सत्यमेव जयते

परीक्षण मार्गदर्शक
सं: 21051:2022

TEST Guide
No.: 21051:2022

इ-नॉड बी
eNodeB

(जीआर सं: टीईसी 21050:2019)
(GR No.:TEC 21050:2019)

I
SO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र
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CONTENTS

A. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of eNodeB as per GR/IR/Applicant's spec. No TEC/GR/WS/ENB-001/01 March 2019.

B. HISTORY SHEET

Sl. No.	TSTP No.	Equipment/Interface	Issue
1.	**TEST Guide No.: 21051:2022**	**eNodeB**	**01**
2.			

C. General information:

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

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

Sno.	Name	Designation	Organization	Signature
1.				
2.				

E. List of the Test Instruments:

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

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

(a) **<Equipment/product name> Configuration:**

S.No.	Item	Details	Remarks

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

(b) **<Other equipment name> Configuration:**

S.No.	Item	Details	Remarks

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

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

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

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

Clause No.	*Clause Description*	*Type of Test / Test No. etc. **
1	**Introduction**	
1.1	**Scope** This document contains the Generic Requirements (GR) of Long Term Evolution (LTE) eNodeB defined by 3GPP up to Release-14 of 36 series for deployment in the Indian mobile network. The E-UTRAN (Evolved – Universal Terrestrial Radio Access Network) consists of eNodeBs, providing the E-UTRA (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 eNodeB System including Small Sized LTE based mobile systems, with its various derivatives including rural and disaster communications, Macro and Micro eNodeB as envisaged in Gazette Notification No. 18-10/2017-IP dated 29th August 2018. This document covers eNodeB, Home eNodeB and various applications including IOT, Public Safety and V2X	1. Submit datasheet of eNodeB 2. Network architecture indicating supported interfaces 3. Submit undertaking for type of eNodeB, viz., Macro, Micro, Pico, home eNodeB 4. Submit undertaking for supported applications, viz., Telecom, IOT, Public Safety, V2X

	This GR is applicable for both FDD and TDD modes of operation	
2	**eNodeB**	
2.1	**Description** eNodeB is the RAN node in the network architecture that is responsible for radio transmission to and reception from UEs in one or more cells. The E-UTRAN consists of eNodeBs, providing the E-UTRA user plane (PDCP/RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNodeBs are interconnected with each other by means of the X2 interface. The eNodeBs are also connected by means of the S1 interface to the EPC (Evolved Packet Core), more specifically to the MME (Mobility Management Entity) by means of the S1-MME and to the Serving Gateway (S-GW) by means of the S1-U. The S1 interface supports a many-to-many relation between MMEs / Serving Gateways and eNodeBs. The eNodeB design can be based on a distributed architecture or integrated architecture • Integrated Architecture: Integrated architecture consists of single unit implementing all	1. Submit network diagram depicting placement of eNodeB in the system. 2. Submit design architecture and functional split of the eNodeB: Subsystems along with their functional description, Hardware Functional Blocks, Sub-units

	necessary functions of baseband subsystem and radio subsystem. • Distributed Architecture: The distributed architecture comprised of baseband unit (BBU) collocated with eNodeB Layer 2, Layer 3 functionality and Remote radio head (RRH) connected via a CPRI or OBSAI interface or another interface. This also covers centralised/cloud RAN (C-RAN) based architecture This GR defines eNodeB functionality independent of implementation architecture.	
2.2	**eNodeB Classes**	
2.2.1	3GPP Specification (TS 36.104) define the following eNodeB classes 1. Wide Area Base Station 2. Medium Range Base Station 3. Local Area Base Station Each class of eNodeB has different requirements in terms of output power, transmitter characteristics and receiver performance.	Submit undertaking stating class of eNodeB under testing: Wide Area, Medium Range, Local Area or Home eNodeB.

<table>
<tr><td></td><td><table>
<tr><td>Clause</td><td>BS Class</td><td>Derivation from</td><td>PRAT</td></tr>
<tr><td>1</td><td>Wide Area BS</td><td>Macro cell scenario</td><td>(NOTE)</td></tr>
<tr><td>2</td><td>Medium Range BS</td><td>Micro cell scenario</td><td>≤38 dBm</td></tr>
<tr><td>3</td><td>Local Area BS</td><td>Pico cell scenario</td><td>≤24 dBm</td></tr>
<tr><td colspan="4">NOTE: There is no upper limit for the rated output power of the wide area base station</td></tr>
</table></td><td>Submit undertaking of maximum output power per port per carrier.</td></tr>
<tr><td></td><td>Rated output power, PRAT of the base station is the mean power level per carrier for BS operating in single carrier, multi-carrier, or carrier aggregation configurations that the manufacturer has declared to be available at the antenna connector during the transmitter ON period.
The limits/ levels for antennae (BS) emissions for general public exposure shall be as prescribed by the licensor from time to time.
The maximum power radiation shall be regulated by latest DoT guidelines/ instructions/ licensing conditions</td><td>Explanatory only</td></tr>
<tr><td>2.2.2</td><td>Depending upon applicability in Indian scenario, the requirements have further been categorised as under (Refer The Gazette of India Notification No. 18-10/2017-IP dated 29th August 2018)</td><td>Explanatory only</td></tr>
<tr><td>2.2.2.1</td><td>Category 1: LTE based mobile systems, with its various derivatives including rural and disaster communications, Macro and Micro eNodeB</td><td>Submit undertaking if the eNodeB under test belong to Category-1.</td></tr>
<tr><td></td><td>Category 2: Small Size LTE based</td><td>Vendor to provide</td></tr>
</table>

2.2.2.2	mobile systems with its various derivatives including Rural and Disaster communication, Macro and Micro eNodeB Small Size LTE based mobile systems (Category 2) has been envisaged for Indian scenario with the key objective of power efficient (low power consumption) and eco-friendly solution, which can address the requirements in terms of coverage, capacity, quality with ease of maintenance. The prime requirement of the solution is to provide mobile services in unconnected, remote and rural areas with diverse clutter/ terrain, capacity and coverage needs as well as easy deployability at shortest possible timeframe. Small Size eNodeB system is characterized as below:	undertaking with 1. list of supported deployments 2. Category of eNodeB 3. Installation procedure and expected installation time - for ease of deployability Low power consumption: GR_TSTP_2.2.2.2_C
a	eNodeB – Low power consumption	GR_TSTP_2.2.2.2_C
b	Enclosure	Explanatory Only
b.i	For outdoor – IP65 compliant	Compliance certificate from accredited lab
b.ii	For indoor – IP20 or higher	Compliance certificate from accredited lab
c	Typical configuration & Maximum RF Transmit power (Output Power) and Maximum power consumption (per sector): i. Macro Cell - up to 2 x 10W - 250W ii. Micro Cell - up to 2 x 5W – 130W,	GR_TSTP_2.2.2.2_C for Max RF transmit power GR_TSTP_2.2.2.2_D for max electric power consumption

	2 x 2W – 75W, 2 x 1W – 60W iii. Pico Cell - up to 2 x 250 mW – 40W	
	The limits/ levels for antennae (BS) emissions for general public exposure shall be as prescribed by the licensor from time to time. Note: The Tendering Authority/ Purchaser may decide among Category 1 or Category 2 type eNodeB depending upon specific deployment in urban/ rural areas as per requirements	Explanatory only
2.3	**Functional Requirements**	**Explanatory only**
2.3.1	Radio Resource Control/ Radio Resource Management (RRC/RRM) Functionality	Explanatory only
2.3.1.1	Cell control and MME support: eNodeB owns and controls the radio resources of its own cell or cells. Cell resources as requested by and granted to MMEs shall be in an ordered fashion.	GR_TSTP_2.3.1.1
2.3.1.2	Measurements and reporting: The eNodeB shall support Event-triggered measurement reporting.	GR_TSTP_2.3.1.2
2.3.1.3	The eNodeB shall support System Information Broadcast (SIB).	GR_TSTP_2.3.1.3
2.3.1.4	The eNodeB shall support Signaling	GR_TSTP_2.3.1.4

	Radio Bearer (SRB), including SRB0, SRB1, and SRB2.	
2.3.2	Packet Data Convergence Protocol (PDCP)	Explanatory Only
2.3.2.1	Control and User Plane security: eNodeB shall support the ciphering of user plane data over the radio interface and integrity protection of RRC signaling.	GR_TSTP_2.3.2.1
2.3.2.2	The eNodeB shall store one-to-one mapping between data radio bearers and S1 bearers to create the binding between a data radio bearer and an S1 bearer in both the uplink and downlink to enable Quality of Service (QoS) enforcement.	GR_TSTP_2.3.2.2
2.3.3	Radio Link Control (RLC)	Explanatory Only
2.3.3.1	Segmentation/Concatenation: RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.	GR_TSTP_ 2.3.3.1
2.3.4	Medium Access Control / Layer-1 (MAC-L1)	Explanation Only
2.3.4.1	Shared Channel handling: eNodeB shall be able to handle the shared and random access channels used for signaling and initial access.	GR_TSTP_ 2.3.4.1
2.3.4.2	eNodeB shall support HARQ functionality	GR_TSTP_ 2.3.4.2
2.3.4.3	eNodeB shall support dynamic resource allocation (Scheduling)	GR_TSTP_ 2.3.4.3
2.3.4.4	Multiplexing and Mapping: The eNodeB	GR_TSTP_ 2.3.4.4

	shall be support mapping of logical channels onto transport channels.	
2.3.4.5	Physical layer functionality: eNodeB shall support scrambling, Tx diversity, and OFDM modulation.	GR_TSTP_ 2.3.4.5
2.3.4.6	The eNodeB shall support Contention based and Contention free Random Access (RA) procedure.	GR_TSTP_ 2.3.4.6
2.3.4.7	The eNodeB shall support DL Power Allocation for data channels.	GR_TSTP_ 2.3.4.7
2.3.4.8	eNodeB shall support Downlink power allocation parameters, such PDSCH-to-RS ratios	GR_TSTP_ 2.3.4.8
2.3.4.9	The eNodeB shall support DL Power setting for signaling and control channels.	GR_TSTP_ 2.3.4.9
2.3.4.10	The eNodeB shall support both the open-loop power control and the closed-loop power control of the UE.	GR_TSTP_ 2.3.4.10
2.3.4.11	The eNodeB shall support Normal cyclic prefix. Optionally for Macro scenarios, Extended Cyclic prefix may be supported (Applicable to Category 1 eNodeB only).	GR_TSTP_ 2.3.4.11
2.3.4.12	The eNodeB shall support Uplink demodulation reference signal	GR_TSTP_ 2.3.4.12
2.3.4.13	Radio Bearer (RB) combinations dynamic mapping to Physical Resource Block (PRB).	GR_TSTP_ 2.3.4.13
2.3.4.14	The eNodeB shall support UL & DL Link Adaptation.	GR_TSTP_ 2.3.4.14
2.3.4.15	Uplink-Downlink frame configuration for	GR_TSTP_2.3.4.15_A

	TDD defined by 3GPP as Configuration-1 & Configuration-2 shall be supported. Optionally eNodeB shall support all the configurations.	GR_TSTP_2.3.4.15_B
2.3.4.16	The transmission modes viz: open loop, closed loop for spatial multiplexing and Transmit diversity etc. shall be supported.	GR_TSTP_2.3.4.16
2.3.4.17	The eNodeB shall support Short Buffer Status Report (BSR) and Long BSR.	GR_TSTP_2.3.4.17
2.3.4.18	The eNodeB shall support Random Access Preamble burst format 0 (FDD/TDD) and 4(TDD).	GR_TSTP_2.3.4.18
2.3.4.19	The eNodeB shall support Cell-specific reference signal.	GR_TSTP_2.3.4.19
2.3.4.20	The eNodeB shall support frequency selective scheduling (FSS) in Downlink	Undertaking
2.3.4.21	The eNodeB shall support Interference aware and channel aware frequency selective scheduling on PUSCH using Sounding Reference Signals (SRS)	Undertaking
2.3.4.22	Support for Discontinuous Reception (DRX) to enable reasonable UE battery consumption.	GR_TSTP_2.3.4.22

2.3.5	S1 Interface The S1 interface is specified at the boundary between the EPC and the E-UTRAN. From the S1 perspective, the E-UTRAN access point is an eNodeB, and the EPC access point is either the control plane MME logical node or the user plane S-GW logical node. Two types of S1 interfaces are thus defined at the boundary depending on the EPC access point: S1-MME towards an MME and S1-U towards an S- GW. The E-UTRAN may thus have several S1access points towards the EPC. As a minimum, each S1 access point (in E-UTRAN or EPC) shall independently fulfill the requirements of the relevant S1 specifications (3GPP TS 36.41x series). S1 is a logical interface. There may be multiple S1-MME logical interfaces towards the EPC from any one eNodeB. The selection of the S1-MME interface is then determined by the NAS Node Selection Function. There may be multiple S1-U logical interfaces towards the EPC from any one eNodeB. The selection of the S1-U interface is done within the EPC and signaled to the eNodeB by the MME.	GR_TSTP_ 2.3.5_A GR_TSTP_ 2.3.5_B GR_TSTP_ 2.3.5_C
2.3.5.1	Functions of S1 Interface:	Explanation only
a.	S1 UE context management function.	GR_TSTP_ 2.3.5.1_A1

		GR_TSTP_ 2.3.5.1_A2 GR_TSTP_ 2.3.5.1_A3 GR_TSTP_ 2.3.5.1_A4
b	E-RAB management functions.	GR_TSTP_ 2.3.5.1_B1 GR_TSTP_ 2.3.5.1_B2 GR_TSTP_ 2.3.5.1_B3
c	S1 link management function.	GR_TSTP_ 2.3.5.1_C
d	GTP-U tunnels management function.	GR_TSTP_ 2.3.5.1_D1 GR_TSTP_ 2.3.5.1_D2
e	S1 Signaling link management function	GR_TSTP_ 2.3.5.1_E
f	Mobility functions for UEs in LTE_Active.	GR_TSTP_ 2.3.5.1_F1 GR_TSTP_ 2.3.5.1_F2
g	Intra-LTE handover.	GR_TSTP_ 2.3.5.1_G
h	Inter-3GPP RAT handover.	GR_TSTP_2.3.30_D
i	Paging function.	GR_TSTP_ 2.3.5.1_I
j	S1 interface management function.	GR_TSTP_ 2.3.5.1_J1 GR_TSTP_ 2.3.5.1_J2 GR_TSTP_ 2.3.5.1_J3
k	Security function.	GR_TSTP_ 2.3.5.1_K
l	Service and network access function	
l.a	Core network signaling data transfer function	GR_TSTP_ 2.3.5.1_L1
l.b	Delivery of Warning messages	GR_TSTP_ 2.3.5.1_L2
m	Functions of S1 Interface: Location reporting function.	GR_TSTP_ 2.3.24
n	MME Selection with MME Load re-balancing & Overload Indication Management.	GR_TSTP_2.3.5.1_N1 GR_TSTP_2.3.35_A GR_TSTP_2.3.35_B
o	Functions of S1 Interface: The S1-U interface shall be Ethernet	GR_TSTP_ 2.3.5.1_O

2.3.6	X2 Interface The interface allowing interconnecting eNodeBs with each other is referred to as the X2 interface. The X2 interface shall support the exchange of signalling information between two eNodeBs, in addition the interface shall support the forwarding of PDUs to the respective tunnel endpoints. From a logical standpoint, the X2 is a point-to-point interface between two eNodeBs within the E-UTRAN	GR_TSTP_ 2.3.6
2.3.6.1	Functions of the X2 interface - The list of functions on the X2 interface shall include the following:	Explanation only
a	Intra LTE-Access-System Mobility Support for UE in LTE_ACTIVE.	GR_TSTP_ 2.3.6.1_A
b	Context transfer from source eNodeB to target eNodeB.	GR_TSTP_ 2.3.6.1_B
c	Control of user plane tunnels between source eNodeB and target eNodeB.	GR_TSTP_ 2.3.6.1_C
d	Handover cancellation.	GR_TSTP_ 2.3.6.1_D
e	General X2 management and error handling functions.	GR_TSTP_ 2.3.6.1_E
f	Error indication.	GR_TSTP_ 2.3.6.1_F
g	The X2 interface shall support Ethernet	GR_TSTP_ 2.3.6.1_G
2.3.6.2	It shall be mandatory that the X2 interface implementation with reference to intercell Coordination for Interference Mitigation (ICIC), mobility robustness and mobility load balancing as per	Submit document defining X2 interface implementation of ICIC, mobility robustness and mobility load balancing

	applicable category be shared with the Purchaser to allow interworking with other vendors eNodeB and/or small cell.	procedures (as per applicable category).
2.3.7	Uu Interface The Uu interface is the radio interface between the mobile and the radio access network. The protocol stack has two planes: the user plane carries the data streams of interest to the user, while the control plane carries the network's signaling messages.	Explanatory only
2.3.7.1	Functions of the Uu interface:	Explanatory only
a	RACH access.	GR_TSTP_ 2.3.7.1_A
b	RRC Connection Establishment procedure.	GR_TSTP_ 2.3.7.1_B
c	RRC Connection Re-establishment procedure.	GR_TSTP_ 2.3.7.1_C
d	Mobility Control through RRC Connection Reconfiguration.	GR_TSTP_ 2.3.7.1_D
e	Measurement Event Reporting.	GR_TSTP_ 2.3.7.1_E1 GR_TSTP_ 2.3.7.1_E2 GR_TSTP_ 2.3.7.1_E3
2.3.8	Power Requirements	Explanatory only
2.3.8.1	eNodeB shall support DC/AC power supply	Undertaking from the vendor for supported options.
2.3.8.2	eNodeB with DC power supply	GR_TSTP_2.3.8.2
a	eNodeB shall support nominal voltage -48V (-40 to -60 V) DC supply voltage	GR_TSTP_2.3.8.2_A

b	Protection on Power Input Ports	GR_TSTP_2.3.8.2_B
c	Reverse Polarity at the DC input	GR_TSTP_2.3.8.2_C
d	Over voltage protection at the DC input	GR_TSTP_2.3.8.2_D
e	DC input under voltage cut-off. Limit of under voltage shall be indicated by the vendor	GR_TSTP_2.3.8.2_E
f	In case AC option, the required AC to DC converter shall be provided by the supplier.	Undertaking
2.3.8.3	eNodeB with AC power supply eNodeB shall have in-built/external AC to DC converter module, which shall support nominal voltage as per IS 12360:1988 (as amended from time to time)	Certificate from accredited lab.
2.3.9	Operation & Maintenance	Explanatory only
2.3.9.1	O&M Interface: The eNodeB shall include an O&M interface for debugging, troubleshooting and for providing fault, configuration and performance data to an O&M server (OMC / EMS). The O&M interface shall be Ethernet.	GR_TSTP_2.3.9.1_A GR_TSTP_2.3.9.1_B GR_TSTP_2.3.9.1_C GR_TSTP_2.3.9.1_D
2.3.9.2	eNodeB shall support at least one of the following interfaces towards EMS / OMC	GR_TSTP_2.3.9.2_A GR_TSTP_2.3.9.2_B
2.3.9.3	The eNodeB control software shall interact with various hardware / software entities of the eNodeB and provide the health status/Alarms of the entire system on the EMS / OMC	GR_TSTP_2.3.9.3_A GR_TSTP_2.3.9.3_B
2.3.9.4	The eNodeB shall support remote	GR_TSTP_2.3.9.4_A

	Software/firmware updates via the EMS / OMC.	GR_TSTP_2.3.9.4_B
2.3.9.5	The eNodeB control software shall be responsible for logging and sending the log file on the network to a designated syslog server.	GR_TSTP_2.3.9.5
2.3.9.6	The system shall maintain a system log and core dump logs.	GR_TSTP_2.3.9.6
2.3.9.7	The eNodeB should support both local and remote software upgrade.	GR_TSTP_2.3.9.7_A GR_TSTP_2.3.9.4_A
2.3.9.8	The eNodeB shall support alarms, events to OMC / EMS for visual indicators of status and fault.	GR_TSTP_2.3.9.8
2.3.9.9	The eNodeB shall have reboot / restart capability.	GR_TSTP_2.3.9.9
2.3.9.10	eNodeB shall support built-in power-on diagnostics and system monitoring capabilities to detect hardware failures.	GR_TSTP_2.3.9.10
2.3.9.11	The eNodeB should support Local Maintenance Ports for any debugging and troubleshooting.	GR_TSTP_2.3.9.11
2.3.9.12	The system shall provide the count for the total number of UEs connected to the eNodeB.	GR_TSTP_2.3.9.12
2.3.9.13	The eNodeB shall be capable of providing the system configuration data to the Management Information Base (MIB) of the system (applicable with SNMP based management only).	GR_TSTP_2.3.9.13
2.3.9.14	The eNodeB shall have the ability to detect and report any hardware fault within the equipment.	GR_TSTP_2.3.9.14

2.3.9.15	The system shall provide multiple level of recovery from software and hardware faults such that the impact on system operation shall be in accordance of the severity of the faults.	GR_TSTP_2.3.9.15
2.3.10	Ethernet Transport features	Explanatory only
2.3.10.1	The eNodeB shall support the operator configurable use of VLANs compliant to IEEE802.1Q on any Ethernet interfaces.	GR_TSTP_2.3.10.1
2.3.10.2	The eNodeB shall be able to flexibly map traffic onto one or more VLANs.	GR_TSTP_2.3.10.2
2.3.11	IP Transport	Explanatory only
2.3.11.1	Both IPV4 and IPV6 (dual stack) shall be supported on all Ethernet transport interfaces in compliance with IETF RFC 4213.	GR_TSTP_2.3.11.1_A
2.3.12	QoS in the Transport Layer	Explanatory only
2.3.12.1	The eNodeB shall comply with the IETF DiffServe architecture as defined in IETF RFC2475 and shall support the DSCP interpretation of the TOS field in the IPv4 header as defined in IETF RFC2474.	GR_TSTP_2.3.12.1
2.3.12.2	The eNodeB shall support the use of the Ethernet Priority Code Point (PCP) field as defined in IEEE802.1Q-2005 section 9.	GR_TSTP_2.3.12.2
2.3.12.3	The transport QoS is managed at layer 3 with the DSCP field of IP packets and at layer 2 with the "PCP" bits in the Ethernet frames.	GR_TSTP_2.3.12.3
2.3.12.4	The DSCP for S1-U and X2-U are	GR_TSTP_2.3.12.4

	configurable by operator.	
2.3.12.5	DSCP values that are supported in the eNodeB shall be indicated in the technical document supplied with the equipment.	The vendor shall provide technical documentation indicating supported DSCP values.
2.3.12.6	Layer 2 QoS marking shall be supported when the backbone network supporting the eNodeB is a layer 2 switched network	GR_TSTP_2.3.12.6
2.3.12.7	DSCP-PCP mapping shall be configurable. Default DSCP-PCP to be provided.	GR_TSTP_2.3.11.7
2.3.13	eNodeB Synchronization	Explanatory only
2.3.13.1	eNodeB shall support at least one of the following synchronization options a. GPS b. IEEE 1588 V2 c. SyncE d. IRNSS timing source	GR_TSTP_2.3.13.1
2.3.13.2	eNodeB for Wide Area BS TDD systems shall support a phase accuracy as specified below, Cell Type, Cell Radius, Requirement Small Cell, ≤ 3Km, ≤ 3 µs Large Cell, > 3Km, ≤ 10 µs	GR_TSTP_2.3.13.2
2.3.13.3	eNodeB shall support at least 48 hr hold over mode in case of frequency synchronization loss and at least 6 hr hold over mode in case of Phase synchronization loss.	GR_TSTP_2.3.13.3
2.3.14	Security IPsec in Transport	Explanatory only

