परीक्षण निर्देशिका

टीईसी २११०१: २०२६

TEST GUIDE

TEC 21101:2026

छोटे आकार का जीनोडबी

Small Size gNodeB

(जीआर सं: टीईसी २११००:२०२४)

(GR No.: TEC 21100:2024)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली – ११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE

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FORWARD

Telecommunication Engineering Centre (TEC) is the technical arm of Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
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- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DoT on technical/technology issues

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 Test Guide of testing pertains to detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of Small Size gNodeB as per GR/IR/Applicant's spec. No GR No.: 21100:2024

CONTENTS

Section	***Item***	***Page No.***
A	History Sheet	
B	Introduction	
C	General information	
D	Testing team	
E	List of the test instruments	
F	Equipment Configuration offered	
G	Equipment/System Manuals	
H	Clause-wise Test Type and Test No.	
I	Test Setup & Procedures	
J	Summary of test results	

A. HISTORY SHEET

Sl. No.	Test Guide No.	Equipment/Interface	Issue
1.	**TEST GUIDE No.: TEC 21101:2026**	**Small Size gNodeB**	**Release No.** XX

B. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of Small Size gNodeB as per GR/IR/Applicant's spec. No GR No.: 21100:2024

C. General Information:

S. No.	General Information	Details	
1	Name, Address and Contact Details of the Applicant		
2	Date of Application		
3	Details of Equipment		
	Type of Equipment	Model No.	Serial No.
(i)			
(ii)			
4	Any other relevant Information: -		

D. Testing team:

S.No.	Name	Designation	Organization	Signature
1.				
2.				
3.				

E. List of the Test Instruments:

S.No.	Name of the test instrument	Make /Model	Validity of calibration
1			dd/mm/yyy
2			
3			

F. Equipment Configuration:

(i) *<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

G. Equipment/System Manuals:

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

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

Clause No	Clause Description	Type of Test/ Test No. etc..
	Introduction	
1.1	**Overview** This document contains the Standard for Generic Requirements (GR) for New Radio (NR) based Small Size gNB for deployment in the Indian mobile communication network. The NGRAN (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.	1. Submit Datasheet of the small size gNodeB 2. Network architecture indicating supported interfaces
1.2	**Objective** The key objective of Small Size gNB is to have a compact, cost effective, power efficient and eco-friendly solution, which may address the requirements in terms of coverage, capacity, and quality with ease of deployment and ease of maintenance.	Informational
1.3	**Applications** As the system is small, compact suitable for providing the 5G mobile communication services, the system may be used for the following applications, as may be required: i. Private Networks ii. 5G Mobile Services in remote/ inaccessible areas iii. Network Offloading iv. Mobile Networks on Wheels (MNoW) Small Size gNodeB may be integrated into mobile platforms such as trucks or drones to create rapidly deployable mobile networks. This is particularly useful in emergency situations, disaster recovery, or events where temporary network capacity is needed.	Informational

	The small size gNodeB is compact, cost effective, power efficient and eco-friendly solution and has the scope of operation in Micro, Pico and other lower cell size scenario. For different requirements in terms of output power, transmitter characteristics and receiver performance for these small cell sizes, 3GPP Specification (TS 38.104) defines the gNB classes for Medium Range Base Station and Local Area Base Station which may be referred to.	
1.4	**gNodeB** gNodeB (or gNB in short) is the NG-RAN node in the 5G network architecture that is responsible for radio transmission to and reception from UEs in one or more cells. For NSA, 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. For SA, The NG-RAN consists of gNB (serving NR devices using the NR user-plane and control plane protocols). 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: 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	1. Submit network diagram depicting placement of gNodeB in the system. 2. Submit design architecture and functional split of the gNodeB: Subsystems along with them functional description, Hardware Functional Blocks, Sub-units

	EN-DC, the 4G's eNB is the Master Node (MN) while the 5G's en-gNB is the Secondary Node (SN). 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. The gNB (or en-gNB) is responsible for all radio-related functions to and from UEs in one 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.) 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 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.	
1.4.1	**Functional Requirements** The Small size gNB shall support the following functionalities related to NG-RAN and shall provide the New Radio (NR) air interface user plane (PDCP/ RLC/ MAC/PHY) and control plane (RRC) protocol terminations towards the User Equipment (UE).	Explanatory Only
1.4.1.1	**Radio Resource Control/ Radio Resource Management (RRC/ RRM)**	Explanatory Only
a.	Cell control and AMF support: NG-RAN owns and controls the radio resources of its own cell or cells. Cell resources as requested by and granted to AMF shall be provided in an ordered fashion.	GR_TSTP_1.4.1.1_A
b.	RRC messages shall be transmitted to the device using signalling radio bearers (SRBs) including SRB0, SRB1and SRB2.	GR_TSTP_1.4.1.1_B
c.	The NG-RAN shall support:	
i).	Event-triggered measurement reporting;	GR_TSTP_1.4.1.1_C1
ii).	System Information Broadcast (SIB); and	GR_TSTP_1.4.1.1_C2
iii).	RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.	GR_TSTP_1.4.1.1_C3
1.4.1.2	**Service Data Adaptation Protocol (SDAP)** SDAP shall be responsible for mapping Quality-of-Service (QoS) bearers to radio bearers according to their QoS requirements.	GR_TSTP_1.4.1.2
1.4.1.3	**Packet Data Convergence Protocol (PDCP)**	Explanatory Only
a.	The system shall support;	
i).	integrity protection and ciphering of RRC signalling;	GR_TSTP_1.4.1.3_A1
ii).	RoHC, (As per Procurer requirements)	GR_TSTP_1.4.1.3_A2
iii).	data recovery; and	GR_TSTP_1.4.1.3_A3
iv).	ciphering of DRBs (As per Procurer requirements)	GR_TSTP_1.4.1.3_A4
b.	PDCP shall also handle retransmissions, in-sequence delivery, and duplicate removal in the case of handover.	GR_TSTP_1.4.1.3_B
1.4.1.4	**Radio Link Control (RLC)**	Explanatory Only
a.	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	GR_TSTP_1.4.1.4_A

	(and hence per radio bearer) configured for a device.	
b.	Segmentation/ Concatenation: RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.	GR_TSTP_1.4.1.4_B
1.4.1.5	**Medium Access Control (MAC)**	Explanatory Only
a.	The MAC shall handle multiplexing of logical channels, hybrid-ARQ retransmissions, and dynamic resource allocation (scheduling) and scheduling-related functions.	GR_TSTP_1.4.1.5_A
b.	The MAC shall provide services to the RLC in the form of logical channels.	GR_TSTP_1.4.1.5_B
c.	From the physical layer, the MAC layer shall use the services in the form of transport channels.	GR_TSTP_1.4.1.5_C
d.	Short Buffer Status Report (BSR) and Long BSR	GR_TSTP_1.4.1.5_D
e.	Discontinuous Reception (DRX) to enable reasonable UE battery consumption	GR_TSTP_1.4.1.5_E
f.	The system shall support:	
i).	Link adaptation and power control; and	GR_TSTP_1.4.1.5_F1
ii).	Contention based Random Access (RA) procedure.	GR_TSTP_1.4.1.5_F2
1.4.1.6	**Physical Layer**	Explanatory Only
a.	The System shall Support:	
i).	Synchronization Signal Block (SSB).	GR_TSTP_1.4.1.6_A1
ii).	Uplink (UL) and downlink (DL) demodulation reference signal.	GR_TSTP_1.4.1.6_A2
iii).	UL and DL Link Adaptation.	GR_TSTP_1.4.1.6_A3
iv).	UL and DL Power Allocation for data channels.	GR_TSTP_1.4.1.6_A4
v).	DL Power setting for data channels.	GR_TSTP_1.4.1.6_A5
vi).	DL Power setting for signalling and control channels.	GR_TSTP_1.4.1.6_A6
vii).	Normal cyclic prefix.	GR_TSTP_1.4.1.6_A7
viii).	At least one Static TDD Mode with single Bandwidth Part.	GR_TSTP_1.4.1.6_A8
ix).	Communication of timing advance value to UE.	GR_TSTP_1.4.1.6_A9
b.	The System shall support following Physical Channel Types:	
i).	Physical Downlink Shared Channel (PDSCH): Main physical channel used for unicast data transmission, but also for transmission of, for example, paging information, random-access	GR_TSTP_1.4.1.6_B1

	response messages, and delivery of parts of the system information.	
ii).	Physical Broadcast Channel (PBCH): Carries system information, required by the device to access the network.	GR_TSTP_1.4.1.6_B2
iii).	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.	GR_TSTP_1.4.1.6_B3
iv).	Physical Uplink Shared Channel (PUSCH): the uplink counterpart to the PDSCH. There is at most one PUSCH per uplink component carrier per device.	GR_TSTP_1.4.1.6_B4
v).	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.	GR_TSTP_1.4.1.6_B5
vi).	Physical Random-Access Channel (PRACH): Used for random access. The gNB shall support Contention based and Contention free Random Access (CBRA, CFRA) procedure.	GR_TSTP_1.4.1.6_B6
c.	The System may Support:	
i).	Following physical layer values for cell carrier bandwidth, sub-carrier spacing and modulation schemes (Procurer can chose as per deployment scenario and applications): NR Physical Layer – Low Band (LB)(<1GHz) 1. Cell carrier bandwidth: 5, 10, 15, 20 MHz 2. Sub-carrier spacing: 15 kHz 3. Modulation schemes: Up to 256 QAM in downlink and uplink	GR_TSTP_1.4.1.6_C1_A
	NR Physical Layers – Mid Band (MB) (1GHz-6GHz) 1. Cell carrier bandwidth: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz 2. Sub-carrier spacing: 15kHz, 30 kHz and/ or 60 kHz 3. Modulation schemes: Up to 256 QAM in downlink and uplink	GR_TSTP_1.4.1.6_C1_B
	NR Physical Layers – High Band (HB) (24 GHz-52.5GHz) 1. Cell carrier bandwidth: 50, 100, 200, 400MHz 2. Sub-carrier spacing: 60kHz and 120 kHz	GR_TSTP_1.4.1.6_C1_C

