complete messages to verify gNB support for both UE-initiated and network-initiated dedicated bearer creation.
Test Limits	NA
Expected Results	gNB need to successfully create both network initiated as well as UE initiated dedicated bearers

Test No.	GR_TSTP_3.10_F
Test Details	Verify that the gNB scheduler shall support prioritization of traffic in downlink as per the QCI/5QI priority value.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring the gNB to the operational Enabled state 2. Perform UE attach. 3. Initiate Voice/video call and data traffic. 4. In PDUsessionresourcenotify message in wireshark capture, check for notification cause as 'fullfilled.'
Test Limits	NA
Expected Results	gNB needs to successfully prioritize traffic as per 5QI priority values.

Test No.	GR_TSTP_3.11_A1
Test Details	Verify that the gNB shall support NR intra-frequency cell re-selection.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two cells (Cell A and Cell B) with the same frequency. 2.Camp the UE on Cell A and keep the device in IDLE mode. 3.Start moving the UE from Cell A toward Cell B to perform mobility. 4.As the RSRP of Cell A decreases and Cell B meets the reselection criteria, the UE should perform cell reselection to Cell B.
Test Limits	NA
Expected Results	UE should successfully perform intra-frequency cell reselection to Cell B without any connection loss while in IDLE mode.

Test No.	GR_TSTP_3.11_A2
Test Details	Verify that the gNB shall support NR inter-frequency cell re-selection.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two cells (Cell A and Cell B) with different frequency. 2.Camp the UE on Cell A and keep the device in IDLE mode. 3.Start moving the UE from Cell A toward Cell B to perform mobility. 4.As the RSRP of Cell A decreases and Cell B meets the reselection criteria, the UE should perform cell reselection to Cell B. 5.UE is now camped on Cell B
Test Limits	NA
Expected Results	UE should successfully perform inter-frequency cell reselection to Cell B without any connection loss while in IDLE mode.

Test No.	GR_TSTP_3.11_A3
Test Details	Verify that the gNB shall support IRAT inter-frequency cell re-selection towards EUTRAN. (As per tenderer requirement in view of deployment)
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. Configure two cells: an NR (5G) serving cell and an LTE (EUTRA) neighbor cell operating on a different frequency. 2. Camp the UE on the NR cell in IDLE mode. 3. Start moving the UE from the NR cell's coverage area toward the LTE cell to simulate mobility. 4. As the NR cell's signal quality (e.g., RSRP/RSRQ) degrades and the LTE cell meets the IRAT reselection criteria the UE should perform IRAT cell reselection from NR to EUTRA (LTE).
Test Limits	NA
Expected Results	UE reselects from NR to LTE cell in IDLE mode when LTE cell meets IRAT reselection criteria and NR signal degrades.

Test No.	GR_TSTP_3.11_B1
Test Details	Verify that the gNB shall support Connected mode mobility within NR frequency (Intra-frequency Handover).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two cells on the same NR frequency. 2.UE camp successfully and perform mobility. 3. Initiate data transmission (e.g., video, throughput, call). 4. Move the UE from the source cell to the target cell to perform the handover.
Test Limits	NA
Expected Results	UE successfully Perform Connected mode mobility with intra frequency handover without any connection lost.

Test No.	GR_TSTP_3.11_B2
Test Details	Verify that the gNB shall support Connected mode mobility within or between gNB (Inter-frequency Handover including same band and different band).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Case 1: Same band, different carrier frequencies Case 2: Different bands 1.Under the same gNB, or On different gNBs with Xn or NG interface between them. 2.Configure proper neighbor relationships, handover parameters, and measurement events between the two cells. 3.Power on the UE, connect to the source cell, and establish an RRC Connected session with active data (e.g., file download, video). 4.Move the UE into the coverage area of the target frequency cell to trigger handover conditions. When conditions are met: a. Source gNB initiates handover (Xn or NG-based, depending on setup) b. Target gNB (or same gNB) prepares resources c. UE receives RRC Reconfiguration, performs handover, and responds with RRC Reconfiguration Complete.
Test Limits	NA

Expected Results	UE successfully performs Connected mode handover between different NR frequencies (same band and different band).

Test No.	GR_TSTP_3.11_B3
Test Details	Verify that the gNB shall support Connected mode mobility towards E-UTRAN in the form of release with redirection towards E-UTRAN frequency (only applicable to SA). (As per tenderer requirement in view of deployment)
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Configure a 5G SA gNB with a neighbor LTE (E-UTRA) cell operating on a valid LTE frequency. 2.Ensure that the E-UTRA neighbor is defined in the gNB configuration with appropriate redirection parameters (e.g., EARFCN, PLMN ID, Cell ID). 3.Ensure the UE supports LTE fallback and is properly configured to access both NR SA and E-UTRAN. 4.Power on the UE and register it to the 5G NR SA cell in Connected mode (with active data or signaling). 5.Simulate a condition to trigger mobility towards E-UTRAN (e.g., cell reselection not possible due to poor NR coverage or policy-based redirection). 6.gNB should trigger RRC Release with redirection info, pointing to the LTE frequency. 7.UE processes the release and performs cell selection and registration on the redirected E-UTRA frequency.
Test Limits	NA
Expected Results	UE receives RRC Release with redirection info to E-UTRAN, then successfully camps and registers on LTE.

Test No.	GR_TSTP_3.11_B4
Test Details	Verify that the gNB shall support interworking between FR1/FR2, including session continuity.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two NR cells under the same or different gNBs: One operating in FR1 One operating in FR2 2.Ensure that both cells are interconnected via Xn or NG interface (depending on whether same or different gNBs), and are configured as neighbors. 3.Configure handover or dual connectivity parameters to support mobility or traffic routing between FR1 and FR2. 4.Power on the UE and ensure it connects to the FR1 cell and establishes an active session (e.g., data streaming or VoNR call). 5.Move the UE into the FR2 coverage area so that the handover (or addition of FR2 as a secondary cell in dual connectivity) is triggered. 6.Ensure session continuity is maintained during this mobility. For Handover: UE receives RRC Reconfiguration, synchronizes with FR2 cell, and sends Reconfiguration Complete. For DC: FR2 is added as a secondary node, and traffic is split.

Test Limits	NA
Expected Results	UE successfully switches between FR1 and FR2 cells maintaining the same data session with no session drop or interruption.

Test No.	GR_TSTP_3.11_B5
Test Details	Verify that the gNB shall support PS Handover to LTE for SA mode (In NSA Mobility control is governed by anchor LTE cell).
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Configure a 5G SA gNB with inter-RAT neighbor LTE cell and ensure the NG and S1 interfaces are properly integrated with a common AMF/MME or EPC-compatible core. 2.Ensure inter-RAT neighbor relations and handover parameters (e.g., EARFCN, PCI) are correctly set in the NR cell configuration. 3.Power on the UE with SA capability and register it on the NR SA cell. 4.Establish a data session (e.g., ping, FTP, or video stream) to keep the UE in RRC Connected mode. 5.Simulate poor NR radio conditions or trigger handover thresholds (e.g., Event B2) to initiate inter-RAT handover to LTE. 6.The gNB initiates the PS Handover Sending Handover Required to AMF
Test Limits	NA
Expected Results	UE successfully performs Packet-Switched handover from 5G SA NR cell to LTE (E-UTRAN), with ongoing session preserved (no data loss or drop)

Test No.	GR_TSTP_3.11_B6
Test Details	Verify that the gNB shall support inter technology handover i.e; FDD to TDD and vice versa.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two NR gNB cells, One operating in FDD mode (e.g., n1, n5) and one operating in TDD mode (e.g., n78, n41). They are connected either via Xn or via NG interface through the AMF. 2.Establish proper neighbor configuration and handover parameters between the FDD and TDD cells in both directions. 3.Power on the UE, and ensure it registers to the source cell (e.g., FDD cell) and enters Connected mode with an active session (data or signaling). 4.Start UE mobility toward the target cell (e.g., TDD) to meet handover trigger conditions (e.g., A3 measurement event). 5.Once conditions are met, the source gNB initiates handover (Xn-based or NG-based depending on setup): 6.Repeat the test in reverse (TDD → FDD) to verify bi-directional support.
Test Limits	NA
Expected Results	UE successfully performs inter-technology handover between FDD and TDD cells (and vice versa) with seamless session continuity, and without service interruption during the switch.

Test No.	GR_TSTP_3.11_B7
Test Details	Verify that the gNB shall support X2(NSA) or Xn(SA) handover.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two gNBs (source and target) with Xn interface connectivity established (i.e., XnAP setup is complete). 2.Ensure both gNBs are using compatible frequencies (intra- or inter-frequency), and neighbor relationships are configured properly. 3.Power on the UE and ensure it registers and establishes an RRC connection with the source gNB (UE in Connected mode). 4.Initiate an active data session (e.g., ping, video streaming, call) to maintain the UE in RRC Connected mode. 5.Move the UE from the source gNB's coverage area toward the target gNB. 6.When handover criteria are met (e.g., Event A3 triggered), the source gNB initiates Xn-based handover. 7.UE synchronizes with the target gNB and sends RRC Reconfiguration Complete. 8.Target gNB informs the source gNB via Handover Notify, and the source releases the context.
Test Limits	NA
Expected Results	UE successfully performs Xn-based handover from the source gNB to the target gNB

Test No.	GR_TSTP_3.11_B8
Test Details	Verify that the gNB shall support S1(NSA) or NG(SA) handover.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 3 and 5
Test Procedure	1.Configure two SA gNBs (source and target) connected to the same AMF over the NG-C interface (NG setup complete). 2.Ensure both gNBs are on different frequencies (inter-frequency scenario) or same frequency (intra-frequency), and the UE is allowed to handover between them. 3.Configure neighbor relationships and handover parameters between the two gNBs. 4.Power on the UE, and ensure it registers to the source gNB and establishes an RRC connection. 5.Initiate a data session to keep the UE in RRC Connected mode. 6.Move the UE toward the coverage area of the target gNB to trigger handover conditions .
Test Limits	NA
Expected Results	UE successfully completes NG-based handover from the source gNB to the target gNB using the core network (NG-C) path, with data session continuity.

Test No.	GR_TSTP_3.11_C
Test Details	Verify that the gNB shall support access class barring parameters
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure the gNB to broadcast Access Class Barring (ACB) parameters in SIB1, enabling barring for specific access classes . 2.Ensure ACB is configured with appropriate values for ac-BarringForMO-Signalling or ac-BarringForMO-Data, including barringFactor and barringTime. 3.Use a test UE configured with a barred access class. 4.Power on the UE and attempt to initiate a mobile-originated service.
Test Limits	NA
Expected Results	UE with a barred access class does not initiate access (e.g., RRC connection) immediately, but instead waits or backs off according to the ACB parameters broadcast by the gNB.

Test No.	GR_TSTP_3.11_D
Test Details	Verify that the gNB shall support inter PLMN reselection
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure two PLMNs (e.g., PLMN A and PLMN B) with valid broadcast parameters on two different gNBs, each with distinct MCC/MNC values. 2.Ensure both gNBs are on the same or different frequencies, and the cells are broadcasting SIBs with proper PLMN info. 3.Place the UE under the coverage of PLMN A and power it on. 4.Ensure the UE registers successfully to PLMN A in IDLE mode. 5.Move the UE toward the coverage area of PLMN B (inter-PLMN neighbor). 6.Ensure PLMN B meets the reselection criteria, and that PLMN B is allowed in the UE's SIM/operator PLMN list.
Test Limits	NA
Expected Results	UE performs inter-PLMN reselection from PLMN A to PLMN B in IDLE mode, successfully camps on a cell of PLMN B, and is able to initiate registration if allowed.

Test No.	GR_TSTP_3.11_E
Test Details	Verify that the gNB shall support “Connection re-establishment” procedure.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Power on the UE and ensure it successfully registers and enters RRC Connected mode with the serving gNB. 2.Establish an active data session (e.g., youtube) to keep the UE in Connected mode. 3.Move the UE out of coverage area to trigger Radio Link Failure (RLF), wait until signal is lost, then bring the UE back into coverage to allow it to initiate the Connection Re-establishment procedure. 4.UE sends an RRC Re-establishment Request to the gNB. 5.gNB processes the request and responds with RRC Re-establishment.
Test Limits	NA
Expected Results	The UE successfully performs the Connection Re-establishment procedure with the gNB, restores the RRC connection, and resumes the data session without requiring full re-registration.

Test No.	GR_TSTP_3.11_F
Test Details	Verify that the system shall support data forwarding at intra-LTE/NR handover, both over X2/ Xn and S1 interfaces based on NSA or SA.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Configure two LTE eNBs (for LTE handover) or two NR gNBs (for NR handover), ensuring: X2 interface is established between eNBs, or Xn interface is established between gNBs S1 (LTE) or NG (NR) interfaces are also connected to MME or AMF 2.Enable data forwarding configuration on the source and target nodes. 3.Power on the UE and register it to the source LTE or NR cell, with an active data session (e.g., ping, FTP, video). 4.Trigger intra-RAT handover by moving the UE toward the target cell (eNB/gNB), under conditions that cause handover.
Test Limits	NA
Expected Results	The system performs data forwarding successfully during intra-LTE or intra-NR handovers over X2/Xn or via fallback to S1/NG, ensuring session continuity and no data loss, in both NSA and SA scenarios.

Test No.	GR_TSTP_3.12_A
Test Details	Verify that the gNB shall support VoNR to VoLTE handover for Standalone mode.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. UE is attached to 5G base station 2. VoNR call is started 3. UE moves out of 5G coverage area towards 4G base station 4. UE is handed over to 4G base station 5. Voice bearer is also handed over to LTE and call continues.
Test Limits	NA
Expected Results	Call does not disconnect when UE moves from 5G to 4G coverage.

Test No.	GR_TSTP_3.12_B
Test Details	Verify that the gNB shall support EPS Fallback from NR to LTE for IMS Voice in Standalone mode
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. UE supports NR SA and EPS Fallback 2. gNB is operating in Standalone NR mode 3. LTE coverage is available and IMS is provisioned 4. UE is camped on NR and registered for IMS 5. Attach UE to NR SA network and verify IMS registration 6. Initiate an MT or MO IMS voice call while in NR SA coverage 7. Monitor fallback procedure to LTE 8. Observe IMS voice call setup over LTE
Test Limits	NA
Expected Results	UE initiates call on NR SA EPS Fallback is triggered to LTE Voice call is established over LTE IMS Seamless call setup with no call drop

Test No.	GR_TSTP_3.12_C
Test Details	Verify that If the NR-Standalone RAN is not able to provide voice services, then initiated or received voice calls shall be supported by moving the UE from NR RAN to LTE RAN to provide a seamless voice service.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 & 12-2
Test Procedure	1. UE supports NR SA and EPS Fallback 2. gNB is operating in Standalone NR mode 3. LTE coverage is available and IMS is provisioned 4. UE is camped on NR and registered for IMS 5. Attach UE to NR SA network and verify IMS registration 6. Initiate an MT or MO IMS voice call while in NR SA coverage 7. Monitor fallback procedure to LTE 8. Observe IMS voice call setup over LTE
Test Limits	NA
Expected Results	UE initiates call on NR SA EPS Fallback is triggered to LTE Voice call is established over LTE IMS Seamless call setup with no call drop

Test No.	GR_TSTP_3.12_D
Test Details	Verify that the gNB shall support measurement-based release with redirection and measurement-based handover, to perform EPS fallback from NR to LTE for voice service in Standalone mode.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 & 12-2
Test Procedure	1. gNB operates in NR Standalone mode 2. LTE neighbor cells are configured and measurable 3. UE supports EPS Fallback and IMS voice 4. IMS registration is complete over NR 5. Attach UE to NR SA and ensure LTE neighbors are reported 6. Initiate voice call on NR (MO or MT) 7. Monitor if gNB triggers EPS Fallback via: a. Release with Redirection if LTE RSRP > threshold b. Measurement-based Handover if conditions met 8. Observe call continuation on LTE via IMS
Test Limits	NA
Expected Results	UE reports LTE neighbor measurements gNB triggers EPS Fallback using release or HO method UE redirects or hands over to LTE IMS voice call successfully established on LTE

Test No.	GR_TSTP_3.12_E
Test Details	Verify that If EPS fallback is opted for voice services, the gNB shall be able to handle Emergency Calls during Fallback. The gNB shall offer the operator the possibility to apply separate priorities for Fallback of emergency calls as compared to Fallback for ordinary voice calls in Standalone mode.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 & 12-2
Test Procedure	1. gNB in NR SA mode with EPS Fallback enabled Priority configuration for emergency vs. ordinary call fallback is set UE supports emergency services and IMS voice 2. Attach UE to NR SA and confirm IMS registration Initiate an emergency call (e.g., 112) → trigger EPS Fallback 3. Capture and compare fallback triggering behavior and priority handling
Test Limits	NA
Expected Results	gNB uses standard priority for ordinary call fallback gNB applies higher priority or faster fallback for emergency call Both calls are redirected to LTE and established over IMS Emergency fallback is given precedence in resource-constrained scenarios

Test No.	GR_TSTP_3.13_A
Test Details	Verify that the gNB shall support Voice over NR (VoNR) functionality for Standalone mode
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the operational Enabled state. 2.Perform a UE attach procedure between two UEs. 3.Perform IMS voice and video call testing. 4.while initiating voice call , observe the 5QI values defined for VONR voice established in NGAP PDU Session Modification Request message. 5.Check the NGAP PDU Session Modification response message to confirm successful acceptance. 6.while terminating call observe the same 5QI values are being released or not.
Test Limits	NA
Expected Results	gNB need to successfully perform VONR call in SA mode

Test No.	GR_TSTP_3.13_B
Test Details	Verify that the gNB shall support Basic Voice over NR, which provides traffic functions and protocol procedures for establishing, maintaining, and releasing a voice call in NR Standalone mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the operational Enabled state. 2.Perform a UE attach procedure between two UEs. 3.Perform IMS voice call testing. 4.while initiating voice call , observe the 5QI values defined for VONR voice established in NGAP PDU Session Modification Request message. 5.Check the NGAP PDU Session Modification response message to confirm successful acceptance. 6.In wireshark Observe the data traffic through gtp packets with extension header PDU session container flow through corresponding QFI value or not. 7.while terminating call observe the same 5QI values are being released or not.
Test Limits	NA
Expected Results	gNB need to successfully perform Basic Voice over NR with traffic fuctions, establishing and releasing bearers in NR SA mode.