2.3.14.1	System shall support IPSEC and key management (e.g. IKEv2 or pre-shared key) for the backhaul transport.	GR_TSTP_2.3.14.1
2.3.15	Transmission Modes, MIMO requirements & Modulation Schemes	Explanatory only
	Category 1 Specification	
1	DL TM Modes: TM 1 – TM 4. (TM5 to TM10 optional) – to be specified by the tendering authority	GR_TSTP_CAT1_1
2	DL SU MIMO	GR_TSTP_CAT1_2
3	DL MU-MIMO (optional)	GR_TSTP_CAT1_3
4	DL MIMO Layers: 2X2,4X2, 4X4	GR_TSTP_CAT1_4
5	Optional upgradability (AAS) which has large array of antenna elements i.e. more than 8 Tx Rx antenna elements e.g. 8X8, 12X12, 16X16, 32X32, 64X64 MIMO	Undertaking
6	UL TM Modes: TM 1 – TM 2	GR_TSTP_CAT1_6
7	UL Rx Diversity: 2X, 4X	GR_TSTP_CAT1_7
8	UL-MIMO 2x2, 4x4	GR_TSTP_CAT1_8
9	Optional FD-MIMO or Massive MIMO upgradability	Undertaking
10	The AAS system shall support dynamic switching of transmission modes of TM7/8 to TM3 or TM4 based on radio conditions and UE support	GR_TSTP_CAT1_10
11	DL modulation Schemes: BPSK, QPSK, 16 QAM, 64 QAM, 256 QAM	GR_TSTP_CAT1_11
12	UL Modulation Schemes: BPSK, QPSK, 16 QAM, 64 QAM	GR_TSTP_CAT1_12
	Category 2 Specification	
1	DL TM Modes: TM1 – TM4	GR_TSTP_CAT2_1

2	DL SU MIMO	GR_TSTP_CAT2_2
3	DL MIMO Layers: 2X2	GR_TSTP_CAT2_3
4	UL TM Modes: TM1	GR_TSTP_CAT2_4
5	UL Rx Diversity: 2X	GR_TSTP_CAT2_5
6	DL modulation Schemes: BPSK, QPSK, 16 QAM, 64 QAM	GR_TSTP_CAT2_6
7	UL modulation Schemes: BPSK, QPSK, 16 QAM	GR_TSTP_CAT2_7
2.3.16	LTE QoS Requirements	Explanatory only
a	The eNodeB shall support all nine Quality of Service Class Identifiers (QCIs)	GR_TSTP_2.3.16_A
b	The eNodeB shall support multiple data radio bearers (DRBs).	GR_TSTP_2.3.16_B
c	The eNodeB shall support dynamic addition and deletion of dedicated bearers.	GR_TSTP_2.3.16_C
d	The eNodeB shall support both UE initiated as well as Network Initiated dedicated bearer creation.	GR_TSTP_2.3.16_D
e	The eNodeB scheduler shall support prioritization of traffic in downlink as per the QCI priority value	GR_TSTP_2.3.16_E
f	The eNodeB shall consider ARP (Allocation and Retention Priority) parameters of priority level, the pre-emption capability and the pre-emption vulnerability during bearer establishment	GR_TSTP_2.3.16_F
2.3.17	LTE QoS Requirements Advanced (Applicable to Category-1)	Explanatory only

a	The eNodeB shall support Extended QCI which enables the operator to define and configure new Quality of Service Class Identifier (QCIs) in addition to the existing standardized QCIs (0-9). This will further enable the operator to more flexibly differentiate between bearers or service flows from a Quality of Service (QoS) perspective	GR_TSTP_2.3.17_A
b	The inactivity timer for RRC and NAS (that makes the connection to be released) should be configurable by the operator for each QCI (standard and extended)	GR_TSTP_2.3.17_B
c	The eNodeB shall support mapping of QCIs to DSCP bits and marking the Egress IP Packets for different QCIs as per the configured mapping. This is important for end-to-end QoS in uplink.	GR_TSTP_2.3.17_C
d	The eNodeB shall support the pre-scheduling of resources to UEs (access grants) even if not required, which can be activated if certain load thresholds are reached.	GR_TSTP_2.3.17_D
2.3.18	Mobility control	Explanatory only
a	The eNodeB shall be able to control the mobility for terminals in active state.	GR_TSTP_2.3.18_A
b	The eNodeB shall support Cell reselection procedures. Cell Re-selection based on:	
b.i	Broadcast priority indication	GR_TSTP_2.3.18_B1
b.ii	Broadcast cell-specific reselection	GR_TSTP_2.3.18_B2

	parameters.	
b.iii	The eNodeB shall support Cell reselection procedures. Cell Re-selection based on : Broadcast cell-specific blacklists	GR_TSTP_2.3.18_B3
b.iv	Access class baring parameters	GR_TSTP_2.3.18_B4
c	The eNodeB shall support Inter PLMN reselection	GR_TSTP_2.3.18_C
d	The eNodeB shall support “connection re-establishment”	GR_TSTP_2.3.18_D
e	The system shall support following types of Inter eNodeB handover :	Explanatory only
e.i	Intra frequency	GR_TSTP_2.3.18_E1
e.ii	Inter frequency - same band	GR_TSTP_2.3.18_E2
e.iii	Inter frequency - different band	GR_TSTP_2.3.18_E3
e.iv	Over X2	GR_TSTP_2.3.18_E4
e.v	Over S1	GR_TSTP_2.3.18_E5
e.vi	Intra MME and SGW	GR_TSTP_2.3.18_E6
e.vii	Inter MME	GR_TSTP_2.3.18_E7
e.viii	Inter MME and SGW	GR_TSTP_2.3.18_E8
e.ix	Inter SGW	GR_TSTP_2.3.18_E9
e.x	Inter mode (TDD / FDD)	GR_TSTP_2.3.18_E10
f	The eNodeB shall support interworking between FDD and TDD, including session continuity	GR_TSTP_2.3.18_F
g	The system shall support data forwarding at Intra-LTE handover, both over X2 and S1 interfaces.	GR_TSTP_2.3.18_G
h	The eNodeB shall support PS Handover to WCDMA Based on Coverage	GR_TSTP_2.3.18_H
i	The eNodeB shall support UTRAN/	GR_TSTP_2.3.18_I

	GERAN session release with redirect information.	
2.3.19	Mobility Requirements Advanced	Explanatory only
a	The eNodeB shall support Load control mechanisms that provides overload protection for cells with a highly loaded air interface, by throttling incoming handovers and initial accesses in the cell	GR_TSTP_2.3.19_A
b	The eNodeB shall support load based Handover to GERAN/UTRAN/E-UTRAN	GR_TSTP_2.3.19_B
2.3.20	CSFB Support The eNodeB shall support CS Fallback to UTRAN and GERAN as primary CS service for traditional voice traffic if IP Multimedia Subsystem (IMS) for Voice over IP (VoIP) services are not available.	GR_TSTP_2.3.20
2.3.21	Advanced CSFB If CSFB is opted for voice services, the eNodeB shall be able to handle Emergency Calls during CS Fallback. The eNodeB should offer the operator the possibility to apply separate priorities for CS Fallback for emergency calls as compared to CS Fallback for ordinary voice calls.	GR_TSTP_2.3.21
2.3.22	Carrier Aggregation (Applicable for Category 1)	Explanatory only
a	The eNodeB shall support LTE-FDD Carrier Aggregation (CA) upto 5 Component Carriers. The tendering	GR_TSTP_2.3.22_A

	authority shall indicate the component carriers	
b	The eNodeB shall support Inter-Band CA between various standardized FDD bands (not applicable for TDD system)	GR_TSTP_2.3.22_B
c	The eNodeB shall support Intra-Band contiguous and non-contiguous CA	GR_TSTP_2.3.22_C
d	The eNodeB shall support CA between FDD and TDD (applicable only when eNodeB supports both options of FDD & TDD)	GR_TSTP_2.3.22_D
e	The eNodeB shall support Carrier Aggregation band combinations which are specific to India and already standardized	Undertaking
f	The eNodeB shall support Uplink Carrier	GR_TSTP_2.3.22_F
g	The eNodeB shall support Dynamic selection of Secondary frequency when having multiple cell carriers for CA	GR_TSTP_2.3.22_G
h	The eNodeB shall consider CA users during Load Balancing to avoid losing CA capabilities and to avoid congestion because of CA activation	GR_TSTP_2.3.22_H
i	It should be possible to aggregate carriers where different Transmission Modes (TM) are used in the aggregated cells	GR_TSTP_2.3.22_I
2.3.23	eMBMS (Applicable to Category-1 only and optional)	Explanatory Only
a	The MCE shall be supported logically within the eNodeB and should support	GR_TSTP_2.3.23_A

	all associated interfaces: M2, M3 and M1	
b	The eNodeB shall support Multicast Channel (MCH) and associated Physical Multicast Channel (PMCH)	GR_TSTP_2.3.23_B
c	The eNodeB shall support extended cyclic prefix	GR_TSTP_2.3.23_C
d	The eNodeB shall support Multimedia Broadcast/Multicast Service over Multimedia Broadcast Single Frequency Network (MBSFN)	GR_TSTP_2.3.23_D
e	The eNodeB shall support SIB13. MBSFN control channel information and MBSFN Area specification are specified by SIB13	GR_TSTP_2.3.23_E
f	The eNodeB shall support up to 3 MBSFN Areas in the same location	GR_TSTP_2.3.23_F
g	The eNodeB shall support SIB16 which contains information related to GPS time and Coordinated Universal Time (UTC). The UE may use the time information for numerous purposes, e.g. to synchronize the UE clock (to determine MBMS session start/ stop)	GR_TSTP_2.3.23_G
h	eMBMS should be supported in case of multiple carriers also, which means operator can choose to broadcast service on one of the carriers or both carriers simultaneously. The eNodeB shall support SIB15 which is broadcasted by RAN and it enables all cells to provide MBMS SAIs for the	GR_TSTP_2.3.23_H

	current frequency and also for neighboring frequencies where MBMS is provided	
i	The eNodeB shall be able to support unicast traffic and eMBMS services simultaneously. Unicast traffic should not be affected by eMBMS traffic and vice versa.	GR_TSTP_2.3.23_I
j	The seamless mobility for eMBMS shall be supported in both RRC_IDLE state as well as RRC_CONNECTED state	GR_TSTP_2.3.23_J
2.3.24	Location Services Support The system shall support Cell ID Based Location Support where the cell ID for a specific UE is transferred to MME upon request	GR_TSTP_2.3.24
2.3.25	Location Services Advanced:	Explanatory Only
a	The eNodeB shall support location determination based on Enhanced Cell ID (ECID) by providing the following information	Explanatory Only
a.i	Geographical coordinates of its serving eNB	GR_TSTP_2.3.25_A1
a.ii	Additional UE and radio resource measurements	GR_TSTP_2.3.25_A2
b.i	The eNodeB shall support the OTDOA i. The eNodeB can optionally support Positioning Reference Signal (PRS) to improve the accuracy and performance of the OTDOA methods for location determination by UE	GR_TSTP_2.3.25_B1
2.3.26	Interference Mitigation Requirements	Explanatory only

a	The eNodeB shall support Interference Rejection Combining in its PHY layer receiver for improved performance in interference limited scenarios. (Applicable to Category 1 only)	Undertaking
b	eNodeB shall support maximum-ratio combining (MRC), a method of diversity combining in which the signals from each channel are added together, the gain of each channel is made proportional to the RMS signal level and inversely proportional to the mean square noise level in that channel.	Undertaking
c	The eNodeB shall support coordinated scheduling in downlink &uplink between all cells of the same logical eNodeB whereby interference between neighbour cells is minimized via scheduling of resources in a dynamic and coordinated way	GR_TSTP_2.3.26_C
2.3.27	SON requirements	Explanatory only
a	The eNodeB shall support self-configuration	GR_TSTP_2.3.27_A
b	The eNodeB SON shall support Automatic PCI planning	GR_TSTP_2.3.27_B
c	The eNodeB shall support Automatic Neighbour Relations (ANR) based on UE Measurement Report	GR_TSTP_2.3.27_C
d	The eNodeB shall support power saving functionality	GR_TSTP_2.3.27_D
2.3.28	SON Advanced requirements (Applicable to Category 1)	

a	The eNodeB shall support PCI collision detection and resolution	GR_TSTP_2.3.28_A
b	The eNodeB SON shall support Automatic Root Sequence Index (RSI) allocation for PRACH planning	GR_TSTP_2.3.28_B
c	The eNodeB shall support automated configuration of best neighbor relations for Intra-RAT load management	GR_TSTP_2.3.28_C
d	It shall be possible to black list and exclude neighbors that have a low handover success rate, from the neighbor list	GR_TSTP_2.3.28_D
e	The eNodeB shall support Mobility Robustness Optimization (MRO) related to Too-early, Too-late or Handovers to Wrong Cell	GR_TSTP_2.3.28_E
f	The eNodeB shall support Mobility Load Balancing (MLB)	GR_TSTP_2.3.28_F
g	The system shall support soft lock of cells making it possible to take cells out of traffic with minimal impact on ongoing traffic	GR_TSTP_2.3.28_G
h	The eNodeB shall support Coverage and Capacity optimization features thus ensuring optimum tradeoff between coverage, capacity and quality as well as handling load imbalance	GR_TSTP_2.3.28_H
i	The eNodeB shall support Self-Healing procedures	GR_TSTP_2.3.28_I
j	The eNodeB shall have capability to supervise all cells. It should able to detect sleeping cells and supports self-	GR_TSTP_2.3.28_J

	healing by automatically trying to recover the suspected sleeping cells	
k	The eNodeB shall support micro sleep in the Downlink enabling discontinuous transmission to save energy during low traffic. The TX in the eNodeB shall be able to mute transmission during empty OFDM symbols	GR_TSTP_2.3.28_K
l	The eNodeB shall be able to automatically reconfigure the antenna system from MIMO to SIMO mode and back based on traffic load in the eNodeB order to lower the power consumption	GR_TSTP_2.3.28_L
m	The system shall support advanced monitoring of the antenna system in order to be able to indicate problems related to the antenna system, e.g. mismatched antenna pair Rx diagrams, swapped or disconnected feeders and loss in RF path	GR_TSTP_2.3.28_M
n	The system shall support means to monitor the CPRI link quality	GR_TSTP_2.3.28_N
o	The eNodeB shall support Minimization of Drive Test feature	GR_TSTP_2.3.28_O
2.3.29	Coordinated Multi-Point (CoMP) (Applicable to Category-1 only and optional)	Explanatory only
a	The eNodeB shall Support UL intra-site CoMP	GR_TSTP_2.3.29_A
b	The eNodeB shall Support DL intra-site CoMP	GR_TSTP_2.3.29_B

c	The eNodeB shall support at least one of the following methods:	GR_TSTP_2.3.29_C
C i	Joint Transmission: When two or more Tx point, transmit on a same frequency in the same subframe	
C ii	ii. Dynamic Transmission: When two or more Tx/Rx point ready to transmit but only scheduled from one Tx point in each subframe	
2.3.30	VoLTE, ViLTE Support	
a	The eNodeB shall support creation of dedicated bearers with the following QCIs for carrying different type of traffic associated with the VoLTE Service: QCI-5 for IMS Signaling, QCI-1 for Voice Traffic, QCI-2 for Video Traffic.	GR_TSTP_2.3.30_A1 GR_TSTP_2.3.30_A2 GR_TSTP_2.3.30_A3
b	The eNodeB shall support RLC UM (Unacknowledged Mode) for services that tolerate a higher packet loss rate but require lower latency, e.g. VoLTE.	GR_TSTP_2.3.30_B
c	The eNodeB shall support Robust Header Compression (RoHC).	GR_TSTP_2.3.30_C
d	The eNodeB shall support Single Radio Voice Call Continuity (SRVCC) handover to UTRAN/ GERAN. Voice calls (VoLTE) that have been established over LTE shall be able to continue if the user moves away from LTE coverage to areas with only WCDMA/GSM coverage while still on a call.	GR_TSTP_2.3.30_D
2.3.31	PWS (Public Warning System)	Explanatory only

a	PWS provides a service that allows the network to distribute warning messages on behalf of public authority	GR_TSTP_2.3.31
b	PWS enables the distribution of ETWS	GR_TSTP_2.3.31
2.3.32	eMPS	Explanatory only
a	The eNodeB shall be capable of prioritization of calls (RRC establishment cause highPriorityAccess) by using dedicated resources in admission control during initial access.	GR_TSTP_2.3.32_A
b	The eNodeB shall have capability to prioritize paging messages in overload situations based on a priority provided by the MME.	GR_TSTP_2.3.32_B
2.3.33	Active RAN Sharing	Explanatory only
2.3.33.1	MOCN	
a	The eNodeB shall indicate the support of multiple operator	GR_TSTP_2.3.33_A
b	The eNodeB shall route operator specific traffic to its respective core network	GR_TSTP_2.3.33_B
2.3.34	ePDCCH (Applicable for Category-1 only and optional) The eNodeB shall support Enhanced PDCCH (ePDCCH) capability that enable support of UE specific control signaling. ePDCCH can therefore be used to increase amount of downlink PDCCH capacity since the ePDCCH resource can be scheduled to the UEs	GR_TSTP_2.3.34

	in addition to traditional PDCCH resources.	
2.3.35	Overload handling The eNodeB shall have the capability to support the S1-AP procedures (Overload Start and Overload Stop) that can be used to aid an MME in handling overload situations.	GR_TSTP_2.3.35_A GR_TSTP_2.3.35_B
2.3.36	Features Specific to Category 2	Explanatory only
a	Shal be all outdoor designed preferably pole/tower mounted (not applicable for eNodeB deployed indoor for in-building coverage)	i) Vendor to provide compliance certificate for “Environmental Test Conditions” for Outdoor eNodeB as per Category D of QM333. ii) Vendor to provide undertaking for pole/tower mount design.
b	eNodeB shall be power efficient and implement power saving functionality.	GR_TSTP_2.2.2.2_D GR_TSTP_2.3.27_D
c	Shall be minimum IP65 and shall not require any air-conditioning (not applicable for eNodeB deployed indoor for in-building coverage)	Vendor to provide compliance certificate for “Environmental Test Conditions” for Outdoor eNodeB as per Category D of QM333, IP rating.
2.3.37	eNodeB shall support satellite based backhaul system with following characteristics	Explanatory only
a	Shall be able to support a round trip latency up to 800ms on the satellite	GR_TSTP_2.3.37_A

<table>
<tr><td></td><td>backhaul (S1) interface</td><td></td></tr>
<tr><td>b</td><td>Shall be able to support packet jitter of up to 100ms on the satellite backhaul (S1) interface</td><td>GR_TSTP_2.3.37_B</td></tr>
<tr><td>2.3.38</td><td>System Specifications
<table>
<tr><th>Clause</th><th>Parameter</th><th>Standard</th><th>Notes</th></tr>
<tr><td>1</td><td>Operating Frequency
The Base Station shall be capable of operating in at least one of the frequency bands as per the National Frequency Allocation Plan.</td><td>Applicable National Frequency Allocation Plan</td><td></td></tr>
<tr><td>2</td><td>Channel bandwidth</td><td>Applicable National Frequency Allocation Plan</td><td></td></tr>
</table></td><td>Explanatory only</td></tr>
<tr><td>2.3.38.1</td><td>The additional tolerance for all parameters defined below will be as per 3GPP TS 36.141
These specifications shall be applicable for :
a. integrated eNodeB
b. Split / Distributed architecture eNodeB
c. MSR based eNodeB
d. eNodeB with Active Antenna System</td><td>Explanatory only.