	3. Modulation schemes: Up to 64 QAM in downlink and uplink	
ii).	Both the open-loop power control and the closed-loop power control of the UE. (As per Procurer's requirement)	GR_TSTP_1.4.1.6_C2
iii).	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.	GR_TSTP_1.4.1.6_C3
iv).	DFT-s-OFDM with pi/2 BPSK filtering (LMLC) in Uplink. (As per Procurer requirement)	GR_TSTP_1.4.1.6_C4
1.4.1.7.	**Synchronisation**	
a.	The system shall support:	
i).	Frequency Synchronization.	GR_TSTP_1.4.1.7_A1
ii).	Time and Phase Synchronization.	GR_TSTP_1.4.1.7_A2
iii).	At least one of following synchronization option: 1. GNSS (GPS or NAVIC) (to be specified by procurer) 2. IEEE 1588 V2 3. Sync E	GR_TSTP_1.4.1.7_A3
b.	At least 1 hr hold over mode in case of phase synchronization loss.	GR_TSTP_1.4.1.7_B
1.4.1.8.	**MIMO requirements and Modulation Schemes** Subject to valid combinations of SCS, Cell Carrier Bandwidth and cyclic prefix as specified by 3GPP. (The Procurer may specify specific sub-clauses as well as MIMO configuration, and modulation scheme depending on specific deployment scenario as per their requirements.)	Explanatory Only
a.	The system shall support:	
i).	SISO, 2X2 MIMO option	GR_TSTP_1.4.1.8_A1
ii).	up to 4 DL MIMO layers in Low Band	GR_TSTP_1.4.1.8_A2
iii).	Downlink Single-User MIMO in Mid Band.	GR_TSTP_1.4.1.8_A3
iv).	Downlink Multi-User MIMO in Mid Band to support minimum 8 layers (As per Procurer requirements)	GR_TSTP_1.4.1.8_A4
v).	Uplink Multi-User MIMO in Mid Band to support minimum 4-layer UL MU-MIMO for PUSCH transmission (As per Procurer requirements)	GR_TSTP_1.4.1.8_A5
vi).	DL modulation schemes: QPSK, 16QAM, 64QAM and 256QAM	GR_TSTP_1.4.1.8_A6
vii).	UL modulation schemes: π/2-BPSK (As per Procurer requirements), QPSK, 16QAM, 64QAM and 256QAM (Low/ Mid-band)	GR_TSTP_1.4.1.8_A7
1.4.1.9.	**5G QoS Requirements**	Explanatory Only
a.	The System may support:	

i).	5QI (5G QoS Identifiers) for NR-Standalone mode as per 3GPP TS 23.501 Table 5.7.4-1.	GR_TSTP_1.4.1.9_A1
ii).	Multiple data radio bearers (DRBs).	GR_TSTP_1.4.1.9_A2
iii).	Dynamic addition and deletion of dedicated bearers.	GR_TSTP_1.4.1.9_A3
iv).	Both UE initiated as well as Network Initiated dedicated bearer creation.	GR_TSTP_1.4.1.9_A4
v).	Prioritization of traffic in downlink as per the QCI/ 5QI priority value.	GR_TSTP_1.4.1.9_A5
1.4.1.10.	**Mobility Control**	Explanatory Only
a.	Idle mode mobility (Re-selection): The system shall support:	
i).	NR intra-frequency cell re-selection.	GR_TSTP_1.4.1.10_A1
ii).	NR inter-frequency cell re-selection.	GR_TSTP_1.4.1.10_A2
iii).	Need to support connected mode mobility control	GR_TSTP_1.4.1.10_A3
1.4.1.11.	**Voice over NR (VoNR)**	
a.	The system may support Voice over NR (VoNR) functionality, including:	Explanatory Only
i).	Basic Voice over NR, which provides traffic functions and protocol procedures for establishing, maintaining, and releasing a voice call in NR;	GR_TSTP_1.4.1.11_A1
ii).	Voice over NR calls, which allow the handling of voice traffic directly;	GR_TSTP_1.4.1.11_A2
iii).	Intra frequency handover for voice services; and	GR_TSTP_1.4.1.11_A3
iv).	IP header compression.	GR_TSTP_1.4.1.11_A4
v).	Need to include EPS fall-back mechanism since VoNR may not be supported by all the UEs	GR_TSTP_1.4.1.11_A5
1.4.1.12.	**Energy Efficiency and Power Savings**	Explanatory Only
a.	The System shall support:	
i).	Power saving functionality and shall be power efficient.	GR_TSTP_1.4.1.12_A1
ii).	Micro Sleep Transmission, which reduces energy consumption by turning off certain radio hardware components when there is no traffic.	GR_TSTP_1.4.1.12_A2
iii).	Low energy scheduler solution (LESS) uses a large amount of resource blocks in the frequency domain to free up space in the time domain. It can help to increase energy efficiency while maintaining the same network performance.	GR_TSTP_1.4.1.12_A3
iv).	Discontinuous transmission (DTX) on downlink to save energy during low traffic.	GR_TSTP_1.4.1.12_A4
v).	Long cycle Discontinuous Reception (C-DRX).	GR_TSTP_1.4.1.12_A5
vi).	Decrease of UE battery consumption by typical traffic patterns and reduces the risk of overheating.	GR_TSTP_1.4.1.12_A6
vii).	Automatic enablement/ disablement of the main power amplifier (PA) in the radio-unit. The PA may be turned off in the following cases:	GR_TSTP_1.4.1.12_A7

	1. When no PDSCH traffic is scheduled on a subframe; and 2. During symbols that do not carry mandatory information.	
1.4.1.13.	**Uu Interface**	Explanatory Only
a.	The system shall support Uu interface towards the user equipment/ device (UE).	GR_TSTP_1.4.1.13_A
1.4.1.14.	**Operating Frequency and Channel Bandwidth**	Explanatory Only
a.	Operating frequency and Channel bandwidth shall be as per the applicable National Frequency Allocation Plan.	GR_TSTP_1.4.1.14_A
b.	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_1.4.1.14_B
1.4.1.15.	**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
1.4.1.16.	**Transmitter Specification (Radiated)**	Explanatory Only
01	OTA Base Station Output Power	TEC 25591:2022 (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 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
1.4.1.17.	**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 7.4.2 & 7.5
03	Receiver intermodulation	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.7
04	Adjacent Channel Selectivity (ACS) and narrow-band blocking	Test procedure and limits are defined as per 3GPP TS 38.104 Clause 7.4.1

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
1.4.1.18.	**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 10.5.2 & 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
1.5	**Operational, Reliability, Quality, EMI/EMC, Safety Requirements**	Explanatory Only
1.5.1.	**System Radio Operating Environments**	Explanatory Only
1.5.1.1	**System Supervision** 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 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	GR_TSTP_1.5.1.1_A GR_TSTP_1.5.1.1_B
1.5.1.2.	**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)	GR_TSTP_1.5.1.2

	b) Pedestrian (up to 10 km/h) c) Vehicular: 10 km/h to 120 km/h (As per Procurer requirements) d) High speed vehicular: 120 km/h to 500 km/h (As per Procurer requirements) For High band, the targeted relative speed between the gNB and the mobile station may be up to 100 km/h. (As per Procurer requirements)	
1.5.2.	**System and Network Management** a) Facility shall be available for introduction of centralized maintenance control (OMC). b) The maintenance spares supplied shall take into account the MTBF and MTTR	GR_TSTP_1.5.2_A GR_TSTP_1.5.2_B
1.5.3.	**Diagnostic Capability** a) 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. b) 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_1.5.3_A GR_TSTP_1.5.3_B
1.5.4.	**Environmental 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_1.5.4
1.5.5.	**Qualitative Requirements (QR)** a) 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. b) 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_1.5.5_A GR_TSTP_1.5.5_B
1.5.6.	**gNB Safety Requirements** The equipment shall conform to IS 13252 part 1:2010- "Information Technology Equipment – Safety- Part 1: General Requirements"	GR_TSTP_1.5.6

	OR IEC 62368-I:2023 – "Audio/video, information and communication technology equipment - Part 1: Safety requirements"	
1.5.7.	**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_1.5.7_1
2.	Immunity to Electrostatic discharge: Contact discharge level 2 {± 4 kV}	GR_TSTP_1.5.7_2
3.	Immunity to Electrostatic discharge: Air discharge level 3 {± 8 kV}	GR_TSTP_1.5.7_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 c) Radio Frequency: 1.4 GHz to 6 GHz, Electromagnetic field: 10V/m	GR_TSTP_1.5.7_4
5.	Immunity to fast transients (burst): Test Level 2: a) 1 kV for AC/DC power port b) 0. 5 kV for signal / control / data / telecom lines.	GR_TSTP_1.5.7_5
6.	Immunity to surges: AC/DC ports a) 2 kV peak open circuit voltage for line to ground b) 1kV peak open circuit voltage for line to line	GR_TSTP_1.5.7_6
7.	Immunity to surges: Telecom ports a) 2 kV peak open circuit voltage for line to ground coupling. b) 2 kV peak open circuit voltage for line-to-line coupling.	GR_TSTP_1.5.7_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 kHz80 MHz for AC / DC lines and Signal /Control/telecom lines	GR_TSTP_1.5.7_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)	GR_TSTP_1.5.7_9

	c) avoltage interruption corresponding to a reduction of supply voltage of > 95% for 5s d) 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 e) 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_1.5.7_10
1.6	General Requirements	Explanatory Only
a.	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_1.6.1_A
b.	The operation of the equipment shall be in the frequency band allotted.	Undertaking
1.6.2	**Support of Multiple Equipment Vendors as per tender requirement** a) The system shall support the possibility of using equipment and subsystems of different vendors as per defined industry standards, wherever relevant.	Undertaking
1.6.3.	Hardware	Explanatory Only
a.	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
b.	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_1.6.3_B
c.	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_1.6.3_C
1.6.4.	**Processors**	Explanatory Only
a.	Provision shall be made to prevent the loss/alteration of memory contents due to power failures, improper operating procedures and the	GR_TSTP_1.6.4_A

	procedure for restoring the system to its normal state, etc.	
1.6.5.	**Input-Output Devices**	Explanatory Only
a.	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_1.6.5_A
b.	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_1.6.5_B
c.	Adequate number of man-machine interfaces shall be available.	GR_TSTP_1.6.5_C
d.	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_1.6.5_D
e.	A suitable alarm and display system at OMC shall be provided for a continuous indication of the system status.	GR_TSTP_1.6.5_E
1.6.6.	**Equipment Practice**	Explanatory Only
a.	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
b.	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
c.	All components and material used in the equipment shall be noninflammable or in absence of it, self-extinguishable. They shall be fully tropicalised.	GR_TSTP_1.6.6_C
d.	For a Distributed gNB, the method used for connection of permanent wiring outside the printed cards shall be indicated.	Undertaking