Test No.	GR_TSTP_3.13_C
Test Details	Verify that the gNB shall support Voice over NR calls, which allow the handling of voice traffic directly in NR RAN instead of EPS Fallback to LTE for Standalone mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the "Operationally Enabled" state. 2.Attach the two UE(s) and ensure successful registration to the 5G SA network. 3.Initiate IMS-based voice and video calls between two UEs to trigger VoNR. 4.During call setup, observe the NGAP PDU Session Modification Request message in Wireshark to verify that 5QI values for VoNR are correctly assigned—typically 5QI 1 for voice and 5QI 2 for video. 5.Check the corresponding NGAP PDU Session Modification Response message to confirm successful acceptance of the QoS flows. 6.Using Wireshark, analyze GTP-U packets to ensure that user-plane traffic flows correctly through the PDU session container with the appropriate QFI values mapped to the voice and video services.
Test Limits	NA
Expected Results	gNB successfully need to perform VONR calls handling voice traffic directly in NG RAN with out fallback to EPS

Test No.	GR_TSTP_3.13_D
Test Details	Verify that the gNB shall support intra frequency handover for voice services to be maintained in NR RAN for Standalone mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB's to the "Operationally Enabled" state. 2.Attach the UE and ensure successful registration to the 5G SA network in the source gNB. 3.Perform intra frequency XN or NG based handover scenario by camping one UE to target gNB. 4.Check whether voice call is stable or not after performing handover.
Test Limits	NA
Expected Results	gNB shall successfully able to perform intra frequency handover while performing VONR voice call in NR SA mode

Test No.	GR_TSTP_3.13_E
Test Details	Verify that the gNB shall support IP header compression
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE Attach. 3. Initiate VoNR call or perform data test 4. Verify through UE logs that header compression is used.
Test Limits	NA
Expected Results	gNodeB shall use header compression during VoNR call or data test.

Test No.	GR_TSTP_3.14_A
Test Details	Verify that the System shall support LTE-NR Downlink Carrier Aggregation for EN-DC mode
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Set up the LTE eNodeB (Master Node) and NR gNodeB (Secondary Node) with appropriate configuration to enable EN-DC. 2. Ensure LTE and NR downlink carriers are available and configured for CA 3. Connect UE that supports EN-DC with DL CA capability. 4. Ensure both eNodeB and gNodeB are in an Operationally Enabled state. 5. Verify the interface connectivity. 6. Power on the UE and initiate the attach procedure. 7. Ensure that the UE is attached to the LTE anchor and EN-DC is established. 8. Initiate downlink traffic to reach the threshold where carrier aggregation is triggered.
Test Limits	UE should have have the capabilities to support the scenario.
Expected Results	Verify that secondary NR carriers are added during active data sessions. Use UE logs and protocol analyzers (e.g., Wireshark) to: Confirm DC setup via RRC signaling (LTE as MN, NR as SN). Measure downlink throughput before and after CA activation.

Test No.	GR_TSTP_3.14_B
Test Details	Verify that the System shall support LTE-NR Uplink Carrier Aggregation for EN-DC mode.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. Set up the LTE eNodeB (Master Node) and NR gNodeB (Secondary Node) with appropriate configuration to enable EN-DC. 2. Ensure LTE and NR uplink carriers are available and configured for CA 3. Connect UE that supports EN-DC with UL CA capability. 4. Ensure both eNodeB and gNodeB are in an Operationally Enabled state. 5. Verify the interface connectivity. 6. Power on the UE and initiate the attach procedure. 7. Ensure that the UE is attached to the LTE anchor and EN-DC is established. 8. Start uplink traffic from UE to the network, with sufficient volume to trigger aggregation.
Test Limits	UE should have have the capabilities to support the scenario.
Expected Results	Verify that secondary NR carriers are added during active data sessions. Use UE logs and protocol analyzers (e.g., Wireshark) to: Confirm DC setup via RRC signaling (LTE as MN, NR as SN). Measure downlink throughput before and after CA activation.

Test No.	GR_TSTP_3.14_C
Test Details	Verify that the gNB shall support NR DL Carrier Aggregation up to 2CC for Low-Band and Mid-Bands.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Define two component carriers: 2 CC in Low-Band and/or 2 CC in Mid-Band (2CC should be in same band) 2. Configure inter-band CA support. 3. Bring the gNB into an Operationally Enabled state. 4. Confirm cells are active and broadcasting SIBs for both carriers. 5. Power on the UE and initiate the NR attach / registration procedure. 6. Confirm successful RRC connection setup. 7. Initiate downlink traffic to trigger carrier aggregation activation.
Test Limits	UE should be capable of supporting 2 CC in Low-Band and/or on Mid Band
Expected Results	Measure DL throughput to confirm that both CCs are contributing to the data session and compare to baseline single-CC throughput to verify CA gain.

Test No.	GR_TSTP_3.14_D
Test Details	Verify that the gNB shall support up to 8CC DL Carrier Aggregation for High Bands, as per tendering authority requirements
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Enable and configure 8 DL Component Carriers within the same or multiple bands. Define and activate an 8CC CA set (either contiguous or non-contiguous). 2. Ensure all carriers are properly synchronized and use compatible numerology. 3. Activate the gNB and verify all 8 cells (carriers) are ON and broadcasting. 4. Initiate UE registration and RRC connection. 5. Trigger downlink data traffic to force CA activation.
Test Limits	UE must be capable of supporting 8 CC and relevant band combinations.
Expected Results	All 8 DL CCs are successfully configured and active. Combined DL throughput is significantly higher than single or dual-CC setups.

Test No.	GR_TSTP_3.14_E
Test Details	Verify that the gNB shall support Inter-Band CA between various standardized FDD bands (not applicable for TDD system)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Enable and configure at least two standardized FDD NR bands for CA and set up inter-band CA configuration with separate physical cells per band. 2. Power on gNB and verify that both FDD carriers are active and in operational state. Check that SIBs are broadcast for all configured bands. 3. Power on the UE and perform registration to the gNB. Establish RRC connection. 4. Start data flow to activate Carrier Aggregation
Test Limits	
Expected Results	Inter-band CA configuration is successfully activated on the gNodeB. Aggregate throughput is higher than with a single FDD band.

Test No.	GR_TSTP_3.14_F
Test Details	Verify that the gNB shall support Intra-Band contiguous and non-contiguous CA
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Configure gNB for Intra-Band Contiguous CA: 1. Enable two adjacent component carriers (e.g., CC1: 3650–3700 MHz, CC2: 3700–3750 MHz). Configure them as part of the same cell group and CA set. 2. Power on the gNB and UE. Attach UE and establish RRC connection. 3. Trigger data session to activate CA. Configure gNB for Intra-Band Non-Contiguous CA: 1. Enable two non-adjacent CCs within the same band (e.g., CC1: 3650–3690 MHz, CC2: 3730–3770 MHz). Configure them as part of the same cell group and CA set. 2. Power on the gNB and UE. Attach UE and establish RRC connection. 3. Trigger data session to activate CA.
Test Limits	Confirm UE supports contiguous/non-contiguous CA for the configured band and spacing.
Expected Results	Downlink data is transmitted over both component carriers. Total DL throughput is higher than single carrier.

Test No.	GR_TSTP_3.14_G
Test Details	Verify that the gNB shall support CA between FDD and TDD
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Enable Carrier Aggregation between one FDD band and one TDD band. Assign appropriate bandwidths, frequency ranges, and SCS per band. Ensure both carriers belong to the same serving cell group or configured for CA via RRC. 2. Power on UE and perform registration. Confirm RRC connection is established successfully. 3. Start data transmission to trigger CA
Test Limits	Confirm from UE Capability Information that the UE supports the selected FDD–TDD CA combination.
Expected Results	gNB correctly configures and signals CA between an FDD and a TDD carrier. Throughput is higher than with a single carrier.

Test No.	GR_TSTP_3.14_H
Test Details	Verify that the gNB shall support Carrier Aggregation combinations for 3CC 1xFDD+2xTDD with FDD or TDD as PCell 2xFDD+ 1xTDD with FDD or TDD as PCell 3xFDD with FDD as PCell
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Enable 3CC CA configuration with 1xFDD and 2xTDD carriers. Set appropriate PCell (FDD or TDD depending on test case variation). Assign correct frequencies, bandwidths, and numerology. A. FDD as PCell (Test Variation 1): Start gNB and bring all cells operational. Power on UE and perform registration. Ensure UE connects with the FDD cell as the PCell. Trigger high-throughput traffic. B. TDD as PCell (Test Variation 2): Start gNB and bring all cells operational. Power on UE and perform registration. Ensure UE connects with the TDD cell as the PCell. Trigger high-throughput traffic.
Test Limits	Confirm UE supports: 3CC CA: 1 FDD + 2 TDD, The specific combination of bands (e.g., CA_n1+n78+n78) PCell flexibility (i.e., can operate with FDD or TDD as the PCell)

	Validate combo support from 3GPP TS 38.101-1 and UE CA capabilities.
Expected Results	All component carriers are activated and assigned as per test variation. Test A: FDD is the PCell and TDDs are secondary. Test B: TDD is the PCell and FDD is a secondary cell. UE logs show all 3 CCs active and transmitting DL data.

Test No.	GR_TSTP_3.14_I
Test Details	Verify that the gNB shall support Uplink Carrier Aggregation
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Define 2 or more UL component carriers. 2. Activate and verify all uplink carriers are ON. 3. Power on UE, register with the gNodeB, and establish RRC connection. 4. Start UL traffic to drive data volume (e.g., large file upload or iPerf).
Test Limits	Confirm via UE Capability Information message that the UL CA combo is supported. E.g. 1. Intra-band UL CA: 2xUL carriers in band n78 2. Inter-band UL CA: 1 UL carrier in n1 + 1 UL carrier in n78 Actual combinations should be based on UE and gNB CA capability.
Expected Results	UL throughput is measurably higher than a single carrier.

Test No.	GR_TSTP_3.14_J
Test Details	Verify that the gNB shall support Dynamic selection of Secondary frequency when having multiple cell carriers for CA
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Enable multiple potential SCell frequencies. 2. Bring UE online, attach to gNB with PCell on primary frequency. 3. Initiate data session to trigger CA activation. 4. Simulate degraded radio condition or load on selected SCell. Verify if gNB dynamically reconfigures SCell to another available frequency.
Test Limits	Verify via UE Capability Information that all SCell frequency options are supported.
Expected Results	UE log shows SCell activation and traffic over it.

Test No.	GR_TSTP_3.14_K
Test Details	Verify that the gNB shall consider CA users during Load Balancing to avoid losing CA capabilities and to avoid congestion because of CA activation
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure Cell A and Cell B with appropriate capabilities and thresholds. Cell A (Primary): Supports 2CC CA and currently moderate load Cell B (Neighbor): Supports only 1CC (no CA) or is near overload. 2. Attach UE to Cell A and activate 2CC Carrier Aggregation. Start DL traffic session on UE. 3. Generate load on Cell A to bring it near its load balancing threshold, such that it should trigger gNB's internal load balancing logic. 4. Ensure gNB evaluates whether moving UE to Cell B (with no CA or congested CA) would result in loss of CA performance or worsen congestion. 5. Capture handover decision or lack thereof. 6. gNB retains UE on Cell A or moves to a better cell that maintains CA support.
Test Limits	UE: Supports CA and is initially camped on Cell A with CA active
Expected Results	gNB prioritizes keeping CA UEs on cells that maintain throughput expectations. gNB does not activate additional CCs on already congested cells, even if UE supports more CA combinations.

Test No.	GR_TSTP_3.15_A
Test Details	Verify that the system shall support LTE-NR Dual Connectivity to enable support for EN-DC in the gNB
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 & 12-2
Test Procedure	1. Configure and Bring up NSA Setup. 2. MeNb and SgNB exchanges X2 setup messages on SCTP connection 3. Verify X2 messages in wireshark captures 4. NR PCI for the cells in gNB are detected by UE or testing tools
Test Limits	NA
Expected Results	MeNB, SgNB hand over the end to end bearers whenever required

Test No.	GR_TSTP_3.15_B
Test Details	Verify that the gNB shall support UE to be served simultaneously by multiple component carriers from 2 cell groups (Master eNodeB and Secondary gNB) scheduling resources independently for NR-NSA mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure and Bring up NSA Setup. 2. In wireshark, observe X2 Setup and Sgnb Addition messages.
Test Limits	NA
Expected Results	UE should be able to connect to NSA (EN-DC) setup.

Test No.	GR_TSTP_3.15_C
Test Details	Verify that Band combinations for end-to-end performance, standardization and ecosystem may be as per tenderer requirements.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Configure and Bring up NSA Setup. 2. In wireshark, observe X2 Setup and Sgnb Addition messages. 3. Check the band combinations.
Test Limits	NA
Expected Results	gNB supports UE capability enquiry gNB should filter band capabilities according to UE requirement and try to establish ENDC connection if possible

Test No.	GR_TSTP_3.15_D
Test Details	Verify that System shall support periodic NR search thereby providing the UE multiple chances to establish EN-DC connection.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. Configure and Bring up NSA Setup. 2. Establish X2 connections towards MeNBs 3. Send MTC (measurement timing config) configurations for each serving cell to MeNBs connected 4. LTE node should configure MTC (measurement timing config) to search for NR PCIs in the network
Test Limits	NA
Expected Results	UE should find all the NR PCIs in NR coverage areas

Test No.	GR_TSTP_3.15_E
Test Details	Verify that EN-DC-Triggered Handover at incoming handover may be as per tenderer requirements.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1. UE is connected to network in NSA mode 2. UE moves away from MeNb coverage towards SA gNB node. 3. LTE node initiates inter RAT handover between 4G and 5G node 4. UE attaches to 5G node.
Test Limits	NA
Expected Results	UE voice or data transfers are not dropped when moving from ENDC network to SA node

Test No.	GR_TSTP_3.15_F
Test Details	Verify that Carrier aggregation features available to achieve high capacity may be as per tenderer requirements.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Verify number of CCs that supported in the system 2. Activate CCs according to capacity needs 3. Send CC configuration to UEs 4. De-activate CC when capacity is not required
Test Limits	NA
Expected Results	gNB broadcasts and queries CC capacity to and from the UE gNB activates CCs, schedules data according to the need

Test No.	GR_TSTP_3.15_G
Test Details	Verify that the LTE-NR Dual Connectivity system shall support addition, modification, and release of resources allocated in the Secondary Node for the EN-DC-capable UE.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring up the NSA setup. 2. In wireshark, observe Sgnb Addition Request, Sgnb Addition Response and Sgnb Release messages.
Test Limits	NA
Expected Results	UE should be able to attach and detach from NSA setup multiple times.

Test No.	GR_TSTP_3.16_A
Test Details	Verify that System shall support Location Services for NR Standalone mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is in Standalone mode and properly configured. 2. 5GC components (AMF, LMF) are operational. 3. Power on and initialize gNB. 4. LMF initiates NRPPa POSITIONING INFORMATION REQUEST via AMF over NG-C.
Test Limits	NA
Expected Results	In wireshark or such tool check if received “NRPPa POSITIONING INFORMATION RESPONSE” from gNB for the “NRP POSITIONING INFORMATION REQUEST” message

Test No.	GR_TSTP_3.16_B
Test Details	Verify that System shall support receiving a positioning request for a specific device from the AMF for NR Standalone mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is in Standalone mode and properly configured. 2. 5GC components (AMF, LMF) are operational. 3. Power on and initialize gNB. 4. LMF initiates “LPP Request Location Information” message toward UE.
Test Limits	NA
Expected Results	In wireshark or such tool check if received “LPP Provide Location Information” message from UE for the “LPP Request Location Information”

Test No.	GR_TSTP_3.17_A
Test Details	gNB shall be power efficient and implement power saving functionality
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state 2. Schedule power saving of gNodeB via OMC. 3. Verify that the gNodeB goes into power saving mode at the scheduled time
Test Limits	NA
Expected Results	The gNodeB shall implement power saving has per OMC configuration.

Test No.	GR_TSTP_3.17_B
Test Details	The gNB shall support Energy Metering to provide a standardized way to observe power consumption and energy consumption measurements on a node or parts of a node
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state 2. Query the gNB using NetConf/REST/SNMP to list supported Energy Metering capabilities via OMC. 3. Record energy/power reading with no traffic load. 4. Apply a synthetic traffic load via traffic generator (e.g., IPerf or UE emulator) and capture energy readings during peak load 5. Request energy metrics per module (e.g., baseband, RF, cooling). 6. Configure periodic reporting (e.g., every 5 mins) via NetConf. 7. Compare gNB-reported values with those from a physical power meter.
Test Limits	NA
Expected Results	gNB shall respond with a list of supported energy metrics (e.g., total power, component-level power). Energy consumption values should increase proportionally with load. gNB shall returns distinct energy readings for each component if supported. gNB shall push energy readings at configured intervals if configured for periodic measurement. Readings should be within ±5% deviation (or vendor-defined tolerance).