The Vendor to provide undertaking for architecture of eNodeB.</td></tr>
<tr><td>2.3.38.2</td><td>TX Specifications</td><td>Explanatory only</td></tr>
<tr><td>a</td><td>Base station output power</td><td>GR_TSTP_2.3.38.2_A</td></tr>
<tr><td>b</td><td>RE Power control dynamic range</td><td>GR_TSTP_2.3.38.2_B</td></tr>
<tr><td>c</td><td>Total Power dynamic range</td><td>GR_TSTP_2.3.38.2_C</td></tr>
<tr><td>d</td><td>Transmitter OFF power</td><td>GR_TSTP_2.3.38.2_D</td></tr>
<tr><td>e</td><td>Frequency Error</td><td>GR_TSTP_2.3.38.2_E</td></tr>
<tr><td>f</td><td>Error Vector Magnitude</td><td>GR_TSTP_2.3.38.2_F</td></tr>
<tr><td>g</td><td>Time alignment error</td><td>GR_TSTP_2.3.38.2_G</td></tr>
<tr><td>h</td><td>DL RS power</td><td>GR_TSTP_2.3.38.2_H</td></tr>
<tr><td>i</td><td>Occupied Bandwidth</td><td>GR_TSTP_2.3.38.2_I</td></tr>
</table>

j	Adjacent Channel Leakage Power Ratio (ACLR)	GR_TSTP_2.3.38.2_J
k	Operating band unwanted emissions	GR_TSTP_2.3.38.2_K
l	Transmitter spurious emissions	GR_TSTP_2.3.38.2_L
m	Transmitter intermodulation	GR_TSTP_2.3.38.2_M
2.3.38.3	RX Specifications	Explanatory only
a	Receiver spurious emissions	GR_TSTP_2.3.38.3_A
b	Blocking	GR_TSTP_2.3.38.3_B
c	Receiver intermodulation	GR_TSTP_2.3.38.3_C
d	Adjacent Channel Selectivity (ACS) and narrow-band blocking	GR_TSTP_2.3.38.3_D
e	Reference sensitivity level	GR_TSTP_2.3.38.3_E
f	Dynamic range	GR_TSTP_2.3.38.3_F
g	In-channel selectivity	GR_TSTP_2.3.38.3_G
2.4	Dimensioning Requirements	Explanatory only
2.4.1	eNB shall allow subscribers capacity to be pooled between all sectors. Baseband subscriber capacity shall be pooled over all sectors. **(applicable to split architecture)**	GR_TSTP_2.4.1
2.4.2	eNB shall be able to support at least 32 simultaneously scheduled subscribers (up to 8 users per TTI: 4 users in UL and 4 users in DL). A scheduled subscriber has data to be sent in the uplink or downlink and is queued in the scheduler.	GR_TSTP_2.4.2
2.4.3	eNB shall be able to support at least 32 simultaneously connected subscribers. Required number of RRC connected subscriber shall be indicated by the	GR_TSTP_2.4.3

	tenderer	
2.4.4	eNB shall be able to support Omni and multi-sector configurations	GR_TSTP_2.4.4
2.4.5	eNB shall provide VLAN separation for O&M and X2/S1 traffic. Two separate VLANs on a common physical interface	GR_TSTP_2.4.5
2.4.6	For coverage target RSRP shall be as -110dB. However, it may be reviewed in tender requirement	Explanatory Only
3	Home eNodeB (Voice and Data) Home eNodeBs can be used in residential and enterprise deployments. This category maps to the "Home Base Station" category as defined in 3GPP Specification (TS 36.104)	Explanatory Only
3.1	Basic Functional Requirements	
3.1.1	The system shall support self-configuration functionality	Undertaking
3.1.2	The system may support LIPA functionality	
3.1.3	The system shall support mutual authentication with the core network	
3.1.4	The system shall support secure IPSEC communication with core network if communicating over an insecure link	
3.1.5	The system shall provide location information to satisfy various security, regulatory and operational requirements	
3.2	Synchronization	
3.2.1	eNodeB for Home BS TDD systems shall support a phase accuracy in 3GPP	

<table>
<tr><td></td><td>TS 36.133 as specified below
<table>
<tr><td>Cell Type</td><td>Propagation Distance</td><td>Requirement</td></tr>
<tr><td>Small cell</td><td>≤ 500 m</td><td>≤ 3 μs</td></tr>
<tr><td>Large Cell</td><td>> 500 m</td><td>$\leq 1.33 + T_{propagation}$ μs</td></tr>
</table>
</td><td></td></tr>
<tr><td>3.3</td><td>System Specification</td><td>Refer to Clause 2.3.38</td></tr>
<tr><td>4</td><td>IOT
eNodeB can optionally provide IOT service using the LTE-M and/or NB-IOT functionality</td><td>Explanatory Only</td></tr>
<tr><td>4.1</td><td>Basic Functional requirements</td><td></td></tr>
<tr><td>4.1.1</td><td>The system shall support eDRX function in idle mode to provide energy efficiency.</td><td>GR_TSTP_4.1.1</td></tr>
<tr><td>4.1.2</td><td>The system shall support PSM (Power Save Mode) to provide energy efficiency</td><td>Undertaking</td></tr>
<tr><td>4.1.3</td><td>The system shall support “Attach without PDN” allows the UE to be attached without having a Default PDN connection established. SMS is available to UE that has attached without PDN connection</td><td>GR_TSTP_4.1.3</td></tr>
<tr><td>4.1.4</td><td>The system shall support control plane optimization to transport user data within signaling on the access network until the MME</td><td>Undertaking</td></tr>
</table>

4.1.5	The system shall support user plane optimisation to transfer on the user plane data without the need for using the Service Request procedure to establish the Access Stratum (AS) when the user is in ECM-IDLE mode	Undertaking
4.2	Specific Requirements	
4.2.1	LTE-M Requirements	
4.2.1.1	The system shall support Cat M1 capability of operating in bandwidth of 1.4 MHz (6 PRBs), a single antenna, half-duplex and full duplex operation and lower peak rate	GR_TSTP_4.2.1.1
4.2.1.2	The system shall support Cat M capability in LTE eNodeB in co-existence with existing functionality	GR_TSTP_4.2.1.2
4.2.1.3	The system shall support coverage enhancements mode A.	Undertaking
4.2.2	NB-IOT Requirements	
4.2.2.1	The system shall support at least one of the NB-IOT deployment modes defined in 3GPP: in-band, guard-band and stand-alone	Undertaking
4.2.2.2	The system shall support Half Duplex FDD UE (Applicable to FDD system only)	Explanatory Only
4.2.2.3	The system shall support narrow band	**GR_TSTP_4.2.2.3**

	physical uplink channel on single-tone (15 kHz or 3.75 kHz) or multi-tone (n*15 kHz, n up to 12)	
5	Public Safety eNodeB shall support public safety service	Explanatory Only
5.1	Basic Functional Requirements	Explanatory Only
5.1.1	The system shall support PWS as defined in section 2.3.31	GR_TSTP_2.3.31
5.2	Advanced Functionality (Applicable to Category-1 only and Optional feature)	Explanatory Only
5.2.1	The eNodeB shall support ProSe/D2D for public safety using the PC5 side link channel and/or E-UTRA air interface	Undertaking
a.	The system shall support discovery	
b.	The system shall support one to one communication	
c.	The system shall support one to many communications	
d.	The system shall support group communication	
e.	The system shall support broadcast communication to all ProSe capable UEs within the transmission range	
f.	The system shall support relay functionality where a given ProSe capable UEs acts as a communication relay for one or more UEs	
g.	The system shall support in-network	

	coverage, partial in-network coverage and out of coverage scenarios	
h.	The system shall support both scheduled and autonomous resource allocation modes	
5.2.2	The eNodeB shall support MCPTT	**GR_TSTP_5.2.2**
a.	The system shall support access control mechanisms: Access Class Barring, Service Specific Access Control, Access control for CSFB, Extended Access Class barring	Undertaking
b.	The system shall support ARP (Allocation and Retention Priority) parameters of priority level, the pre-emption capability and the pre-emption vulnerability during bearer establishment	
c.	The system shall support QOS based scheduling	
d.	The system shall support on network operation using either dedicated EPS bearers or MBMS bearers	
e.	The system shall support off network operation using ProSe Discovery and the ProSe Communication path for MCPTT Users using Public Safety ProSe-enabled UEs as a direct communication between UEs	
5.2.3	The system shall support IOPS (Isolated E-UTRAN Operation for Public Safety)	

	Establish a stand-alone mobile LTE MCPTT network to provide local PTT communication and data coverage without backhaul connection to the centralized macro core. IOPS assumes that local EPC function is co-sited with eNodeB	
6	V2X eNodeB can optionally provide V2X service (applicable to Category 1 only)	Explanatory only
6.1	Functional Requirements	
6.1.1	The system shall support ProSe/D2D for V2X using the PC5 side link channel or E-UTRA air interface	Undertaking
6.1.2	The system shall support discovery	
6.1.3	The system shall support one to one communication	
6.1.4	The system shall support in-network coverage scenario	
6.1.5	The system shall support 4 DMRS symbols per sub frame on the PC5 interface	
6.1.6	The system shall support one Tx-Rx turnaround symbol at the end of each subframe on the PC5 interface	
6.1.7	The system shall support deployment configuration 1 and/or deployment configuration 2 for resource scheduling	

	and interference management	
7	General Requirements	Explanatory Only
7.1	General	Explanatory Only
7.1.1	LTE provides users a facility for high speed data & voice. The system shall have facilities for automatic roaming, locating and updating mobile subscribers.	GR_TSTP_7.1.1
7.1.2	The operation of the equipment shall be in the frequency band allotted.	Undertaking
7.2	Support of Multiple Equipment Vendors as per tender requirement The system shall support the possibility of using equipment and sub-systems of different vendors like EPC, HSS, PCRF etc. as per defined industry standards, wherever relevant	Vendor to submit undertaking
7.3	Hardware	Explanatory Only
7.3.1	The system hardware shall be modular in design and shall permit growth in steps. The arrangement shall be such that failure/ deterioration of service shall not occur when implementing the growth.	Undertaking
7.3.2	Design precautions shall be taken to minimise 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_7.3.2
7.3.3	The system hardware shall not pose any problem, due to changes in date	GR_TSTP_7.3.3

	and time caused by events such as changeover of leap year etc., in the normal functioning of the system.	
7.4	Processors	Explanatory Only
7.4.1	Provision shall be made to prevent the loss/alteration of memory contents due to power failures, improper operating procedures and the procedure for restoring the system to its normal state, etc.	GR_TSTP_7.4.1
7.5	Input-Output devices	Explanatory Only
7.5.1	The communication facilities provided for exchange of information between the elements of LTE-RAN and the maintenance and operating personnel shall include facilities for a system test, control and alarm indication at OMC.	GR_TSTP_7.5.1
7.5.2	Input / output terminals shall be capable of transmitting/ receiving characters of a subset of the ITU-T No.5 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_7.5.2
7.5.3	Adequate number of man-machine interfaces shall be available.	GR_TSTP_7.5.3
7.5.4	If provision is made for monitoring from a remote terminal, it shall be ensured that the data links conform to the ITU-T Recommendations Q.513. Care shall	GR_TSTP_7.5.4

	be taken that the reliability of the data links towards remote terminal does not, in any way, affect the reliability of the LTE-RAN. Special provision shall also be made for storage of failure event even when the system is unable to transmit an output message.	
7.5.5	A suitable alarm and display system at OMC shall be provided for a continuous indication of the system status.	GR_TSTP_7.5.5
7.6	Equipment Practice	Explanatory Only
7.6.1	For a Distributed eNodeB, 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.	
7.6.2	The equipment shall have natural cooling arrangement which shall not involve any forced cooling, such as by using fans etc., either inside or outside the equipment. However, in case this is unavoidable and the fans are to be used, these shall be DC operated and shall not impact on the MTBF of the equipment.	GR_TSTP_7.6.2
7.6.3	For a Distributed eNodeB, it shall be indicated whether printed board connectors are of edge-type or plug-	Undertaking

	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.	
7.6.4	All components and material used in the equipment shall be non-inflammable or in absence of it, self-extinguishable. They shall be fully tropicalised.	GR_TSTP_7.6.4
7.6.5	For a Distributed eNodeB, the method used for connection of permanent wiring outside the printed cards shall be indicated.	Undertaking
7.6.6	The buses, if any, shall be suitably protected against electrical and magnetic interference from neighbouring systems (like electromechanical systems, fluorescent tubes, motors, etc.).	Refer Clause 8.7 of GR
7.6.7	For a Distributed eNodeB, the different plug-in cards shall have suitable mechanical safeguards to prevent damage due to accidental interchange of cards.	Undertaking
7.6.8	The requirement at the external interface against induced voltages and currents due to lightning, high power system, etc. shall be indicated.	GR_TSTP_7.6.8
7.6.9	The system shall provide for human isolation and protection from accidental	GR_TSTP_7.6.9

	high voltage power contact.	
7.7	Quality Requirements	Explanatory Only
7.7.1	The components used shall be available from multiple sources with adequate qualification. Number of proprietary components used shall be minimum. List of such components shall be indicated.	GR_TSTP_7.7.1
7.7.2	All the equipment shall have a tropical finish and coated to protect against saline atmosphere.	GR_TSTP_7.7.2
7.8	Software	Explanatory Only
7.8.1	The software shall be written in a High Level Language. The software shall be modular and structured.	Undertaking
7.8.2.1	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_7.8.2.1
7.8.2.2	The functional modularity of the software shall permit introduction of changes wherever necessary with least impact on other modules.	Undertaking
7.8.2.3	It shall be open-ended to allow addition of new features.	Undertaking
7.8.2.4	Adequate flexibility shall be available to easily adopt changes in service features & facilities and technological evolution in hardware.	Undertaking
7.8.2.5	The design shall be such that propagation of software faults is contained.	Undertaking

7.8.2.6	Test programs shall include fault tracing for detection and localization of system faults.	GR_TSTP_7.8.2.6
7.9	Software Maintenance	Explanatory Only
7.9.1	All software updates, for a period as specified, shall be supplied on continuing basis. These updates shall include new features and services and other maintenance updates.	Undertaking
7.9.2	Integration of software updates without posing any problem to the existing functionality shall be possible.	Undertaking
7.10	eNode B DoS (Denial of Service) Attack Protection	GR_TSTP_7.10.1
7.10.1	The eNode shall provide the protection against DOS attack.	GR_TSTP_7.10.1
8	Operational, Reliability, Quality, EMI/ EMC, Safety Requirements	Explanatory Only
8.1	System Radio Operating Environments	Explanatory Only
8.1.1	System supervision	Explanatory Only
8.1.1.1	Provision shall be made for continuous testing of the system to allow both system qualities check and fault indication as a fault arises.	GR_TSTP_8.1.1.1
8.1.1.2	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_8.1.1.2
8.1.2	Relative UE speed The targeted relative speed between	GR_TSTP_8.1.2

	the eNB and the mobile stations may be chosen from the following categories Stationary (0 km/h) Pedestrian (up to 10 km/h) Typical vehicular (up to 100 km/h) High speed vehicular (up to 120 km/h) – If required as per tender High Speed train (up to 300 km/h) – If required as per tender	
8.2	System and Network Management	Explanatory Only
8.2.1	Facility shall be available for introduction of centralized maintenance control (OMC).	GR_TSTP_8.2.1
8.2.2	The maintenance spares supplied shall take into account the MTBF and MTTR	GR_TSTP_8.2.2
8.3	Diagnostic capability	Explanatory Only
8.3.1	The diagnostic capability of the system shall be such as to minimize the human efforts required. The diagnostic programs which are normally resident in the on line program shall be indicated. Details of the off-line diagnostic programs shall be given. The procedure for invoking such programs shall be described. The procedure for consulting fault dictionary for diagnostic programs shall be made available.	GR_TSTP_8.3.1
8.3.2	The system shall provide facility for automatic restart under severe fault conditions. Where automatic restart fails to restore system sanity, facility shall be provided for manual restart of	GR_TSTP_8.3.2

	the system.	
8.4	Environmental Test Conditions a. Indoor eNodeB: Category A SD: QM-333 b. Outdoor eNodeB, BBU & RRH: Category D SD: QM-333 and IP65 c. Antenna & Feeders: Category E as per SD: QM-333	GR_TSTP_8.4
8.5	Qualitative Requirements (QR)	Explanatory Only
8.5.1	The supplier/manufacturer shall conform to ISO 9001:2008 certifications. A quality plan describing the quality assurance system followed by the manufacturer shall be required to be submitted.	GR_TSTP_8.5.1
8.5.2	For a Distributed eNodeB, the failure of any component/sub-system in the system shall not result in the failure of complete system.	GR_TSTP_8.5.2
8.6	eNodeB Safety Requirements: 1. The equipment shall conform to IS 13252 part 1:2010- “Information Technology Equipment – Safety- Part 1: General Requirements” [equivalent to IEC 60950-1 {2005} “Information Technology Equipment –Safety- Part 1: General Requirements”; Amendment 2:2013 Or IEC 62368-I:2014 2. IEC 60215 (1987)) Safety requirements of radio transmitting equipments (for Radio equipments only)	GR_TSTP_8.6
8.7	eNodeB Electromagnetic Compatibility	GR_TSTP_8.7_1

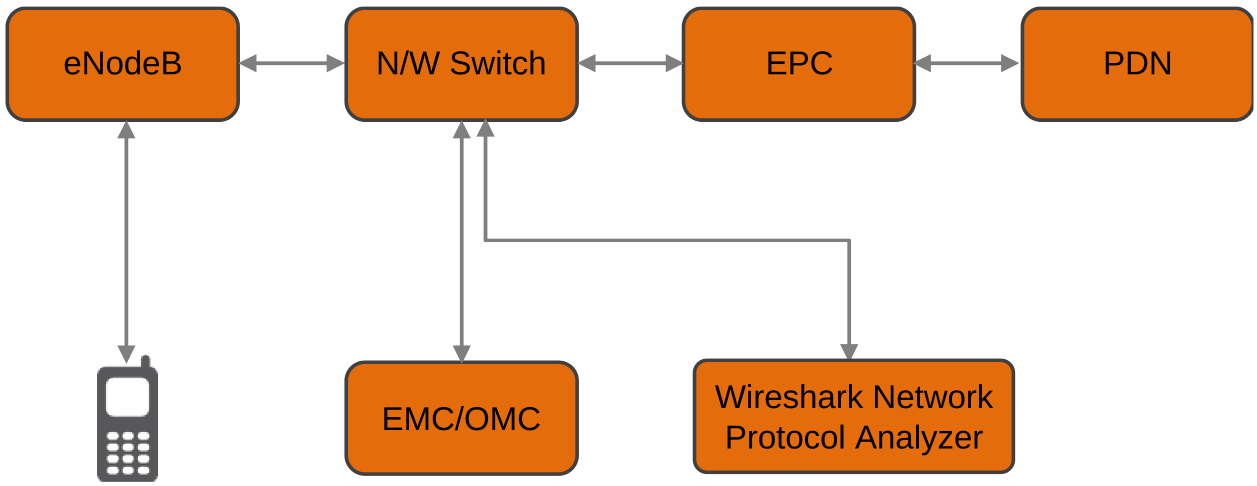
	(EMC) (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)	GR_TSTP_8.7_2 GR_TSTP_8.7_3 GR_TSTP_8.7_4 GR_TSTP_8.7_5 GR_TSTP_8.7_6 GR_TSTP_8.7_7 GR_TSTP_8.7_8 GR_TSTP_8.7_9 GR_TSTP_8.7_10

[Add as per requirement]

** Physical Check/Declaration/Documentation/ Report from Accredited test lab/ Functional verification / Information / Test No.*

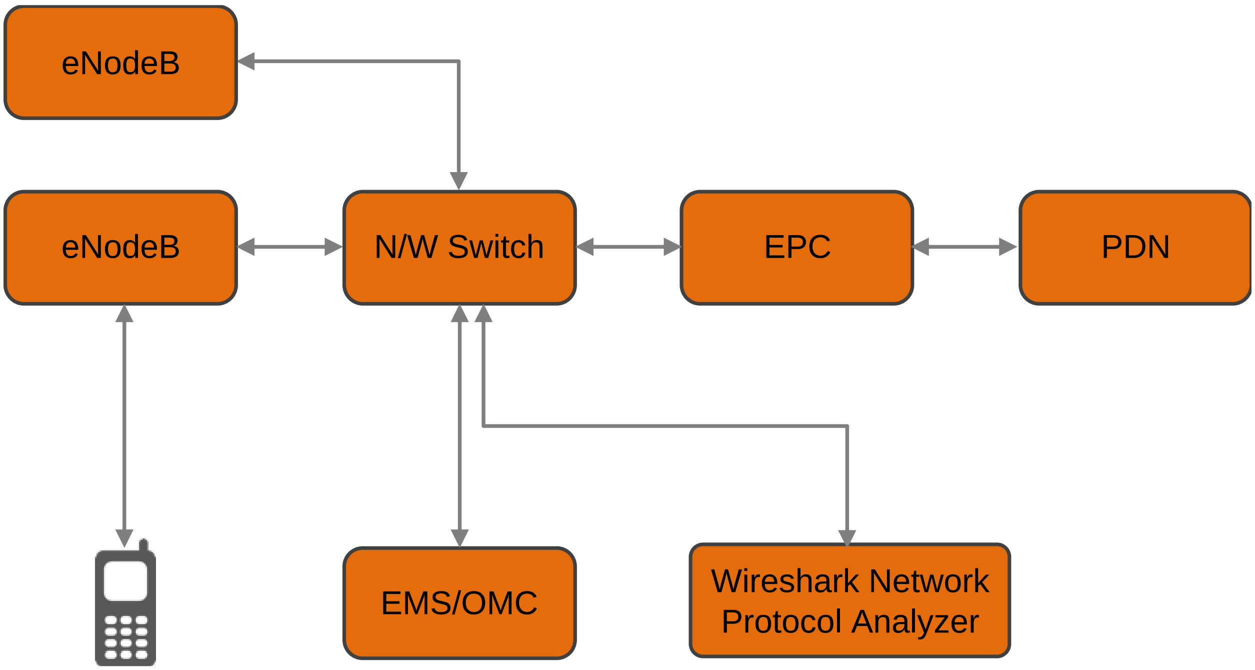
TEST SETUP 1

This setup represents single eNodeB connected to 4G core network



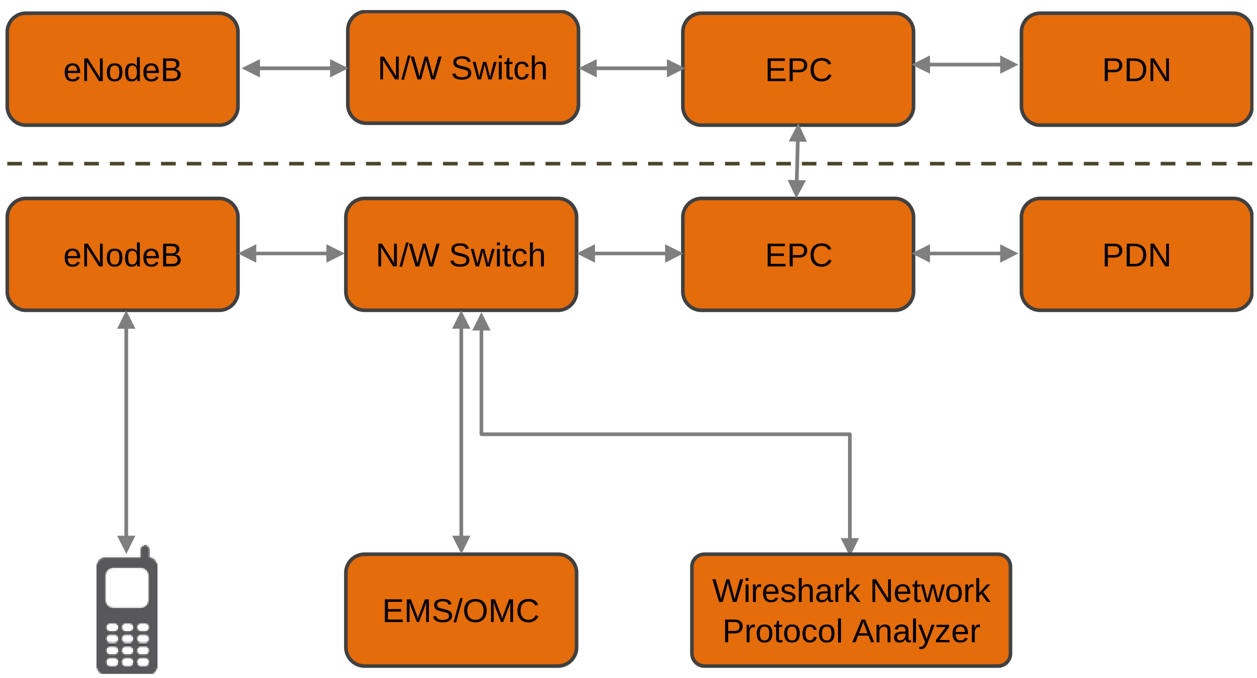
TEST SETUP 2

This setup represents two eNodeBs connected to 4G core network (for Intra LTE Intra MME handover).