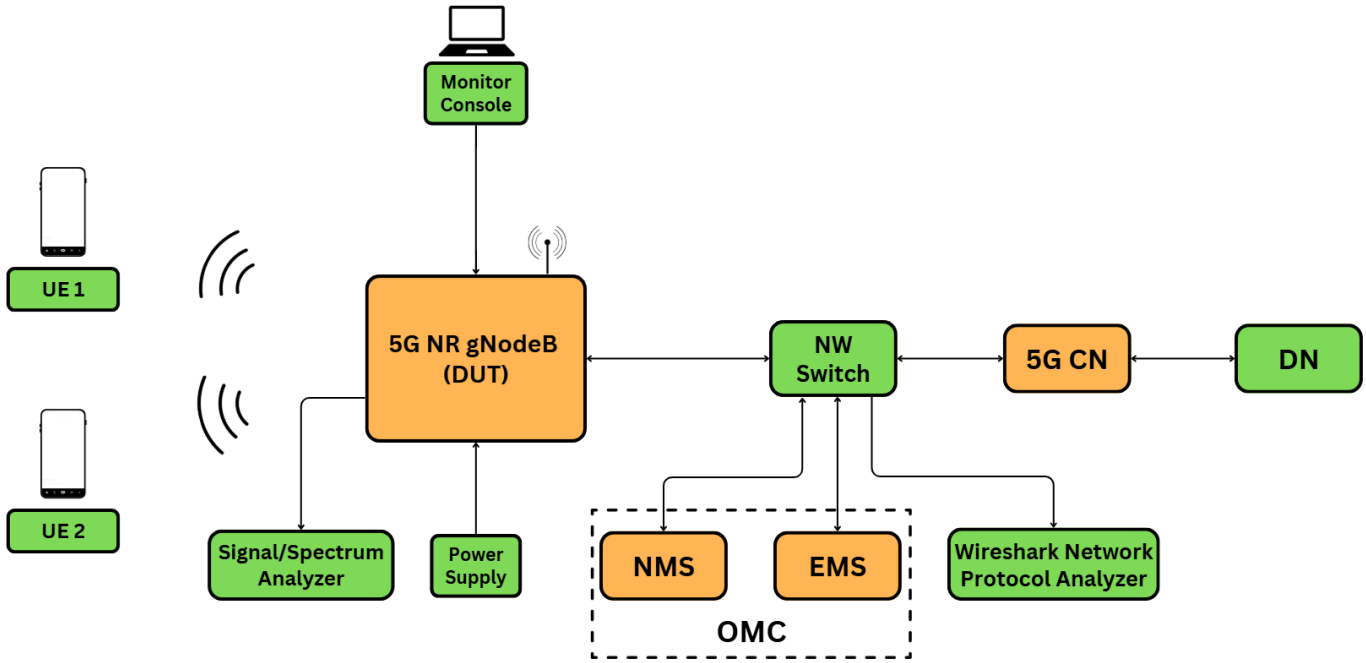
e.	The buses, if any, shall be suitably protected against electrical and magnetic interference from neighbouring systems (like electromechanical systems, fluorescent tubes, motors, etc.).	Undertaking
f.	For a Distributed gNB, the different plug-in cards shall have suitable mechanical safeguards to prevent damage due to accidental interchange of cards.	Undertaking
g.	The requirement at the external interface against induced voltages and currents due to lightning, high power system, etc. shall be indicated.	Undertaking
h.	The system shall provide for human isolation and protection from accidental high voltage power contact.	Undertaking
1.6.7.	**Quality Requirements**	Explanatory Only
a.	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_1.6.7_A
b.	All the equipment shall have a tropical finish and coated to protect against saline atmosphere.	GR_TSTP_1.6.7_B
1.6.8.	**Software**	Explanatory Only
a.	The software shall be written in a High-Level Language. The software shall be modular and structured.	Undertaking
b.	The software shall include the following characteristics: i. 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_1.6.8_B1
	ii. The functional modularity of the software shall permit introduction of changes wherever necessary with least impact on other modules	Undertaking
	iii. It shall be open-ended to allow addition of new features.	Undertaking
	iv. Adequate flexibility shall be available to easily adopt changes in service features & facilities and technological evolution in hardware.	Undertaking
	v. The design shall be such that propagation of software faults is contained	Undertaking
	vi. Test programs shall include fault tracing for detection and localization of system faults	GR_TSTP_1.6.8_B6
1.6.9.	**Software Maintenance**	Explanatory Only
a.	All software updates, for a period as specified, shall be supplied on continuing basis. These updates	Undertaking

	shall include new features and services and other maintenance updates.	
b.	Integration of software updates without posing any problem to the existing functionality shall be possible.	Undertaking
1.6.10.	gNB DoS (Denial of Service) Attack Protection	Explanatory Only
a.	The gNB shall provide the protection against DOS attack. The vendor shall describe how to protect against DOS attack in their system.	GR_TSTP_1.6.10_A