Test No.	GR_TSTP_3.17_C
Test Details	The gNB shall support Micro Sleep Transmission, which reduces energy consumption by turning off certain radio hardware components when there is no traffic.
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Do not perform any UE attach i.e. keep the gNodeB idle for some specified amount of time. 3. When the gNodeB is in idle state i.e. when it is not serving any user, then verify that gNodeB should be able to enter the micro sleep mode. 4. Verify from gNodeB logs that DTX has been activated. 5. Also verify when the DTX is activated, gNodeB remains accessible i.e. it remains in "IN_SERVICE" state. 6. The transmission of cell specific reference signals, PBCH and the PSS/SSS will continue as earlier. ** Procedure as per Distributed SON functionality
Test Limits	NA
Expected Results	gNodeB supports micro sleep mode when there is no traffic

Test No.	GR_TSTP_3.17_D
Test Details	The gNB shall support discontinuous transmission (DTX) on downlink to save energy during low traffic.
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Do not perform any UE attach i.e. keep the gNodeB idle for some specified amount of time. 3. When the gNodeB is in idle state i.e. when it is not serving any user, then verify that gNodeB should be able to enter the micro sleep mode. 4. Verify from gNodeB logs that DTX has been activated. 5. Also verify when the DTX is activated, gNodeB remains accessible i.e. it remains in "IN_SERVICE" state. 6. The transmission of cell specific reference signals, PBCH and the PSS/SSS will continue as earlier. **** Procedure as per Distributed SON functionality**
Test Limits	NA
Expected Results	gNodeB supports micro sleep mode when there is no traffic.

Test No.	GR_TSTP_3.17_E
Test Details	The gNB shall automatically enables and disables the main power amplifier (PA) in the radio-unit (as per tenderer requirements) The PA is turned off in the following cases: a. When no PDSCH traffic is scheduled on a subframe b. During symbols that do not carry mandatory information
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state 2. Configure the gNB scheduler to not schedule any PDSCH traffic on a given subframe (e.g., subframe #5). Monitor the PA status for that subframe: • Through gNB logs/indicators • Or via power measurement (RF output should drop to near zero). 4. Schedule PDSCH traffic on a given subframe (e.g., subframe #6). Monitor the PA status as ON for this. 5. Schedule PDSCH traffic such that some OFDM symbols in the subframe carry mandatory information (e.g., DM-RS, PBCH), but others do not. Monitor the PA status as ON for mandatory symbols and OFF for others. 6. Run a test with alternating subframes having PDSCH scheduled and not scheduled and monitor PA status as above and verify PA ON/OFF toggling is consistent and timely.
Test Limits	NA
Expected Results	The PA is turned off in the following cases: a. When no PDSCH traffic is scheduled on a subframe

	b. During symbols that do not carry mandatory information To measure, RF output power drops accordingly. Logs or telemetry reflect PA OFF state

Test No.	GR_TSTP_3.17_F
Test Details	The system shall support decrease of UE battery consumption by typical traffic patterns and reduces the risk of overheating.
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure DRX and UE inactivity timers. 2. Bring gNodeB in operationally enabled state 3. Perform UE attach 4. Verify through UE logs DRX and UE inactivity Parameters
Test Limits	NA
Expected Results	gNodeB shall indicate configured DRX and UE inactivity timers to the UE.

Test No.	GR_TSTP_3.17_G
Test Details	The system shall support long cycle Discontinuous Reception (C-DRX).
Test Instruments Required	gNodeB, RF cables and attenuators, 5GC/ 5GC Emulator, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring gNodeB in operationally enabled state 2. Configure gNB to enable long cycle C-DRX parameters via RRC (e.g., setting drx-LongCycleStartOffset). 3. Verify that UE receives the DRX configuration in RRC Reconfiguration message. 4. Allow UE to camp and idle. Monitor UE DRX state and ensure it enters sleep mode for the configured long cycle period. 4. Trigger a paging message during UE's DRX ON duration. Verify UE wakes up and responds to paging promptly.
Test Limits	NA
Expected Results	UE confirms configuration and applies long cycle C-DRX. UE wakes up and responds to paging promptly.

Test No.	GR_TSTP_3.18_A
Test Details	Verify that System shall provide support for Autointegration.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB Network functions like CU/DU support any of the management interfaces like O1/SNMP. 2. NF like CU/DU/RU discovers SMO/NETCONF/Management system over DHCP. 3. gNB can send request to management system to be discovered. 4. NF can perform system related diagnostics and recovers in case of critical faults, send critical faults to management system.
Test Limits	NA
Expected Results	Network Functions should be automatically discovered to the management functions. Network Function should recover from CRITICAL crashes Network Function should automatically send PNF registration or Call home to be discovered by management entities.

Test No.	GR_TSTP_3.18_B
Test Details	Verify that System shall provide support for Automatic Neighbour Relations or provide suitable API support for Automatic Neighbour Relations.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Verify gNB has a initial list of Neighbors added at the time of Network Planning 2. Verify if gNB is able to identify new cells which are brought up subsequently over period and are in coverage range for the cell 3. Verify if gNB is able configure measurements reports for UEs, so that it can identify new neighbors. 4. Verify if gNB is can send measurement reports on demand to SON or Management entity
Test Limits	NA
Expected Results	gNB will automatically discover new cells that are brought up subsequently after initial radio planning gNB will automatically assign priority order to discovered neighbors based on HO stats gNB will accept any overwrites from Centralised SON or any other Management entity.

Test No.	GR_TSTP_3.18_C
Test Details	Verify that System shall provide suitable API support for minimization of drive test in NSA mode of operation.
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 & 12-2
Test Procedure	1. gNB sends logged/periodic MDT configurations to UEs via eNB 2. Supported UEs sends logged MDT results, periodic results to eNB 3. eNB transfers reports to the SgNB 4. SgNB sends notifications to management entities that MDT files are ready to transferred over HTTP API 5. Files are transferred over SFTP
Test Limits	NA
Expected Results	MDT results are configured and gNB receives MDT results HTTP notifications are sent to management entities regarding MDT files Every file generated should have notification sent to management entity.

Test No.	GR_TSTP_3.18_D
Test Details	Verify that System shall provide support for autoconfiguration.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB network functions supports any of the interfaces towards management systems like O1/SNMP/TR069 2. gNB applies configurations sent over the management interface. 3. gNB discovers management entities over DHCP
Test Limits	NA
Expected Results	gNB discovers management entities, applies configurations sent by them

Test No.	GR_TSTP_3.19_A
Test Details	Verify that the gNB shall support Public Warning System (PWS).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is in Standalone mode and properly configured. 2. 5GC components (AMF, SMF) are operational. 3. Power on and initialize gNB. 4. gNB initiates NG setup procedure with AMF over NG-C. 5. Establish NG-U for user-plane path. 6. Attach UE and trigger PWS from AMF.
Test Limits	NA
Expected Results	Verify the UE Receives the Specified ETWS/CMAS Message and show on the UE as Popup if configured.

Test No.	GR_TSTP_3.19_B
Test Details	Verify that the gNB shall supports the ETWS and CMAS (also known as WEA) cell broadcast functions.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is in Standalone mode and properly configured. 2. 5GC components (AMF, SMF) are operational. 3. Power on and initialize gNB. 4. gNB initiates NG setup procedure with AMF over NG-C. 5. Establish NG-U for user-plane path. 6. Attach UE and trigger Write Replace Warning Request from AMF.
Test Limits	NA
Expected Results	Verify the UE Receives the Specified ETWS/CMAS Message and show on the UE as Popup if configured.

Test No.	GR_TSTP_3.20_A
Test Details	Verify that the gNB shall support network slices in NR RAN.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure multiple network slices on the gNB to enable network slicing functionality. 2.Connect two different UEs to two different network slices based on their slice configuration. 3.Verify that each UE is connected to a different slice by checking the Slice/Service Type (SST) and Slice Differentiator (SD) values in the UE context. 4.Validate network slicing functionality by verifying that PRB (Physical Resource Block) allocation is performed according to the percentage defined for each slice.
Test Limits	NA
Expected Results	gNB need to perform Network slicing based on defined slice sst & sd values & perform slicing functionalities like resource sharing.

Test No.	GR_TSTP_3.20_B
Test Details	Verify that the gNB shall support slice-aware Quality of Service (QoS) mapping framework and support QoS differentiation within a slice.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure multiple network slices on the gNB to enable network slicing functionality. 2.Connect two different UEs with two different QoS to two different network slices based on their slice configuration. 3.Compare Each UE connected QoS values and their Network slicing SST & SD values to check the gNB support of slice aware QoS mapping.
Test Limits	NA
Expected Results	gNB need to allocate different slices based on QoS values to support slice aware QoS mapping.

Test No.	GR_TSTP_3.20_C
Test Details	Verify that the gNB shall support Slice-aware NG-based handover.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring both gNBs to the "Operationally Enabled" state and ensure they are connected to the same AMF. 2.Connect the UE to the source gNB and perform an NG-based handover to the target gNB. 3.Using Wireshark, analyze the NG handover messages to verify the presence of S-NSSAI information, including SST and SD values, to confirm support for slice-aware NG-based handover.
Test Limits	NA
Expected Results	gNB successfully need to perform Slice aware NG-based handover

Test No.	GR_TSTP_3.20_D
Test Details	Verify that the gNB shall support S-NSSAI (Single Network Slice Selection Assistance Information) of neighbouring gNB (received by the Xn interface) in order to avoid unnecessarily initiating NG-based handovers.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring both gNBs to the "Operationally Enabled" state and ensure they are properly connected via the Xn interface. 2.Connect the UE to the source gNB and perform an Xn-based handover to the target gNB. 3.Using Wireshark, analyze the Xn handover messages to verify the presence of S-NSSAI information—including SST and SD values—without the involvement of NG handover messages. 4.Observe the successful XN handover procedure
Test Limits	NA
Expected Results	gNB successfully need to perform Slice aware XN handover without unnecessarily initiating NG- based Handover.

Test No.	GR_TSTP_3.20_E
Test Details	Verify that the RAN Slicing Framework feature enables the mapping of PDU sessions to resource partitions based on PLMN and S-NSSAI.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure multiple network slices on the gNB by enabling the RAN Slicing Framework feature. Define separate S-NSSAIs (consisting of SST and SD). 2.Connect two different UEs to two different network slices, ensuring that each UE is configured to request a specific S-NSSAI during the PDU session establishment. 3.Verify UE slice assignment by checking the Slice/Service Type (SST) and Slice Differentiator (SD) values in each UE's context at the gNB and the core network. Ensure the UEs are connected to their intended slices. 4.Validate the RAN Slicing Framework functionality by confirming that: a)PDU sessions are mapped to the correct resource partitions based on PLMN and S-NSSAI.Physical Resource Block (PRB) allocation aligns with the predefined resource percentage configured for each slice
Test Limits	NA
Expected Results	RAN Slicing need to resource partitions based on PLMN & S-NSSAI values.

Test No.	GR_TSTP_3.20_F
Test Details	Verify that for NSA mode: The EN-DC RAN Slicing extends QoS differentiation and dynamically sharing spectral resources to be applicable to EN-DC traffic
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	1.Set up multiple network slices on the gNB, each with different SST and SD values, and define how much PRB (radio resource) each slice should get. 2.Connect two UEs to different slices, based on their slice configuration. Each UE should use a different SST/SD. 3.Check the UE context to confirm that each UE is connected to the correct slice by verifying the SST and SD values. 4.Verify RAN slicing in NSA (EN-DC) mode by checking that PRB allocation follows the configured percentage for each slice. Make sure resources are shared properly
Test Limits	NA
Expected Results	UEs need to be connected to its assigned network slice with the correct SST and SD values, and PRB resources are allocated according to the defined slice configuration for dynamic resource sharing in NSA (EN-DC)

Test No.	GR_TSTP_3.21_A
Test Details	Verify that the gNB shall support MORAN (Multi-Operator RAN) functionality for both NR NSA and NR SA modes, which allows two operators to share the same Radio unit with dedicated spectrum per operator.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure multiple cells on the gNB as per the operator's requirements. 2.Bring the gNB to the operational (enabled) state. 3.Perform the UE attach procedure. 4.Capture UE logs to validate the initial cell selection process and connection establishment.
Test Limits	NA
Expected Results	UE successfully need to established connection with gNB with same RU and dedicated spectrum as per operator

Test No.	GR_TSTP_3.21_B
Test Details	Verify that the gNB shall support MOCN (Multi-Operator Core Network) functionality, which allows shared NR RAN with Spectrum sharing for NR Cell among up to 12 operators for NR-SA mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure the gNB to connect with multiple core networks. 2.Ensure 5GC components (AMF, SMF) are operational. 3.Power on and initialize the gNB. 4.The gNB initiates the NG setup procedure with the AMF over the NG-C interface. 5.Establish NG-U for the user-plane path. 6.Attach the UE and verify registration and data flow.
Test Limits	NA
Expected Results	NG setup is successfully established between the gNB and the multiple 5GC. The UE registers with the network and establishes a PDU session.

Test No.	GR_TSTP_3.21_C
Test Details	Verify that the gNB shall support MOCN (Multi-Operator Core Network) functionality, which allows shared NR RAN with Spectrum sharing for NR Cell among up to 6 operators for NR-NSA (EN-DC) mode.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Configure the gNB to connect with multiple core networks. 2.Ensure 5GC components (AMF, SMF) are operational. 3.Power on and initialize the gNB. 4.The gNB initiates the NG setup procedure with the AMF over the NG-C interface. 5.Establish NG-U for the user-plane path. 6.Attach the UE and verify registration and data flow.
Test Limits	NA
Expected Results	NG setup is successfully established between the gNB and the multiple 5GC. The UE registers with the network and establishes a PDU session.

Test No.	GR_TSTP_3.22_A
Test Details	Shall be able to support a round-trip latency up to 800ms on the satellite backhaul (NG) interface.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Insert Round Trip Latency up to 800 ms using delay simulator tool on NG Interface. 2. Bring gNodeB in operationally enabled state 3. Perform UE Attach/Detach Procedure 4. Verify that UE Successfully Attached and Detached from Network. 5. Verify through UE/Wireshark logs
Test Limits	NA
Expected Results	The gNodeB shall successfully execute Attach/Detach procedure with round trip latency up to 800ms.

Test No.	GR_TSTP_3.22_B
Test Details	Shall be able to support packet jitter of up to 100ms on the satellite backhaul (NG) interface
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Insert Jitter of upto 100ms using simulator tool on NG Interface. 2. Bring gNodeB in operationally enabled state 3. Perform UE Attach/Detach Procedure 4. Verify that UE Successfully Attached and Detached from Network. 5. Verify through UE/Wireshark logs.
Test Limits	NA
Expected Results	The gNodeB shall successfully execute Attach/Detach procedure with packet jitter of 100ms.

Test No.	GR_TSTP_3.23_A
Test Details	Verify that Operating frequency and Channel bandwidth shall be as per the applicable National Frequency Allocation Plan.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture a PCAP and check the SIB1 message to ensure that the “freqInfo” contains the band and operating frequency. Also, verify “NumRb” reflects the configured channel bandwidth. 4.Capture UE logs to confirm that the UE successfully decodes all scheduled information from the gNB
Test Limits	NA
Expected Results	gNB needs to successfully schedule both the frequency and channel bandwidth, and the UE must be able to decode this information and establish the connection

Test No.	GR_TSTP_3.23_B
Test Details	Verify that the Base Station shall be capable of operating in at least one of the frequency bands as per the applicable National Frequency Allocation Plan.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1.Bring the gNB to the Operational (Enabled) state. 2.Perform a UE attach procedure. 3.Capture a PCAP and check the SIB1 message to ensure that the “freqInfo” contains the band. 4.Capture UE logs to confirm that the UE successfully decodes all scheduled information from the gNB
Test Limits	NA
Expected Results	gNB needs to successfully schedule in that frequency band, and the UE must be able to decode this information and establish the connection.

Test No.	GR_TSTP_3.29_A
Test Details	gNB shall support DC power supply.
Test Instruments Required	48V DC Power Supply, gNodeB, 5GC / 5GC Emulator, RF cables and attenuators, PC, UE/UE simulator
Test Setup	TEST SETUP 2
Test Procedure	1. Apply specified DC Input Voltage to EUT. 2. Bring gNodeB in operationally enabled state 3. Perform UE attach 4. Verify through UE logs
Test Limits	Operating Voltage: -44.4V to -56V DC
Expected Results	The gNodeB shall successfully execute UE attach procedure on specified voltage.