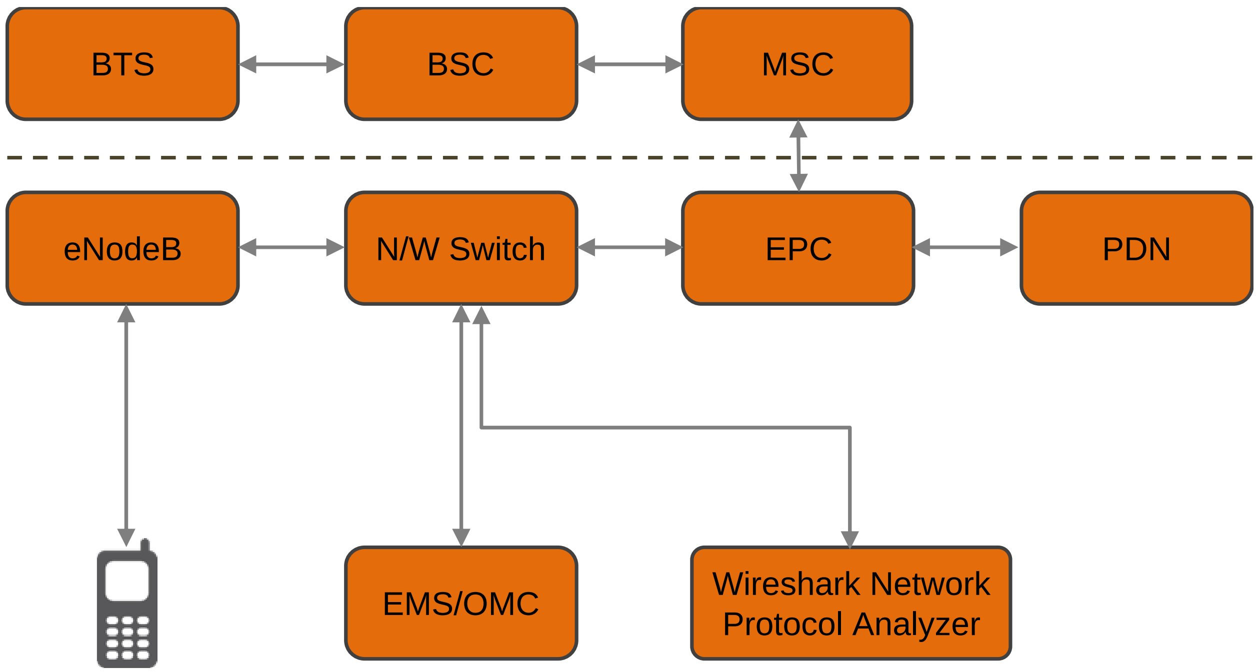
TEST SETUP 3

This setup represents two eNodeBs connected to 4G core network, each eNodeB connected to different EPC (for Intra LTE Inter MME handover).



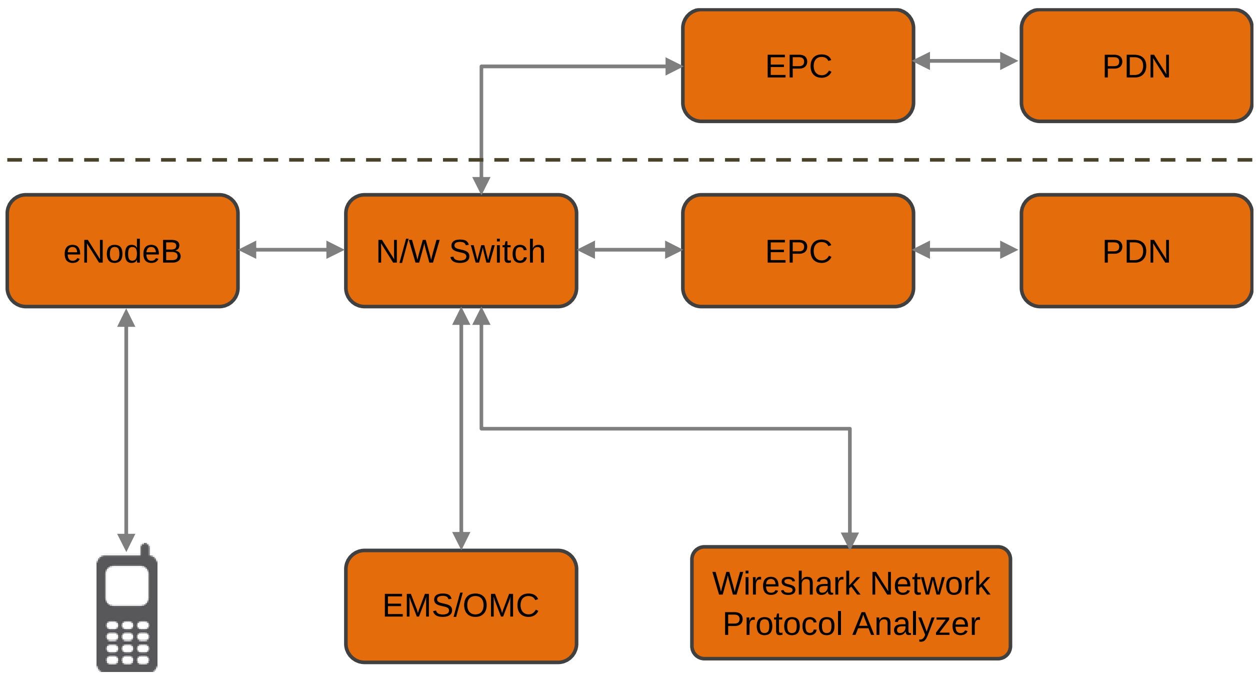
TEST SETUP 4

This setup represents one eNodeB connected to 4G core network and one BSS connected to MSC (For Inter RAT Handover i.e. for E-UTRAN to GERAN handover).



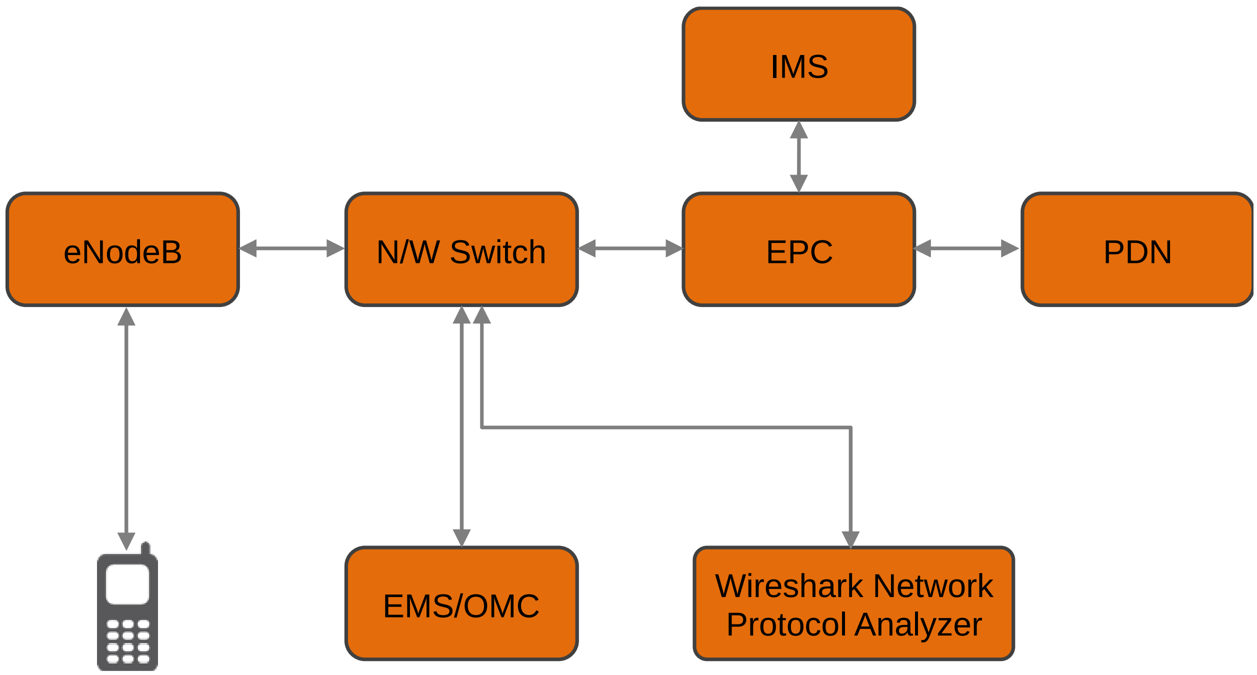
TEST SETUP 5

This setup represents one eNodeB connected to multiple EPC (for S1 flex)



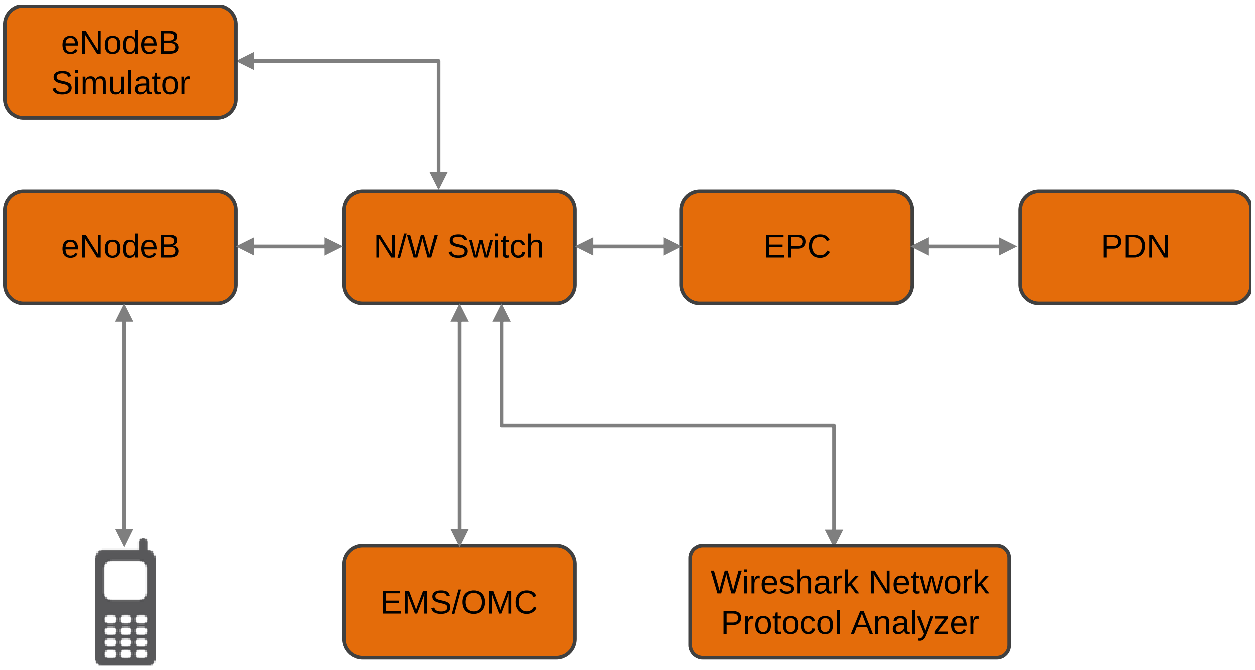
TEST SETUP 6

This setup represents VoLTE/ViLTE setup. EPC is connected to IMS.



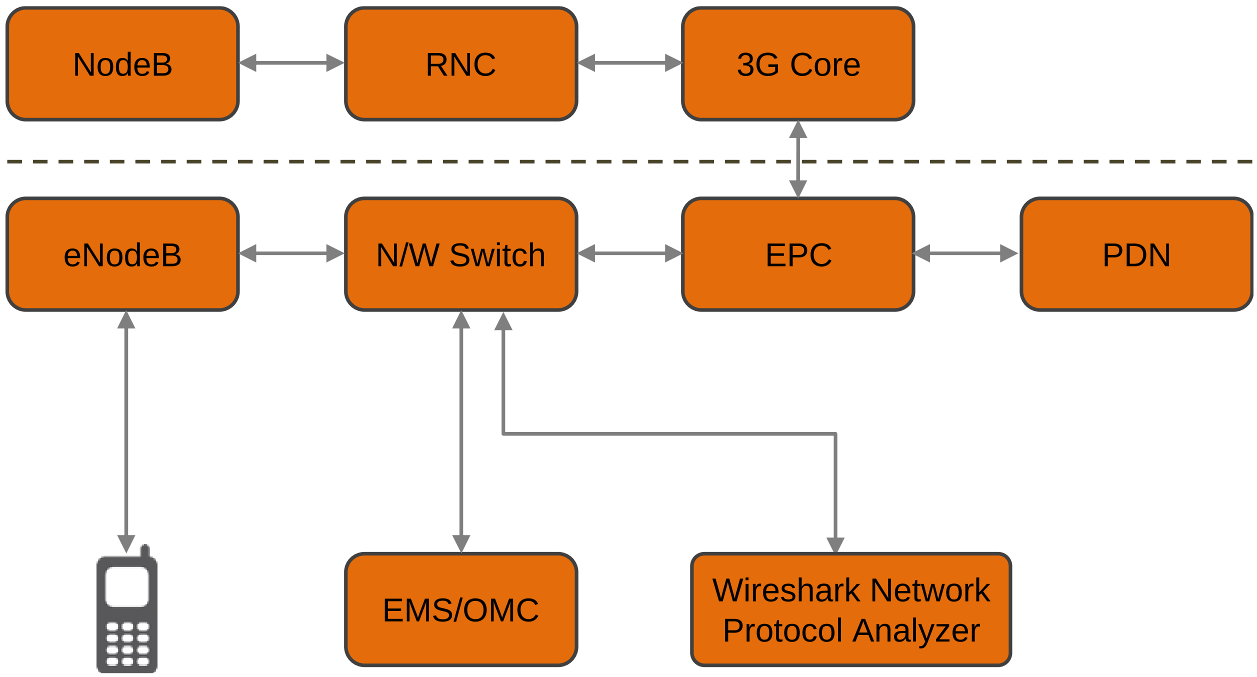
TEST SETUP 7

This setup represents two eNodeBs connected to 4G core network such that one is real eNodeB and the other is an eNodeB simulator.



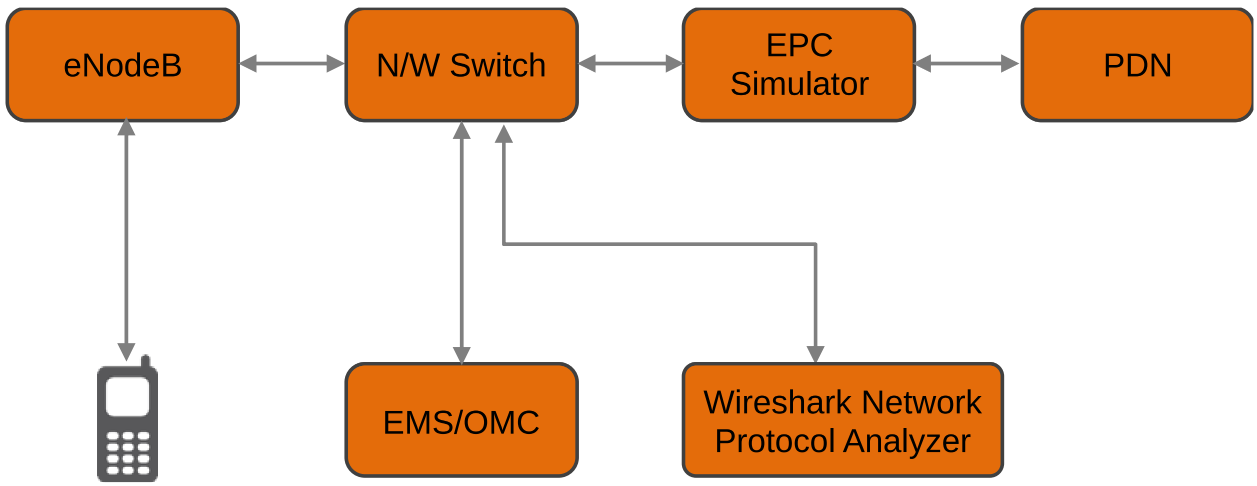
TEST SETUP 8

This setup represents one eNodeB connected to 4G core network and one RNC connected to 3G core network (For Inter RAT Handover i.e. for E-UTRAN to UTRAN handover).



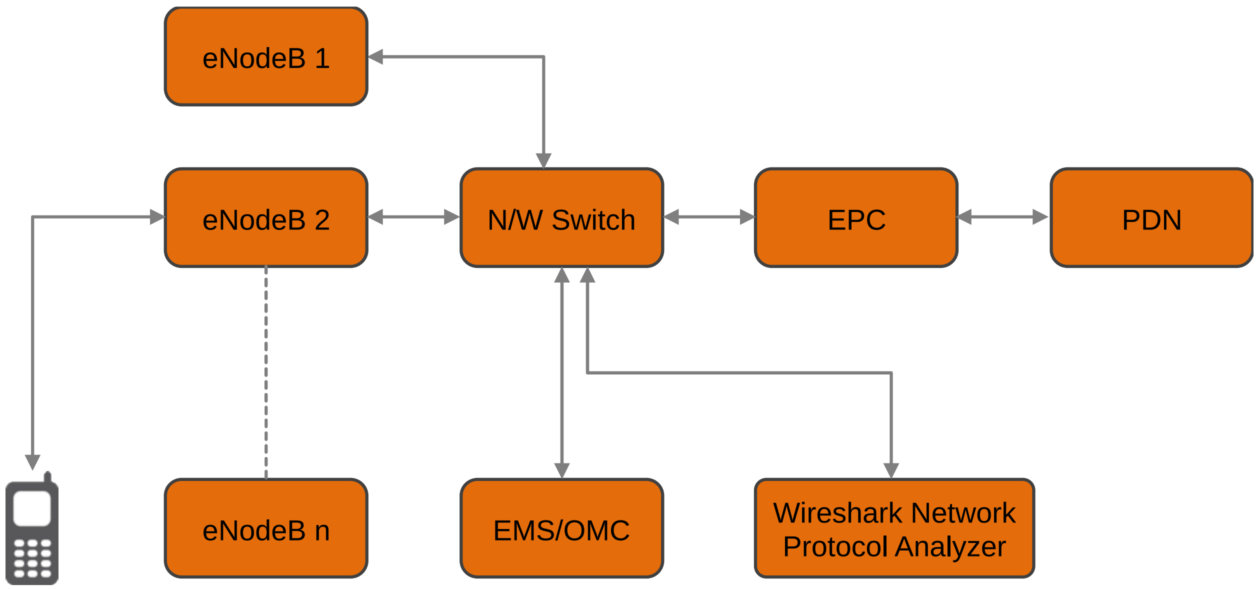
TEST SETUP 9

This setup represents one eNodeB connected to EPC simulator.

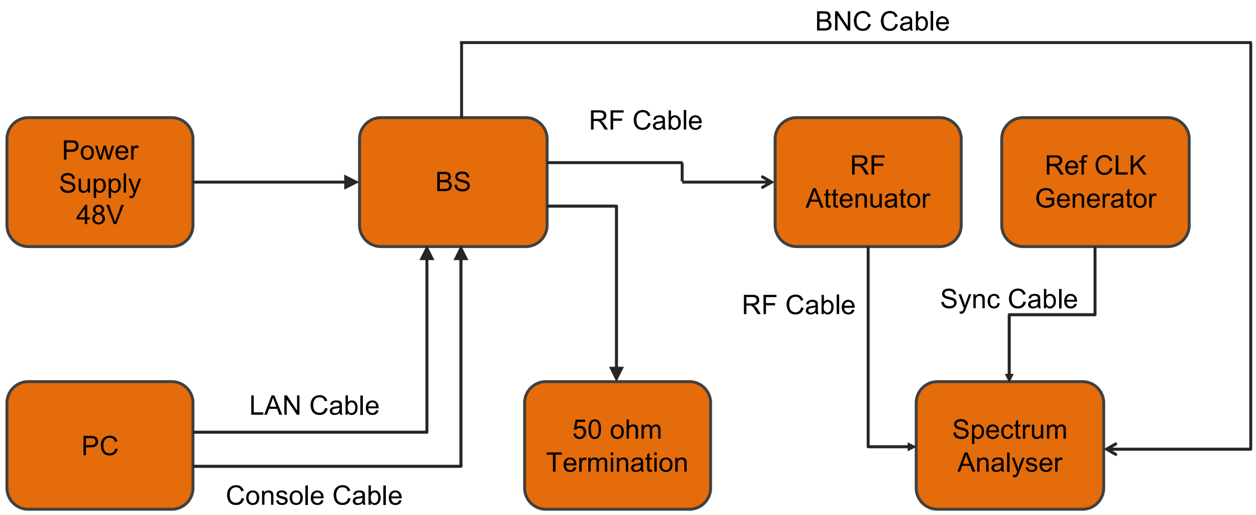


TEST SETUP 10

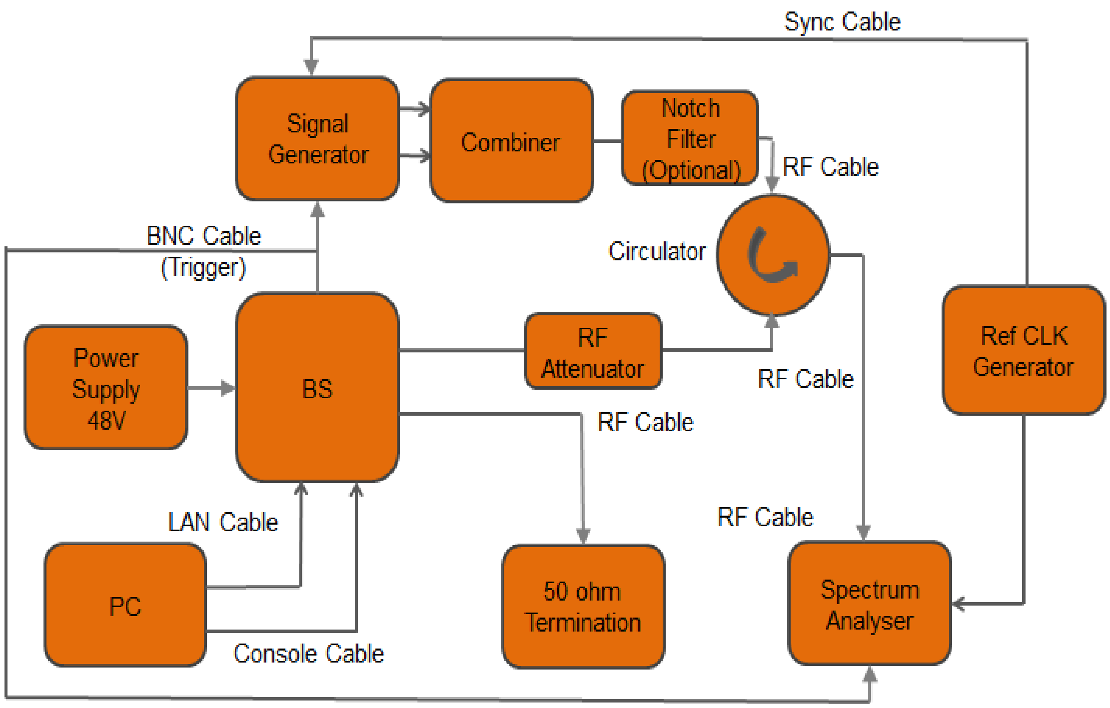
This setup represents multiple eNodeBs connected to EPC.