I. Test Setup & Procedures:

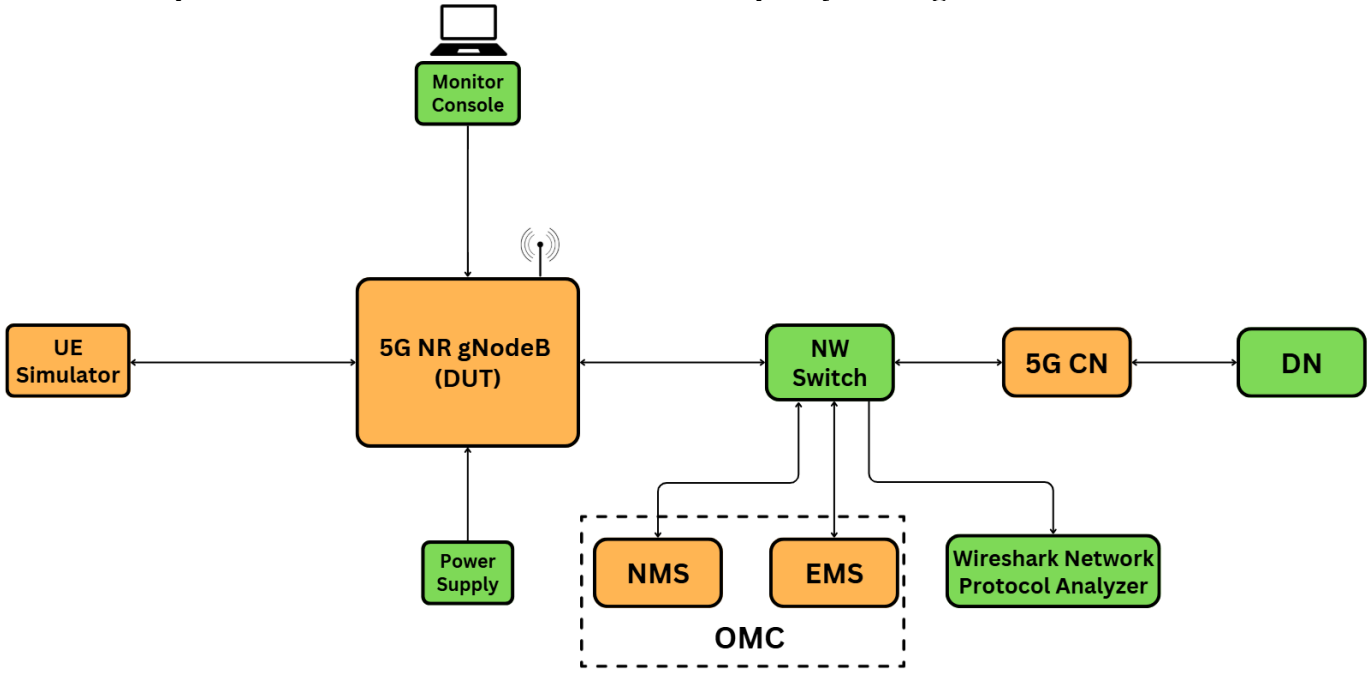
TEST SETUP_1

5G NR Test Setup with single gNodeB connected to 5G Core Network



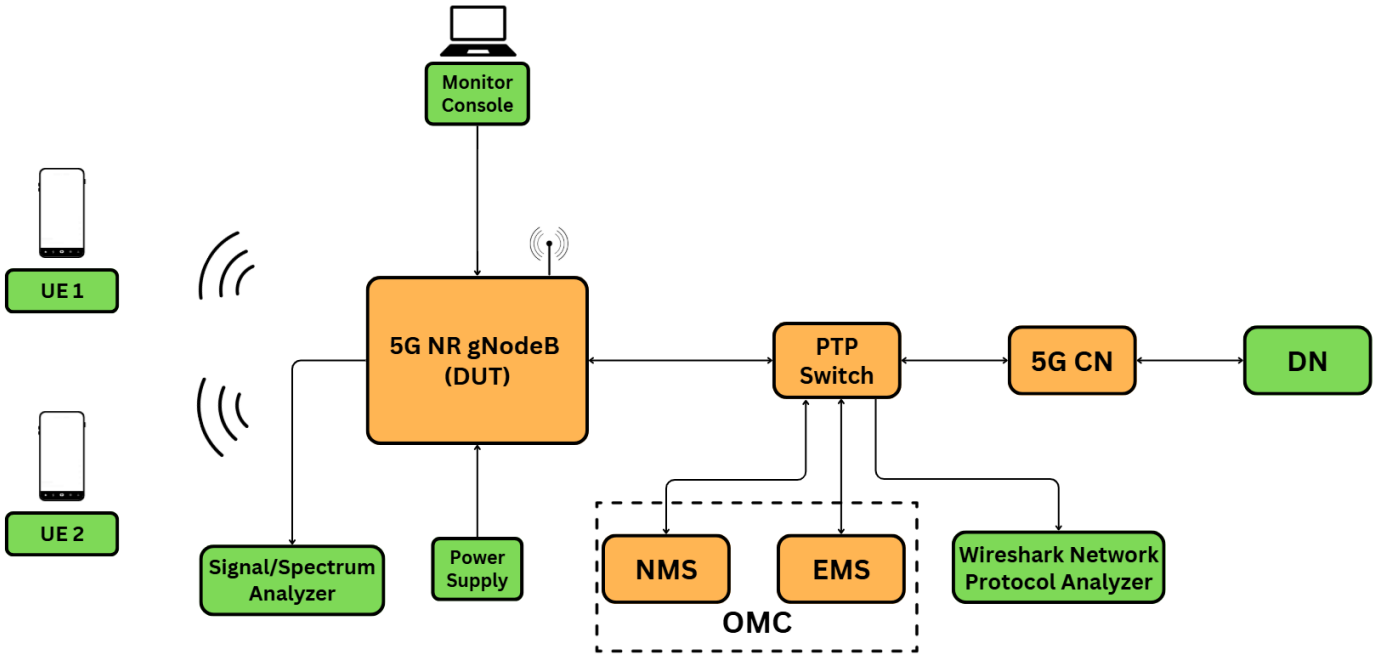
TEST SETUP_2

5G Test Setup with UE Simulator for Relative AMF Capacity Testing



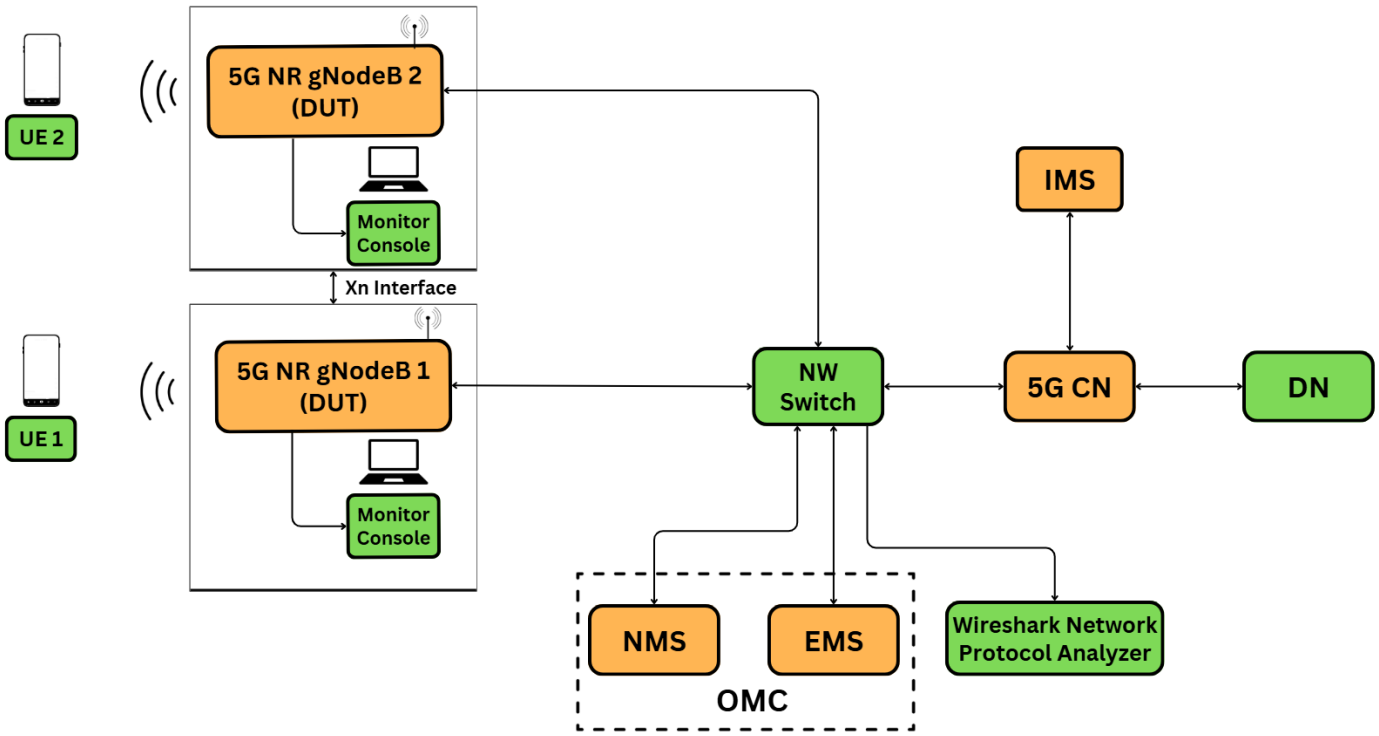
TEST SETUP_3

PTP 1588 and SyncE Testing Setup for 5G



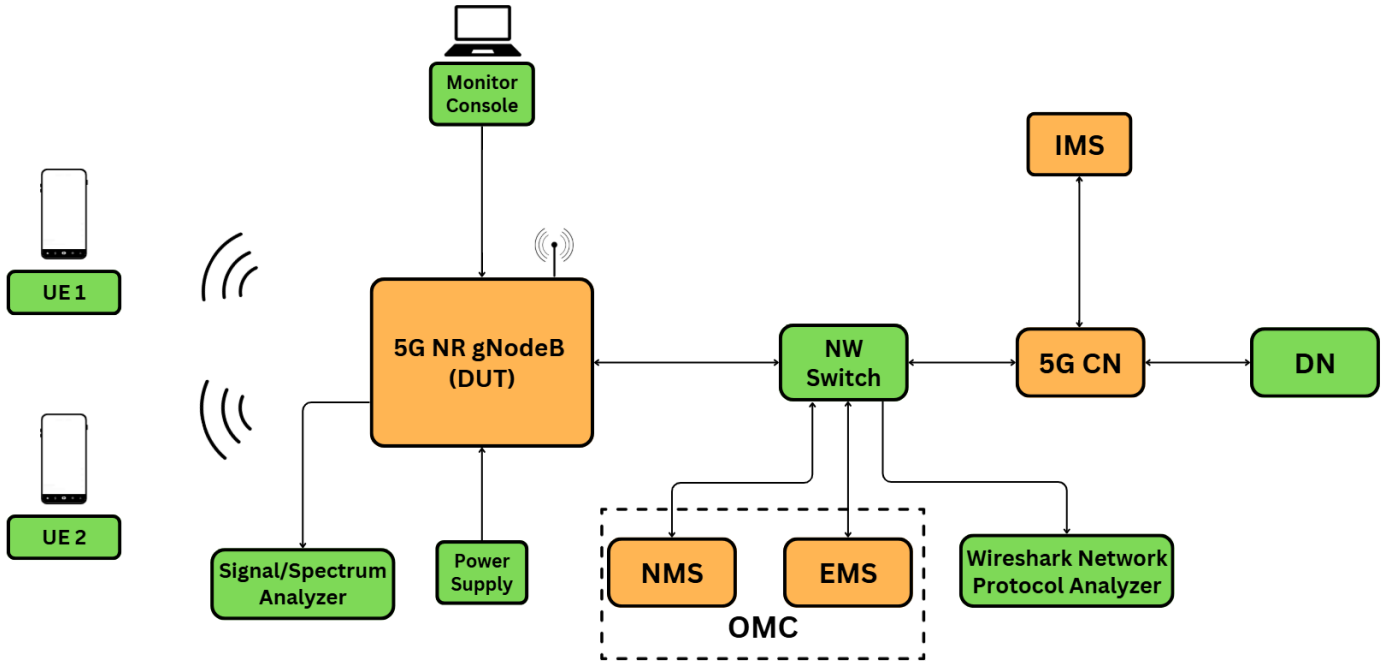
TEST SETUP_4

NR Handover Test Setup for 5G Network (Xn Interface)



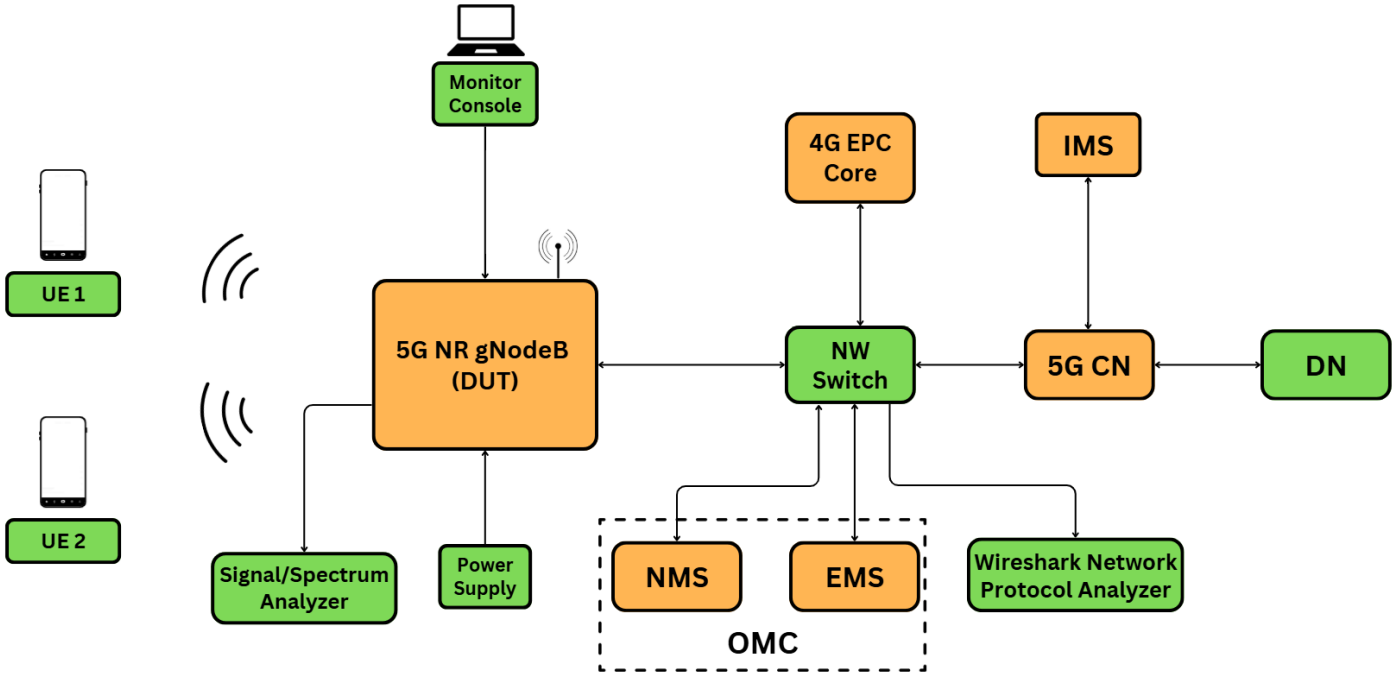
TEST SETUP_5

VoNR / ViNR Setup: 5G CN is connected to IMS



TEST SETUP_6

5G Test Setup for EPS Fallback Mechanism



Test Setup & Procedures:

1.Test No	GR_TSTP_1.4.1.1 _A
2. Test Details	To verify that Cell control and AMF support: NG-RAN owns and controls the radio resources of its own cell or cells. Cell resources as requested by and granted to AMF shall be provided in an ordered fashion.
3. Test Instruments Required	gNodeB, AMF, RF cables and attenuators, UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_2
5. 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.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall allocate resources as in the order requested by UE and AMF.

1.Test No	GR_TSTP_1.4.1.1 _B
2. Test Details	To verify that the RRC messages shall be transmitted to the device using signalling radio bearers (SRBs) including SRB0, SRB1and SRB2.
3. Test Instruments Required	gNodeB, RF cables and attenuators, 5G Core Network, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Perform UE attach. 2. Verify from UE logs that SRB0, SRB1, and SRB2 are established successfully 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.
6. Test Limits	NA
7. Expected Results	UE logs shall indicate allocation of signalling bearers SRB0, SRB1, and SRB2.

1.Test No	GR_TSTP_1.4.1.1 _C1
2. Test Details	To verify that NG-RAN shall support Event-triggered measurement reporting
3. Test Instruments Required	gNodeB (2 Qty), 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_4
5. 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.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall configure UE with different events for measurement reporting.

1.Test No	GR_TSTP_1.4.1.1 _C2
2. Test Details	To verify that the NG-RAN shall support System Information Broadcast (SIB)
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. 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 for example Wireshark to analyze the broadcast of SIBs that the gNodeB is transmitting configured system information.
6. Test Limits	NA
7. Expected Results	The small size gNodeB shall broadcast system information as per configuration.

1.Test No	GR_TSTP_1.4.1.1 _C3
2. Test Details	To verify that the NG-RAN shall support RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	small size gNB shall support RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.

1.Test No	GR_TSTP_1.4.1.2
2. Test Details	To verify the Service Data Adaptation Protocol (SDAP) shall be responsible for mapping Quality-of-Service (QoS) bearers to radio bearers according to their QoS requirements.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. 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.

1.Test No	GR_TSTP_1.4.1.3_A1
2. Test Details	To verify that the system shall support Integrity protection and ciphering of RRC signalling
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. 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. Verify that Security Mode Command contains selected integrity and ciphering algorithms. 5. UE responds with Security Mode Complete message. 6. Capture and verify subsequent RRC signalling messages to confirm integrity protection and ciphering are activated. 7. Verify through UE/gNB logs or protocol analyzer that protected RRC messages are successfully decoded and integrity check passes.
6. Test Limits	NA
7. Expected Results	The small size gNodeB shall support ciphering and integrity protection procedures on radio interface over RRC.