Test No.	GR_TSTP_3.29_B
Test Details	gNB shall support nominal voltage of -48V DC supply voltage
Test Instruments Required	Variable DC Power Supply, Multimeter, gNodeB, 5GC/5GC Emulator, RF cables and attenuators, PC, UE/UE simulator.
Test Setup	TEST SETUP 2
Test Procedure	1. Power ON the setup at nominal voltage (-48V DC) 2. Bring gNodeB in operationally enabled state 3. Perform UE attach. 4. Vary the voltage slowly in 1V step from -48V to -40V DC and perform UE attach. 5. Vary the voltage slowly in 1V step from -48V to -60V DC and perform UE attach. 6. Verify through UE logs
Test Limits	Operating Voltage: -40V to -60V DC
Expected Results	The gNodeB shall successfully execute Attach Procedure in the complete voltage range

Test No.	GR_TSTP_3.29_C
Test Details	Protection on Power Input Ports
Test Instruments Required	NA
Test Setup	NA
Test Procedure	Following protections to be checked at Power Input Port :- 1. Reverse Polarity Protection: - GR_TSTP_3.29_D 2. Over Voltage Protection: - GR_TSTP_3.29_E 3. Immunity to Surge Voltage: - GR_TSTP_5.7.6 4. Over Current Protection: - Details of the over current Protection scheme to be provided by supplier.
Test Limits	NA
Expected Results	EUT has necessary protection on power input ports.

Test No.	GR_TSTP_3.29_D
Test Details	Reverse Polarity at the DC input
Test Instruments Required	Variable DC Power Supply, Multimeter, gNodeB, 5GC/5GC Emulator, RF cables and attenuators, PC, UE/UE simulator.
Test Setup	TEST SETUP 2
Test Procedure	1. Prepare the setup for gNodeB as per Test setup 2 and check it to be functional. 2. Apply power feed in reverse (i.e. 0V at power supply should be connected to -48V terminal at gNodeB and -48V at power supply should be connected to 0V terminal at gNodeB. 3. The EUT may be functional or may not be functional when reverse polarity is applied. 4. Now apply correct power feed. 5. Bring gNodeB in operationally enabled state. 6. Perform UE attach. 7. Verify through UE logs
Test Limits	NA
Expected Results	The gNodeB shall successfully execute UE attach procedure after correct feed applied.

Test No.	GR_TSTP_3.29_E
Test Details	Over voltage protection at the DC input
Test Instruments Required	Variable DC Power Supply, Multimeter, gNodeB, 5GC/5GC Emulator, RF cables and attenuators, PC, UE/UE simulator.
Test Setup	TEST SETUP 2
Test Procedure	1. Supplier to give details of the overvoltage protection provided at the DC input. 2. Apply overvoltage to the EUT as per above. 3. Now apply nominal voltage -48V DC to EUT. 4. Bring gNodeB in operationally enabled state. 5. Perform UE attach. 6. Verify through UE logs
Test Limits	NA
Expected Results	The gNodeB shall successfully execute attach procedure after nominal -48V DC applied

Test No.	GR_TSTP_3.29_F
Test Details	DC input under voltage cut-off. Limit of under voltage shall be indicated by the vendor
Test Instruments Required	Variable DC Power Supply, Multimeter, gNodeB, 5GC/5GC Emulator, RF cables and attenuators, PC, UE/UE simulator.
Test Setup	TEST SETUP 2
Test Procedure	1. Prepare the EUT Test setup as per Test setup 1. 2. Power ON EUT at nominal voltage (-48V DC). 3. Decrease the Power supply voltage slowly till Under Voltage Cut off limit (provided by supplier) in 1V step. 4. Check the current flowing in EUT, it should become less than 0.1Amps. 5. Change the Power supply voltage to -48V DC. 6. Check the current flowing in EUT, it should be normal operational current. 7. Bring gNodeB in operationally enabled state. 8. Perform UE attach. 9. Verify through UE logs.
Test Limits	Under Voltage Cut Off Limit (provided by supplier)
Expected Results	The Current draw in EUT should < 0.1Amps at specified UVLO limits.

Test No.	GR_TSTP_3.30_A
Test Details	Verify that the gNB shall include an O&M interface for debugging, troubleshooting and for providing fault, configuration and performance data to an O&M server (EMS). The O&M interface shall be Ethernet.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Case 1: Fault 1. Bring the gNodeB and O1-Handler to the operationally enabled state. 2. If any fault occurs in gNodeB setup, it will send a fault notification to O1 Handler. 3. O1 Handler should forward the fault notification to SMO GUI, including the severity level (e.g., Critical, Major, Minor). 4. To verify that the SMO GUI can get any fault notifications from the O1 Handler. Case 2: Configuration 1. Bring the gNodeB and O1-Handler to the operationally enabled state. 2. Update CU/DU configurations using SMO GUI. 3. Verify in CU, DU XML configurations. Case 3: Performance 1. Bring the gNodeB and O1-Handler to the operationally enabled state. 2. Validate that the O1Handler receives file readiness notifications and subsequently dispatches VES Events

	incorporating precise file details and system credentials to facilitate the retrieval of generated files. 3. Verify that the SMO GUI can get the KPIs from the O1 Handler.
Test Limits	NA
Expected Results	gNodeB shall provide local maintenance ports.

Test No.	GR_TSTP_3.30_B
Test Details	Verify that gNB shall support at least one of the following interfaces towards EMS. XML TR.069 SNMP CLI NETCONF/YANG
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring the gNodeB and O1-Handler to the operationally enabled state. 2. The SMO GUI initiates a request to update the CU and DU configuration information via the O1 Handler using NETCONF. Alternatively, a NETCONF session can be established using the CLI to update configurations based on the YANG model. 3. The O1 Handler receives and processes this request, updating the respective configuration details. 4. Verify that the updated configuration changes are reflected either in the CU and DU TR XML configuration files. 5. Verify that the SMO Netconf GUI then receives a response from the O1 Handler indicating the success or failure of the RPC request.
Test Limits	NA
Expected Results	The gNodeB shall use vendor specified protocol(s) e.g., XML, TR-069,SNMP,CLI and NETCONF/YANG, over the management interface.

Test No.	GR_TSTP_3.30_C
Test Details	Verify that the gNB control software shall interact with various hardware / software entities of the gNB and provide the health status/Alarms of the entire system on the EMS.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Bring the gNodeB and O1-Handler to the operationally enabled state. 2. Generate alarms from gNB software/hardware entities 3. O1-Handler takes alarms or health status modifies to NETCONF standard formats 4. gNB sends alarms to O1-Handler. 5. O1 Handler should forward the fault notification to SMO GUI, including the severity level (e.g., Critical, Major, Minor). 6. To verify that the SMO GUI can get any fault notifications.
Test Limits	NA
Expected Results	gNB is capable of raising and clearing various severity alarms towards management entities. gNB is capable of sending periodic health stats over management interfaces

Test No.	GR_TSTP_3.30_D
Test Details	Verify that the gNB shall support remote Software/firmware updates via the EMS.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. The vendor to specify procedure for software upgrade through SMO. This may include gNodeB restart. 2. Initiate a software upgrade for an gNodeB via O1-Handler. 3. Verify that the system comes up with the new release. Also, the new release version is updated at the SMO. 4. Bring gNodeB in operationally enabled state 5. Perform UE attach 6. Verify through UE logs
Test Limits	NA
Expected Results	The gNodeB shall report updated software version The UE logs shall indicate successful attach after new software upgrade

Test No.	GR_TSTP_3.30_E
Test Details	Verify that the gNB control software shall be responsible for logging and sending the log file on the network to a designated syslog server.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Vendor to specify procedure to configure logging and log server in the gNodeB 2. Verify that the gNodeB is able to send the logging information / log file to the designated server.
Test Limits	NA
Expected Results	The gNodeB shall send logs to the designated syslog server.

Test No.	GR_TSTP_3.30_F
Test Details	Verify that the system shall maintain a system log and core dump logs.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Vendor to specify mechanism to verify system logs and core dumps 2. Generate event that shall be logged into system logs 3. Generate event that shall result in core dump of a process 4. Verify that the event are logged into system logs 5. Verify that the core dump files is present at designated place
Test Limits	NA
Expected Results	The gNodeB shall log event into system logs. The gNodeB shall store core dump file at designated place.

Test No.	GR_TSTP_3.30_G
Test Details	Verify that the gNB shall support both local and remote software upgrade.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. The vendor to specify procedure for local software. This may include gNodeB restart. 2. Initiate local software upgrade for gNodeB 3. Verify that the system comes up with the instructed release. 4. Bring gNodeB in operationally enabled state 5. Perform UE attach 6. Verify through UE logs
Test Limits	System will go for auto reboot for activation of new release
Expected Results	The gNodeB shall come-up with new release. UE attach shall be successful.

Test No.	GR_TSTP_3.30_H
Test Details	Verify that the gNB shall support alarms, events to OMC for visual indicators of status and fault.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Vendor to provide list of sample events along with their severity and affected objects (logical or physical) 2. Vendor to provide list of sample objects with status values a. Alarm Verification 3. Trigger various events at gNodeB 4. Verify that the alarms are reported by the gNodeB to the SMO with specified levels of severity associated with the alarms such as (CRITICAL, MAJOR, MINOR, CLEAR, WARNING etc.) 5. Each alarm shall have attributes like unique identifier, valid time-stamp, description of the fault and affected object. a. Status Verification 6. Trigger events that will result in object status change 7. Verify at SMO that the object status has been updated as per event.
Test Limits	NA
Expected Results	The gNodeB shall report alarms and status to the OMC / EMS.

Test No.	GR_TSTP_3.30_I
Test Details	Verify that the gNB shall have reboot and shut-down capability.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Trigger reboot action of an gNodeB from SMO 2. Verify that system goes for reboot and registers again with SMO after it comes up.
Test Limits	NA
Expected Results	System reboot shall be successful.

Test No.	GR_TSTP_3.30_J
Test Details	Verify that the gNB shall support built-in power-on diagnostics and system monitoring capabilities to detect hardware failures.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Vendor to provide details of mechanism to verify power on diagnostics report 2. Vendor to provide procedure details to induce hardware failure 3. Power ON gNodeB and verify the diagnostics logs 4. Induce hardware failure as per vendor specified procedure 5. Verify that hardware failure is logged.
Test Limits	NA
Expected Results	gNodeB supports built-in power on diagnostics and system monitoring capabilities.

Test No.	GR_TSTP_3.30_K
Test Details	Verify that the gNB shall support Local Maintenance Ports for any debugging and troubleshooting.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Vendor to specify local maintenance ports for debugging and troubleshooting 2. Verify availability of local ports 3. Verify debugging and troubleshooting procedures
Test Limits	NA
Expected Results	gNodeB shall provide local maintenance ports.

Test No.	GR_TSTP_3.30_L
Test Details	Verify that the system shall provide the count for the total number of UEs connected to the gNB.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Bring gNodeB and O1-Handler in operationally enabled state Perform attach for multiple UEs. Verify the count of active users is maintained correctly by gNodeB in SMO. Then, perform detach for few UEs. Verify that the count of active users is correctly maintained by the gNodeB in SMO.
Test Limits	NA
Expected Results	The gNodeB shall provide correct count of connected UEs.

Test No.	GR_TSTP_3.30_M
Test Details	Verify that the gNB shall be capable of providing the system configuration data to the Management Information Base (MIB) of the system (applicable with SNMP based management only).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Vendor to provide SNMP MIB details 2. Connect gNodeB to EMS / OMC / Simulation tool 3. Perform add / delete / modify operation 4. Verify through Wireshark logs that the operations are carried out using SNMP on objects defined by the MIB.
Test Limits	NA
Expected Results	The operations through EMS / OMC shall be indicate MIB objects.

Test No.	GR_TSTP_3.30_N
Test Details	Verify the gNB shall have the ability to detect and report any hardware fault within the equipment.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. The vendor to specify procedure to induce hardware faults and reporting mechanism 2. Induce hardware fault 3. Verify that the fault has been detected and reported by the gNodeB
Test Limits	NA
Expected Results	gNodeB is able to detect and report the hardware fault.

Test No.	GR_TSTP_3.30_O
Test Details	Verify that the system shall provide multiple level of recovery from software and hardware faults such that the impact on system operation shall be in accordance of the severity of the faults.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. The vendor to specify various faults, severity levels and recovery levels 2. The vendor to specify mechanism to induce software and hardware faults 3. Induce software faults and verify recovery against the fault 4. Induce hardware faults and verify recovery against the fault
Test Limits	NA
Expected Results	The gNodeB shall recovery as per severity level of the fault

Test No.	GR_TSTP_3.31_A1
Test Details	Verify that in case IPv4 is supported, the gNB hardware and software shall support IPv4 packet formats on all Ethernet transport interfaces in compliance with IETF RFC791.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Verify that the gNodeB allows to configure IPv4 addresses at the time of software release installation or at the time of setting the environment parameters for the board.
Test Limits	NA
Expected Results	gNodeB support IPv4 addresses.

Test No.	GR_TSTP_3.31_A2
Test Details	Verify that In case IPv6 is supported, the gNB hardware shall support IPv6 packet formats on all Ethernet transport interfaces in compliance with IETF RFC2460
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Verify that the gNodeB allows to configure IPv6 addresses at the time of software release installation or at the time of setting the environment parameters for the board.
Test Limits	NA
Expected Results	gNodeB support IPv6 addresses.

Test No.	GR_TSTP_3.31_B1
Test Details	The gNB shall support the operator configurable use of VLANs compliant to IEEE802.1Q on any Ethernet interfaces.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure multiple VLANs on the Ethernet interface 2. Verify data transfer as per VLAN through Wireshark logs 3. Modify VLAN id 4. Verify data transfer as per modified VLAN id through Wireshark logs
Test Limits	NA
Expected Results	gNodeB shall support configurable VLANs

Test No.	GR_TSTP_3.31_B2
Test Details	The gNB shall be able to flexibly map traffic onto one or more VLANs. The default SA mapping shall be User (NG_u), Control (NG_C, Xn) and O&M (PTP, Sync, Management)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure different VLANs on gNodeB. 2. Bring gNodeB in operationally enabled state 3. Attach 2 UEs 4. Start UL and DL data for the UEs. 5. Verify through Wireshark logs that the gNodeB is able to map traffic on to different VLANs
Test Limits	NA
Expected Results	The gNodeB shall successfully map traffic as per VLAN configuration

Test No.	GR_TSTP_3.31_B3
Test Details	The transport QoS is managed at layer 3 with the DSCP field of IP packets and at layer 2 with the "PCP" bits in the Ethernet frames.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Configure DSCP value for NG-U interface 2. Configure PCP value for NG-U interface VLAN 3. Attach multiple UEs and perform data transfer 4. Verify from Wireshark logs that gNodeB applies configured DSCP value at IP (layer-3) and configured PCP value at Ethernet (Layer-2).
Test Limits	NA
Expected Results	The gNodeB shall use configured ToS value at IP layer. The gNodeB shall use configured PCP value at Ethernet layer

Test No.	GR_TSTP_3.31_B4
Test Details	Layer 2 QoS marking shall be supported when the backbone network supporting the gNodeB is a layer 2 switched network
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Attach multiple UEs and perform data transfer. 2. Verify from Wireshark logs that gNodeB supports the use of Ethernet Priority Code Point field in the Ethernet header specific to a VLAN.
Test Limits	NA
Expected Results	The gNodeB shall use configured Ethernet PCP.

Test No.	GR_TSTP_3.31_B5
Test Details	DSCP-PCP mapping shall be configurable. Default DSCP-PCP to be provided.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Attach multiple UEs and perform data transfer. 2. Verify through Wireshark logs that default mapping exists for DSCP and PCP. 3. Modify DSCP - PCP 4. Verify through Wireshark logs that modified DSCP-PCP Mapping is used.
Test Limits	NA
Expected Results	The gNodeB shall use default DSCP - PCP mapping while transmitting data Ethernet interface. After configuration, the gNodeB shall use modified DSCP-PCP mapping while transmitting data on Ethernet interface.

Test No.	GR_TSTP_3.32_A
Test Details	Verify that gNB shall support IPSec using Encapsulating Security Payload (ESP) tunnel mode for node terminated traffic, which is compliant to RFC 4301, RFC 4303 and RFC 7296.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is configured for IPSec tunnel mode. 2. Valid IPSec policies and IKEv2 settings are provisioned. 3. Establish Security Associations (SAs). 4. Verify encapsulation using ESP headers.
Test Limits	NA
Expected Results	In Wireshark filter ESP and check IPSec tunnel is established successfully Traffic is encrypted and encapsulated using ESP tunnel mode.