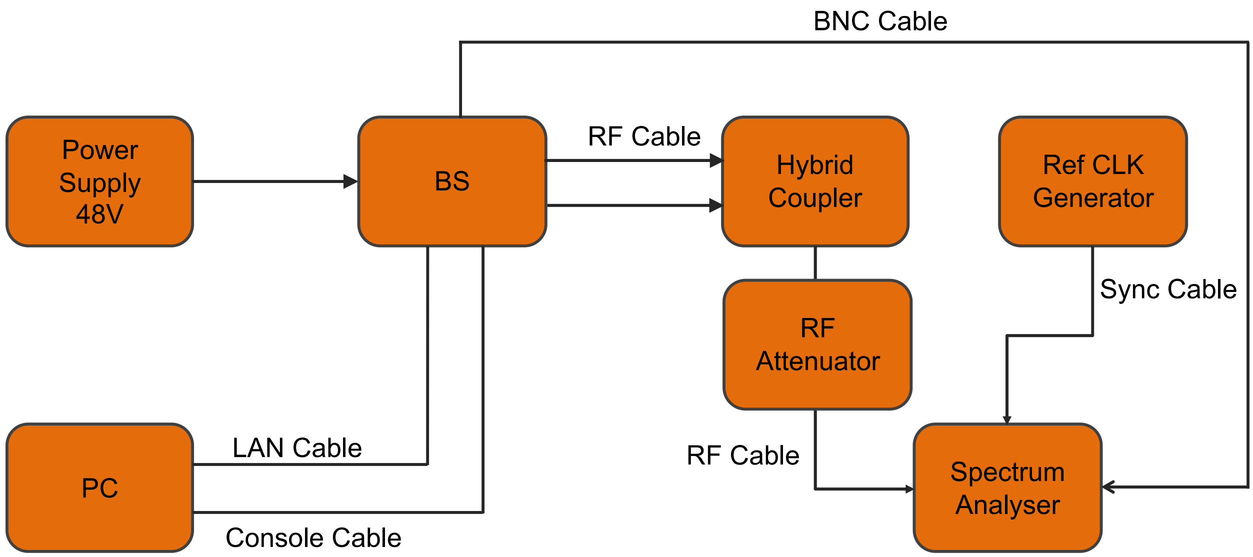
TEST SETUP 11



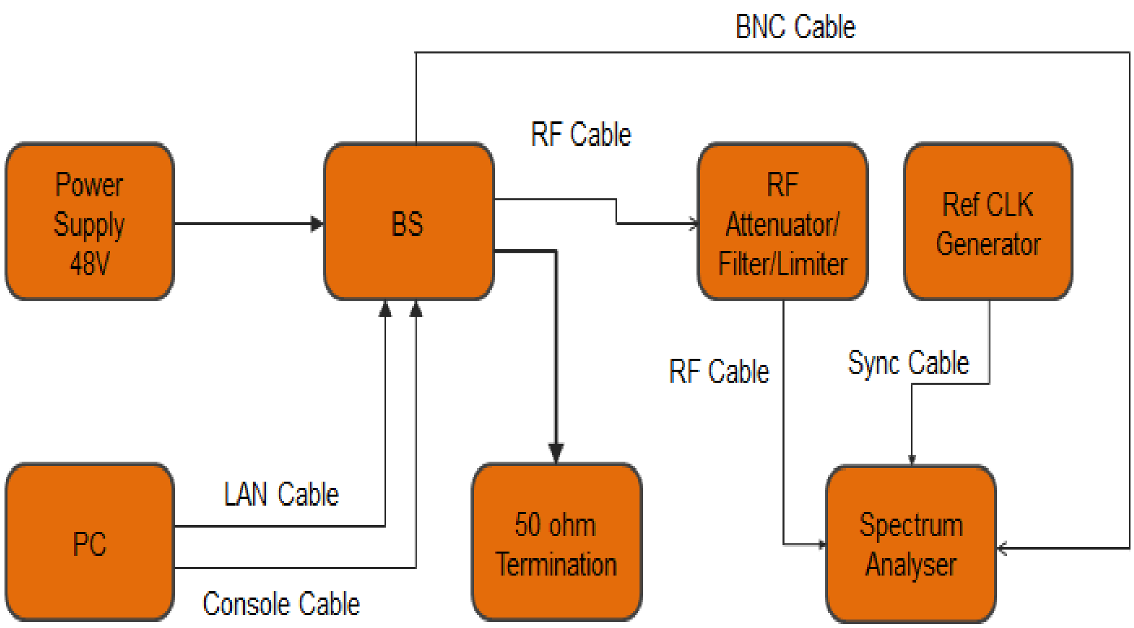
TEST SETUP 12



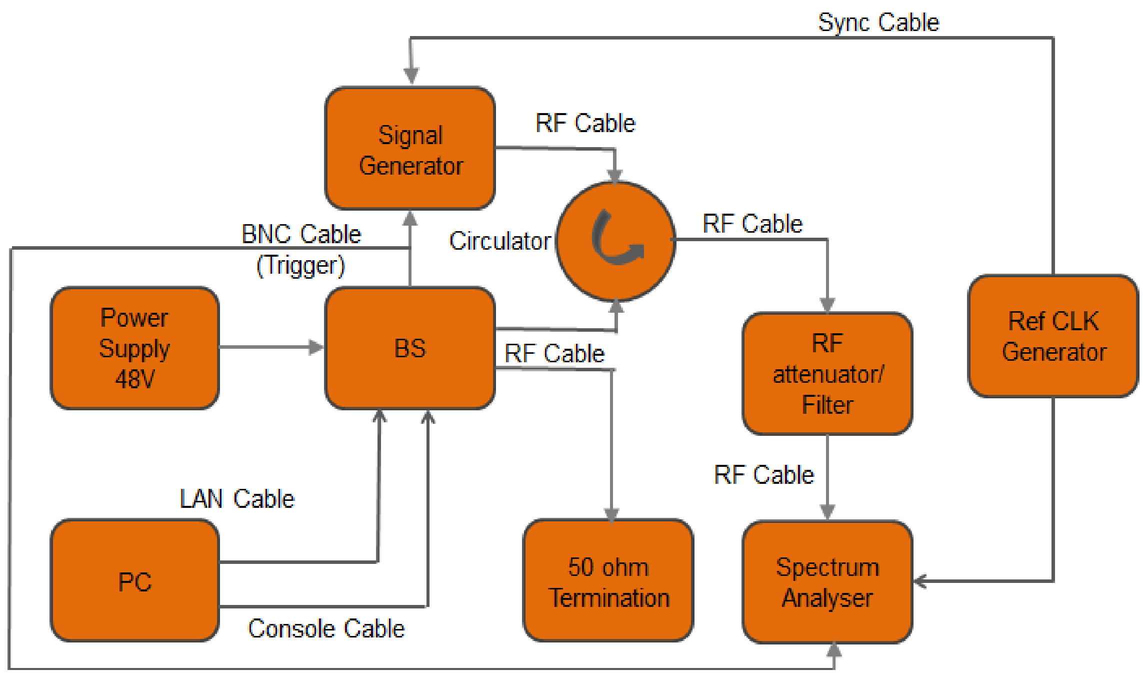
TEST SETUP 13



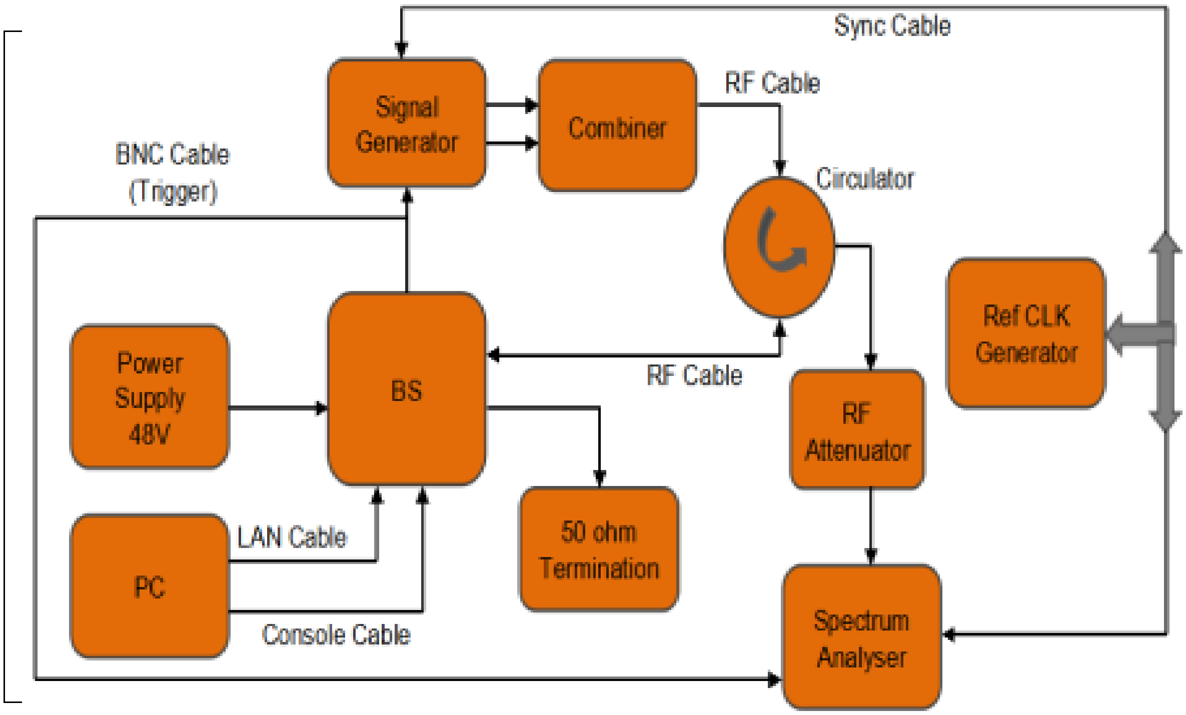
TEST SETUP 14



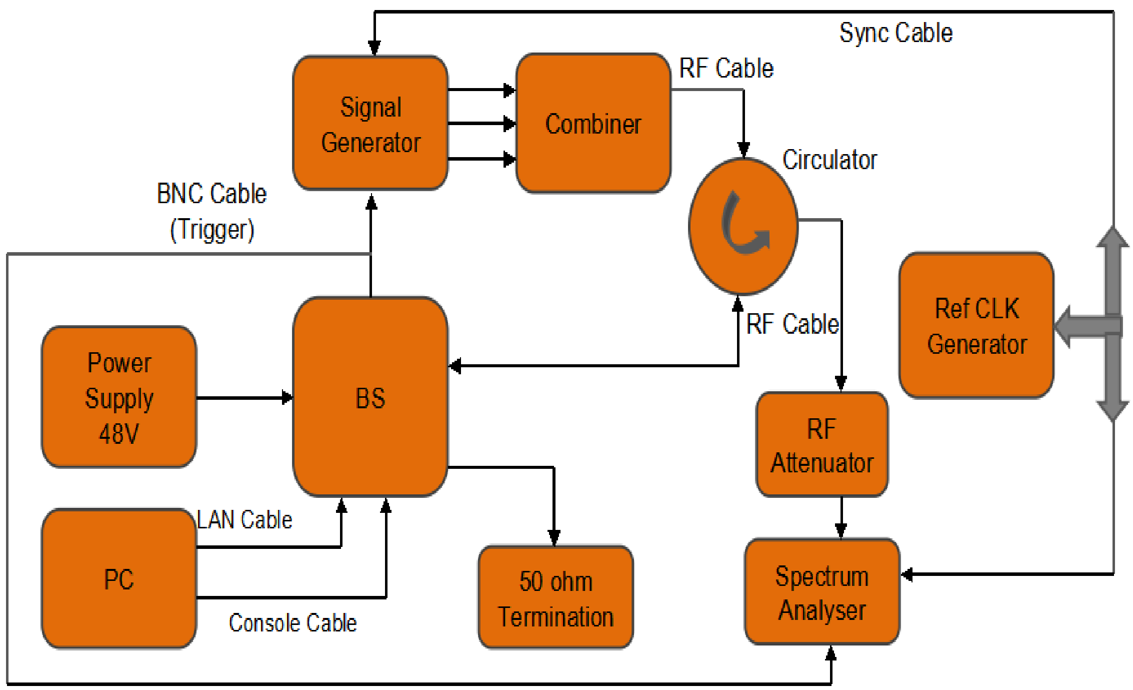
TEST SETUP 15



TEST SETUP 16



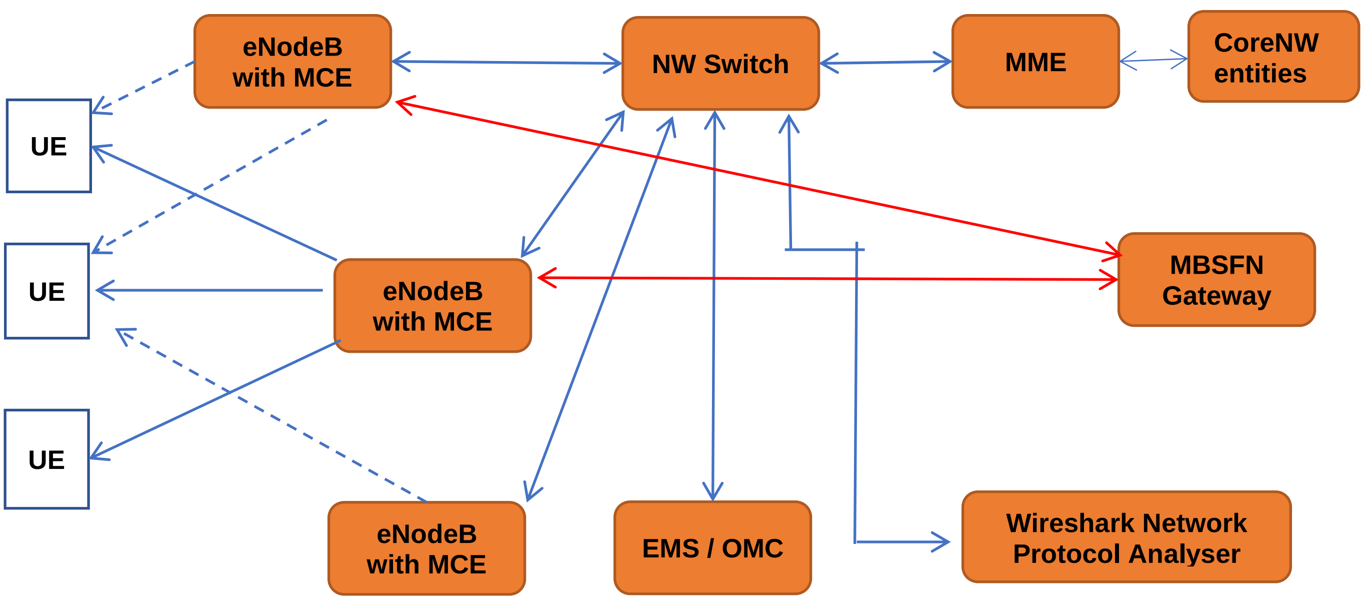
TEST SETUP 17



TEST SETUP 18

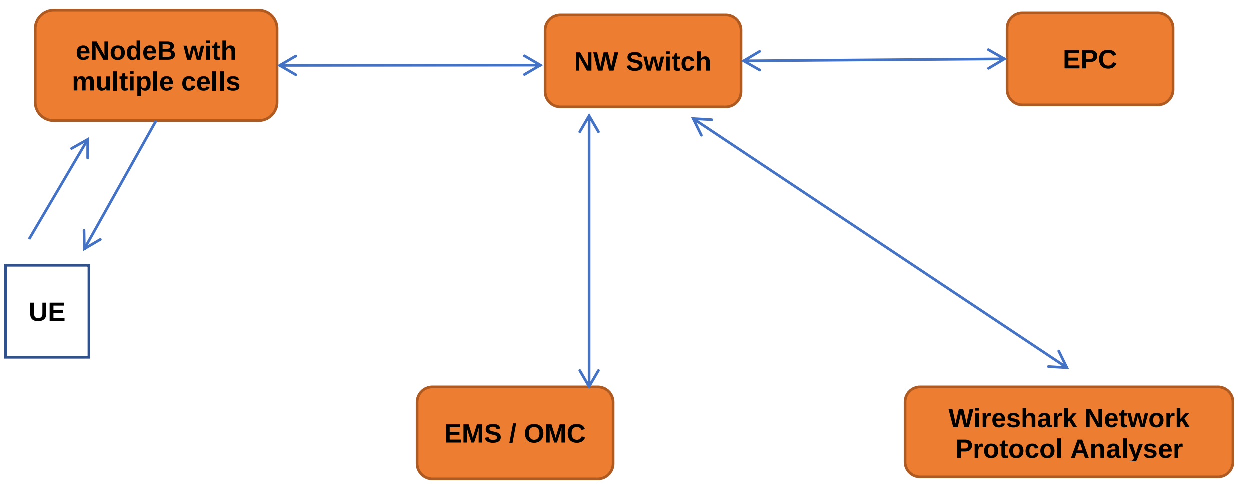
This setup represents multiple eNodeBs with MCE connected to 4G core network and MBSFN Gateway

(Multiple eNodeBs can be part of this setup. Three eNodeBs are taken as an example)



TEST SETUP 19

This setup represents eNodeB having multiple cells.



TEST SETUP & PROCEDURES:

1.	Test No.	**GR_TSTP_2.2.2.2_C**
2.	Test Details	To verify maximum RF transmit power of eNodeB i. Macro Cell - up to 2 x 10W -250W ii. Micro Cell - up to 2 x 5W – 130W, 2 x 2W – 75W, 2 x 1W – 60W iii. Pico Cell - up to 2 x 250 mW – 40W
3.	Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.
4.	Test Setup	Test Setup 11
5.	Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.2.4.2 of 3GPP36.141
6.	Test Limits	≤ Declared BS Power ± 2.7 dB, f ≤ 3.0GHz ≤ Declared BS Power ± 3.0 dB, 3.0GHz < f ≤ 4.2GHz
7.	Expected Results	Declared BS power must be with-in test limits.

1. Test No.	**GR_TSTP_2.2.2.2_D**
2. Test Details	To verify Maximum electric power consumption of eNodeB i. Macro Cell - up to 2 x 10W -250W ii. Micro Cell - up to 2 x 5W – 130W, 2 x 2W – 75W, 2 x 1W – 60W iii. Pico Cell - up to 2 x 250 mW – 40W
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser, Digital Power Supply
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure eNodeB to transmit maximum RF power with two chains enabled 2. Use suitable RF attenuators 3. Ensure all components of eNodeB are present (e.g., RRH in case of split architecture) 4. Laptop, other test tools are excluded from power consumption measurement 5. Bring eNodeB in operationally enabled state. 6. Configure EnodeB for 100 % PRB Allocation 7. Measure power consumption over a period of 1 hour with full load (100% RB consumption) using digital Power Supply Instrument. 8. Use observation that has maximum power consumption 9. Add 25% for eNodeB requiring external climate control
6. Test Limits	
7. Expected Results	1. Macro Cell - up to 2 x 10W - 250W 2. Micro Cell - up to 2 x 5W – 130W, 2 x 2W – 75W, 2 x 1W – 60W 3. Pico Cell - up to 2 x 250 mW – 40W

1. Test No.	**GR_TSTP_2.3.1.1**
2. Test Details	To verify that eNodeB owns and controls its radio resources. The radio resources are granted in order of request by MMEs.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser
4. Test Setup	TEST SETUP 5
5. Test Procedure	1. Configure two S1-MME interface towards MMEs from eNodeB. 2. Configure Relative MME Capacity for both MMEs. 3. Verify relative MME capacity from S1SetupResponse. 4. Perform attach from 2 UEs 5. Verify UE logs for allocation of radio resources 6. UE's shall be attached as per the Relative MME capacity. 7. Verify through Wireshark logs that resources are allocated in an ordered fashion
6. Test Limits	NA
7. Expected Results	eNodeB shall allocate resources as in the order requested by UE and MME.

1.	Test No.	**GR_TSTP_2.3.1.2**
2.	Test Details	To verify that the eNodeB shall support Event-triggered measurement reporting in case of Intra LTE - Intra Frequency Handover.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Configure event triggered measurement reporting parameters at eNodeB. Ensure that the 2 eNodeBs are in operationally enabled state. 2. Perform UE attach on first eNodeB. Through UE logs, verify the RRC connection reconfiguration message sent after the completion of security procedure. Check that the eNodeB configures different events A1, A2, A3, A4 etc 3. Move the UE from first eNodeB towards the second eNodeB such that the UE gets better coverage from the potential target eNodeB 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	eNodeB shall configure UE with different events for measurement reporting.

1. Test No.	**GR_TSTP_2.3.1.3**
2. Test Details	To verify that eNodeB supports system information broadcast
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure eNodeB with System Information Broadcast parameters. Ensure that the eNodeB is operationally enabled. 2. Power on a user equipment 3. Verify through UE logs that the eNodeB is transmitting configured system information.
6. Test Limits	NA
7. Expected Results	The eNodeB shall broadcast system information as per configuration.

1.	Test No.	**GR_TSTP_2.3.1.4**
2.	Test Details	To verify that eNodeB supports signaling radio bearer including SRB0, SRB1 and SRB2
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), 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: i. SRB0 is mapped to CCCH in UL and DL. (RRC Connection Request and RRC Connection setup) ii. 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.) iii. 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 signaling bears SRB0, SRB1 and SRB2.

1.	Test No.	**GR_TSTP_2.3.2.1**
2.	Test Details	To verify Control and User Plane security: eNodeB shall support the ciphering of user plane data over the radio interface and integrity protection of RRC signaling.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify through UE logs that ciphering procedure is successful.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall support ciphering and integrity protection procedures on radio interface.

1.	Test No.	**GR_TSTP_2.3.2.2**
2.	Test Details	To verify that eNodeB stores one-to-one mapping between data radio bearers and S1 bearers in both the uplink and downlink to enable Quality of Service (QoS) enforcement.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Create multiple bearers. 4. Verify from UE logs that multiple bearers are created successfully. 5. Verify through UE logs and Wireshark logs that data sent on a radio bearer is mapped to corresponding S1 bearer.
6.	Test Limits	NA
7.	Expected Results	eNodeB shall maintain one-to-one mapping among radio bearers and S1 bearers.

1. Test No.	**GR_TSTP_ 2.3.3.1**
2. Test Details	RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify concatenation and segmentation meets all RLC mode requirements from UE analyser tool.
6. Test Limits	NA
7. Expected Results	The RLC layer shall support segmentation and concatenation functionality.

1. Test No.	GR_TSTP_ 2.3.4.1
2. Test Details	To verify that eNodeB shall be able to handle the shared and random access channels used for signalling and initial access.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify eNodeB shall be able to handle the shared channels used for signaling. 4. Verify eNodeB shall be able to handle random access channel used for initial access.
6. Test Limits	NA
7. Expected Results	a) eNodeB shall be able to handle the shared channels used for signaling. b) eNodeB shall be able to handle random access channel used for initial access.