1.Test No	GR_TSTP _1.4.1.3_A2
2. Test Details	To verify that the system shall support RoHC (As per Procurer requirements)
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_5
5. 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.
6. Test Limits	NA
7. Expected Results	Small size gNodeB uses RoHC framework for upper layers (PDCP).

1.Test No	GR_TSTP_1.4.1.3_A3
2. Test Details	To verify that the system shall supports data recovery.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	PDCP supports data recovery.

1.Test No	GR_TSTP_1.4.1.3_A4
2. Test Details	To verify that system shall supports ciphering of DRBs (As per Procurer requirements)
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST_SETUP_1
5. Test Procedure	1. Configure gNodeB and UE to support ciphering algorithms for exchange of user data between them. 2. Bring up gNodeB and register UE to the network. 3. Ensure UE is in RRC connected state and initiate data transfer. Ensure RRC security is activated. 4. Monitor the RRC Reconfiguration message from the gNB using protocol analyzer (Wireshark) and verify the ciphering algorithm for specified DRBs in security configuration. 5. Ensure the UE sends RRC Reconfiguration Complete message to the gNB, confirming the successful activation of User Plane security for the specified DRBs.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall support ciphering of DRBs.

1.Test No	GR_TSTP_1.4.1.3_B
2. Test Details	To verify that PDCP shall also handle retransmissions, in-sequence delivery, and duplicate removal in the case of handover.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_4
5. 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.
6. Test Limits	NA
7. Expected Results	Small size gNB shall ensure in-sequence transmission of data. In the event out-of-sequence data is detected, the gNB shall initiateretransmission 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.

1.Test No	GR_TSTP_1.4.1.4_A
2. Test Details	To 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.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	The RLC layer provides services - segmentation and retransmission handling to PDCP in the form of RLC channels and RLC entities.

1.Test No	GR_TSTP_1.4.1.4_B
2. Test Details	To verify that RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Configure DRBs with RLC AM/UM mode for enabling segmentation. 2. Bring gNodeB in operationally enabled state. 3. Register UE to the network. 4. Ensure UE is in RRC Connected State. 5. In the UE logs, verify that the AM/UM RLC entity is associated with DCCH/DTCH logical channels as per 3GPP 38.322 in RRC messages. 6. Start large DL/UL traffic (exceeding MAC grant size) for RLC SDU segmentation to occur. 7. Capture gNodeB and UE logs. 8. Verify the RLC-BearerConfig (sn-FieldLength) in RRC Reconfiguration message to check segmentation.
6. Test Limits	NA
7. Expected Results	RLC layer supports segmentation to adapt the payload to the transport block size.

1.Test No	GR_TSTP_1.4.1.5_A
2. Test Details	To verify that the MAC shall handle multiplexing of logical channels, hybrid-ARQ retransmissions, and dynamic resource allocation (scheduling) and scheduling-related functions.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_4
5. Test Procedure	**A. Procedure to verify MAC layer supports multiplexing and de-multiplexing of logical channels:** 1. Bring up gNodeB and 5G CN. 2. NGAP is established. 3. Perform UE Attach. 4. Start DRB traffic iperf/youtube streaming in the UE. Simultaneously initiate intra/inter gNodeb handover (A3/A5 events). 5. To verify multiplexing (in UL) and de-multiplexing (in DL) of logical channels. Capture Wireshark logs and verify IE: LogicalChannelIdentity. 6. Verify the logical channels are mapped to corresponding transport channels as per section 4.5, 3GPP: 5G NR: Medium Access Control (MAC) protocol specification, 38.321, version 15.3.0 Release 15. 7. Verify single MAC PDU contains multiple LCID's referencing to logical channels (refer table 6.2.1-1 and 2 in 3GPP TS 38.21) **B. Procedure to verify MAC layer supports Hybrid-ARQ retransmissions:** 1. Bring up the gNodeB in operational state and connect to 5G CN. 2. Register the UE to the Network and establish a PDU session such as voice/data. 3. Capture gNodeB and UE Logs. 4. Verify that HARQ Process IDs are assigned for transport block transmissions and reused for retransmissions until ACK reception. In case of no packet drop or weak radio link, verify CRC = PASS. Verify UE sends ACK feedback to gNodeB. 5. In case of packet drop or weak radio link, verify CRC = FAIL. In this case, re-transmission should be initiated automatically by MAC layer. 6. Verify toggling of New Data Indicator (NDI) for new transmission. 7. Verify UE sends NACK feedback to gNodeB.

	8. To verify successful retransmission, the MAC layer shall allocate same HARQ ID for the SFN which has CRC = FAIL, with updating RV indicating incremental redundancy. **C. Procedure to verify MAC layer supports dynamic resource allocation (scheduling) and scheduling-related functions.** 1. Register UE to the network. 2. Establish different PDU session with different QoS requirements simultaneously in DL and UL. 3. Capture gNodeB and UE logs. 4. Verify that RB allocation and MCS dynamically adapt according to radio conditions, QoS requirements, and traffic demand. With different 5QI value, mcs and number of RBs also should vary i.e., verify that scheduler resource allocation and prioritization vary according to configured 5QI/QoS requirements and radio conditions. 5. In Wireshark logs verify mcs table and scheduling parameters in RRCReconfiguration message.
6. Test Limits	1. Logical channel identity value will range in integer from 0 to maxLC-ID. 2. Refer Table 6.2.1-1 and 6.2.1-2 Values of LCID DL-SCH and Values of LCID UL-SCH in 3GPP TS 38.321 version 15.3.0 Release 15 3. In case of retransmission: DCI format, SFN, Slot Number, HARQ_PID, MCS can be same, while NID must not toggle, and TBS, RV, ReTx parameters will be updating. 4. Refer 3GPP TS 38.214 v15.2.0 Release 15, Section 5.1.3 for mcs index values.
7. Expected Results	The MAC layer in the gNodeB supports multiplexing and de-multiplexing of logical channels, hybrid-ARQ retransmissions, and dynamic resource allocation (scheduling) and scheduling-related functions.

1.Test No	GR_TSTP_1.4.1.5_B
2. Test Details	To verify that the MAC shall provide services to the RLC in the form of logical channels.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Ensure gNB is loaded with correct configurations. 2. Bring gNB to operational state and perform UE attach. 3. Establish SRB and DRB between UE and gNB. 4. Initiate UL and DL data transfer. 5. Capture UE/gNB logs and MAC/RLC protocol traces. 6. Verify that MAC receives SDUs from RLC through configured logical channels (e.g., SRB/DRB logical channels). 7. Verify logical channel IDs (LCIDs) are correctly mapped and scheduled in UL and DL transmissions. 8. Verify successful data transfer over mapped logical channels without packet loss or protocol failure.
6. Test Limits	NA
7. Expected Results	The MAC layer provides services to the RLC in the form of logical channels.

1.Test No	GR_TSTP_ 1.4.1.5_C
2. Test Details	To verify that from the physical layer, the MAC layer shall use the services in the form of transport channels.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	Test setup X
5. Test Procedure	1. Bring up gNodeB in operational state and connect to 5G CN. Enable gNodeB MAC logs. 2. Verify NG Setup procedure completes successfully. BCH Transport Channel 3. Verify that MIB is decoded from PBCH RACH Transport Channel 4. UE initiates Random Access Procedure 5. Verify PRACH preamble (Msg1) DL-SCH Transport Channel 6. Allow UE to complete RRC connection setup 7. gNodeB transmits RRCSetup (Msg4) on PDSCH UL-SCH Transport Channel 8. Register UE to network and establish a PDU session (eg : data) 9. Start UL data transfer using iperf or similar tools 10. Verify UL MAC PDU present on PUSCH PCH Transport Channel 11. Release UE to RRC_IDLE state. Trigger a paging message from 5GC(AMF) towards the UE (ex: MT call attempt or NAS signalling) 12. Verify Paging message received on PDSCH.
6. Test Limits	NA
7. Expected Results	The physical layer provides services to MAC layer in the form of transport channels.

1.Test No	GR_TSTP_1.4.1.5_D
2. Test Details	To verify the Short Buffer Status Report (BSR) and Long BSR
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST_SETUP_1
5. 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
6. Test Limits	NA
7. Expected Results	The MAC entities use Buffer status reporting procedure in uplink data transfer

1.Test No	GR_TSTP_1.4.1.5_E
2. Test Details	To verify the Discontinuous Reception (DRX) to enable reasonable UE battery consumption
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST_SETUP_1
5. 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
6. Test Limits	NA
7. Expected Results	MAC Layer indicates configured DRX and UE inactivity timers to the UE.

1.Test No	GR_TSTP_1.4.1.5_F1
2. Test Details	To verify the Link adaptation and power control
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform UE attach. 3. Start UL and DL data transfer. 4. Gradually attenuate the radio link. 5. Verify through UE/gNB logs that MCS is dynamically modified according to channel conditions. 6. Verify CQI variation and corresponding scheduling adaptation.
6. Test Limits	NA
7. Expected Results	Link adaptation is working as intended, adjusting modulation and coding based on real-time channel conditions to optimize reliability and throughput.

1.Test No	GR_TSTP_1.4.1.5_F2
2. Test Details	To verify the Contention based Random Access (RA) procedure.
3. Test Instruments Required	gNodeB, 5G Core Network, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring Small Size gNB in operationally enabled state. 2. Perform UE attach procedure. 3. Verify from logs that PRACH preamble transmission and Random Access Response (RAR) are exchanged successfully. 4. Verify that contention resolution procedure is executed successfully. 5. Verify that UE successfully completes attach after Random Access procedure.
6. Test Limits	NA
7. Expected Results	The MAC Layer shall support Contention Based Random access procedure.

1.Test No	GR_TSTP_1.4.1.6_A1
2. Test Details	To verify the Synchronization Signal Block (SSB).
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	UE needs to successfully decode the SSB and be able to decode SIB1.

1.Test No	GR_TSTP_1.4.1.6_A2
2. Test Details	To verify the supports Uplink (UL) and Downlink (DL) demodulation reference signal
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring Small Size gNB in operationally enabled state. 2. Perform UE attach. 3. Start UL and DL data transfer between UE and gNB. 4. Capture the logs or protocol traces. 5. Verify that UL DMRS is transmitted and used for uplink demodulation. 6. Verify that DL DMRS is transmitted and used for downlink demodulation. 7. Verify successful UL and DL data decoding without errors.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall be able to decode uplink data and the UE shall be able to decode downlink data. This will verify uplink and downlink DMRS.

1.Test No	GR_TSTP_1.4.1.6_A3
2. Test Details	To verify the Uplink and Downlink link adaptation.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	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
6. Test Limits	NA
7. Expected Results	MCS (Modulation Coding Scheme) shall change as per link condition in both UL and DL.