Test No.	GR_TSTP_3.32_B
Test Details	Verify that gNB shall support IPSec solution where IKEv2 must be used as control and key exchange protocol.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is configured for IPSec tunnel mode. 2. Valid IPSec policies and IKEv2 settings are provisioned. 3. Establish Security Associations (SAs). 4. Verify encapsulation using ESP headers.
Test Limits	NA
Expected Results	In Wireshark filter “**isakmp**” and check Verify IKEv2 must be used as control and key exchange protocol

Test No.	GR_TSTP_3.32_C
Test Details	Verify that gNB shall support IKE initiator mode to initiate set up of IKE session.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is configured for IPSec tunnel mode. 2. Valid IPSec policies and IKEv2 settings are provisioned. 3. Establish Security Associations (SAs). 4. Verify encapsulation using ESP headers.
Test Limits	NA
Expected Results	In Wireshark filter "**isakmp**" and check Verify IKEv2 must be used as control and key exchange protocol. Check for the flag "Initiator" in IKE_SA_INIT Message

Test No.	GR_TSTP_3.32_D
Test Details	Verify that gNB shall support Anti-replay protection.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is in Standalone mode and properly configured. 2. 5GC components (AMF, SMF) are operational. 3. Power on and initialize gNB. 4. Attach UE and verify registration and data flow.
Test Limits	NA
Expected Results	Tester shall confirm that gNB provides replay protection by dropping/ignoring the replayed packet if no corresponding response is received from the gNB to the replayed packet

Test No.	GR_TSTP_3.32_E
Test Details	Verify that gNB shall support at least one of ESP encryption algorithm with 128- & 256-bit key length based on ciphers AES_GCM_16, AES-CBC and AES_GMAC.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is configured for IPSec tunnel mode. 2. Valid IPSec policies and IKEv2 settings are provisioned. 3. Establish Security Associations (SAs). 4. Verify encapsulation using ESP headers.
Test Limits	NA
Expected Results	In Wireshark filter “isakmp” and check Verify IKEv2 must be used as control and key exchange protocol. Check for the flag “Transform ID (ENCR)” in IKE_SA_INIT Messages

Test No.	GR_TSTP_3.32_F
Test Details	Verify that gNB shall support DPD (Dead Peer Detection) mechanism at IPsec that can send out DPD messages in case no ESP traffic ongoing.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is configured for IPSec tunnel mode. 2. Valid IPSec policies and IKEv2 settings are provisioned. 3. Establish Security Associations (SAs). 4. Verify encapsulation using ESP headers. 5. DPD is enabled and properly configured on the gNB. 6. Logging/monitoring tools are available to capture IPsec and DPD messages.
Test Limits	NA
Expected Results	The gNB successfully detects inactivity on the IPsec tunnel when no ESP traffic is ongoing. It sends out DPD messages after the inactivity threshold is reached. If the peer is alive, the gNB receives a DPD response and keeps the tunnel active. If the peer is unreachable and fails to respond to DPD messages, the gNB detects the peer as dead.

Test No.	GR_TSTP_3.32_G
Test Details	Verify that IPSec solution shall support IPv4 and IPv6.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. gNB is configured for IPv4/IPv6 IPSec tunnel mode. 2. Valid IPSec policies and IKEv2 settings are provisioned. 3. Establish Security Associations (SAs). 4. Verify encapsulation using ESP headers.
Test Limits	NA
Expected Results	In Wireshark filter ESP and check IPSec tunnel is established successfully with IPv4/IPv6 Traffic is encrypted and encapsulated using ESP tunnel mode.

Test No.	GR_TSTP_4.1
Test Details	Verify that NR-based access to unlicensed spectrum
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 4 & 5
Test Procedure	1. Configure the gNodeB (DUT) to operate NR in unlicensed bands (5 GHz / 6 GHz). 2. Perform NR-U Carrier Aggregation with unlicensed SCell in DL and DL+UL. 3. Validate Dual Connectivity with NR-U as PSCell and LTE licensed as PCell. 4. Execute Standalone NR-U testing using only the unlicensed spectrum. 5. Conduct Listen-Before-Talk (LBT) tests (Cat-1/2/4) under various channel conditions. 6. Trigger the PRACH procedure for access initiation in the unlicensed band. 7. Verify SSB transmission under LBT constraints and within maximum COT. 8. Execute Dual connectivity between NR in licensed spectrum (PCell) and NR in shared spectrum (PSCell) 9. Decode PUSCH/PUCCH/DCI using interlace formats and verify timing. 10. Create HARQ retransmission scenarios and observe ACK/NACK behavior. 11. Test Configured Grants (CG) for UL data without dynamic scheduling. 12. Simulate MAC-layer failure via repeated LBT denials to assess fallback. 13. Capture Wireshark logs and UE side logs to analyze.

Test Limits	NA
Expected Results	The NR-U test procedures were successfully executed, with all features functioning as expected.

Test No	GR_TSTP_4.2_A
Test Details	Verify 2-step Contention based RACH for NR
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Bring up gNodeB and broadcast SIB with both 4-Step NR RACH and 2-Step NR RACH enabled. 2. Trigger the random access procedure based on events like initial access. 3. UE select 2-Step RACH if RSRP is above configured threshold. 4. UE transmits MSGA (with preamble on PRACH and payload on PUSCH) to gNodeB. 5. UE monitors network response and receives MSGB (RA response and contention resolution) from gNodeB. 6. If 2-step RA is unsuccessful, UE switches to 4-step RA.
Test Limits	NA
Expected Results	The successful completion of the 2-step RACH procedure or a switch to the 4-step RACH after retries and UE registration is successful.

Test No	GR_TSTP_4.2_B
Test Details	Verify 2-step Contention Free RACH for NR
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. Bring up gNodeB and broadcast SIB 2. Perform UE Registration and Initiate Handover based on Measurement event. 3. Enable 2-Step NR RACH as part of RRC Reconfiguration 4. Trigger the random access procedure based on Handover event. 5. UE transmits MSGA (with pre-configured preamble on PRACH and payload on PUSCH) to gNodeB. 6. UE monitors network response and receives MSGB from gNodeB. 7. If 2-step RA is unsuccessful, UE switches to 4-step RA.
Test Limits	NA
Expected Results	Successful completion of 2-step Contention Free RACH.

Test No.	GR_TSTP_4.3_A
Test Details	Verify Power Saving Techniques in CONNECTED state
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. gNodeB is configured with power saving techniques 2. Connect UE to the gNodeB. 3. Verify the UE capabilities message IE drx-Adaptation-r16. 4. Verify RRC messages for DRX Configuration and DPC-Config-r16 IE. 5. Verify DCI format 2_6 at UE for wakeup signal.
Test Limits	NA
Expected Results	1. gNodeB shall indicate Configured DRX Configuration and DPC-Config-r16 IE in RRC Message. 2. UE shall receive valid DCI format 2_6 with PS-RNTI and show proper wakeup signalling

Test No.	GR_TSTP_4.3_B
Test Details	Verify Cross slot scheduling feature in NR gNodeB.
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure gNodeB with slot offsets in the relevant DCI for cross slot scheduling. 2. Bring up gNodeB and perform UE registration. 3. Perform data transform. 4. Verify the DCI formats 0_1 and/or 1_1. 5. Check the presence of PDSCH/PUSCH transmissions in the slots corresponding to the offsets indicated by the DCI format(s). 6. Verify that UE enters sleep mode when there is not data transfer or aperiodic CSI indicated by the DCI format(s).
Test Limits	NA
Expected Results	The UE shall be able to do power saving using cross-slot scheduling feature.

Test No.	GR_TSTP_4.3_C
Test Details	Maximum MIMO Layer Adaptation with characterisation of the Power saving impact of DRX adaptation
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 8
Test Procedure	1. UE should support MIMO Layer Adaptation, which can be verified in the UE specifications or UE capability response. 2. NR gNB is configured for UE power saving features. 3. Register UE to the network. 4. Generate downlink traffic and verify through UE logs the MIMO layer is adapted and correlates with traffic profile. 5. Configure DRX in UE with: • Semi-static RRC parameters (on-duration, inactivity timer, long and short cycle) • PS-offset and DCP monitoring occasion with DCI format 2_6 and PS-RNTI 6. Use Wireshark to validate the presence of DCI 2_6, PS-RNTI use, and proper DCP timing.
Test Limits	NA
Expected Results	Different maximum DL MIMO Layers verified from Wireshark logs / UE logs. User-plane traffic is not affected when the feature is enabled. DRX cycles should be executed as per configuration with wake-up alignment to DCP.

Test No.	GR_TSTP_4.3_D
Test Details	Verify that Power Saving Techniques in idle/inactive state.
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Network Performance Measurement Tool, 5GC/ 5GC Emulator, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 9
Test Procedure	1. Configure RRM measurement behaviour in UE via system information or RRC signalling. 2. Configure UE to enter RRC_IDLE or RRC_INACTIVE state with RRM measurement configuration. 3. Simulate UE in low mobility conditions and ensure it is not near the cell edge using UE Simulator. 4. Observe if the UE reduces neighbour cell measurements with respect to system info parameters like **mobilityStateParameters** and **cellReselectionInfoCommon**. 5. Measure and log the number and frequency of RRM measurement reports generated by UE. 6. Repeat the test in high mobility and cell-edge condition to compare with baseline. 7. Measure and compare power consumption between reduced RRM vs normal RRM. 8. Use Wireshark or protocol analyzer to validate signalling indicating measurement configuration or relaxation.
Test Limits	NA
Expected Results	UE reduces frequency of RRM measurements and measurement reports resulting in reduction in UE power consumption in idle/inactive state Correct configuration of measurement control parameters validated via protocol logs.

	UE returns to normal measurement behaviour when entering a high mobility or cell-edge scenario.

Test No.	GR_TSTP_4.4_A
Test Details	Verify that Integrated access and backhaul for NR (Single Hop)
Test Instruments Required	IAB Donor gNodeB, IAB Node DU , 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 10
Test Procedure	1. Bring up IAB-node and IAB-Donor gNodeB to an operationally enabled state. 2. Broadcast SIB1 with IAB-support set to true from IAB-Donor gNodeB. 3. Verify that IAB-MT performs cell search, synchronization, and Random Access Channel (RACH) procedures to connect with the parent IAB-donor DU. 4. Validate the establishment of RRC connections between IAB-MT and IAB-donor CU using wireshark logs. 5. Validate IAB-DU establishes the F1 interface with the IAB-donor CU using wireshark logs. 6. Verify that IE bh-RLC-ChannelToAddModList inside RRC Reconfiguration message contains necessary BAP and BH link configuration 7. Perform UE Registration and Data Transfer
Test Limits	NA
Expected Results	Successful UE Registration and data transfer using IAB-Node .

Test No.	GR_TSTP_4.4_B
Test Details	Verify that Integrated Access and Backhaul for NR (UE Registration using Multi Hop)
Test Instruments Required	IAB Donor gNodeB, IAB Node1 DU, IAB Node2 DU , 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 11
Test Procedure	1. Bring the IAB-node and IAB-Donor gNB to an operationally enabled state in SA mode. 2. Broadcast SIB1 with IAB-support set to true from IAB-Donor gNB. 3. Verify that IAB-node 1 is latched to IAB Donor. 4. Verify that the IAB-node 2 performs cell search, synchronization, and Random Access Channel (RACH) procedures to connect with the IAB-node 1. 5. Validate the establishment of RRC connections between IAB-node2 and IAB-donor CU using wireshark logs. 6. Ensure that the IAB-node2 establishes the F1 interface with the IAB-donor CU using wireshark logs 7. Verify IE: bh-RLC-ChannelToAddModList inside RRC Reconfiguration message contains necessary BAP and BH link configuration 8. Perform UE Registration and Data Transfer
Test Limits	NA
Expected Results	Successful UE Registration and data transfer using IAB-Node .

Test No.	GR_TSTP_4.4_C
Test Details	Verify IAB Backhaul Dual connectivity for better backhaul performance
Test Instruments Required	IAB Donor gNodeB, IAB Node1 DU, IAB Node2 DU, Dual Connectivity capable master and secondary nodes, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 21
Test Procedure	1. Configure IAB Donor to connect with two IAB-node. One will act as Master node and other one as secondary node. 2. Dual Connecting IAB-MT should send Measurement Report message to donor CU through first parent IAB-DU. (This report is based on a Measurement Configuration the dual-connecting IAB-MT received from the IAB-donor-CU before.) 3. Verify that dual connecting IAB-MT receives RRC Reconfiguration message from donor CU. 4. Verify RACH Procedure with second parent IAB Node. 5. Verify Message flow as per figure 8.2.4-2 of 3GPP 38.401, v16.8.0 6. Simulate primary path failure. 7. Check continued operation via redundant path by performing UE registration and data transfer. 8. Verify that DRBs are mapped to QoS flows using RRC Messages (for e.g. RRCSetup/RRCreconfig and PDU session establishment accept.)
Test Limits	NA
Expected Results	Successful UE Registration and data transfer using IAB Dual connectivity architecture.

Test No.	GR_TSTP_4.5
Test Details	Verify that Dual Connectivity (EN-DC) with 3 bands DL and 3 bands UL
Test Instruments Required	gNodeB, eNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser.
Test Setup	TEST SETUP 12-1 and 12-2
Test Procedure	**Scenario A: EN-DC with 3DL (1 LTE + NR FR1 + NR FR2) and 3UL (1 LTE + NR FR1 + NR FR2)** 1. UE supports NSA Dual Connectivity and support for carrier aggregation defined in 3GPP spec TS38.101-3, table 5.5B.6.2-1 2. Bring the LTE eNodeB and NR gNBs operationally enabled state and configure them for carrier aggregation supported as per 3GPP spec TS38.101-3, table 5.5B.6.2-1 for 6 CC consisting of 3 bands DL and 3 bands UL combination provided. 3. Enable EN-DC via Secondary Node Addition procedure from eNB to gNB. 4. Register UE to eNodeB (PCell). Confirm RRC connection setup. 5. gNodeB sends SgNB Addition Request Acknowledge and configures SCG for both NR bands (FR1 and FR2). 6. UE receives RRC Reconfiguration including SCG config and applies dual NR connection. 7. Confirm active DL/UL configuration: LTE (DL+UL), NR FR1 (DL+UL), NR FR2 (DL+UL). 8. Start traffic on DL and UL (use iPerf). Measure per-band and aggregate throughput. **Scenario B: EN-DC with 3DL (2 LTE + NR FR2) and 3UL (2 LTE + NR FR2)**

	1. Setup eNodeB on two LTE bands (example: Band3 and Band7). 2. Configure gNodeB for FR2 band. 3. Register UE to eNB (anchor on Band3, SCell on Band7) 4. Enable EN-DC via Secondary Node Addition procedure from eNB to gNB. 5. gNB configures SCG with NR FR2, sends SgNB Acknowledgement. 6. UE receives RRC Reconfiguration including SCG config 7. Start full-buffer traffic on DL and UL (use iPerf). Measure per-band and aggregate throughput.
Test Limits	NA
Expected Results	**Scenario A:** Verify SCG successfully established for NR FR1 and FR2 UL/DL traffic stable over all 3 carriers 1. Use spectrum analyzer to verify Tx power, EVM, ACLR as per TS 38.141. **Scenario B:** 8. Verify RRC Reconfiguration Complete, and that all three UL bands (2 LTE + 1 NR) are activated. 9. UL/DL traffic stable over all 3 carriers 10. Use spectrum analyzer to verify Tx power, EVM, ACLR as per TS 38.141.

Test No	GR_TSTP_4.6_A
Test Details	Verify that NR mobility enhancements (DAPS and CHO)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. gNodeB is configured with DAPS and Conditional Handover based parameters at all the cells. 2. Perform UE registration and Data transfer. 3. Perform DAPS based handover 4. verify that data is not dropped during daps handover 5. Perform Conditional handover 6. Verify that UE performed handover based on Conditional handover parameters. 7. verify UECapabilityInformation message (RRC). Check for the presence of the daps-Support-r16 parameter and Check for the presence of the conditionalHO-r16 parameter 8. Verify daps-Config-r16 parameter in RRC-Reconfiguration message in DRB-ToAddModList IE during handover. 9. Verify measurement report is sent by UE with neighbour gNodeBs which will be used for Conditional Handover. 10. Verify that handover request is sent for all the potential cells where conditional handover can happen. 11. Verify that RRCReconfiguration is sent by Source gNodeB for conditional handover with conditionalReconfiguration-r16 IE with condExecutionCond-r16 parameter. 12. Verify that UE performs handover based on Conditional handover conditions. 13. Verify that RRC Reconfiguration Complete message sent by the UE to the target gNodeB.

Test Limits	NA
Expected Results	Successful DAPS and Conditional Handover (CHO).

Test No.	GR_TSTP_4.6_B
Test Details	Verify that NR mobility enhancement is done using T312 based fast failure recovery.
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. Configure gNodeB with T312 and T310 based timers during handover. 2. Bring up gNodeB and perform UE registration. 3. UE shall initiate RRC reestablishment on RLF. 4. Verify that T312 is less than T310. 5. Verify that UE performs RLF failure-based recovery upon expiry of T312.
Test Limits	NA
Expected Results	UE shall be able to perform RLF failure immediately after T312.