1. Test No.	GR_TSTP_ 2.3.4.2
2. Test Details	To verify that eNodeB shall support HARQ functionality
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL data. 4. Verify HARQ ACK/NACK is received every 4 sub frames in FDD or in next available UL transmission in TDD. 5. Verify HARQ process ID and RV is allocated in PDCCH for DL. 6. Start UL data. Verify HARQ ACK/NACK for UL data is received after 4 sub frames on PHICH channel for FDD or in next available UL transmission in TDD. 7. Verify RV and MCS used in UL re-transmissions is as per UL HARQ mode applicable. Also verify from UE analyser tool. 8. Verify at max, 8 HARQ processes are used FDD. 9. Verify appropriate number of HARQ processes are used according to the TDD configuration used for TDD.
6. Test Limits	NA
7. Expected Results	HARQ ACK/NACK is received every 4 sub frames in FDD or in next available UL transmission in TDD. HARQ process ID and RV is allocated in PDCCH for DL. RV is allocated in UL Grant for UL. at max, 8 HARQ processes are used FDD. appropriate number of HARQ processes are used according to the TDD configuration used for TDD.

1. Test No.	**GR_TSTP_ 2.3.4.3**
2. Test Details	To verify that eNodeB shall support dynamic resource allocation (Scheduling)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL data and change CQI. 4. Verify from UE logs that MCS and TB size are dynamically selected.
6. Test Limits	NA
7. Expected Results	The eNodeB shall dynamically change MCS and TB size.

1. Test No.	**GR_TSTP_ 2.3.4.4**
2. Test Details	To verify that eNodeB shall be support mapping of logical channels onto transport channels.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Start DL data. 4. From UE logs , Verify appropriate mapping of logical channels to transport channels and vice-versa.
6. Test Limits	NA
7. Expected Results	The eNodeB shall map various logical channels onto transport channels.

1. Test No.	**GR_TSTP_ 2.3.4.5**
2. Test Details	To verify that eNodeB shall support scrambling, Tx diversity, and OFDM modulation.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform 2 UE attach. 3. Start DL data. 4. To verify Tx Diversity support, check UE logs for TM mode. 5. To verify scrambling and OFDM modulation, check that each UE receives its own data
6. Test Limits	NA
7. Expected Results	a) The UE log shall indicate TM mode used for Tx diversity b) Each UE shall receive own data

1. Test No.	**GR_TSTP_ 2.3.4.6**
2. Test Details	To verify that eNodeB shall support Contention based and Contention free Random Access (RA) procedure.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify from UE logs that contention resolution procedure is executed. 4. Perform UE handover 5. Verify from UE logs that contention free procedure is executed.
6. Test Limits	NA
7. Expected Results	eNodeB shall support both contentions based and contention free RA procedures.

1. Test No.	**GR_TSTP_ 2.3.4.7**
2. Test Details	To verify that eNodeB shall support DL Power Allocation for data channels.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. From OMC/ Console configure P-A, P-B
6. Test Limits	NA
7. Expected Results	The eNodeB shall allow configuration of P-A, P-B parameters from OMC / Console

1. Test No.	**GR_TSTP_ 2.3.4.8**
2. Test Details	To verify that eNodeB shall support Downlink power allocation parameters, such PDSCH-to-RS ratios
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. From OMC/ Console configure P-A, P-B
6. Test Limits	NA
7. Expected Results	The eNodeB shall allow configuration of P-A, P-B parameters from OMC/ Console

1. Test No.	**GR_TSTP_ 2.3.4.9**
2. Test Details	To verify that eNodeB shall support DL Power setting for signalling and control channels.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. From EMS/Console , configure PCFICH power offset, PHICH power offset, PBCH power offset, PDCCH Power offset
6. Test Limits	NA
7. Expected Results	eNodeB shall configuration of PCFICH power offset, PHICH power offset, PBCH power offset, PDCCH Power offset from OMC/Console

1.	Test No.	**GR_TSTP_ 2.3.4.10**
2.	Test Details	To verify that eNodeB shall support both the open-loop power control and the closed-loop power control of the UE.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1

5.	Test Procedure	1. Bring eNodeB in operationally enabled state.
		2. Perform UE attach.
		3. Start DL and UL data.
		4. Open loop power control (TPC disabled)
		    a. Attenuate the radio link.
		    b. Verify through UE logs, the UE Tx power is modified
		5. Close loop power control (TPC enabled)
		    a. Attenuate the radio link.
		    b. Verify through UE logs that eNodeB sends TPC command
		    c. Verify through UE logs, the UE Tx power is modified

6.	Test Limits	NA
7.	Expected Results	a) The Tx power of UE shall be modified in both cases.

1. Test No.	**GR_TSTP_ 2.3.4.11**
2. Test Details	To verify that eNodeB shall support Normal cyclic prefix. Optionally for Macro scenarios, Extended Cyclic prefix may be supported (Applicable to Category 1 eNodeB only).
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB up and radiating with Normal and extended cyclic prefix as applicable. 2. Verify the S1AP link is up. 3. Verify UE is attached successfully. 4. Verify via UE logs, eNodeB shall support Normal cyclic prefix. Optionally for Macro scenarios, Extended Cyclic prefix may be supported (Applicable to Category 1 eNodeB only).
6. Test Limits	NA
7. Expected Results	eNodeB shall support Normal cyclic prefix. Optionally for Macro scenarios, Extended Cyclic prefix may be supported (Applicable to Category 1 eNodeB only).

1. Test No.	**GR_TSTP_ 2.3.4.12**
2. Test Details	Verify that eNodeB shall support Uplink demodulation reference signal
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify that uplink data transfer is successful.
6. Test Limits	NA
7. Expected Results	The eNodeB shall be able to decode uplink data. This will verify uplink DMRS.

1. Test No.	**GR_TSTP_ 2.3.4.13**
2. Test Details	To verify that eNodeB support Radio Bearer (RB) combinations dynamic mapping to Physical Resource Block (PRB).
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Through UE logs, Verify Radio Bearer (RB) combinations dynamic mapping to Physical Resource Block (PRB).
6. Test Limits	NA
7. Expected Results	Radio Bearer (RB) combinations dynamic mapping to Physical Resource Block (PRB).

1. Test No.	**GR_TSTP_ 2.3.4.14**
2. Test Details	The eNodeB shall support UL & DL Link Adaptation.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB 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 shall change as per link condition in both UL and DL.

1. Test No.	GR_TSTP_2.3.4.15_A
2. Test Details	To verify that the TDD variant of eNodeB supports Uplink-Downlink frame configuration 1
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure the TDD system with UL/DL configuration 1. 2. Bring eNodeB in operationally enabled state. 3. Perform an UE attach and DL/UL data transfer from the attached UE.
6. Test Limits	NA
7. Expected Results	In TDD configuration-1, the eNodeB shall support data transfer.

1. Test No.	**GR_TSTP_2.3.4.15_B**
2. Test Details	To verify that the TDD variant of eNodeB supports Uplink-Downlink frame configuration 2
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure the TDD system with UL/DL configuration 2. 2. Bring eNodeB in operationally enabled state. 3. Perform an UE attach and DL/UL data transfer from the attached UE.
6. Test Limits	NA
7. Expected Results	In TDD configuration-2, the eNodeB shall support data transfer.

1. Test No.	**GR_TSTP_2.3.4.16**
2. Test Details	To verify that eNodeB support transmission modes viz., open loop, closed loop for spatial multiplexing and Transmit diversity.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1

5. Test Procedure	1. Bring eNodeB in operationally enabled state.
	2. Perform UE attach.
	3. Open loop:
	    a. Configure TM-3
	    b. Verify that DL data is successful
	4. Closed loop for spatial multiplexing:
	    a. Configure TM-4
	    b. Verify that DL data is successful
	5. Transmit Diversity
	    a. Configure TM-2
	    b. Verify that DL data is successful

6. Test Limits	NA
7. Expected Results	The DL data should be successful in TM-2, TM-3 and TM-4.

1. Test No.	**GR_TSTP_2.3.4.17**
2. Test Details	To verify that eNodeB shall support Short Buffer Status Report (BSR) and Long BSR.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB 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 eNodeB.
6. Test Limits	NA
7. Expected Results	The eNodeB shall allocate resources considering short BSR and long BSR.

1.	Test No.	**GR_TSTP_2.3.4.18**
2.	Test Details	Verify that eNodeB shall support Random Access Preamble format 0 (FDD/TDD) and 4(TDD).
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	FDD or TDD eNodeB: 1. Configure eNodeB with preamble format-0 2. Bring eNodeB in operationally enabled state. 3. Perform UE attach. 4. Verify through UE logs that SIB has appropriate information TDD eNodeB 1. Configure eNodeB with preamble format-4 2. Bring eNodeB in operationally enabled state. 3. Perform UE attach. 4. Verify through UE logs that SIB as appropriate information
6.	Test Limits	NA
7.	Expected Results	The PRACH configuration index in SIB shall indicate configured preamble formats.

1. Test No.	**GR_TSTP_2.3.4.19**
2. Test Details	Verify that eNodeB shall support Cell-specific reference signal.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Verify eNodeB is transmitting Cell-specific reference signal via UE logs or SIB2
6. Test Limits	NA
7. Expected Results	eNodeB is transmitting Cell-specific reference signal

1. Test No.	**GR_TSTP_2.3.4.22**
2. Test Details	Support for Discontinuous Reception (DRX) to enable reasonable UE battery consumption.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure DRX and UE inactivity timers. 2. Bring eNodeB 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	eNodeB shall indicate configured DRX and UE inactivity timers to the UE.

1. Test No.	GR_TSTP_ 2.3.5_A
2. Test Details	To verify S1 is a logical interface.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 5
5. Test Procedure	1. Configure two S1 interfaces on eNodeB. 2. Bring eNodeB in operationally enabled state 3. Verify Wireshark logs that eNodeB initialized S1 interface towards both EPC.
6. Test Limits	NA
7. Expected Results	The S1 procedures shall be executed on logical S1 interface, on same physical link.

1.	Test No.	**GR_TSTP_ 2.3.5_B**
2.	Test Details	To verify multiple S1-MME logical interfaces towards the EPC from any one eNodeB. The selection of the S1-MME interface is then determined by the NAS Node Selection Function.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 5
5.	Test Procedure	1. Configure two S1 interfaces on eNodeB. 2. Configure two MMEs on eNodeB 3. Bring eNodeB in operationally enabled state 4. Perform 2 UE attach 5. Verify Wireshark logs that UE shall be attached as per the relative MME capacity configuration.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall forward attach request towards MME as determined by NAS node selection function.

1. Test No.	**GR_TSTP_ 2.3.5_C**
2. Test Details	To verify multiple S1-U logical interfaces towards the EPC from any one eNodeB. The selection of the S1-U interface is done within the EPC and signalled to the eNodeB by the MME.
3. Test Instruments 4. Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
5. Test Setup	TEST SETUP 5
6. Test Procedure	1. Configure two MME and S-GW on eNodeB 2. Bring eNodeB in operationally enabled state 3. Perform 2 UE attach 4. Initiate UL data transfer for both UEs 5. Verify Wireshark logs that UE shall be attached as per the relative MME capacity configuration. The uplink data of UE shall be transferred to corresponding S-GW.
7. Test Limits	NA
8. Expected Results	eNodeB shall route UE data to appropriate MME/S-GW.

1. Test No.	**GR_TSTP_ 2.3.5.1_A1**
2. Test Details	To verify successful Initial Context Setup procedure.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE attach procedure. 3. The MME sends the eNodeB an INITIAL CONTEXT SETUP REQUEST message, initiating the Initial Context Setup procedure. 4. The eNodeB sends an Initial Context Setup Response message to notify the MME of the result. 5. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	eNodeB shall successfully execute Initial Context Setup procedure.

1.	Test No.	**GR_TSTP_ 2.3.5.1_A2**
2.	Test Details	To verify successful eNodeB initiated UE Context Release Request procedure.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE Attach 3. Move UE from the coverage area of eNodeB. 4. The eNodeB sends a UE Context Release Request message to the MME. The release cause value is carried in this message. 5. The MME sends the eNodeB a UE CONTEXT RELEASE COMMAND message to release the S1 signalling connection. 6. Verify through Wireshark logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute context release procedure.

1. Test No.	**GR_TSTP_ 2.3.5.1_A3**
2. Test Details	To verify successful MME initiated UE Context Release procedure.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE Attach procedure 3. Perform UE detach procedure. The MME sends the eNodeB a UE CONTEXT RELEASE COMMAND message to initiate the UE Context Release procedure. 4. After receiving the UE CONTEXT RELEASE COMMAND message, the eNodeB releases all related signalling and UE data transmission resources, and then sends a UE CONTEXT RELEASE COMPLETE message to the MME. 5. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successful execute UE context release procedure.

1. Test No.	**GR_TSTP_ 2.3.5.1_A4**
2. Test Details	To verify successful UE Context Modification procedure.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform 2 UE attach procedure. 3. Perform data session on UE1 with VoLTE disabled. 4. Initiate Originating call from UE1 to UE2 MME sends S1-AP: UE Context Modification Request a CS Fallback Indicator IE. 5. eNodeB sends to MME a S1-AP UE Context Modification Response 6. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute UE context modification procedure.

1. Test No.	**GR_TSTP_ 2.3.5.1_B1**
2. Test Details	To verify successful E-RAB Setup procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE attach procedure. 3. Establish dedicated bearer. MME sends S1-AP E-RAB Setup Request including the E-RAB to be Setup List IE containing one E-RAB to be setup (E-RAB ID IE) 4. eNodeB acknowledges the successful establishment by sending a S1-AP E-RAB Setup Response, including the E-RAB Setup Items IE for the successfully established E-RAB, including the same E-RAB ID IE originally included into the request.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute E-RAB setup procedure

1. Test No.	**GR_TSTP_ 2.3.5.1_B2**
2. Test Details	To verify successful E-RAB Modify procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE attach procedure 3. Perform HSS initiated bearer modification with QoS update procedure. MME sends S1-AP E-RAB Modify Request including the E-RAB to be Modified List IE containing one E-RAB to Be Modified Item (with the corresponding E-RAB ID IE) 4. eNodeB acknowledges the modification by sending back a S1-AP E-RAB Modify Response message with the same E-RAB Modify List IE containing the same E-RAB Modify Item IEs (with same E-RAB ID IE).
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute E-RAB Modify procedure

1.	Test No.	**GR_TSTP_ 2.3.5.1_B3**
2.	Test Details	To verify successful E-RAB Release procedure
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 6
5.	Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE attach procedure 3. Perform VoLTE call. 4. Release VoLTE call. 5. Verify that eNodeB Releases ERAB after receiving ERAB Release command from MME.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute E-RAB Release procedure

1. Test No.	**GR_TSTP_ 2.3.5.1_C**
2. Test Details	To verify successful S1 link management function.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Check from Wireshark logs that SCTP link is established successfully. 3. Verify heartbeat messages are exchanged for SCTP.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully establish S1 link with MME

1. Test No.	**GR_TSTP_ 2.3.5.1_D1**
2. Test Details	To verify successful GTP-U tunnel establishment procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE attach procedure 3. Verify from Wireshark logs that GTP-U tunnel is established when ERAB setup procedure is completed.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully perform GTP-U tunnel establishment procedure

1. Test No.	**GR_TSTP_ 2.3.5.1_D2**
2. Test Details	To verify successful GTP-U tunnel release procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach procedure. 3. Verify from Wireshark logs that GTP-U tunnels established. 4. Perform UE detach procedure. 5. Verify from Wireshark logs that GTP-U tunnel is released.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully perform GTP-U tunnel release procedure

1.	Test No.	**GR_TSTP_ 2.3.5.1_E**
2.	Test Details	To verify successful S1 signalling link management function.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Power on eNodeB. 3. Verify from Wireshark logs that S1 AP interface is established successfully between eNodeB and MME. (S1 setup request and S1 setup response).
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully establish S1 signalling link with MME

1. Test No.	**GR_TSTP_ 2.3.5.1_F1**
2. Test Details	To verify successful inter frequency S1 based HO between two eNodeBs
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring eNodeBs in operationally enabled state. eNodeBs are configured with different frequencies. 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the handover time. 4. Initiate inter frequency S1-based HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully perform inter frequency S1 Handover.

1.	Test No.	**GR_TSTP_ 2.3.5.1_F2**
2.	Test Details	To verify successful intra frequency S1 based HO between two eNodeBs
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring eNodeBs in operationally enabled state. eNodeBs are configured with same frequency. 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the handover time 4. Initiate intra frequency S1-based HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully perform intra frequency S1 Handover.

1. Test No.	**GR_TSTP_ 2.3.5.1_G**
2. Test Details	To verify successful inter frequency S1 based HO between two eNodeBs
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring eNodeBs in operationally enabled state. eNodeBs are configured with different frequencies. 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the handover time. 4. Initiate inter frequency S1-based HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully perform inter frequency S1 Handover.

1.	Test No.	**GR_TSTP_ 2.3.5.1_I**
2.	Test Details	To verify successful Paging procedure
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach procedure. 3. Send DL Data to the UE while UE is in RRC Idle Mode 4. Verify that MME is sending S1-AP: Paging. 5. Verify from UE logs that Paging is received 6. Verify from UE logs that UE is subsequently re-entering RRC Active Mode. 7. Verify from UE logs that the UE context is established successfully, and that the UE is able to receive the DL data, as well as send UL data.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully perform paging procedure

1. Test No.	**GR_TSTP_ 2.3.5.1_J1**
2. Test Details	To verify S1 interface management function
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Lock the eNodeB from the OMC. 3. Verify that the operational state of the eNodeB becomes disabled at OMC. 4. After some time unlock the eNodeB from OMC. Verify from Wireshark logs that the S1AP interface is established successfully. 5. Verify that the operational state of the eNodeB is updated to "enabled" at OMC. 6. Verify that UE attach is successful.
6. Test Limits	NA
7. Expected Results	Verify lock/unlock is successful.

1. Test No.	**GR_TSTP_ 2.3.5.1_J2**
2. Test Details	To verify successful MME initiated Reset Procedure.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Trigger MME to send a S1 Reset to eNodeB 3. Verify that eNodeB sends back a S1-AP Reset Acknowledge message.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute the MME initiated Reset Procedure.

1. Test No.	**GR_TSTP_ 2.3.5.1_J3**
2. Test Details	To verify successful S1 setup procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Power on MME and eNodeB 2. Bring eNodeB in operationally enabled state. 3. The eNodeB sends S1 SETUP REQUEST message to the MME. 4. MME responds with the S1 setup response message acknowledging the connectivity and including the same PLMN Identifier 5. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute S1 Setup procedure.

1.	Test No.	**GR_TSTP_ 2.3.5.1_K**
2.	Test Details	Security Function
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach procedure and Data transfer. 3. Verify ciphering and integrity algorithms used through Wireshark logs.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute security functions over S1 interface.

1. Test No.	**GR_TSTP_ 2.3.5.1_L1**
2. Test Details	To verify successful Core network signalling data transfer function
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach procedure and data transfer. 3. The NAS EPC signalling data shall be transparently conveyed between the EPC and the UE. 4. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall transparently forward NAS messages to the UE.

1. Test No.	**GR_TSTP_ 2.3.5.1_L2**
2. Test Details	To verify successful Delivery of ETWS Warning messages
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. eNodeB configured with SIB-10 / SIB-11 information so that those can be broadcasted 3. Trigger ETWS message from MME 4. Verify through UE logs that it receives paging message with its “ETWS” IE present and UE can decode SIB-10/ SIB-11
6. Test Limits	NA
7. Expected Results	The eNodeB shall delivery ETWS warning message to the UE.

1. Test No.	**GR_TSTP_2.3.5.1_N1**
2. Test Details	To verify that eNodeB is able to distribute traffic towards MME evenly for load balancing purpose
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 5
5. Test Procedure	1. Connect the eNodeB with different MME belonging to same PLMN i.e. S1 flex configuration. (Multi S1-MME interfaces). 2. Verify the relative capacity of all MME in S1 setup response. 3. Perform attach for multiple UEs. 4. Verify that the eNodeB distributes UEs to the different connected MME evenly according to their respective capacities.
6. Test Limits	NA
7. Expected Results	eNodeB is able to distribute traffic evenly across all the connected MME.

1.	Test No.	**GR_TSTP_ 2.3.5.1_O**
2.	Test Details	To verify S1-U interface shall be Ethernet.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Initiate UE attach and data transfer 2. Verify that GTP tunnel established and data transfer successful through Wireshark logs
6.	Test Limits	NA

7. Expected Results	The eNodeB shall implement S1-U procedures over Ethernet.

1. Test No.	**GR_TSTP_ 2.3.6**
2. Test Details	To verify successful X2 Interface connection between two eNodeB's.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Add neighbour to one eNodeB. 2. Verify that eNodeB1 send X2 setup request to eNodeB2. 3. Verify that eNodeB2 send X2 setup response to eNodeB1. 4. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute X2 setup procedure.

1. Test No.	**GR_TSTP_ 2.3.6.1_A**
2. Test Details	To verify successful Intra LTE-Access-System Mobility Support for UE in LTE_ACTIVE. (Inter frequency X2 Handover)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Initiate a Data session of a large file that can span the handover time 2. Initiate inter frequency X2-based HO to the target eNodeB. 3. UE shall move to target eNodeB after successful Handover. 4. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The data session shall continue after handover.

1. Test No.	**GR_TSTP_ 2.3.6.1_B**
2. Test Details	To verify successful Context transfer from source eNodeB to target eNodeB during X2 Handover.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Initiate a Data session of a large file that can span the handover time 2. Initiate inter frequency X2-based HO to the target eNodeB. 3. The Source eNodeB transfers UE context in HANDOVER REQUEST message to the Target eNodeB passing necessary information to prepare the handover at the target side 4. UE shall move to target eNodeB after successful Handover. 5. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully transfer UE context.

1. Test No.	**GR_TSTP_ 2.3.6.1_C**
2. Test Details	To verify successful Control of user plane tunnels between source eNodeB and target eNodeB. during X2 Handover.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Initiate UL/DL data session of a large file that can span the handover time 2. Initiate inter frequency X2-based HO to the target eNodeB. 3. Verify successful Handover of UE from source to target cell. 4. Verify GTP-U tunnels through Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeBs shall establish GTP-U tunnel during handover procedure.

1. Test No.	**GR_TSTP_ 2.3.6.1_D**
2. Test Details	To verify Handover cancellation procedure between source eNodeB and target eNodeB. during X2 Handover.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 7
5. Test Procedure	1. Initiate a Data session of a large file that can span the handover time 2. Initiate inter frequency X2-based HO to the target eNodeB simulator. 3. Source eNodeB sends Handover Request to target eNodeB simulator. 4. Do not respond with Handover Request Ack from eNodeB simulator. 5. Source eNodeB shall send Handover Cancel to target eNodeB simulator. 6. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The Source eNodeB shall send Handover Cancel message to target eNodeB.