1.Test No	GR_TSTP_1.4.1.6_A4
2. Test Details	To verify the UL and DL Power Allocation for data channels.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Perform UE registration and establish PDU session. 3. From SIB1 message, verify ss_PBCH_BlockPower (used to configure DL transmit power of SS/PBCH) 4. Verify in UE, RSRP is stable non-zero value and DL throughput > 0. 5. From RRCReconfiguration message verify PUSCH-PowerControl IEs. 6. Verify UL throughput >0
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall allow configuration of DL and UL power for data channels.

1.Test No	GR_TSTP_1.4.1.6_A5
2. Test Details	To verify the DL Power setting for data channels.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Configure gNB EPRE from EMS/OAM. 3. Perform UE registration. 4. Measure the power received in the UE.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall allow configuration of DL power for data channels.

1.Test No	GR_TSTP_1.4.1.6_A6
2. Test Details	To verify the DL Power setting for signalling and control channels.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Perform UE registration and establish PDU session. 3. From SIB1 message, verify ss_PBCH_BlockPower (used to configure DL transmit power of SS/PBCH) 4. From RRCReconfiguration message, verify in NZP-CSI-RS-Resource, powerControlOffset and powerControlOffsetSS values are present. 5. The downlink PDCCH EPRE is assumed as the ratio of the PDCCH EPRE to NZP CSI-RS EPRE and takes the value of 0 dB.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall allow configuration of PBCH power offset, PDCCH Power offset from O&M / Console which is verified through UE logs.

1.Test No	GR_TSTP_1.4.1.6_A7
2. Test Details	To verify the Normal cyclic prefix.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB up and radiating with normal cyclic prefix. 2. Verify that the NGAP link is up. 3. Verify UE is attached successfully. 4. Check configuration logs or decoded broadcast messages (MIB/SIB1) for numerology settings. 5. Verify through UE logs that the gNodeB supports Normal Cyclic Prefix.
6. Test Limits	NA
7. Expected Results	Small size gNodeB shall support the configured normal cyclic prefix.

1.Test No	GR_TSTP_1.4.1.6_A8
2. Test Details	To verify at least one Static TDD Mode with single Bandwidth Part.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Configure TDD pattern and BWP. 2. Bring the gNodeB to the operationally enabled state. 3. Register UE to the network. 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.
6. Test Limits	NA
7. Expected Results	Small size gNB should be able to schedule the TDD pattern and BWP, and the UE should successfully decode them.

1.Test No	GR_TSTP_1.4.1.6_A9
2. Test Details	To verify the communication of timing advance value to UE.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	Test setup X
5. Test Procedure	1. Bring the gNodeB to the operationally enabled state. 2. Register UE to the network. 3. Capture UE side logs and check for the RACH Response message, which provides the TA (Timing Advance) value sent by gNB during Random Access. 4. Capture DL MAC PDU and verify Timing Advance Command MAC CE is present.
6. Test Limits	NA
7. Expected Results	UE logs shall indicate the timing advance value sent by the gNodeB.

1.Test No	GR_TSTP_1.4.1.6_B1
2. Test Details	To verify 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.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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).
6. Test Limits	NA
7. Expected Results	UE shall successfully decode the PDSCH Payload.

1.Test No	GR_TSTP_1.4.1.6_B2
2. Test Details	To verify the Physical Broadcast Channel (PBCH): Carries system information, required by the device to access the network.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	UE shall successfully decode the PBCH Payload.

1.Test No	GR_TSTP_1.4.1.6_B3
2. Test Details	To verify 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.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	UE needs to successfully decode both DL-DCI for PDSCH and UL-DCI for PUSCH.

1.Test No	GR_TSTP_1.4.1.6_B4
2. Test Details	To verify the Physical Uplink Shared Channel (PUSCH): the uplink counterpart to the PDSCH. There is at most one PUSCH per uplink component carrier per device.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	Small size gNB shall successfully decode the PUSCH.

1.Test No	GR_TSTP_1.4.1.6_B5
2. Test Details	To verify 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.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	**PUCCH for HARQ-ACK Feedback:** 1. Bring gNB to operational state, connect to 5GC and perform UE registration with PDU session establishment. 2. Capture RRC Reconfiguration and verify PUCCH-config IE is present with atleast one PUCCH-Resouce configured. 3. Start DL data transfer. 4. Verify from gNB logs that UE transmits HARQ-ACK on PUCCH **PUCCH for Channel State Information (CSI):** 1. Capture RRCReconfiguration and verify CSI-ReportConfig IE is present. 2. From gNB logs verify periodic CSI report is received from UE on PUCCH **PUCCH for Scheduling Request (SR):** 1. Capture RRCReconfiguration and verify SchedulingRequestResourceConfig IE is present inside PUCCH-Config. 2. Start UL data transfer. 3. Verify from gNodeB logs that SR received from UE on PUCCH.
6. Test Limits	NA
7. Expected Results	Small size gNB shall support the Physical Uplink Control Channel (PUCCH) functionalities.

1.Test No	GR_TSTP_1.4.1.6_B6
2. Test Details	To verify the Physical Random-Access Channel (PRACH): Used for random access. The gNB shall support Contention based and Contention free Random Access (CBRA, CFRA) procedure.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_4
5. Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Register UE to the network. 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.
6. Test Limits	NA
7. Expected Results	gNodeB shall support both contentions based and contention free RA procedures.

1.Test No	GR_TSTP_1.4.1.6_C1_A
2. Test Details	To verify that NR Physical Layer – Low Band (LB)(<1GHz) 1. Cell carrier bandwidth: 5, 10, 15, 20 MHz 2. Sub-carrier spacing: 15 kHz 3. Modulation schemes: Up to 256 QAM in downlink and uplink
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Set the NR-ARFCN parameter: a. Set the carrier bandwidth (BWP) to 5 MHz, 10 MHz, 15 MHz, 20 MHz on Low-Band. b. Set the Sub carrier Spacing to 15kHz on Low-Band. c. Configure link adaptation. 3. Register UE to the network. 4. Capture UE logs and check the SIB1 message to verify the "NumRb" as per the configured bandwidth and "Subcarrier Spacing". 5. Run data and perform mobility from good RSRP to bad RSRP. 6. Capture UE logs and check the PDSCH and PUSCH to verify the varying "MCS" based on channel conditions. 7. Validate that all MCS are triggering correctly according to the MCS index table. 8. Capture gNB side logs to validate whether the UE is decoding correctly.
6. Test Limits	NA
7. Expected Results	1. Radiated Carrier frequency should be as per the valid NR-ARFCNs mentioned in the gNodeB Configuration files. 2. The configured cell bandwidth and subcarrier spacing (15KHz) shall be observed in SIB1 messages, and the UE must be able to decode it correctly. 3. gNB must successfully schedule up to 256 QAM for both DL and UL.

1.Test No	GR_TSTP_1.4.1.6_C1_B
2. Test Details	To verify that NR Physical Layers – Mid Band (MB) (1GHz- 6GHz) 1. Cell carrier bandwidth: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz 2. Sub-carrier spacing: 15kHz, 30 kHz and/ or 60 kHz 3. Modulation schemes: Up to 256 QAM in downlink and uplink
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Set the NR-ARFCN parameter: a. Set the carrier bandwidth (BWP) to 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz on Mid-Band. b. Set the Sub carrier Spacing to 15kHz, 30 kHz and/ or 60 kHz on Mid-Band. c. Configure link adaptation. 3. Register UE to the network. 4. Capture UE logs and check the SIB1 message to verify the "NumRb" as per the configured bandwidth and "Subcarrier Spacing". 5. Run data and perform mobility from good RSRP to bad RSRP. 6. Capture UE logs and check the PDSCH and PUSCH to verify the varying "MCS" based on channel conditions. 7. Validate that all MCS are triggering correctly according to the MCS index table. 8. Capture gNodeB side logs to validate whether the UE is decoding correctly.
6. Test Limits	NA
7. Expected Results	1. Radiated Carrier frequency should be as per the valid NR-ARFCNs mentioned in the gNodeB Configuration files. 2. The configured cell bandwidth and subcarrier spacing shall be observed in SIB1 messages, and the UE must be able to decode it correctly. 3. gNB must successfully schedule up to 256 QAM for both DL and UL.

1.Test No	GR_TSTP_1.4.1.6_C1_C
2. Test Details	To verify that NR Physical Layers – High Band (HB) (24 GHz-52.5GHz) 1. Cell carrier bandwidth: 50, 100, 200, 400MHz 2. Sub-carrier spacing: 60kHz and 120 kHz 3. Modulation schemes: Up to 64 QAM in downlink and uplink
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Set the NR-ARFCN parameter: a. Set the carrier bandwidth (BWP) to 50, 100, 200, 400MHz on High-Band. b. Set the Sub carrier Spacing to 60kHz and 120 kHz on High-Band. c. Configure link adaptation. 3. Register UE to the network. 4. Capture UE logs and check the SIB1 message to verify the "NumRb" as per the configured bandwidth and "Subcarrier Spacing". 5. Run data and perform mobility from good RSRP to bad RSRP. 6. Capture UE logs and check the PDSCH and PUSCH to verify the varying "MCS" based on channel conditions. 7. Validate that all MCS are triggering correctly according to the MCS index table. 8. Capture gNodeB side logs to validate whether the UE is decoding correctly.
6. Test Limits	NA
7. Expected Results	1. Radiated Carrier frequency should be as per the valid NR-ARFCNs mentioned in the gNodeB Configuration files. 2. The configured cell bandwidth and subcarrier spacing shall be observed in SIB1 messages, and the UE must be able to decode it correctly. 3. gNodeB must successfully schedule up to 64 QAM for both DL and UL.

1.Test No	GR_TSTP_1.4.1.6_C2
2. Test Details	To verify Both the open-loop power control and the closed-loop power control of the UE. (As per Procurer's requirement)
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Register UE to the network. 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.
6. Test Limits	NA
7. Expected Results	The Tx power of UE shall be modified in both cases.

1.Test No	GR_TSTP_1.4.1.6_C3
2. Test Details	To verify the 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.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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.
6. Test Limits	NA
7. Expected Results	1. The gNB is successfully able to configure Transform Precoding, and the UE is able to decode and schedule transmissions accordingly. 2. DL: gNodeB uses OFDM (CP-OFDM) modulation for all downlink transmissions. 3. UL: a. With DFT-precoding: UE transmits with only 1 layer. b. With OFDM (no DFT-precoding): UE transmits with multiple layers.

1.Test No	GR_TSTP_1.4.1.6_C4
2. Test Details	To verify the DFT-s-OFDM with pi/2 BPSK filtering (LMLC) in Uplink. (As per Procurer requirement)
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. 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
6. Test Limits	NA
7. 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.

1.Test No	GR_TSTP_1.4.1.7_A1
2. Test Details	To verify the Frequency Synchronization
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Run the SyncE in gNB server with GPS signal.
6. Test Limits	NA
7. Expected Results	SyncE status gets locked in RU. Observing the QL (Quality level) logs in gNB, it should be equal to 0x20.