Test No.	GR_TSTP_4.7_A1
Test Details	To verify that the gNodeB supports inter-band Carrier Aggregation (CA) or Dual Connectivity (DC) in 3GPP Rel-16, with two bands aggregated in the Downlink and one or two bands in the Uplink.
Test Instruments Required	gNodeB (Rel-16 capable with CA/DC support), UE / UE simulator (supporting target CA/DC bands and configurations),RF cables and attenuators, Signal Analyzer, Network Performance Measurement Tool (e.g., iPerf), Protocol Analyzer, Spectrum Analyzer
Test Setup	TEST SETUP 13
Test Procedure	**Prerequisites:** 1. gNodeB is powered on and configured with the Rel-16 software version. 2. The UE supports Rel-16, inter-band CA/DC, and the target band combinations. 3. Two or more carrier bands are available and activated in the network. 4. Core network is reachable (AMF, UPF connectivity established). 5. The RF environment is clean and bands are not blocked or heavily interfered. 6. Logging and performance monitoring tools are enabled (e.g., UE log collection, gNB counters, packet captures). **Procedure:**

	1. Configure the gNB configuration to Inter-band Carrier aggregation configuration support with 2 bands (e.g. n1 and n78) DL and 1 band (e.g. n78) UL (inter-band CA_n1-n78 configuration) Refer **Table 6.1.1.2-1: Supported bandwidths per CA band combination of band n1+n78** below. 2. Reboot gNB and verify that gNB is successfully up and all gNB services are running with the new Inter-band Carrier aggregation configuration. 3. Perform UE Attach and enable CA/DC configuration during RRC setup. 4. Start simultaneous DL data traffic across both DL bands (e.g. FTP/iPerf) 5. Start UL data traffic on one or both UL bands, depending on test case For x = 1: only on n78 and For x = 2: on n1 and n78 6. Monitor and log UE and gNodeB data throughput, MCS, and band usage. 7. Verify via UE logs that both DL bands are active, and either one or both UL bands are transmitting. 8. Confirm signal quality and CA/DC activation through signaling logs and physical layer measurements. 9. Verify RRC connection setup complete message and RRC Connection reconfiguration complete messages between UE and gNB in Wireshark. **Repeat the steps from 1 to 5 for all the inter-band CA configurations mentioned in 3GPP TR 38.716-02-00 V16.0.0 (Table 1-1: Release 16 Inter-band NR CA for 2 bands DL with 1 band UL)**

Test Limits	UE should support Rel-16 inter-band CA configuration as per following table given in **3GPP TS 38.101 16.5.0, Section 5.2A.2.1** UE should support Rel-16 Dual Connectivity configuration as per following table given in **3GPP TS 38.101 16.5.0, Section 5.2B, 5.5B, 5.5C**
Expected Results	Verify the UE capability information message and corresponding IEs and conform the support for Inter-band Carrier aggregation (2 Band) with the configuration mentioned above (during step 1 in test Procedure). UE logs shall indicate that both DL bands are aggregated and active. For x = 1: UE transmits on a single UL band; for x = 2: both UL bands are active. Protocol analyzer confirms CA/DC configuration via RRC signaling (e.g CarrierAggregationConfig, SecondaryCellGroupConfig) Throughput shall increase due to multiple DL bands. Signal analyzer confirms transmission/reception on all involved bands. Verify the RRC Connection Reconfiguration message and confirm the support of Inter-band Carrier aggregation at the gNodeB. 1. Verify bandwidth and Component carrier's center frequency also. 2. **Repeat the steps above for all the inter-band CA configurations mentioned in 3GPP TR 38.716-02-00**

	V16.0.0 (Table 1-1: Release 16 Inter-band NR CA for 2 bands DL with 1 band UL)

Test No.	GR_TSTP_4.7_A2
Test Details	To verify that the gNodeB supports NR Rel-16 Inter-Band Carrier Aggregation (CA) with three component carriers in the Downlink (DL) and one component carrier in the Uplink (UL), as defined in supported CA combinations.
Test Instruments Required	gNodeB supporting 3DL+1UL inter-band CA (Rel-16 compliant), UE / UE simulator capable of 3DL+1UL CA combinations, RF cables and attenuators, Network Performance Measurement Tool (e.g., iPerf), Signal Analyzer, Protocol Analyzer (e.g., QXDM, TEMS), Spectrum Analyzer.
Test Setup	TEST SETUP 13
Test Procedure	**Prerequisites:** 1. gNodeB is powered on and configured with the Rel-16 software version. 2. The UE supports Rel-16, inter-band CA/DC, and the target band combinations. 3. Two or more carrier bands are available and activated in the network. 4. Core network is reachable (AMF, UPF connectivity established). 5. The RF environment is clean and bands are not blocked or heavily interfered. 6. Logging and performance monitoring tools are enabled (e.g., UE log collection, gNB counters, packet captures). **Procedure:**

	1. Configure the gNB configuration to support inter-band Carrier Aggregation with 3 DL bands (for example, n1, n78, and n41) and 1 UL band (for example, n78), i.e., inter-band CA_n1-n78-n41 configuration. **Refer to 3GPP TR 38.716-02-00 V16.0.0, Table 6.1.1.2-1 and Table 1-1 for valid combinations of 3DL+1UL inter-band CA.** 2. Reboot the gNB and verify that the gNB is successfully up and all services are running with the new inter-band CA configuration. 3. Power on the UE and verify that UE attach is successful with the new gNB configuration. 4. Perform RRC setup and verify that the RRC Connection Setup Complete and RRC Connection Reconfiguration Complete messages are received between the UE and the gNB in Wireshark. 5. Activate downlink data traffic (e.g., using iPerf or FTP) to initiate Carrier Aggregation. Start uplink traffic on the configured UL band. 6. Monitor the UE logs and confirm that all three DL bands are active. 7. Check **RRCConnectionReconfiguration, PhysicalCellGroupConfig, and ServingCellConfig** messages for confirmation. 8. Measure and log UE throughput (DL and UL), band usage, MCS, and signal quality metrics (e.g., RSRP, SINR).

	9. Repeat steps 2 to 8 for all supported 3DL+1UL inter-band CA configurations listed in 3GPP TR 38.716 Table 1-1. 10. Ensure that the UE under test supports Rel-16 inter-band CA configurations for 3DL+1UL as per its capability.
Test Limits	UE should support Rel-16 inter-band CA configuration as per following table given in **3GPP TS 38.101 16.5.0, Section 5.2A.2.2** UE should support Rel-16 Dual Connectivity configuration as per following table given in **3GPP TS 38.101 16.5.0, Section 5.2B, 5.5B, 5.5C**
Expected Results	Verify the UE capability information message and corresponding IEs and conform the support for Inter-band Carrier aggregation (2 Band) with the configuration mentioned above(during step 1 in test Procedure) Verify a) All three DL carriers are aggregated and confirmed through UE logs and RRC signaling. b) One UL carrier is active, supporting stable uplink transmission. c) DL throughput demonstrates enhanced performance over a single or dual-carrier setup. d) No errors or RLFs occur during CA setup and data transfer. e) Spectrum analyzer and signal logs confirm activity on all configured bands.

	f) Band width and Component carrier's center frequency also. **Repeat the steps from 2. a to 2. e for all the inter-band CA configurations mentioned in 3GPP TR 38.716-02-00 V16.0.0 (Table 1-1: Release 16 Inter-band NR CA for 2 bands DL with 1 band UL)**

Test No.	GR_TSTP_4.8
Test Details	To verify that gNodeB shall support DL modulation Scheme 256 QAM for frequency range 2 (FR 2).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Core Network / Core Network Simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 10
Test Procedure	1.Configure FR2 frequency band ARFCN. 2. Configure and enable DL 256QAM modulation. 3. Bring up the gNodeB to the operationally enabled state. 4.Verify that FR2 frequency band is allocated to UE. 5.Perform UE registration and perform DL Data transfer. 6. Verify that Channel is in good condition so that DL 256 QAM can be allocated to UE. 7. Capture UE logs and gNodeB Logs and PCAP files. 8. Verify that 256 QAM is seen in the logs during DL Data Transfer
Test Limits	EVM shall be less than 3.5%, same required value with FR1. Maximum input level for both single carrier and intra-band CA: -27dBm (**as specified in Table 7.4-1 and 7.4A.1-1 of TS 38.101-2 version 16.15.0**)
Expected Results	The gNB shall successfully support Downlink 256QAM modulation for Frequency Range 2 (FR2).

Test No.	GR_TSTP_4.9
Test Details	SON and MDT support SON (Self-Organising Networks) and MDT (Minimization of Drive Tests) support for NR
Test Instruments Required	gNodeB, MME/AMF, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser, TCE (Trace Collection Entity) Server.
Test Setup	TEST SETUP 14
Test Procedure	Enable SON features in the NR gNB such as MLB, MRO, RACH Optimization, NR-MDT. 1.) **For MRO and MLB verification** 1. Generate handovers at poor radio conditions and trigger handover failures due to coverage related problems. 2. Verify that Cell Individual offset CIO is updated based upon the above dataset in SIBs and RRC connection reconfiguration. 3. Verify load balancer at RRM is adjusting the connected users as per the MLB algorithms implemented. 2.) **For RACH optimization** 1. NR-gNB shall configure the UE to send RACH reports. 2. Verify if the UE sends RACH report over Uu interface. 3. At NR-gNB end verify the below procedures a. gNB shall send PRACH configuration per served cell from DU to CU and over Xn b. gNB shall send PRACH configuration of Served Cells over X2 c. gNB shall also send RACH report from CU to DU over F1 3.) **For MDT** 7. NR-gNB shall be configured either for immediate or logged MDT mode. 8. For Immediate MDT mode

	a. Verify that gNB sends 'measurement configuration' as part of 'RRC Connection Reconfiguration' message to UE. b. Also verify if measurement reports consisting of parameters mentioned in the above configuration are flowing from UE to gNB when the reporting condition is met. 9. For Logged MDT mode a. Verify that gNodeB is sending 'RRC Logged Measurement Configuration' message to UE to trigger the measurement and logging on UE. b. In Logged MDT, UE saves the measurements if the triggers in the 'RRC Logged Measurement Configuration' are met and these measurements will be reported to gNB at a later time. 10. In both modes after gNB receives the measurement reports from UE, verify that the gNB uploads the reports to TCE Server.
Test Limits	NA
Expected Results	Various SON/MDT features verified to be working and not impacting system performance.

Test No.	GR_TSTP_4.11
Test Details	Verify that Cross Link Interference handling and Remote Interference Management for NR
Test Instruments Required	gNodeB (2 Nos), Channel emulator, UE/UE simulator, RF cables and attenuators, Channel emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 15 & 16
Test Procedure	**Pre-Requisites:** 1. Deploy two gNBs: one configured as an aggressor cell and another as a victim cell, both operating in TDD mode with uncoordinated UL/DL configurations (i.e., neighbouring cells with non-aligned TDD patterns). 2. Simulate typical CLI conditions (UE-to-UE) and remote interference (DL-to-UL) using the channel emulator. 3. Enable Xn interface coordination for CLI; configure RIM-RS signalling and backhaul messaging for RIM. 4. Position UEs in victim and aggressor cells to trigger CLI and remote interference scenarios. **Test Procedure**: **CLI Handling** 1. Configure TDD UL/DL patterns differently in neighbouring cells (gNB-A and gNB-B). 2. Trigger uplink transmission from UE in one gNB (Victim) and downlink reception for UE in neighbouring gNB (Aggressor) in overlapping time slots. 3. Configure CLI-RSSI and SRS-RSRP measurement resources in victim UE.

	4. Verify CLI measurements are performed and reported periodically via event trigger. 5. Ensure that gNBs exchange TDD DL/UL configuration via Xn and F1 interfaces. 6. Observe if gNBs adapt DL/UL scheduling to avoid CLI after receiving reports. 7. Record UE throughput and PDSCH/UL transmission reliability before and after adaptation. **Remote Interference Management (RIM)** 1. Simulate tropospheric ducting conditions using the channel emulator to cause long-distance DL signal interference. 2. Configure victim gNB to transmit RIM-RS Type 1 with victim set ID. 3. Verify aggressor gNB receives RIM-RS Type 1 and transmits RIM-RS Type 2 if configured. 4. Ensure RIM detection messages ("RIM-RS detected" and "RIM-RS disappeared") are sent over the NG and F1 interface using Wireshark. 5. Confirm aggressor gNBs perform interference mitigation (e.g., DL power backoff or schedule adaptation). 6. Log core network behaviour for backhaul RIM and confirm messages remain transparent to core elements. 7. Verify restoration of UL performance in the victim cell.
Test Limits	NA
Expected Results	CLI measurements (CLI-RSSI and SRS-RSRP) should be reported correctly and gNBs shall successfully coordinate to reduce cross-link interference. RIM-RS Type 1 and Type 2 signals must be detected and backhaul messaging must function correctly.

	Remote interference must be identified, reported, and mitigated by the aggressor cell. UE throughput and UL/DL reliability must improve after CLI and RIM mitigation actions.

Test No.	GR_TSTP_4.12
Test Details	Verify that RF requirements for NR frequency range 1 (FR1) 1) Intra-Band Contiguous DL CA upto 300MHz 2) Intra-band contiguous and non-contiguous UL CA 3) Enhancement on UL performance with 2Tx transmission on one UL carrier for Inter-band UL CA, SA SUL and Inter-band EN-DC.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Signal Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	**a. Intra-Band Contiguous DL CA upto 300MHz** 1. Bring gNodeB in operationally enabled state with carrier aggregation including intra band Contiguous component carriers as per gNodeB capability. 2. Perform UE attach. 3. Perform downlink data transfer. 4. Verification through UE logs. **b. Intra-band contiguous and non-contiguous UL CA** 1. Bring gNodeB in operationally enabled state with carrier aggregation including intra band non-contiguous component carriers as per gNodeB capability. 2. Perform UE attach. 3. Perform uplink data transfer. 4. Verification through UE logs in RRC messages on CA info.

	c. Enhancement on UL performance with 2Tx transmission on one UL carrier for Inter-band UL CA, SA SUL and Inter-band EN-DC. 1. Bring gNodeB in operationally enabled state with inter-band carrier aggregation as per gNodeB capability. 2. Perform UE attach. 3. Perform uplink data transfer. 4. Verify the UL performance through UE logs with 2Tx transmission on one UL carrier for SA and EN-DC modes.
Test Limits	NA
Expected Results	UE logs shall indicate that configuration of carrier aggregation for UE, with intra band contiguous component carriers as per UE capability (upto 300MHz) in DL. 1. UE logs shall indicate configuration of carrier aggregation for UE, with intra band contiguous & non-contiguous component carriers as per UE capability in UL. 2. UE logs shall indicate that UE can support 2Tx transmission on one UL carrier for SA and EN-DC modes.

Test No.	GR_TSTP_4.13_A
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **UE reporting its Max Power Reduction (MPR) enhancements when Maximum Permissible Exposure/Extrapolation (MPE) is triggered**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 18
Test Procedure	1. Bring gNodeB in an operationally enabled state configured for FR2 and UE supports reporting of P-MPR due to MPE. 2. Configure mpe-Reporting-FR2 = TRUE in RRC signalling. 3. Ensure PHR configuration is active (phr-Config IE set appropriately). 4. Emulate RF environment where UE must apply P-MPR >= P-MPR_00 to meet MPE requirements as specified in **Table 6.1.3.8-3 of TS 138 321 V16.9.0.** 5. Optionally, configure multiple serving cells with UL to enable Multiple Entry reporting. 6. Trigger conditions for PHR (e.g., time threshold or power headroom threshold). 7. Allocate uplink grant for UE to report MAC CE (either Single Entry or Multiple Entry) and let UE transmit on the next available uplink grant.

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8. Decode MAC PDU at gNB.
9. Confirm the following fields in the PHR MAC CE:
    - P field = 1 (indicating power backoff due to MPE).
    - MPE field is present and carries an index > 0, indicating actual P-MPR applied.
    - PCMAX,f,c and PH reported correctly (as per expected transmit conditions according to section 6.1.3.8 and 6.1.3.9 of TS 138 321 V16.9.0).
    - In Multiple Entry PHR, ensure at least one Serving Cell entry also shows P = 1 and valid MPE.

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Table 6.1.3.8-3 of TS 138 321 V16.9.0:

Table 6.1.3.8-3: Effective power reduction for MPE P-MPR

MPE	Measured P-MPR value
0	P-MPR_00
1	P-MPR_01
2	P-MPR_02
3	P-MPR_03

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<td>Expected Results</td>
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UE logs shall indicate the value of P-MPR because of MPE. Based on this reporting network can take actions to prevent sudden radio link failures.

Verify through UE logs that

- UE must correctly set the P field = 1 when MPE-induced power backoff is applied.
- UE should include a valid MPE field (non-zero index) corresponding to applied P-MPR (per Table 6.1.3.8-3).
- The PCMAX,f,c and PH values should align with expected UE power capability and current backoff.

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	Note: 1. Measurement of field level for Human Exposure Assessment is an important and sometimes an underestimated problem. 2. To overcome the problem, MPE techniques are used. MPE technique uses a reference signal transmitted at maximum power to estimate the maximum field level assuming that all the resources of the communication system are assigned to a single user. The value obtained from MPE procedures must subsequently be multiplied by an appropriate correction factor that takes into account the stochastic nature of the communication in order to obtain a realistic value of the field level.

Test No.	GR_TSTP_4.13_B
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **SSB-based and CSI-RS based Beam correspondence**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, RF/Beam Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 19
Test Procedure	**SSB-based Beam Correspondence:** 1. Bring gNodeB in an operationally enabled state and configure the gNB to transmit SSBs with known beam directions and wide beamwidth. 2. Only SSB is present (disable CSI-RS). 3. Verify conditions in **Table 6.6.4.3.1-1 (L1-RSRP for SSB).** 4. Verify side conditions as per 6.6.4.3.2. 5. Configure UE to operate on one of the following bands: n257, n258, n259, n260, or n261. 6. Ensure SSB_RP ≥ threshold and Ês/Iot ≥ 6 dB (or apply ΔMBS,n if UE supports multiple bands). 7. Trigger UE to perform L1-RSRP measurement and beam reporting. 8. Check that UE uses the same beam direction for reception and transmission (BC confirmed).

	9. Log beam IDs and corresponding RSRP values. **CSI-RS-based Beam Correspondence:** 1. Bring gNodeB in an operationally enabled state and configure the gNB to transmit both SSB and CSI-RS: • Use wide beam SSB for initial access/idle. • Use narrower beam CSI-RS for connected mode. 2. Ensure QCL Type D relationship is active. 3. Validate signal levels at UE: • SSB_RP ≥ threshold in Table 6.6.4.3.3-1. • CSI-RS_RP ≥ threshold in Table 6.6.4.3.1-2 • Ês/Iot ≥ 1 dB for SSB, ≥ 6 dB for CSI-RS. 4. Trigger UE to report beam pair using L1-RSRP measurements. 5. Check for consistency between selected CSI-RS beam and transmission direction.
Test Limits	**Verify signal conditions according to the tables 6.6.4.3.3-1, 6.6.4.3.3-2 and 6.6.4.3.2 of TS 138 101-2 V16.15.0.**
Expected Results	UE shall maintain consistent RX and TX beam correspondence and all SSB-based and CSI-RS-based thresholds are respected.