1. Test No.	**GR_TSTP_ 2.3.6.1_E**
2. Test Details	To verify General X2 interface management and error handling functions: reset procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Setup X2 interface between “eNodeB 1” and “eNodeB 2”. 2. Verify the X2 context information is maintained at both eNodeB’ s. 3. Now send X2 Reset Request from “eNodeB 1” towards “eNodeB 2”. Verify from Wireshark logs that “eNodeB 2” sends X2 Reset Response. 4. Verify that the X2 context information is removed from both eNodeB’ s.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute X2 reset procedure

1.	Test No.	**GR_TSTP_ 2.3.6.1_F**
2.	Test Details	To verify Error Indication procedure for X2 interface.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 7
5.	Test Procedure	1. Trigger UE attach procedure on eNodeB 2 (eNodeB simulator) 2. Trigger HO and send some incorrect IE in Handover Request from eNodeB2 to eNodeB1. 3. ERROR INDICATION message is sent by eNodeB1 to the peer end to inform that the signalling is incorrect.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall trigger Error Indication procedure after receipt of incorrect message.

1.	Test No.	**GR_TSTP_ 2.3.5.3_G**
2.	Test Details	To verify X2 interface shall be Ethernet.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Add one neighbour to eNodeB. 2. Verify X2 link established. 3. SCTP link up and HEARTBEATS are exchanged. 4. Verify through Wireshark logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute X2 procedure over Ethernet.

1.	Test No.	**GR_TSTP_ 2.3.7.1_A**
2.	Test Details	To verify the RACH access is successful.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Power on a UE so that UE sends a RACH request to eNodeB. 3. Verify from UE logs that eNodeB sends Random Access Response. 4. UE reads RAR and sends RRC connection request to eNodeB.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute RACH procedure.

1.	Test No.	**GR_TSTP_ 2.3.7.1_B**
2.	Test Details	To verify the RRC connection establishment is successful for one UE.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Power on 1 UE so that it sends RACH request. 3. eNodeB sends Random Access Response. 4. UE reads RAR and sends RRC connection request to eNodeB. 5. eNodeB sends RRC Connection Setup to UE 6. Verify through UE logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully implement RRC establishment procedure.

1.	Test No.	**GR_TSTP_ 2.3.7.1_C**
2.	Test Details	To verify the RRC connection re-establishment is successful.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. With help of UE simulator, send RRC connection re-establishment request. 4. The eNodeB shall send RRC connection reestablishment 5. The UE shall send RRC connection reestablishment complete. 6. Verify through UE logs.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully handle RRC connection reestablishment request.

1. Test No.	**GR_TSTP_ 2.3.7.1_D**
2. Test Details	To verify the RRC connection reconfiguration with correct mobility control info is sent to UE in inter freq S1 HO.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. eNodeB 1 and eNodeB 2 are up at different frequency and eNodeB 2 is configured as static neighbour of eNodeB 1. 2. Attach 1 UE on serving cell eNodeB 1. 3. Break the X2 connection, so that S1 HO can be triggered. 4. Move UE to coverage of eNodeB 2 so that HO is triggered. 5. Verify mobility control info in the RRC Connection Reconfiguration message from UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB 1 should send RRC Connection Reconfiguration message with correct mobility control info.

1.	Test No.	**GR_TSTP_ 2.3.7.1_E1**
2.	Test Details	To verify the measurement event A1 is reported as configured.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Attach 1 UE. 2. Attenuate the radio link. 3. Verify that eNodeB has sent all information regarding event A1 in RRC Connection Reconfiguration 4. Reduce attenuation. 5. Verify that UE sends measurement report for event A1 6. Verification through UE logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute measurement report A1

1. Test No.	**GR_TSTP_ 2.3.7.1_E2**
2. Test Details	To verify the measurement event A2 is reported as configured.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Attach 1 UE. 2. Verify that eNodeB has sent all information regarding event A2 in RRC Connection Reconfiguration during attach procedure. 3. Attenuate radio link. 4. UE sends measurement report for event A2 5. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall indicate A2 trigger to the UE.

1. Test No.	**GR_TSTP_ 2.3.7.1_E3**
2. Test Details	To verify the measurement event A3 is reported as configured.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Attach 1 UE on eNodeB 1 2. Verify that eNodeB 1 has sent all information regarding event A3 in RRC Connection Reconfiguration during attach procedure. 3. Move the UE to the coverage of eNodeB 2, such that UE sends measurement report for event A3 (neighbour cell gets better than serving cell by an offset). 4. Verify through UE logs.
6. Test Limits	NA
7. Expected Results	The eNodeBs shall indicate A3 trigger to the UE.

1.	Test No.	**GR_TSTP_2.3.8.2**
2.	Test Details	eNodeB shall support DC Power Supply.
3.	Test Instruments Required	48V DC Power Supply, eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Apply specified DC Input Voltage to EUT. 2. Bring eNodeB in operationally enabled state 3. Perform UE attach 4. Verify through UE logs
6.	Test Limits	Operating Voltage: -44.4V to -56V DC
7.	Expected Results	The eNodeB shall successfully execute UE attach procedure on specified voltage.

1. Test No.	**GR_TSTP_2.3.8.2_A**
2. Test Details	eNodeB shall support nominal voltage -48V (-40 to -60 V) DC supply voltage.
3. Test Instruments Required	Variable DC Power Supply, Multimeter, eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Power ON the setup at nominal voltage (-48V DC) 2. Bring eNodeB in operationally enabled state 3. Perform UE attach. 4. Vary the voltage slowly in 1V step from -48V to -40V DC and perform UE attach. 5. Vary the voltage slowly in 1V step from -48V to -60V DC and perform UE attach. 6. Verify through UE logs
6. Test Limits	Operating Voltage: -40V to -60V DC
7. Expected Results	The eNodeB shall successfully execute Attach Procedure in the complete voltage range.

1.	Test No.	**GR_TSTP_2.3.8.2_B**
2.	Test Details	Protection on Power Input Ports
3.	Test Instruments Required	NA
4.	Test Setup	NA
5.	Test Procedure	Following protections to be checked at Power Input Port :- 1. **Reverse Polarity Protection**: - GR_TSTP_2.3.8.2_C 2. **Over Voltage Protection**: - GR_TSTP_2.3.8.2_D 3. **Immunity to Surge Voltage**: - GR_TSTP_8.7_6 4. **Over Current Protection**: - Details of the over current protection scheme to be provided by supplier.
6.	Test Limits	NA
7.	Expected Results	EUT has necessary protection on power input ports.

1. Test No.	**GR_TSTP_2.3.8.2_C**
2. Test Details	Reverse Polarity at the DC input
3. Test Instruments Required	Variable DC Power Supply, Multimeter, eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Prepare the setup for eNodeB as per Test setup 1 and check it to be functional. 2. Apply power feed in reverse (i.e. 0V at power supply should be connected to -48V terminal at eNodeB and -48V at power supply should be connected to 0V terminal at eNodeB. 3. The EUT may be functional or may not be functional when reverse polarity is applied. 4. Now apply correct power feed. 5. Bring eNodeB in operationally enabled state. 6. Perform UE attach. 7. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute UE attach procedure after correct feed applied.

1. Test No.	**GR_TSTP_2.3.8.2_D**
2. Test Details	Over voltage protection at the DC input
3. Test Instruments Required	Variable DC Power Supply, Multimeter, eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Supplier to give details of the overvoltage protection provided at the DC input. 2. Apply overvoltage to the EUT as per above. 3. Now apply nominal voltage -48V DC to EUT. 4. Bring eNodeB in operationally enabled state. 5. Perform UE attach. 6. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute attach procedure after nominal -48V DC applied.

1.	Test No.	**GR_TSTP_2.3.8.2_E**
2.	Test Details	DC input under voltage cut-off. Limit of under voltage shall be indicated by the vendor
3.	Test Instruments Required	Variable DC Power Supply, Multimeter, eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Prepare the EUT Test setup as per Test setup 1. 2. Power ON EUT at nominal voltage (-48V DC). 3. Decrease the Power supply voltage slowly till Under Voltage Cut off limit (provided by supplier) in 1V step. 4. Check the current flowing in EUT, it should become less than 0.1Amps. 5. Change the Power supply voltage to -48V DC. 6. Check the current flowing in EUT, it should be normal operational current. 7. Bring eNodeB in operationally enabled state. 8. Perform UE attach. 9. Verify through UE logs.
6.	Test Limits	Under Voltage Cut Off Limit (provided by supplier)
7.	Expected Results	The Current draw in EUT should < 0.1Amps at specified UVLO limits.

1. Test No.	**GR_TSTP_2.3.9.1_A**
2. Test Details	To verify successful registration of eNodeB with the EMS / OMC over Ethernet
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Check that EMS server is working. Also check that EMS / OMC client is accessible. 2. Provision the eNodeB at the EMS / OMC e.g. make entry of its IP address in the EMS / OMC database to enable identification to handle incoming registration request from the node. 3. Power on the eNodeB. After the eNodeB comes up, check that eNodeB registers with the EMS / OMC. Also check that eNodeB is accessible via EMS / OMC 4. Check from Wireshark logs that registration process is initiated and successfully completed. 5. In case the provisioning mechanism differs from above, the Vendor need to state and demonstrate the same.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully connect to EMS/OMC over Ethernet.

1.	Test No.	**GR_TSTP_2.3.9.1_B**
2.	Test Details	To verify that eNodeB sends performance data to EMS as per the configured periodicity.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Perform few UE attach and data transfers on the system. Verify at the EMS that eNodeB sends the performance data to the EMS at the configured periodicity. 2. Also verify that the data/file contains all the relevant data related to RRC / S1 / X2 interface. 3. Verify that reports can be fetched from the data.
6.	Test Limits	NA
7.	Expected Results	eNodeB shall upload performance data/file to the EMS at the configured periodicity.

1. Test No.	**GR_TSTP_2.3.9.1_C**
2. Test Details	To verify that all eNodeB connected to EMS register again successfully after EMS restart
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2 or 10
5. Test Procedure	1. Check that EMS server is working. Also check that EMS client is accessible. 2. Check that multiple eNodeB's are registered to EMS and are accessible via the EMS. 3. Now restart the EMS server. 4. After the EMS server comes up, check that all eNodeB's register with EMS successfully in a small frame of time. Also all eNodeB' s are accessible via EMS. 5. In case the registration mechanism differs from above, the Vendor need to state and demonstrate the same.
6. Test Limits	NA
7. Expected Results	eNodeB' s successfully registers with the EMS after EMS restart.

1. Test No.	**GR_TSTP_2.3.9.1_D**
2. Test Details	To verify that raised alarms are stored at eNodeB in case the connectivity between the eNodeB and EMS is down
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Remove the Ethernet connectivity from the eNodeB towards the EMS for some time. 2. Trigger events S1AP down at eNodeB such that the alarms are raised. (Can be done by removing the ethernet connectivity between eNodeB and MME). 3. Verify at eNodeB that alarms are generated and stored at eNodeB.
6. Test Limits	NA
7. Expected Results	The eNodeB shall store alarms locally while connectivity with the OMC/NMS is down.

1. Test No.	**GR_TSTP_2.3.9.2_A**
2. Test Details	To verify that eNodeB supports one of the following interfaces towards EMS (XML / TR-069 / SNMP)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. The vendor needs to provide list of supported protocol between EMS/OMC and eNodeB, e.g., XML, TR-069 or SNMP. 2. Check that EMS server is working. Also check that EMS client is accessible. 3. Provision the eNodeB at the EMS e.g. make entry of IP address of eNodeB in the EMS database to enable identification to handle incoming registration request from the node. 4. Power on eNodeB. After the eNodeB comes up, check that eNodeB registers with the EMS over Ethernet via (XML / TR-069 / SNMP – the protocol(s) indicated by the vendor) interface. Also check that eNodeB is accessible via EMS. 5. Check from Wireshark logs that registration process is initiated and successfully completed.
6. Test Limits	NA
7. Expected Results	The eNodeB shall use vendor specified protocol(s), e.g., XML, TR-069 or SNMP, over the management interface.

1.	Test No.	**GR_TSTP_2.3.9.2_B**
2.	Test Details	To verify that RF and S1 related configuration changes done from EMS / OMC are applied on eNodeB
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	The vendor to specify procedure to modify / apply RF / S1 parameters through EMS / OMC. This may include restart of the eNodeB. 1. Modify the RF parameters of the eNodeB 2. Modify the S1 interface parameters of the eNodeB 3. Apply the RF and S1 parameter 4. Verify through Wireshark logs of S1 interface if modified S1 parameters are applied 5. Verify through UE logs if modified RF parameters are applied 6. Verify through Wireshark logs of eNodeB – EMS/OMC interface that the procedures are executed using protocols specified by the vendor.
6.	Test Limits	
7.	Expected Results	The S1 Wireshark logs shall indicate modified S1 parameters. The UE logs shall indicate modified RF parameters. The eNodeB shall use vendor specified protocol(s), e.g., XML, TR-069 or SNMP, over the management interface.

1. Test No.	**GR_TSTP_2.3.9.3_A**
2. Test Details	To verify that eNodeB reports status and alarm of S1 interface
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Check S1 interface status and related alarms at EMS / OMC 3. Bring down the EPC connectivity 4. Check S1 interface status and related alarms at EMS / OMC
6. Test Limits	NA
7. Expected Results	The eNodeB shall report correct status of S1 interface through EMS / OMC.

1.	Test No.	**GR_TSTP_2.3.9.3_B**
2.	Test Details	To verify that eNodeB reports an alarm to EMS when CPU usage increases
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Vendor to specify mechanism to simulate CPU overload 2. Simulate CPU overload condition 3. Verify that the relevant alarm is reported by the eNodeB to the EMS / OMC 4. Reduce CPU utilization 5. Verify that the relevant alarm is reported by the eNodeB to EMS / OMC
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall generate alarm for CPU overload and returning back to normal condition.

1. Test No.	**GR_TSTP_2.3.9.4_A**
2. Test Details	To verify successful software upgrade procedure to eNodeB from EMS / OMC
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. The vendor to specify procedure for software upgrade through EMS / OMC. This may include eNodeB restart. 2. Initiate a software upgrade for an eNodeB via EMS 3. Verify that the system comes up with the new release. Also, the new release version is updated at the EMS. 4. Bring eNodeB in operationally enabled state 5. Perform UE attach 6. Verify through UE logs
6. Test Limits	
7. Expected Results	The eNodeB shall report updated software version The UE logs shall indicate successful attach after new software upgrade

1. Test No.	**GR_TSTP_2.3.9.4_B**
2. Test Details	To verify that downgrade to previous working image can be done via EMS
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. The vendor to specify procedure for software downgrade through EMS / OMC. This may include eNodeB restart. 2. Initiate a software downgrade for an eNodeB via EMS 3. Verify that the system comes up with the instructed release. Also, the new release version is updated at the EMS. 4. Bring eNodeB in operationally enabled state 5. Perform UE attach 6. Verify through UE logs
6. Test Limits	System will need a restart / may go for auto restart to come up with the new release. This may lead to some downtime.
7. Expected Results	The eNodeB shall successfully implement software downgrade procedure. UE attached procedure shall be successful.

1. Test No.	**GR_TSTP_2.3.9.5**
2. Test Details	To verify that eNodeB is able to send logs to a designated server.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Vendor to specify procedure to configure logging and log server in the eNodeB 2. Verify that the eNodeB is able to send the logging information / log file to the designated server.
6. Test Limits	NA
7. Expected Results	The eNodeB shall send logs to the designated server.

1. Test No.	**GR_TSTP_2.3.9.6**
2. Test Details	To verify that eNodeB is able to maintain set of logs of different modules / core dump logs
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Vendor to specify mechanism to verify system logs and core dumps 2. Generate event that shall be logged into system logs 3. Generate event that shall result in core dump of a process 4. Verify that the event are logged into system logs 5. Verify that the core dump files is present at designated place
6. Test Limits	NA
7. Expected Results	The eNodeB shall log event into system logs. The eNodeB shall store core dump file at designated place.

1.	Test No.	**GR_TSTP_2.3.9.7_A**
2.	Test Details	To verify that local software upgrade is supported
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. The vendor to specify procedure for local software. This may include eNodeB restart. 2. Initiate local software upgrade for eNodeB 3. Verify that the system comes up with the instructed release. 4. Bring eNodeB in operationally enabled state 5. Perform UE attach 6. Verify through UE logs
6.	Test Limits	System will go for auto reboot for activation of new release.
7.	Expected Results	The eNodeB shall come-up with new release. UE attach shall be successful.

1. Test No.	**GR_TSTP_2.3.9.8**
2. Test Details	To verify that the eNodeB shall support alarms, events to OMC for visual indicators of status and fault.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Vendor to provide list of sample events along with their severity and affected objects (logical or physical) 2. Vendor to provide list of sample objects with status values a. Alarm Verification: 3. Trigger various events at eNodeB 4. Verify that the alarms are reported by the eNodeB to the OMC / EMS with specified levels of severity associated with the alarms such as (CRITICAL, MAJOR, MINOR, CLEAR, WARNING etc.) 5. Each alarm shall have attributes like unique identifier, valid time-stamp, description of the fault and affected object. a. Status Verification 6. Trigger events that will result in object status change 7. Verify at OMC / EMS that the object status has been updated as per event
6. Test Limits	NA
7. Expected Results	The eNodeB shall report alarms and status to the OMC / EMS.

1.	Test No.	**GR_TSTP_2.3.9.9**
2.	Test Details	To verify that eNodeB can be rebooted / restarted through EMS / OMC
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Trigger reboot action of an eNodeB from EMS / OMC 2. Verify that system goes for reboot and registers again with EMS / OMC after it comes up.
6.	Test Limits	NA
7.	Expected Results	System reboot shall be successful.

1. Test No.	**GR_TSTP_2.3.9.10**
2. Test Details	To verify that eNodeB shall support built-in power-on diagnostics and system monitoring capabilities to detect hardware failures.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Vendor to provide details of mechanism to verify power-on diagnostics report 2. Vendor to provide procedure details to induce hardware failure 3. Power ON eNodeB and verify the diagnostics logs 4. Induce hardware failure as per vendor specified procedure 5. Verify that hardware failure is logged.
6. Test Limits	NA
7. Expected Results	eNodeB supports built-in power on diagnostics and system monitoring capabilities.

1. Test No.	**GR_TSTP_2.3.9.11**
2. Test Details	To verify that the eNodeB should support Local Maintenance Ports for any debugging and troubleshooting.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Vendor to specify local maintenance ports for debugging and troubleshooting 2. Verify availability of local ports 3. Verify debugging and troubleshooting procedures
6. Test Limits	NA
7. Expected Results	eNodeB shall provide local maintenance ports.

1.	Test No.	**GR_TSTP_2.3.9.12**
2.	Test Details	To verify that the number of UEs connected to eNodeB is maintained at eNodeB.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform attach for multiple UEs. 3. Verify the count of active users is maintained correctly by eNodeB. 4. Then, perform detach for few UEs. 5. Verify that the count of active users is correctly maintained by the eNodeB.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall provide correct count of connected UEs.

1.	Test No.	**GR_TSTP_2.3.9.13**
2.	Test Details	To verify that eNodeB shall be capable of providing the system configuration data to the (MIB) of the system (applicable with SNMP based management only).
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Vendor to provide SNMP MIB details 2. Connect eNodeB to EMS / OMC / Simulation tool 3. Perform add / delete / modify operation 4. Verify through Wireshark logs that the operations are carried out using SNMP on objects defined by the MIB.
6.	Test Limits	NA
7.	Expected Results	The operations through EMS / OMC shall be indicate MIB objects.

1.	Test No.	**GR_TSTP_2.3.9.14**
2.	Test Details	To verify that the eNodeB shall have the ability to detect and report any hardware fault within the equipment.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. The vendor to specify procedure to induce hardware faults and reporting mechanism 2. Induce hardware fault 3. Verify that the fault has been detected and reported by the eNodeB
6.	Test Limits	NA
7.	Expected Results	eNodeB is able to detect and report the hardware fault.

1. Test No.	**GR_TSTP_2.3.9.15**
2. Test Details	To verify that the system shall provide multiple level of recovery from software/hardware faults and impact of fault on the system shall be based on fault severity
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. The vendor to specify various faults, severity levels and recovery levels 2. The vendor to specify mechanism to induce software and hardware faults 3. Induce software faults and verify recovery against the fault 4. Induce hardware faults and verify recovery against the fault
6. Test Limits	NA
7. Expected Results	The eNodeB shall recovery as per severity level of the fault

1. Test No.	**GR_TSTP_2.3.10.1**
2. Test Details	To verify eNodeB supports operator configurable use of VLANs
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure multiple VLANs on the Ethernet interface 2. Verify data transfer as per VLAN through Wireshark logs 3. Modify VLAN id 4. Verify data transfer as per modified VLAN id through Wireshark logs
6. Test Limits	NA
7. Expected Results	eNodeB shall support configurable VLANs

1. Test No.	**GR_TSTP_2.3.10.2**
2. Test Details	To verify that the eNodeB shall be able to flexibly map traffic onto one or more VLANs.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure different VLANs on eNodeB. 2. Bring eNodeB in operationally enabled state 3. Attach 2 UEs 4. Start UL and DL data for the UEs. 5. Verify through Wireshark logs that the eNodeB is able to map traffic on to different VLANs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully map traffic as per VLAN configuration

1.	Test No.	**GR_TSTP_2.3.11.1_A**
2.	Test Details	Both IPV4 and IPV6 (dual stack) shall be supported on all Ethernet transport interfaces in compliance with IETF RFC 4213.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	Verify that the eNodeB allows to configure either IPv4 or IPv6 addresses at the time of software release installation or at the time of setting the environment parameters for the board.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports both IPv4 and IPv6 addresses

1. Test No.	**GR_TSTP_2.3.12.1**
2. Test Details	To verify that the eNodeB shall comply with the IETF Diff Serve architecture and shall support the DSCP interpretation of the TOS field in the IPv4 header as defined in IETF RFC 2474.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach multiple UEs and perform data transfer. 2. Verify from Wireshark logs that eNodeB complies with Differentiated Services architecture. 3. Type of Service field in the IP header is interpreted as Differentiated Services Code Point field.
6. Test Limits	NA
7. Expected Results	eNodeB complies with the differentiated services architecture.

1. Test No.	**GR_TSTP_2.3.12.2**
2. Test Details	To verify that the eNodeB shall support the use of the Ethernet Priority Code Point (PCP) field as defined in IEEE802.1Q-2005 Sec 9.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach multiple UEs and perform data transfer. 2. Verify from Wireshark logs that eNodeB supports the use of Ethernet Priority Code Point field in the Ethernet header specific to a VLAN.
6. Test Limits	NA
7. Expected Results	eNodeB shall use configured PCP value while sending data on the ethernet interface..