1.Test No	GR_TSTP_1.4.1.7_A2
2. Test Details	To verify the Time and Phase Synchronization
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Bring gNodeB in an operationally enabled state. 2. Run Ts2phc synchronize System to the PHC. 3. Run phc2sys for updating system clock with hardware clock. 4. Run Ptp4l for synchronization PHC to PTP master clock on the network. 5. Run the SyncE in gNB server with GPS signal.
6. Test Limits	Offset values should be <10 ns
7. Expected Results	1. PTP status got locked. 2. SyncE status gets locked in RU. 3. Observe the QL (Quality level) logs in gNB, it should be equal to 0x20.

1.Test No	GR_TSTP_1.4.1.7_A3
2. Test Details	To verify at least one of following synchronization option: a. GNSS (GPS or NAVIC) b. IEEE 1588 V2 c. Sync E
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1 : without PTP Switch TEST SETUP_3 : with PTP Switch
5. 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. **Test Procedure for IEEE 1588v2**: 1. Prepare setup as per Test setup 2. 2. Additionally connect a IEEE1588 PTP Grandmaster (GM) on Ethernet Switch. 3. Configure the GM and gNodeB appropriately. 4. gNodeB should recover timing from GM using IEEE 1588v2 protocol 5. 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
6. Test Limits	NA
7. Expected Results	gNodeB shall support vendor specified synchronization options.

1.Test No	GR_TSTP_1.4.1.7_B
2. Test Details	To verify at least 1 hr hold over mode in case of frequency and phase synchronization loss.
3. Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP_1
5. Test Procedure	1. Forcefully disable the GPS service on gNB server for Phase and Frequency synchronization loss 2. Observe the QL (Quality level) logs in gNB, it should be equal to 0xFF. 3. Observer the GPS logs in ts2phc service.
6. Test Limits	NA
7. Expected Results	1. gNodeB supports at least 1 hour holdover in case of frequency and phase synchronization loss.

Test No.	GR_TSTP_1.4.1.8_A1
Test Details	Verify that SISO, 2X2 MIMO option.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Bring gNB to operational state and connect to 5G Core. 2. Configure the gNodeB for SISO/2X2 MIMO. 3. Perform UE registration and PDU session establishment. 4. Capture RRCReconfiguration message and verify phy parameters supports SISO. 5. In UE logs, verify the rank indicator must be 1 for SISO and 2 for 2X2 MIMO. 6. From gNodeB logs verify the number of layers and antenna ports in DCI. 7. Measure throughput received by UE using iperf. 8. (Optional) Using signal analyzer measure RF parameters on TX chains: a. Center frequency, Channel Occupied bandwidth and Output power b. ACLR pass and EVM within limits c. Constellation diagram.
Test Limits	NA
Expected Results	The UE logs shall indicate SISO and 2X2 MIMO and the max rank value observed shall be same as configured in the gNodeB configuration file.

Test No.	GR_TSTP_1.4.1.8_A2
Test Details	Verify that system shall support up to 4 DL MIMO layers in Low Band
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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	gNodeB must successfully schedule all 4 layers, and the UE must be able to decode 4 Downlink MIMO layers in Low Band.

Test No.	GR_TSTP_1.4.1.8_A3
Test Details	To verify that Downlink Single-User MIMO in Mid Band (1GHz to 6GHz)
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_1
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 UE logs and signal analyzer analysis shall indicate configured Transmission Mode supporting Downlink Single-User MIMO in Mid Band (1GHz to 6GHz).

Test No.	GR_TSTP_1.4.1.8_A4
Test Details	To verify that the Downlink Multi-User MIMO in Mid Band to support minimum 8 layers (As per Procurer requirements)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Configure the gNB for SU-MIMO and set Max MIMO layers in DL to minimum 8 or more 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	gNodeB is successfully able to configure MU-MIMO and the maximum layer, and the UE is able to decode them, the UE logs shall indicate configured transmission mode and usage of DL MU MIMO.

Test No.	GR_TSTP_1.4.1.8_A5
Test Details	To verify that Uplink Multi-User MIMO in Mid Band to support minimum 4-layer UL MUMIMO for PUSCH transmission (As per Procurer requirements)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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 gNodeB is successfully able to configure MU-MIMO and the maximum number of layers, and the UE is able to transmit accordingly. UE logs shall indicate configured uplink transmission mode and usage of UL MU MIMO.

Test No.	GR_TSTP_1.4.1.8_A6
Test Details	To verify that DL modulation schemes: QPSK, 16QAM, 64QAM and 256QAM.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Configure link adaptation on the Small Size gNB. 2. Bring gNodeB into operationally enabled state. 3. Register UE to the network. 4. Start DL data transfer. 5. Gradually vary the radio conditions using attenuation. 6. Capture UE logs and verify PDSCH MCS variation according to channel conditions. 7. Verify that DL modulation schemes QPSK, 16QAM, 64QAM and 256QAM are triggered according to the MCS index table.
Test Limits	NA
Expected Results	The UE logs shall indicate required modulation schemes in DL up to 256 QAM.

Test No.	GR_TSTP_1.4.1.8_A7
Test Details	To verify that UL modulation schemes: π/2-BPSK (As per Procurer requirements), QPSK, 16QAM, 64QAM and 256QAM (Low/ Mid-band)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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	The UE logs shall indicate required modulation schemes in UL.

Test No.	GR_TSTP_1.4.1.9_A1
Test Details	To verify that 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_5
Test Procedure	1. Bring the gNodeB 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	gNodeB need to allocate defined 5QI values based on the services like data, voice & video.

Test No.	GR_TSTP_1.4.1.9_A2
Test Details	To verify that Multiple data radio bearers (DRBs)
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_5
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. 6. Verify more than one DRB from any of QCI 1 -9 can be added as a dedicated bearer.
Test Limits	NA
Expected Results	Multiple DRBs need to be established for corresponding QFI values through gNB.

Test No.	GR_TSTP_1.4.1.9_A3
Test Details	To verify that Dynamic addition and deletion of dedicated bearers.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_5
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. Verify QCI 1 bearer is created at call start and deleted at call end. 5. 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 6. 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. 7. Verify through Wireshark and UE logs.
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_1.4.1.9_A4
Test Details	To verify that both UE initiated as well as Network Initiated dedicated bearer creation.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_5
Test Procedure	1. Bring gNodeB in operationally enabled state. 2. Perform a UE attach procedure with two UEs. 3. Both UEs should Register to IMS Automatically. 4. Verify through Wireshark logs that QCI5 is created at time of VoNR Registration. 5. Start VoNR Call. 6. 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. 7. 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. 8. Verify through Wireshark logs that QCI 1 bearer is created for both calling and called UEs at call starting and deleted at call ending.
Test Limits	NA
Expected Results	The gNodeB shall support both UE initiated as well as Network Initiated dedicated bearer creation.

Test No.	GR_TSTP_1.4.1.9_A5
Test Details	To verify that Prioritization of traffic in downlink as per the QCI/5QI priority value.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_5
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	gNodeB should make sure that the UE1's traffic (higher priority) gets scheduled more frequently than UE2.

Test No.	GR_TSTP_1.4.1.10_A1
Test Details	To verify that NR intra-frequency cell re-selection.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_4
Test Procedure	1. Bring 2 gNodeB (Source gNB and Target gNB) in operationally enabled state. Both gNodeB's are configured with same frequency. 2. Register UE to the network procedure. 3. Camp the UE on Source gNB and keep the device in IDLE mode. 4. Start moving the UE from Source gNB towards Target gNB to perform Handover. 5. As the RSRP of Source gNB decreases and Target gNB meets the reselection criteria, the UE should perform cell reselection to Target gNodeB.
Test Limits	NA
Expected Results	UE should successfully perform intra-frequency cell re-selection to Target gNB without any connection loss while in IDLE mode.

Test No.	GR_TSTP_1.4.1.10_A2
Test Details	To verify that NR inter-frequency cell re-selection.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_4
Test Procedure	1. Bring 2 gNodeB (Source gNB and Target gNB) in operationally enabled state. Both gNodeB's are configured with different frequency. 2. Register UE to the network procedure. 3. Camp the UE on Source gNB and keep the device in IDLE mode. 4. Start moving the UE from Source gNB towards Target gNB to perform Handover. 5. As the RSRP of Source gNB decreases and Target gNB meets the reselection criteria, the UE should perform cell reselection to Target gNB. 6. UE is now camped on Target gNodeB.
Test Limits	NA
Expected Results	UE should successfully perform inter-frequency cell re-selection to Target gNB without any connection loss while in IDLE mode.

Test No.	GR_TSTP_1.4.1.10_A3
Test Details	To verify that Need to support connected mode mobility control.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_4
Test Procedure	1. Configure two NR cells for handover testing: a. Case 1: Same band with different carrier frequencies b. Case 2: Different bands The cells may be under the same gNB or under different gNBs connected through Xn or NG interface. 2. Configure proper neighbor relationships, handover parameters, and measurement events between the source and target cells. 3. Power on the UE and ensure that it camps successfully on the source cell. Establish an RRC Connected session with active data transmission (e.g., video streaming, throughput session, file download, or voice call). 4. Move the UE from the source cell towards the target cell coverage area to trigger handover conditions and mobility procedures. 5. When the configured handover conditions are met: a. The source gNB initiates the handover procedure (Xn-based or NG-based depending on the setup). b. The target gNB (or target cell under the same gNB) prepares the required radio resources. c. The UE receives the RRC Reconfiguration message, performs the handover to the target cell, and responds with RRC Reconfiguration Complete. 6. Verify that the UE successfully completes mobility/handover and that ongoing data transmission continues without interruption.
Test Limits	NA
Expected Results	1. UE successfully Perform Connected mode mobility with intra frequency handover without any connection lost. 2. UE successfully performs Connected mode handover between different NR frequencies (same band and different band).

Test No.	GR_TSTP_1.4.1.11_A1
Test Details	To verify that Basic Voice over NR, which provides traffic functions and protocol procedures for establishing, maintaining, and releasing a voice call in NR.
Test Instruments Required	gNodeB, 5G Core Network, IMS, RF cables and attenuators, UE, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
Test Setup	TEST SETUP_5
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	gNodeB successfully performs VoNR.

Test No.	GR_TSTP_1.4.1.11_A2
Test Details	To verify that Voice over NR calls, which allow the handling of voice traffic directly.
Test Instruments Required	gNodeB, 5G Core Network, IMS, RF cables and attenuators, UE, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
Test Setup	TEST SETUP_5
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 userplane 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	gNodeB successfully handles traffic through 5GNR during VoNR

Test No.	GR_TSTP_1.4.1.11_A3
Test Details	To verify that Intra frequency handover for voice services.
Test Instruments Required	gNodeB, 5G Core Network, IMS, RF cables and attenuators, UE, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
Test Setup	TEST SETUP_4
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	gNodeB supports uninterrupted services during intra frequency handover.

Test No.	GR_TSTP_1.4.1.11_A4
Test Details	To verify that IP header compression.
Test Instruments Required	gNodeB, 5G Core Network, IMS RF cables and attenuators, UE, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
Test Setup	TEST SETUP_5
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 supports IP Header compression.