Test No.	GR_TSTP_4.13_C
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **Interband DL Carrier Aggregation (CA_n260-n261)**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Signal Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	1. Bring gNodeB in operationally enabled state with inter band DL carrier aggregation for n260-n261 enabled as per gNodeB capability. 2. Perform UE attach. 3. Perform downlink data transfer. 4. Verification through UE logs.
Test Limits	NA
Expected Results	UE logs shall indicate CA_n260-n261 configuration for UE.

Test No.	GR_TSTP_4.13_D
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **DL Intra-band CA Bandwidth Enhancement (Fs and Fsd classes)**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Signal Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	1. Configure the gNodeB to enable DL CA in FR2 using two or more component carriers within the same band, with frequency separation up to 2400 MHz (Fs class). 2. Perform UE attach. 3. Perform downlink data transfer. 4. Verify through UE logs that the UE successfully detects and aggregates the DL CCs with the configured separation. 5. Repeat the test with DL-only spectrum configuration (Fsd), ensuring the second CC is placed contiguously on one side of the bidirectional spectrum. 6. Measure and log the aggregated throughput, component carrier quality, and resource block assignment.
Test Limits	Maximum frequency separation: 2400 MHz (Fs class)

Expected Results	UE logs shall indicate the configured DL component carriers for both Fs and Fsd class configurations.

Test No.	GR_TSTP_4.13_E
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **Non-contiguous Intra-band Uplink CA (n260)**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Signal Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	1. Bring gNodeB in operationally enabled state with non-contiguous Intra-band Uplink CA for n260 upto three UL sub-blocks enabled as per gNodeB capability. 2. Perform UE attach. 3. Perform Uplink data transfer. 4. Verification through UE logs.
Test Limits	NA
Expected Results	UE logs shall indicate configuration of carrier aggregation for UE, with intra band non-contiguous component carriers for n260 band in UL.

Test No.	GR_TSTP_4.13_F
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **MPR enhancements: Zero dB MPR range extended to cover more allocations**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Signal Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	1. Ensure that gNodeB is configured for FR 2. 2. Assure that configuration for all UE power classes, the waveform defined by BW = 100 MHz, SCS = 120 kHz, DFT-S-OFDM QPSK, 20RB23 is the reference waveform with 0 dB MPR and is used for the power class definition. 3. Bring gNodeB in operationally enabled state. 4. Perform UE Attach. 5. Start downlink and uplink data transfer for the UE. 6. Using drive test tools, measure RF parameters. 7. MPR parameters can be varied as per the measured RF levels.
Test Limits	NA
Expected Results	1. UE logs shall indicate the configuration of above parameters.

	2. UE performance shall improve by varying MPR values by gNodeB. **<u>Note:</u>** 1. "0 dB MPR" refers to a scenario where the power control algorithm does not require any power reduction or increase to meet the required signal strength at the receiver. 2. Generally, UE can configure its maximum output power. Due to max. Power transmission from UEs which are near to gNodeB, may create interference to other UEs. So, gNodeB has to adjust UE power (Power Control) by means of MPR.

Test No.	GR_TSTP_4.13_G
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **1 dB Output power boost for QPSK when in-band emissions are suspended.**
Test Instruments Required	gNodeB, RF cables and attenuators, UE/UE simulator, Signal Analyzer, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	1. Bring gNodeB in operationally enabled state and UE configured as per Rel-16 specifications. 2. Perform UE attach. 3. Set UE to operate in uplink with relaxed IBE constraints (i.e., when emission mask requirements are temporarily relaxed). 4. Perform uplink data transfer with QPSK modulation. 5. Disable IBE constraints per test environment setup. 6. Measure the UE transmit power. 7. Compare with baseline power level for the same conditions with IBE active.
Test Limits	NA
Expected Results	UE transmit power should be **increased by 1 dB** compared to baseline for QPSK when in-band emissions are suspended.

Test No.	GR_TSTP_4.13_H
Test Details	Verify that NR RF requirement enhancements for frequency range 2: **Multiband relaxation framework enhancement**
Test Instruments Required	gNodeB, RF cables and attenuators, Signal Analyzer, UE/UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 17
Test Procedure	1. Bring gNodeB in operationally enabled state and confirm the UE and gNodeB declares Rel-16 capability and indicates support for specific FR2 bands (e.g., n258, n259, n260, n261). 2. Perform UE attach. 3. For each supported band n: a. Measure the UE's maximum EIRP. b. Verify that the measured EIRP meets the requirement after subtracting the ΔMBP,n value defined in TR 38.831 v1.0.0 Rel-16 Table 4.10-2. 4. For each supported band n: a. Measure the UE's receiver sensitivity (EIS). b. Confirm that the measured EIS complies with the baseline limit + ΔMBS,n per TR 38.831 v1.0.0 Rel-16 Table 4.10-2.

<table>
<tr><td></td><td>
5. If the UE only supports n260 + n261, verify that ΔMBP,n = 0 and ΔMBS,n = 0 for both bands per Notes 1 and 2.

6. Repeat same logic for n257 + n261 combo as per Notes 3 and 4.
</td></tr>
<tr><td>Test Limits</td><td>
TR 38.831 v1.0.0 Rel-16 Table 4.10-2:

Table 4.10-2: UE multi-band relaxation factors for power class 3 (Rel-16)
<table>
<tr><th>Band</th><th>DMBP (dB)</th><th>DMBS (dB)</th></tr>
<tr><td>n257</td><td>0.7[3]</td><td>0.7[3]</td></tr>
<tr><td>n258</td><td>0.6</td><td>0.7</td></tr>
<tr><td>n260</td><td>0.5[1]</td><td>0.4[1]</td></tr>
<tr><td>n261</td><td>0.5[2,4]</td><td>0.7[4]</td></tr>
<tr><td colspan="3">Note 1: n260 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n260
Note 2: n261 peak relaxation is 0 dB for UE that exclusively supports n261+n260
Note 3: n257 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257
Note 4: n261 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257</td></tr>
</table>
</td></tr>
<tr><td>Expected Results</td><td>UE logs shall indicate the correct per-band relaxation values (ΔMBP,n and ΔMBS,n) as defined in the enhanced MBR framework.</td></tr>
</table>

Test No.	GR_TSTP_4.14_A
Test Details	Verify that NR RRM enhancement (SRS Carrier Switching)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure link adaptation. 2. Configure carrier aggregation. 3. Enable SRS configuration on NR carriers. 4. Define switching conditions (Timer-based or DCI-based) trigger. 5. Bring up the gNodeB to the operationally enabled state. 6. Perform UE registration and initiate data transfer. 7. Trigger SRS Carrier Switching. 8. Ensure that gNodeB receives SRS post-switch correctly with proper timing and beam. 9. Capture UE logs, gNodeB logs, and PCAP files. 10. Verify the SRS Carrier Switching from RRC messages – especially RRC Reconfiguration containing SRS configs. 11. Validate the SRS indication messages from PHY via FAPI or custom trace.
Test Limits	NA
Expected Results	gNodeB should successfully support the SRS Carrier Switching.

Test No.	GR_TSTP_4.14_B
Test Details	Verify that NR RRM enhancement (Multiple Scell activation Deactivation)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. Configure the gNodeB to support multiple component carriers (CCs), designating one as the Primary Cell (PCell) and others as Secondary Cells (SCells). 2. Define the parameters for each SCell, including frequency, bandwidth, and scheduling information. 3. Bring up the gNodeB to the operationally enabled state. 4. Perform UE registration and initiate data transfer. 5. Activate multiple SCells simultaneously. Monitor the UE's response and ensure it starts utilizing the activated SCells. 6. Similarly, deactivate SCells. Alternatively, configure the sCellDeactivationTimer to allow the UE to autonomously deactivate SCells after a period of inactivity. 7. Verify and validate the RRC messages, MAC CEs, and other signaling information. 8. Verify that the UE correctly processes activation/deactivation commands and that the gNodeB responds appropriately.
Test Limits	NA
Expected Results	gNodeB should successfully support Multiple SCell activation/deactivation

Test No.	GR_TSTP_4.14_C
Test Details	Verify that NR RRM enhancement (CGI reading with Autonomous gap for NR capable UE)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure gNodeB with multiple cells 2. Define Measurement Configuration and parameters for each cell, including frequency, bandwidth, and scheduling. 3. Bring up the gNodeB to the operationally enabled state. 4. Perform UE registration and initiate a data session (data transfer). 5. Configure reportCGI IEs inside RRC Reconfiguration message related to Autonomous gaps a. Setting ReportConfigNR with reportCGI = TRUE. b. Enabling useAutonomousGaps = TRUE. 6. Capture UE logs, gNodeB logs, and PCAP traces. 7. Verify that the UE performs Autonomous CGI Measurement by reading SSB, decoding PBCH (MIB), and reading SIB1 (containing CGI). 8. Verify that RRC MeasurementReport is sent by the UE with the decoded CGI.
Test Limits	NA
Expected Results	An NR UE shall support Autonomous gaps based neighbouring cell CGI measurement and shall report to gNodeB.

Test No.	GR_TSTP_4.14_D
Test Details	Verify that NR RRM enhancement (BWP switching on multiple Component Carriers)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. gNodeB is configured with multiple cells such that Carrier aggregation and multiple DL/UL BWPs per CC are present. 2. Connect UE to the gNodeB. 3. Proceed for testing of BWP switching by either of the three methods a. DCI-based BWP Switching. b. RRC-based BWP Switching c. Timer based 4. Verify that bwp-SwitchingMultiCCs-r16 or bwp-SwitchingMultiDormancyCCs-r16 IEs are received UE capability indication. 5. Verify that BWP switching is happening at multiple Carrier Components.
Test Limits	NA
Expected Results	UE is able to BWP switching across multiple Carrier Components

Test No.	GR_TSTP_4.14_E
Test Details	Verify that NR RRM enhancement (Inter-band CA requirement for FR2)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. gNodeB is configured with multiple carriers with different FR2 frequency bands. 2. Ensure that CA is configured at gNodeB 3. Connect UE to the gNodeB. 4. Verify that UE is configured to proceed for Carrier aggregation.
Test Limits	NA
Expected Results	UE shall be able to register with at least 2 carriers for Carrier aggregation.

Test No.	GR_TSTP_4.14_F
Test Details	Verify that NR RRM enhancement (Inter Frequency measurement without Measurement Gap(MG))
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. gNodeB is configured with 2 cells with different frequencies such that SSB is completely contained in the active BWP of the UE. 2. Connect UE to the gNodeB. 3. Proceed for inter frequency-based measurement. 4. Verify that NeedForGapsInfoNR IE is configured with gapIndication-r16 with no-gap flag 5. Verify that measurement of the neighbor cell is observed after configuring without measurement gap
Test Limits	NA
Expected Results	UE is able to receive measurement report of neighbour cell without measurement gap in inter-frequency

Test No.	GR_TSTP_4.14_G
Test Details	Verify that NR RRM enhancement (Mandatory Measurement gap pattern). Verify UE support for additional mandatory measurement gap patterns (GP#2, #3, #11 for NR-only; #17, #18, #19 universally)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 7
Test Procedure	1. gNodeB is configured to Operationally enabled state 2. Configure NR-only UE for measurement with each of the patterns: GP#2, GP#3, GP#11, GP#17, GP#18, GP# 19 3. Verify gap timing aligns with the Measurement Gap Length (MGL) and Measurement Gap Repetition Period (MGRP) for each selected GP. 4. Connect UE to the gNodeB. 5. Proceed for inter frequency-based measurement based on selected Gap pattern 6. Verify that NeedForGapsInfoNR IE is configured with gapIndication-r16 with no-gap flag 7. Verify that measurement of the neighbor cell is observed after configuring without measurement gap 8. Bring down and bring up gNodeB with another GP #3. Repeat Step 3 to 7. Go to step 9 9. Bring down and bring up gNodeB with another GP #11. Repeat Step 3 to 7. Go to step 10 10. Bring down and bring up gNodeB with another GP #17. Repeat Step 3 to 7. Go to step 11

	11. Bring down and bring up gNodeB with another GP #18. Repeat Step 3 to 7. Go to step 12 12. Bring down and bring up gNodeB with another GP #19. Repeat Step 3 to 7.
Test Limits	
Expected Results	UE shall be able to do measurement as per configured gap pattern. UE shall do successful Inter Frequency Handover.

Test No.	GR_TSTP_4.14_H
Test Details	Verify that NR RRM enhancement (Spatial Relation Switch for Uplink) Verify the uplink spatial relation switch delay requirements as defined in Rel-16.
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure multiple spatial relations with known DL-RS conditions. 2. Connect the UE with gNodeB 3. Perform spatial switch for uplink with the help of below mentioned type(s). a. MAC-CE Based Switch b. DCI Based Switch c. RRC Based Switch 4. Verify that spatial switch for uplink is done with the help of the above-mentioned type(s).
Test Limits	
Expected Results	UE shall be able to switch of active spatial relation within the configured delay.

Test No.	GR_TSTP_4.14_I
Test Details	Verify that NR RRM enhancement (Dynamic change of UE Specific Channel Bandwidth (CBW)
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Precondition: Setup UE with initial channel BW and active DL/UL BWP. 2. Trigger CBW Change: Send RRC reconfiguration to change offsetToCarrier or carrierBandwidth. 3. Measure Delay:Confirm UE is able to receive PDSCH/PDCCH or transmit PUSCH on the new BWPs immediately after the delay window (TRRC_processing + TCBW_Change).
Test Limits	NA
Expected Results	UE should be able to change its bandwidth without re-establishment with help of RRC reconfiguration.

Test No.	GR_TSTP_4.15
Test Details	Verify that RRM requirement for CSI-RS based L3 measurement in NR
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure the network for CSI-RS transmission 2. Bringup gNodeB and perform UE Registration 3. Verify measurement report from UE for CSI-RS as per the configured value (CSI-RSRP / CSI-RSRQ / CSI-SINR etc) at gNodeB.
Test Limits	NA
Expected Results	Verify that gNodeB receives measurement report as per configured CSI-RS.

Test No.	GR_TSTP_4.16_A
Test Details	Verify Enhancement (Type II CSI feedback based) for NR_eMIMO
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure the gNodeB for Type II CSI feedback with SD and FD compression. 2. Bring up the gNodeB and perform UE registration. 3. Perform data transfer. 4. Ensure the UE reports PMI which includes the necessary. 5. Verify that gNodeB is handling these reports and adjusts the transmissions accordingly.
Test Limits	
Expected Results	The UE reports accurate CSI feedback with reduced overhead, maintaining the precoding matrix reporting without significant impact on throughput.

Test No.	GR_TSTP_4.16_B
Test Details	Verify Enhancement (Multiple Transmission and Reception Point (TRP) based) for NR_eMIMO
Test Instruments Required	gNodeB, Multiple TRPs ,5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 20
Test Procedure	1. Configure gNodeB for enabling single-DCI or multi-DCI based non-coherent joint transmission (NCJT) including setting up of PDSCH scheduling with multiple layers for transmission across two TRPs based on the type of NCJT. In case of single-DCI NCJT configure the type of transmission scheme. 2. Bring up gNodeB and perform UE registration. Also bring up required number of TRPs. 3. Perform the data transfer. 4. Verify that UE is able to decode PDSCH transmissions and handle HARQ-ACK feedback from multiple TRPs. 5. Additionally for single-DCI NCJT configuration ,verify the transmission scheme(s) used.
Test Limits	NA
Expected Results	The UE decodes multiple PDSCH transmission occasions and handles HARQ-ACK feedback from multiple TRPs, and exhibits improved DL transmission reliability and/or data rate and/or spectral efficiency.

Test No.	GR_TSTP_4.16_C
Test Details	Verify Multi Beam Enhancement for NR_eMIMO based on Default DL spatial relation / pathloss reference RS
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure gNodeB to support a default DL beam RS as the spatial relation reference RS or pathloss reference RS. 2. Bring up gNodeB and perform UE registration. 3. Perform data transfer. 4. Trigger an event which will update spatial relations/ pathloss resources. 5. Verify that gNodeB indicates UE to update the spatial reference or pathloss resources. 6. Verify that UE is able to update spatial relation or pathloss reference RS.
Test Limits	NA
Expected Results	UE successfully performs spatial relation or pathloss resources related operation using a default DL beam RS as reference RS.

Test No.	GR_TSTP_4.16_D
Test Details	Verify Low PAPR DM-RS.
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 6
Test Procedure	1. Configure gNodeB for CP-OFDM PDSCH/PUSCH transmissions using low PAPR DM-RS sequences. 2. Bring up gNodeB and perform UE registration. 3. Perform data transfer. 4. Verify that UE is able to use low PAPR DM-RS sequences, ensuring the reduction in PAPR compared to the associated DM-RS. Measure the PAPR of the transmitted signal to confirm the expected reduction.
Test Limits	NA
Expected Results	The measured signals should exhibit low PAPR values for the concerned channels.