Test No.	GR_TSTP_1.4.1.11_A5
Test Details	To verify that Need to include EPS fallback mechanism since VoNR may not be supported by all the UEs
Test Instruments Required	gNodeB, eNodeB, 4G-5G Core Network, RF cables and attenuators, UE, Network Performance Measurement Tool, Wireshark Network Protocol Analyzer
Test Setup	TEST SETUP_6
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_1.4.1.12_A1
Test Details	To verify that the power saving functionality and shall nbe powe efficient
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_1.4.1.12_A2
Test Details	To verify that 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.
Test Limits	NA
Expected Results	gNodeB supports micro sleep mode when there is no traffic

1.Test No	GR_TSTP_1.4.1.12_A3
2. Test Details	To verify that the System supports Low Energy Scheduler Solution (LESS) which uses a large amount of resource blocks in the frequency domain to free up space in the time domain and helps to increase energy efficiency while maintaining the same network performance.
3. Test Instruments Required	Small Size gNodeB, Monitor Console, User Equipment (UE) / UE Simulator, 5G Core Network (5GC), Network Switch, NMS/EMS, Wireshark Network Protocol Analyzer, Power Supply, Signal/Spectrum Analyzer
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Configure and power ON the Small Size gNodeB. 2. Establish connection between DUT and 5G Core Network. 3. Attach UE(s) to the DUT and ensure normal traffic operation. 4. Enable/configure Low Energy Scheduler Solution (LESS), if configurable. 5. Generate representative traffic conditions through UE(s). 6. Observe scheduler operation through Monitor Console/OMC and verify resource allocation behaviour. 7. Verify that resource allocation utilizes resource blocks in the frequency domain to free up resources in the time domain. 8. Monitor network performance during the operation of LESS. 9. Record observations and logs.
6. Test Limits	NA
7. Expected Results	The Small Size gNodeB supports Low Energy Scheduler Solution (LESS) and demonstrates energy-efficient scheduling while maintaining network performance.

Test No.	GR_TSTP_1.4.1.12_A4
Test Details	To verify that 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.
Test Limits	NA
Expected Results	gNodeB supports micro sleep mode when there is no traffic.

Test No.	GR_TSTP_1.4.1.12_A5
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. 5. 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_1.4.1.12_A6
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.

1.Test No	GR_TSTP_1.4.1.12_7
2. Test Details	To verify that the system supports Automatic enablement/ disablement of the main power amplifier (PA) in the radio-unit. The PA may be turned off in the following cases: 1. When no PDSCH traffic is scheduled on a subframe; and 2. During symbols that do not carry mandatory information.
3. Test Instruments Required	Small Size gNodeB, Monitor Console, User Equipment (UE) / UE Simulator, 5G Core Network (5GC), Network Switch, NMS/EMS, Wireshark Network Protocol Analyzer, Power Supply, Signal/Spectrum Analyzer
4. Test Setup	TEST SETUP 2
5. Test Procedure	Case–1: Verification of PA automatic disablement and enablement when no PDSCH traffic is scheduled on a subframe 1. Configure and power ON the Small Size gNodeB (DUT). 2. Establish connection with 5G Core Network and attach UE(s). 3. Generate normal traffic and verify that the main power amplifier (PA) remains enabled during active transmission. 4. Stop/suspend PDSCH traffic scheduling for the selected subframe. 5. Observe DUT behaviour through Monitor Console/OMC or available monitoring interface. 6. Verify that the PA is automatically disabled/turned OFF when no PDSCH traffic is scheduled. 7. Resume PDSCH traffic scheduling. 8. Verify that the PA is automatically enabled/turned ON and normal transmission resumes. 9. Record observations and logs. Case–2: Verification of PA automatic disablement and enablement during symbols that do not carry mandatory information 1. Configure the DUT under normal operating conditions and establish UE connectivity. 2. Verify that the PA remains enabled during normal transmission. 3. Identify/configure symbols that do not carry mandatory information. 4. Observe PA operation through Monitor Console/OMC or available monitoring interface. 5. Verify that the PA is automatically disabled/turned OFF during such symbols. 6. Restore transmission conditions requiring mandatory information. 7. Verify that the PA is automatically enabled/turned ON for normal operation. 8. Record observations and logs.

6. Test Limits	NA
7. Expected Results	The Small Size gNodeB supports automatic enablement/disablement of the main power amplifier (PA) and automatically turns OFF the PA when no PDSCH traffic is scheduled and during symbols not carrying mandatory information, while resuming normal operation when required.

Test No.	GR_TSTP_1.4.1.13_A
Test Details	To verify that system shall support Uu interface towards Device/UE.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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	1. RRC connection is established successfully. 2. UE transitions to RRC Connected state. 3. PDU session is established successfully.

Test No.	GR_TSTP_ 1.4.1.14_A
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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_1.4.1.14_B
Test Details	To verify that system 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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_1.5.1.1_A
Test Details	To verify that Provision shall be made for continuous testing of the system to allow both system qualities check and fault indication as a fault arises.
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_1.5.1.1_B
Test Details	To verify that In case a fault is detected requiring reloading of the 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.
Test Instruments Required	gNodeB, RF cables and attenuators, UE / UE simulator, 5GC/5GC Emulator, Network tools, 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_1.5.1.2
Test Details	To verify that 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 (As per Procurer requirements) d) High speed vehicular: 120 km/h to 500 km/h (As per Procurer requirements) For High band, the targeted relative speed between the gNB and the mobile station may be up to 100 km/h. (As per Procurer 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 and 5G Core Network into operationally enabled state. 2. Configure the test setup with: a. UE/UE simulator capable of mobility emulation, b. channel emulator or mobility simulator (if applicable), c. Iperf/server for DL traffic generation. 3. Attach the UE to the gNB successfully. 4. Establish a stable PDU session and verify UE registration. 5. Start continuous DL data transfer using Iperf application. 6. Configure/emulate the required relative speed category between gNB and UE: 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 Low/Mid band e. Up to 100 km/h for High band 7. At each speed category: a. Maintain traffic session for a sufficient duration,

	b. Monitor DL throughput, c. Verify session continuity, d. Verify radio link stability, e. Observe any handover failures, radio link failures (RLF), or call/data drops.
Test Limits	NA
Expected Results	Verify that at all above mentioned speed, Data Downloading is working

Test No.	GR_TSTP_1.5.2_A
Test Details	To veriy that 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_1.5.2_B
Test Details	To veriy that 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_1.5.3_A
Test Details	To verify that 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
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_1.5.3_B
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_1.5.4
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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/report to be attached with compliance to the respective requirements.

Test No.	GR_TSTP_1.5.5_A
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_1.5.5_B
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_1.5.6
Test Details	To verify the equipment shall conform to IS 13252 part 1:2010- “Information Technology Equipment – Safety- Part 1: General Requirements” OR IEC 62368-I:2023 – “Audio/video, information and communication technology equipment - Part 1: Safety requirements”
Test Procedure	gNodeB to be tested in accordance with the test procedure of relevant standards testing to be done at accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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 c) 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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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) Immunity to fast transients (burst): Test Level 2: a) 1 kV for AC/DC power port b) 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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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 a) 2 kV peak open circuit voltage for line to ground b) 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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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) Immunity to surges: Telecom ports a) 2 kV peak open circuit voltage for line to ground coupling. b) 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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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. d) 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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.5.7_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. e) 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 accredited lab.
Test Limits	NA
Expected Results	Test certificate/reports from any accredited lab should be submitted.

Test No.	GR_TSTP_1.6.1_A
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_4
Test Procedure	1. Bring 2 gNodeBs in operationally enabled state. gNodeB2 should be configured with TAC and PLMN value different from gNodeB1. 2. Attach UE1 and UE2 on first gNodeB. 3. Initiate Uplink and Downlink data for UE1. 4. Initiate Voice call from UE1 to UE2. 5. Disconnect Voice Call. 6. Make UE1 reselect to gNodeB2. 7. 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_1.6.3_B
Test Details	To 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	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	This requirement is applicable to gNodeB implementations with field removable electronic packages/modules. 1. Check from physical construction if there is any electronic package(s) which is to be inserted/removed on gNodeB during site installation. 2. 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_1.6.3_C
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Change the date and time at gNodeB through command line /EMS/OMC such that the year given is a leap year. 2. There should not be any impact on hardware on changing the date and time. 3. Register UE to the network. 4. 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_1.6.4_A
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	Prevention of loss/alteration of contents: The vendor to specify data/files that are present on persistent storage. 1. Bring gNodeB in operationally enabled state. 2. Verify vendor specified data/files. 3. Register UE to the network. 4. Switch-off the power supply. 5. Wait for 1 minute. 6. Switch on the power supply. 7. Bring gNodeB in operationally enabled state. 8. Verify that vendor specified data/files are intact. 9. Register UE to the network. System restoration procedure after following improper operating procedure: The vendor to specify procedure to restore the system. 1. Delete some critical data/file or modify data (as per vendor specified procedure) that take gNodeB in inconsistent state. 2. Bring gNodeB in operationally enabled state. The procedure shall fail. 3. Now follow vendor specified restoration procedure. 4. Bring gNodeB in operationally enabled state. 5. Register UE to the network.
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_1.6.5_A
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Make the setup as shown in test setup. 2. Trigger diagnostics tests for elements of 5G-RAN. Verify the test reports at OMC/EMS/Command line. 3. Lock the 5G-RAN elements through OMC/EMS (i.e. Make them out of service from OMC). Verify that the relevant alarms are raised. 4. Make some changes in 5G-RAN elements configuration through OMC/EMS. 5. Unlock them through OMC/EMS (i.e. Make them in service from OMC/EMS). Verify that the relevant alarms are raised.
Test Limits	NA
Expected Results	The elements of 5G-RAN shall successfully execute vendor specified diagnostic procedure. The elements of 5G-RAN shall indicate alarms to OMC/EMS for vendor specified events. The elements of 5G-RAN shall allow configuration of vendor specified parameters through OMC/EMS.

Test No.	GR_TSTP_1.6.5_B
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. 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. 2. 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_1.6.5_C
Test Details	To verify that Adequate number of man-machine interfaces shall be available.
Test Instruments Required	gNodeB, RF cables and attenuators, UE /UE simulator, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
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_1.6.5_D
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Break the ethernet connectivity between the gNodeB and the OMC. 2. Check that the un-reachability status of the gNodeB is updated at the OMC. 3. 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_1.6.5_E
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	. This is a generic clause. Verify that the OMC gives you a provision to check the alarms as and when they are raised. . 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_1.6.6_C
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. Tropicalization: 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_1.6.7_A
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_1.6.7_B
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_1.6.8_B1
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_1.6.8_B6
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_1.6.10_A
Test Details	To 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, Network Performance Measurement Tool, Wireshark Network Protocol Analyser
Test Setup	TEST SETUP_1
Test Procedure	1. Configure some value to limit PRACH in gNodeB 2. Attach multiple UE till that value 3. 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'.***