Test No.	GR_TSTP_4.17
Test Details	Verify that the gNB supports pi/2-BPSK, as per Rel 16.
Test Instruments Required	gNodeB, 5G Core/ 5G Core emulator, RF cables and attenuators, PC, 5G UE /UE simulator, Traffic generator (e.g. Iperf or FTP server), Network Performance Measurement Tool, UE Logging tools, Wireshark Network Protocol Analyser. RF signal measurement tool.
Test Setup	TEST SETUP 1
Test Procedure	1. Configure the gNodeB with parameters associated with measurements and UL/DL link adaptation. Bring up the gNodeB 2. Perform UE Attach, and observe the wireshark logs. 3. Start uplink data transfer from the UE 4. Vary attenuation of the radio link. 5. Observe/Record the UE and gNodeB logs for pi/2-BPSK. 6. Verify Inband selectivity and blocking capability, for DFT-s-OFDM
Test Limits	NA
Expected Results	Verify that gNodeB supports pi/2 BPSK in PUSCH, PUCCH formats 3 and 4. gnodeB should configure UE with pi/2- BPSK. Verify UE capabilities through UE and gNodeB logs: a) Low PAPR DMRS for PUSCH without transform precoding,

	b) Low PAPR DMRS for PUSCH with transform precoding and with pi/2 BPSK. c) Low PAPR DMRS for PUCCH format 3 and 4 with transform precoding and with pi/2 BPSK

Test No.	GR_TSTP_5.1.1_A
Test Details	To verify that the system is capable of reporting different events/alarms to the EMS such that the state of the system can be evaluated.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Verify that the alarms are reported by the gNodeB to the EMS with different levels of severity associated with the alarms such as (CRITICAL, MAJOR, MINOR, CLEAR, WARNING etc.) based on which operator action may be required. 2. Valid time-stamp shall be associated with each alarm. Also proper description indicating the detailed fault shall be included with the alarm. 3. Node identification shall be associated with each alarm.
Test Limits	NA
Expected Results	Provision exists in the system to allow both system qualities check and fault indication as a fault arises

Test No.	GR_TSTP_5.1.1_B
Test Details	To verify that the system shall be able to recover automatically from a software fault. In case auto recovery is not successful manual-reloading shall be possible.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Simulate a process crash at gNodeB by using appropriate command. Check that the gNodeB is able to recover by itself. 2. In case where the auto recovery cannot be done, check that gNodeB gives a provision to stop at a point while boot up, make the required changes and then again start the bootup process. This is a case of provision of recovery by manual intervention if the system cannot recover from a fault by itself
Test Limits	NA
Expected Results	gNodeB shall be able to recover from faults automatically. If unable to do so, manual loading is supported.

Test No.	GR_TSTP_5.1.2
Test Details	The targeted relative speed between the gNB and the mobile stations may be chosen from the following categories: (Applicable for Low/Mid band) a. Stationary (0 km/h) b. Pedestrian (up to 10 km/h) c. Vehicular: 10 km/h to 120 km/h d. High speed vehicular: 120 km/h to 500 km/h For High band, the targeted relative speed between the gNB and the mobile station may be up to 100 km/h.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Attach UE 2. Run Iperf Application to Download data 3. Verify that at all above mentioned speed, Data Downloading is working
Test Limits	NA
Expected Results	Verify that at all above mentioned speed, Data Downloading is working

Test No.	GR_TSTP_5.2.1
Test Details	Facility shall be available for introduction of centralized maintenance control (OMC).
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Connect multiple gNodeBs with the EMS. 2. Check that operations and maintenance tasks can be performed for each gNodeB via OMC. 3. Operations carried out on one gNodeB are mutually exclusive 4. Check that alarms for different gNodeBs are reflected at the OMC. They are identifiable for each gNodeB by a unique field. 5. Also verify that the gNodeBs are accessible by OMC client and operations and maintenance activities can be done remotely.
Test Limits	NA
Expected Results	System shall provide facility for introduction of centralized maintenance control (OMC).

Test No.	GR_TSTP_5.2.2
Test Details	The maintenance spares supplied shall take into account the MTBF and MTTR
Test Instruments Required	NA
Test Setup	NA
Test Procedure	Spare calculations factoring MTBF and MTTR values shall be provided by supplier. No test required.
Test Limits	NA
Expected Results	Spares calculation is provided.

Test No.	GR_TSTP_5.3.1
Test Details	To verify that gNodeB supports diagnostic test for gNodeB to monitor system performance
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Execute the diagnostic test at gNodeB. Verify that test execution is successful and a valid report is generated.
Test Limits	NA
Expected Results	Diagnostic report generated successfully.

Test No.	GR_TSTP_5.3.2
Test Details	To verify auto restart method of gNodeB in case of severe fault conditions
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Simulate a process crash at gNodeB by using appropriate command. Check that gNodeB is able to recover by itself and services are resumed. 2. In exceptional conditions where the system is not able to recover using auto restart, manual restart should enable the system.
Test Limits	System may go in for an auto restart for recovery mechanism.
Expected Results	System is able to recover automatically from the faults.

Test No.	GR_TSTP_5.4
Test Details	Environmental Test Conditions: a. Indoor gNB / Indoor BBU : Category A SD: QM-333 b. Outdoor gNB BBU & RRH : Category D SD: QM-333 and IP65 c. Antenna & Feeders : Category E as per SD: QM-333
Test Procedure	1. Check indoor gNB as per QM-333 standard Category A. 2. Check outdoor gNB, BBU & RRH as per QM-333 standard category D and for IP65. 3. Check Antenna & Feeders as per QM-333 standard category E. 4. Test can be performed in Factory or in any certified Lab.
Test Limits	NA
Expected Results	Test certificate/report to be attached with compliance to the respective requirements.

Test No.	GR_TSTP_5.5.1
Test Details	The supplier/manufacturer shall conform to ISO 9001:2015 certifications. A quality plan describing the quality assurance system followed by the manufacturer shall be required to be submitted.
Test Procedure	No test required. Supplier/Manufacturer to provide ISO 9001 certification details and Quality Plan.
Test Limits	NA
Expected Results	Supplier/Manufacturer to provide ISO 9001 certification and Quality Plan.

Test No.	GR_TSTP_5.5.2
Test Details	For a distributed gNB, the failure of any component/ sub-system in the system shall not result in the failure of complete system.
Test Instruments Required	NA
Test Setup	NA
Test Procedure	Details of compliance to be submitted by supplier.
Test Limits	NA
Expected Results	Distributed gNodeB has suitable provisions.

Test No.	GR_TSTP_5.6
Test Details	The equipment shall conform to IS 13252 part 1:2010- 1. “Information Technology Equipment – Safety- Part 1: General Requirements” [equivalent to IEC 60950-1 {2005} “Information Technology Equipment –Safety- Part 1: General Requirements”] OR IEC 62368-I:2014 2. IEC 60215 (1987) Safety requirements of radio transmitting equipment’s (for Radio equipment’s only)
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_1
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Conducted and Radiated Emission
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_2
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to Electrostatic discharge: Contact discharge level 2 {± 4 kV}
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_3
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to Electrostatic discharge: Air discharge level 3 {± 8 kV}
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_4
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to radiated RF: a) Radio Frequency: 80 MHz to 1 GHz, Electromagnetic field: 3V/m b) Radio Frequency: 800 MHz to 960 MHz, Electromagnetic field: 10V/m Radio Frequency: 1.4 GHz to 6 GHz, Electromagnetic field: 10V/m
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_5
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) 1 kV for AC/DC power port 0. 5 kV for signal / control / data / telecom lines.
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_6
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to surges: AC/DC ports 2 kV peak open circuit voltage for line to ground 1kV peak open circuit voltage for line to line
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_7
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) 2 kV peak open circuit voltage for line to ground coupling. 2 kV peak open circuit voltage for line-to-line coupling.
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_8
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to conducted disturbance induced by Radio frequency fields: Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_9
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any): Limits: - a) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e., 70% supply voltage for 500ms) b) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e.,40% supply voltage for 200ms) c) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_5.7_10
Test Details	gNB Electromagnetic Compatibility (EMC) (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time) Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any): a) Voltage Interruption with 0% of supply for 10ms. b) Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. c) Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. d) Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. Voltage variations corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
Test Limits	NA
Expected Results	Test certificate/reports from any certified lab should be submitted.

Test No.	GR_TSTP_6.1.1
Test Details	Verify that 5G provides users a facility for high-speed data & voice. The system shall have facilities for automatic roaming, locating and updating mobile subscribers.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 3
Test Procedure	Bring 2 gNodeBs in operationally enabled state. gNodeB2 should be configured with TAC and PLMN value different from gNodeB1 Attach UE1 and UE2 on First gNodeB Initiate Uplink and Downlink data for UE1 Initiate Voice call from UE1 to UE2 Disconnect Voice Call Make UE1 reselect to gNodeB2 Verify that UE1 performs Tracking area update
Test Limits	NA
Expected Results	The gNodeB1 shall successfully transport UL and DL data. The gNodeB1 shall successfully support voice call The gNodeB2 shall successfully support roaming of UE1.

Test No.	GR_TSTP_6.3.2
Test Details	Verify that Design precautions shall be taken to minimize the possibility of equipment damage arising from the insertion of an electronic package into the wrong connector or the removal of any package from any connector.
Test Instruments Required	NA
Test Setup	NA
Test Procedure	This requirement is applicable to gNodeB implementations with field removable electronic packages/modules. Check from physical construction if there is any electronic package(s) which is to be inserted/removed on gNodeB during site installation. On such electronic package(s): a. Check if there is a possibility of inserting it into any other connector of system. b. Check by removing the electronic package from the connector, if any impact to system functionality not dependent on that electronic package.
Test Limits	NA
Expected Results	No equipment damage shall arise due to insertion of an electronic package into wrong connector. No equipment damage shall arise due to removal of any package from any connector.

Test No.	GR_TSTP_6.3.3
Test Details	Verify that the system hardware shall not pose any problem, due to changes in date and time caused by events such as changeover of leap year etc., in the normal functioning of the system.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Change the date and time at gNodeB through command line/EMS/OMS such that the year given is a leap year. There should not be any impact on hardware on changing the date and time. Perform UE attach Verify that attach is successful.
Test Limits	NA
Expected Results	There should be no impact at gNodeB when the date is changed to a year which is a leap year.

Test No.	GR_TSTP_6.4.1
Test Details	Verify that Provision shall be made to prevent the loss/alteration of memory contents due to power failures, improper operating procedures and the procedure for restoring the system to its normal state, etc.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	**Prevention of loss/alteration of contents:** The vendor to specify data/files that are present on persistent storage. Bring gNodeB in operationally enabled state Verify vendor specified data/files Perform UE attach Switch-off the power supply Wait for 1 minute Switch on the power supply Bring gNodeB in operationally enabled state Verify that vendor specified data/files are intact Perform UE attach **System restoration procedure after following improper operating procedure** The vendor to specify procedure to restore the system Delete some critical data/file or modify data (as per vendor specified procedure) that take gNodeB in inconsistent state. Bring gNodeB in operationally enabled state. The procedure shall fail. Now follow vendor specified restoration procedure Bring gNodeB in operationally enabled state Perform UE attach

Test Limits	NA
Expected Results	The specified file/data shall not be altered/lost at power-off. The gNodeB shall come to normal state and attach shall be successful.

Test No.	GR_TSTP_6.5.1
Test Details	Verify that the communication facilities provided for exchange of information between the elements of 5G-RAN and the maintenance and operating personnel shall include facilities for a system test, control and alarm indication at OMC.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Trigger diagnostics tests for gNodeB. Verify the test reports at OMC/EMS/Command line. Lock the gNodeB through OMC/EMS (i.e. Make the gNodeB out of service from OMC). Verify that the relevant alarms are raised. Make some changes in the gNodeB configuration through OMC/EMS . Unlock the gNodeB through OMC/EMS (i.e. Make the gNodeB in service from OMC/EMS). Verify that the relevant alarms are raised.
Test Limits	NA
Expected Results	The gNodeB shall successfully execute vendor specified diagnostic procedure. The gNodeB shall indicate alarms to OMC/EMC for vendor specified events. The gNodeB shall allow configuration of vendor specified parameters through OMC/EMS.

Test No.	GR_TSTP_6.5.2
Test Details	Verify that Input / output terminals shall be capable of transmitting/ receiving characters of a subset of the ITU-T T.50 alphabet. The printing/display device shall print/display different graphic symbols for the digit zero and the capital letter O. The input/output terminal shall have the English Keyboard.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Input/output terminals will refer to the serial console for accessing gNodeB as well as the OMC client for operations and management of gNodeB through EMS. Check that the serial console/OMC client shall have the English keyboard.
Test Limits	NA
Expected Results	Input / output terminals shall be capable of transmitting/ receiving characters of a subset of the ITU-T No.5 alphabet

Test No.	GR_TSTP_6.5.3
Test Details	Verify that Adequate number of man-machine interfaces shall be available.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Check that the system provides adequate number of MMI. It could be via a serial port / OMC client through which the operations and management can be carried out for gNodeB.
Test Limits	NA
Expected Results	System shall support adequate number of man machine interfaces.

Test No.	GR_TSTP_6.5.4
Test Details	Verify If provision is made for monitoring from a remote terminal, it shall be ensured that the data links conform to the ITU-T Recommendation Q.513. Care shall be taken that the reliability of the data links towards remote terminal does not, in any way, affect the reliability of the 5G-RAN. Special provision shall also be made for storage of failure event even when the system is unable to transmit an output message.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Break the ethernet connectivity between the gNodeB and the OMC. Check that the un-reachability status of the gNodeB is updated at the OMC. Also check that the gNodeB operations are not affected. In case some alarms are raised in this time, they are stored at gNodeB.
Test Limits	NA
Expected Results	Reliability of the data links towards remote terminals shall not impact the reliability of the gNodeB

Test No.	GR_TSTP_6.5.5
Test Details	Verify that A suitable alarm and display system at OMC shall be provided for a continuous indication of the system status.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. This is a generic clause. Verify that the OMC gives you a provision to check the alarms as and when they are raised 2. It should basically provide you with the complete view of the system status. The alarm view should be clear enough to get a clear picture of the system status.
Test Limits	NA
Expected Results	Alarm and display system is present at OMC.

Test No.	GR_TSTP_6.6.3
Test Details	All components and material used in the equipment shall be non-inflammable or in absence of it, self-extinguishable. They shall be fully tropicalized.
Test Instruments Required	NA
Test Setup	NA
Test Procedure	1. Non-Inflammable/Self-extinguishable: No test required. Check compliance of gNodeB as per the Clause 5.6: gNodeB Safety Requirements. 2. Topicalization: No test required. Check compliance of gNodeB as per Clause 5.4: Environmental Test Conditions. Check compliance of gNodeB as per Clause 6.7.2
Test Limits	NA
Expected Results	gNodeB components and materials are non-inflammable/selfextinguishable. gNodeB has been tropicalized as per the requirements.

Test No.	GR_TSTP_6.7.1
Test Details	Verify that the components used shall be available from multiple sources with adequate qualification. Number of proprietary components used shall be minimum. List of such components shall be indicated.
Test Instruments Required	NA
Test Setup	NA
Test Procedure	Undertaking from the supplier that components other than proprietary components are available from multiple sources with adequate qualification. List of proprietary components & their availability assurance (as per the need) shall be taken from supplier. No test required.
Test Limits	NA
Expected Results	Undertaking of compliance and list of proprietary components is furnished by the supplier.

Test No.	GR_TSTP_6.7.2
Test Details	Verify that all the equipment shall have a tropical finish and coated to protect against saline atmosphere.
Test Instruments Required	NA
Test Setup	NA
Test Procedure	Compliance to be checked against Clause 5.4 Environmental Test Conditions. Supplier to provide detail of tropical finish/coating of outdoor equipment. No test required
Test Limits	NA
Expected Results	Equipment have necessary protection against saline atmosphere.

Test No.	GR_TSTP_6.8.2_A
Test Details	To verify that first time release installation is a simple process and adheres to the steps in the installation manual Also to verify that the system is easy to handle during normal operations
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Install the software release on the gNodeB as per the installation manual. Verify the release is successfully installed. This refers to the first time installation on the board. After this new software release can be applied using the software upgrade procedure initiated through the EMS. 2. Verify that the system comes up with the new release successfully. Also verify that UE attach is successful. 3. In addition, verify that the software upgrade is an easy process. 4. Also, the system is easy to handle during normal operations.
Test Limits	NA
Expected Results	Installation and normal operations in the system are easy to perform.

Test No.	GR_TSTP_6.8.2_B
Test Details	To verify that test programs are implemented for fault tracing, detection and localization of system faults
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	1. Check that utilities/test programs are available at the gNodeB for fault tracing. 2. Whenever a critical event is detected, system should go for an auto recovery procedure.
Test Limits	NA
Expected Results	Test programs available for debugging purposes. Also check that the system can initiate auto recovery procedure in case of critical events.

Test No.	GR_TSTP_6.10.1
Test Details	Verify that the gNB shall provide the protection against DOS attack. The vendor shall describe how to protect against DOS attack in their system.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, 5GC/5GC Emulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP 2
Test Procedure	Configure some value to limit PRACH in gNodeB Attach multiple UE till that value Verify that system will not handle PRACH after reaching that value
Test Limits	NA
Expected Results	Verify that system will not handle PRACH after reaching that value

J. **Summary of test results**

GR/IR No.________________________________

TSTP No.___________________________________

Equipment name & Model No.______________

Clause No.	***Compliance*** *(Complied /Not Complied / Submitted/Not Submitted / Not Applicable)*	***Remarks / Test Report Annexure No.***

[Add as per requirement]

Date:

Place: ***Signature & Name of TEC testing Officer /***

**** Signature of Applicant / Authorized Signatory***

**** Section J as given above is also to be submitted by the Applicant/ Authorised signatory as part of in-house test results along with Form-A. The Authorised signatory shall be the same as the one for Form 'A'.***