1. Test No.	**GR_TSTP_2.3.12.3**
2. Test Details	To verify that the transport QoS at eNodeB is managed at layer 3 with the DSCP field of IP packets and at layer 2 with the "PCP" bits in the Ethernet frames.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure DSCP value for S1-U interface 2. Configure PCP value for S1-U interface VLAN 3. Attach multiple UEs and perform data transfer 4. Verify from Wireshark logs that eNodeB applies configured DSCP value at IP (layer-3) and configured PCP value at Ethernet (Layer-2).
6. Test Limits	NA
7. Expected Results	The eNodeB shall use configured ToS value at IP layer. The eNodeB shall use configured PCP value at Ethernet layer.

1. Test No.	**GR_TSTP_2.3.12.4**
2. Test Details	To verify that the DSCP for S1-U and X2-U are configurable by operator.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Configure DSCP values for S1-U and X2-U interfaces 2. Perform UE attach on eNodeB-1 3. Perform DL/UL data transfer 4. Verify through Wireshark logs that configured DSCP value is used at S1-U interface 5. Execute handover procedure towards eNodeB-2 6. Verify through Wireshark logs that configured DSCP value is used at X2-U interface.
6. Test Limits	NA
7. Expected Results	The eNodeB shall use configured DSCP values for S1-U and X2-U interfaces.

1. Test No.	**GR_TSTP_2.3.12.6**
2. Test Details	Layer 2 QoS marking shall be supported when the backbone network supporting the eNodeB is a layer 2 switched network
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach multiple UEs and perform data transfer. 2. Verify from Wireshark logs that eNodeB supports the use of Ethernet Priority Code Point field in the Ethernet header specific to a VLAN.
6. Test Limits	NA
7. Expected Results	The eNodeB shall use configured Ethernet PCP.

1. Test No.	**GR_TSTP_2.3.12.7**
2. Test Details	To verify that DSCP-PCP mapping shall be configurable. Default DSCP-PCP to be provided.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach multiple UEs and perform data transfer. 2. Verify through Wireshark logs that default mapping exists for DSCP and PCP. 3. Modify DSCP - PCP 4. Verify through Wireshark logs that modified DSCP-PCP mapping is used.
6. Test Limits	NA
7. Expected Results	The eNodeB shall use default DSCP - PCP mapping while transmitting data Ethernet interface. After configuration, the eNodeB shall use modified DSCP-PCP mapping while transmitting data on Ethernet interface.

1. Test No.	**GR_TSTP_2.3.13.1**
2. Test Details	eNodeB shall support at least one of the following synchronization options a. GPS b. IEEE 1588 V2 c. SyncE d. IRNSS timing source
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, PTP Grandmaster, network protocol analyser preferably Wireshark
4. Test Setup	TEST SETUP 1
5. Test Procedure	Vendor to specify the supported synchronization options. **Test Procedure for GPS:** 1. Prepare the Test setup and position eNodeB such that GPS satellite signal is receivable by it. 2. Power ON eNodeB and give it some time to acquire the GPS satellite signals. 3. Verify through EMS / OMC about the synchronization status. **Test Procedure for IRNSS:** 1. Prepare the Test setup and position eNodeB such that IRNSS satellite signal is receivable by it. 2. Power ON eNodeB and give it some time to acquire the IRNSS satellite signals. 3. Verify through EMS / OMC about the synchronization status. **Test Procedure for IEEE 1588v2:** 1. Prepare setup as per Test setup 1. 2. Additionally connect a IEEE1588 PTP Grandmaster (GM) on Ethernet Switch.

	3. Configure the GM and eNodeB appropriately. 4. eNodeB 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 1. 2. Additionally, connect a SyncE PTP Grandmaster (GM) on Ethernet Switch. The Ethernet Switch shall also support SyncE. 3. Configure the GM and eNodeB appropriately. 4. eNodeB should recover timing from GM using SynchE protocol 5. Verify through EMS / OMC about the synchronization status
6. Test Limits	NA
7. Expected Results	eNodeB shall support vendor specified synchronization options.

1.	Test No.	**GR_TSTP_2.3.13.2**
2.	Test Details	eNodeB for Wide Area BS TDD systems shall support a phase accuracy as specified below: Cell Type, Cell Radius, Requirement a) Small Cell, ≤ 3Km, ≤ 3 µs b) Large Cell, > 3Km, ≤ 10 µs This requirement is also applicable for medium range eNodeB.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. The vendor to specify cell type supported by eNodeB 2. Prepare the Test setup. Additionally, connect LTE signal analyzer on Antenna port of eNodeB. 3. Position eNodeB such that GPS satellite signal is receivable by it. Alternately, any other synchronization option can also be used. 4. Let eNodeB synchronize to Synchronization source for enough time. 5. Using LTE Signal Analyzer measure the LTE frame offset wrt a reference 1PPS (derived from Synchronization source and used as trigger). 6. Measure LTE frame offset periodically for at least 1 hour to ensure it is within +/- 1.5 microseconds of small cell limit or +/- 5 microseconds of large cell limit.
6.	Test Limits	NA
7.	Expected Results	eNodeB shall meet phase synchronization accuracy requirement.

1.	Test No.	**GR_TSTP_2.3.13.3**
2.	Test Details	eNodeB shall support at least 48 hr hold over mode in case of

	frequency synchronization loss and at least 6 hr hold over mode in case of Phase synchronization loss.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, LTE Signal Analyzer
4. Test Setup	TEST SETUP 1
5. Test Procedure	**Test Procedure for Frequency Synchronization Loss:** 1. Prepare the Test setup. Additionally, connect LTE signal analyzer on Antenna port of eNodeB. 2. Position eNodeB such that GPS satellite signal is receivable by it. Alternately, any other synchronization option can also be used. 3. Let eNodeB synchronize to Synchronization source for enough time. Check the LTE carrier frequency to be stable on Signal Analyzer. 4. Make the eNodeB enter holdover mode. 5. Using LTE Signal Analyzer, measure LTE carrier frequency error periodically for at least 48 hours to ensure it is within the Frequency Error as specified in Clause 2.3.38.2e. **Test Procedure for Phase Synchronization Loss (For TDD eNodeB only):** 1. Prepare the Test setup. Additionally, connect LTE signal analyzer on Antenna port of eNodeB. 2. Position eNodeB such that GPS satellite signal is receivable by it. Alternately, any other synchronization option can also be used. 3. Let eNodeB synchronize to Synchronization source for enough time. 4. Using LTE Signal Analyzer measure the LTE frame offset w.r.t. a reference 1PPS (derived from Synchronization source and used as trigger).

	5. Make the eNodeB to enter holdover mode 6. Check UE detach/attach. Measure LTE frame offset periodically for at least 6 hours to ensure it is within +/- 1.5 microseconds of small cell limit or +/- 5 microseconds of large cell limit.
6. Test Limits	NA
7. Expected Results	1. eNodeB supports at least 48 hours holdover in case of frequency synchronization loss. 2. eNodeB supports at least 6 hours holdover in case of phase synchronization loss.

1. Test No.	**GR_TSTP_2.3.14.1**
2. Test Details	To verify that system shall support IPSEC and key management (e.g. IKEv2 or pre-shared key) for the backhaul transport.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure pre shared key via EMS / OMC for IPSec 2. Bring eNodeB to operationally enabled state 3. Perform UE attached procedure. 4. Verify through Wireshark logs on S1 interface that IP Security procedures for signaling / data transfer 5. Verify that the packets transmitted from eNodeB towards the core network are encrypted.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully implement IPSec procedure towards EPC.

1. Test No.	**GR_TSTP_CAT1_1**
2. Test Details	To verify that eNodeB support DL TM Modes: TM1 – TM4 (TM5 – TM10 optional)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. For TM1, - Bring eNodeB operationally enabled state with single antenna connected. - Perform UE attach. - Perform downlink data transfer for the UE. 3. For TM2, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach. - Perform downlink data transfer for the UE. 4. For TM3, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach. - Perform downlink data transfer for the UE. 5. For TM4, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE.

	- Perform downlink data transfer for the UE. 6. For TM5, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform multiple UE attach and configure PMI/RI reporting for each UE. - Perform downlink data transfer for each UE. 7. For TM6, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Adjust the radio condition such that UE reports rank 1. - Perform downlink data transfer for the UE. 8. For TM7, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transmission. 9. For TM8, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transfer. 10. For TM9,

	- Bring eNodeB operationally enabled state with minimum of eight antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transmission for the UE. 11. For TM 10, - Bring eNodeB operationally enabled state with minimum of eight antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transmission for the UE 12. Verify TM modes in UE logs by varying radio conditions.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate configured Transmission Mode.

1. Test No.	**GR_TSTP_CAT1_2**
2. Test Details	To verify that eNodeB support DL SU MIMO
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. For TM2, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach. - Perform downlink data transfer for the UE. 2. For TM3, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach. - Perform downlink data transfer for the UE. 3. For TM4, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transfer for the UE. 4. For TM6, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE.

	- Adjust the radio condition such that UE reports rank 1. - Perform downlink data transfer for the UE. 5. For TM7, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transmission. 6. For TM8, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transfer. 7. For TM9, - Bring eNodeB operationally enabled state with minimum of eight antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transmission for the UE. 8. For TM 10, - Bring eNodeB operationally enabled state with minimum of eight antennas connected as per eNodeB capability. - Perform UE attach and configure PMI/RI reporting for UE. - Perform downlink data transmission for the UE 9. Verify UE logs for transmission mode used

10. Test Limits	NA
11. Expected Results	The UE logs shall indicate configured Transmission Mode.

1. Test No.	**GR_TSTP_CAT1_3**
2. Test Details	To verify that eNodeB supports DL MU MIMO
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. For TM5, - Bring eNodeB operationally enabled state with two antennas or four antennas as per eNodeB capability. - Perform multiple UE attach and configure PMI/RI reporting for each UE - Perform downlink data transfer for each UE. 2. For TM8, - Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. - Perform multiple UE attach and configure PMI/RI reporting for UE. - Perform downlink data transfer. 3. For TM9, - Bring eNodeB operationally enabled state with minimum of eight antennas connected as per eNodeB capability. - Perform multiple UE attach and configure PMI/RI reporting for UE. - Perform downlink data transfer 4. Verify UE logs for transmission mode used
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate configured transmission mode and usage of DL MU MIMO.

1. Test No.	**GR_TSTP_CAT1_4**
2. Test Details	To verify that eNodeB supports DL MIMO Layers: 2X2, 4X2 and 4X4
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. For DL MIMO 2X2, - Bring eNodeB in operationally enabled state with two antennas connected. - The transmission modes to be used as TM3 or TM4 mode. - Perform UE Attach. - Perform downlink data transfer for the UE. - Verify UE logs for transmission mode used. 2. For DL MIMO 4X2 and 4X4, - Bring eNodeB in operationally enabled state with four antennas connected. - The transmission modes to be used as TM3 or TM4 mode. - Perform UE Attach. - Perform downlink data transfer for the UE. - Verify UE logs for transmission mode used.
3. Test Limits	NA
4. Expected Results	The UE logs shall indicate 2 and 4 DL MIMO layers.

1. Test No.	**GR_TSTP_CAT1_6**
2. Test Details	To verify that eNodeB supports UL TM Modes: TM1 and TM2
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. For TM1, - Bring eNodeB in operationally enabled with two antennas or 4 antennas as per eNodeB capability. - Perform UE Attach. - Perform uplink data transfer for the UE. - Verify UE logs for transmission mode TM1 in uplink. 2. For TM2, - Bring eNodeB in operationally enabled with two antennas or four antennas as per eNodeB capability. - Perform UE Attach. - Perform uplink data transfer for the UE. - Verify UE logs for transmission mode TM2 in uplink.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate transmission mode used in uplink.

1. Test No.	**GR_TSTP_CAT1_7**
2. Test Details	To verify that eNodeB supports UL Rx Diversity: 2X and 4X
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. For UL Rx Diversity 2X, - Bring eNodeB in operationally enabled state with two antennas (2X2) or four antennas (4X2) as per eNodeB capability. - Perform UE Attach and perform uplink data transfer. - Verify UL Rx diversity (RI=1) in UE logs. 2. For UL Rx Diversity 4X, - Bring eNodeB in operationally enabled state with four antennas (4X4) as per eNodeB capability. - Perform UE Attach and perform uplink data transfer. - Verify UL Rx diversity (RI=1) in UE logs.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate desired UL Rx diversity.

1.	Test No.	**GR_TSTP_CAT1_8**
2.	Test Details	To verify that eNodeB supports UL MIMO 2X2 and 4X4
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. For 2X2, - Bring eNodeB in operationally enabled state with two antennas or four antennas as per eNodeB capability. - Transmission mode to be used in uplink is TM2. - Perform UE attach. - Perform uplink data transfer for the UE. 2. For 4X4, - Bring eNodeB in operationally enabled state with four antennas as per eNodeB capability. - Transmission mode to be used in uplink is TM2. - Perform UE attach. - Perform uplink data transfer for the UE. - Verification through UE logs.
6.	Test Limits	NA
7.	Expected Results	The UE logs shall indicate uplink transmission mode configured as TM2 and desired UL MIMO.

1. Test No.	**GR_TSTP_CAT1_10**
2. Test Details	To verify eNodeB support for dynamic switching of transmission modes of TM7/8 to TM3 or TM4 based on radio conditions and UE support.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	For TM7, • Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. • Perform downlink data transmission for UE..(PMI/RI) reporting should not be configured for the UE. • Degrade radio conditions for the UE • Verify the TM mode is switched to TM3. For TM8, • Bring eNodeB operationally enabled state with two antennas or four antennas connected as per eNodeB capability. • Perform downlink data transmission for UE. • Degrade radio conditions for the UE. • Verify the TM mode is switched to TM3. If (PMI/RI) is not configured for the UE. • Verify the TM mode is switched to TM4. If (PMI/RI) is configured for the UE.

6. Test Limits	NA
7. Expected Results	eNodeB supports dynamic switching of transmission modes 7/8 to 3 or 4 as per radio conditions.

1. Test No.	**GR_TSTP_CAT1_11**
2. Test Details	To verify that eNodeB shall support DL modulation Schemes: BPSK, QPSK, 16 QAM, 64 QAM and 256 QAM
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE Attach. 3. Start downlink data transfer for the UE. 4. Vary attenuation of the radio link. 5. Verify through UE logs for QPSK, 16 QAM, 64 QAM and 256 QAM modulation schemes in DL. 6. The presence of PHICH channel in the UE log indicates BPSK modulation.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate required modulation schemes in DL.

1.	Test No.	**GR_TSTP_CAT1_12**
2.	Test Details	To verify that eNodeB shall support UL modulation Schemes: BPSK, QPSK, 16 QAM and 64 QAM
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE Attach. 3. Start uplink data transfer for the UE. 4. Vary attenuation of the radio link. 5. Verify through UE logs for QPSK, 16 QAM and 64 QAM modulation schemes in UL. 6. The presences of PUCCH 1A channel in the UE log indicate BPSK modulation.
6.	Test Limits	NA
7.	Expected Results	The UE logs shall indicate required modulation schemes in UL.

1. Test No.	**GR_TSTP_CAT2_1**
2. Test Details	To verify that eNodeB support DL TM Modes: TM1 – TM4
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. While using TM1 mode – connect single antenna. For TM2, TM3 and TM4 modes, connect two antenna. 2. Perform UE Attach. 3. Verify Transmission scheme within TM mode is changed by varying radio conditions.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate configured Transmission Mode.

1. Test No.	**GR_TSTP_CAT2_2**
2. Test Details	To verify that eNodeB support DL SU MIMO
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state with 2 antenna connected. The transmission modes to be used as TM3 or TM4 mode. 2. Perform UE Attach. 3. Verify UE logs for transmission mode used
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate configured Transmission Mode.

1.	Test No.	**GR_TSTP_CAT2_3**
2.	Test Details	To verify that eNodeB support DL MIMO Layers: 2X2
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state with 2 antenna connected. The transmission modes to be used as TM3 or TM4 mode. 2. Perform UE Attach. 3. Verify UE logs for transmission mode used
6.	Test Limits	NA
7.	Expected Results	The UE logs shall indicate 2 DL MIMO layers.

1. Test No.	**GR_TSTP_CAT2_4**
2. Test Details	To verify that eNodeB shall support UL TM Modes: TM1
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled with two antenna. 2. Perform UE Attach. 3. Verify UE logs for transmission mode TM1 in uplink.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate TM1 in uplink.

1. Test No.	**GR_TSTP_CAT2_5**
2. Test Details	To verify that eNodeB shall support UL Rx Diversity: 2X
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state with 2 antenna. 2. Perform UE Attach. 3. Verify UL Rx diversity(RI=1) in UE logs.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate UL diversity – 2X

1. Test No.	**GR_TSTP_CAT2_6**
2. Test Details	To verify that eNodeB shall support DL modulation Schemes: BPSK, QPSK, 16 QAM, 64 QAM
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE Attach. 3. Start DL data. 4. Vary attenuation of the radio link 5. Verify through UE logs for QPSK, 16 QAM and 64 QAM modulation schemes in DL. The presence of PHICH channel in the UE log indicates BPSK modulation.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate required modulation schemes in DL.

1. Test No.	**GR_TSTP_CAT2_7**
2. Test Details	To verify that eNodeB shall support UL modulation Schemes: BPSK, QPSK, 16 QAM
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE Attach. 3. Start UL data. 4. Vary attenuation of the radio link 5. Verify through UE logs for QPSK and 16 QAM modulation schemes in UL. 6. The presence of PUCCH 1A channel in the UE log indicate BPSK modulation
7. Test Limits	NA
8. Expected Results	The UE logs shall indicate required modulation schemes in UL.

1. Test No.	**GR_TSTP_2.3.16_A**
2. Test Details	The eNodeB shall support all nine Quality of Service Class Identifiers (QCIs)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify any of QCI 1 -9 can be added as a dedicated bearer 4. Verification through UE logs.
6. Test Limits	NA
7. Expected Results	The eNodeB shall support all nine Quality of Service Class Identifiers (QCIs)

1. Test No.	**GR_TSTP_2.3.16_B**
2. Test Details	The eNodeB shall support multiple data radio bearers (DRBs).
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB up and radiating. 2. Verify the S1AP link is up. 3. Verify UE is attached successfully 4. Verify more than one DRB from any of QCI 1 -9 can be added as a dedicated bearer
6. Test Limits	NA
7. Expected Results	The eNodeB shall support multiple data radio bearers (DRBs).

1.	Test No.	**GR_TSTP_2.3.16_C**
2.	Test Details	The eNodeB shall support dynamic addition and deletion of dedicated bearers.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Initiate VoLTE Call. 4. Verify QCI 1 bearer is created at call start and deleted at call end. 5. Verify through Wireshark and UE logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall add dedicated bearer when VoLTE call is initiated. The dedicated bearer shall be deleted once VoLTE call ends.

1. Test No.	**GR_TSTP_2.3.16_D**
2. Test Details	The eNodeB shall support both UE initiated as well as Network Initiated dedicated bearer creation.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform attached for 2 UEs 3. Both UEs should Register to IMS Automatically 4. Verify through Wireshark logs that QCI5 is created at time of VoLTE Registration. 5. Start Volte Call 6. Verify through Wireshark logs that QCI 1 bearer is created for both calling and called UEs at call starting and deleted at call ending.
6. Test Limits	NA
7. Expected Results	The eNodeB shall support both UE initiated as well as Network Initiated dedicated bearer creation.

1. Test No.	**GR_TSTP_2.3.16_E**
2. Test Details	The eNodeB scheduler shall support prioritization of traffic in downlink as per the QCI priority value
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform attach for 2 UEs. 3. Create 1 GBR bearer for UE 1. Default bearer for UE 2 is Non GBR. 4. Transfer same amount of DL data using File Transfer or Iperf tool 5. Verify that UE 1 file transfer completes earlier than UE 2
6. Test Limits	NA
7. Expected Results	The eNodeB scheduler shall support prioritization of traffic in downlink as per the QCI priority value

1. Test No.	**GR_TSTP_2.3.16_F**
2. Test Details	The eNodeB shall consider ARP parameters (To verify in GBR congested state, the higher priority bearer are established by pre-empting lower priority bearer)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Bring eNodeB in GBR congested state. 3. Attach a new UE and establish a dedicated GBR bearer with pre-emption capability set to true. Lower priority bearers shall exist with pre-emption vulnerability set to true. 4. Verify that new bearer will be established by pre-empting existing lower priority bearer. 5. Verification through Wireshark logs.
6. Test Limits	NA
7. Expected Results	The eNodeB shall pre-empt low priority bearer.

1. Test No.	**GR_TSTP_2.3.17_A**
2. Test Details	To verify that eNodeB support Extended QCI which enables the operator to define and configure new Quality of Service Class Identifier (QCIs) in addition to the existing standardized QCIs (0-9). This will further enable the operator to more flexibly differentiate between bearers or service flows from a Quality of Service (QoS) perspective
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure operator defined extended QCI parameters at eNodeB. 2. Bring eNodeB in operationally enabled state. 3. Perform UE attach. 4. For each operator defined extended QCI, verify whether the respective QCI can be added as a dedicated bearer. 5. Verification through UE logs.
6. Test Limits	NA
7. Expected Results	UE logs shall indicate the successful establishment of dedicated bearers with operator defined extended QCI.

1. Test No.	**GR_TSTP_2.3.17_B**
2. Test Details	The inactivity timer for RRC and NAS (that makes the connection to be released) should be configurable by the operator for each QCI (standard and extended)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure RRC inactivity timer parameter for each QCI (standard and extended) at eNodeB 2. Bring eNodeB in operationally enabled state. 3. Perform UE attach. 4. Configure multiple dedicated bearers each with different QCI of interest (standard and extended). 5. Ensure inactivity as per configuration. 6. Verification through UE logs.
6. Test Limits	NA
7. Expected Results	UE logs shall indicate RRC connection release for UE due to inactivity.

1. Test No.	**GR_TSTP_2.3.17_C**
2. Test Details	To verify that eNodeB supports mapping of QCIs to DSCP bits and marking the Egress IP Packets for different QCIs as per the configured mapping. This is important for end-to-end QoS in uplink
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure the QCI to DSCP mapping at eNodeB. 2. Bring eNodeB in operationally enabled state. 3. Attach multiple UEs. 4. For each UE, configure dedicated bearer(s) with relevant QCI(s) of interest. 5. For each UE, perform UL data transfer on all the configured bearer(s). 6. Verify from Wireshark logs that eNodeB complies with marking the egress IP packets as per the configured QCI to DSCP mapping. 7. Type of Service field in the IP header is interpreted as Differentiated Services Code Point field.
8. Test Limits	NA
9. Expected Results	eNodeB wireshark logs shall indicate that eNodeB has performed DSCP marking for uplink IP packets as per the QCI to DSCP mapping configured at eNodeB.

1. Test No.	**GR_TSTP_2.3.17_D**
2. Test Details	To verify that eNodeB supports the pre-scheduling of resources to UEs (access grants) even if not required, which can be activated if certain load thresholds are reached.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Attach multiple UEs. 3. Ensure certain load thresholds are reached. 4. Verification through UE logs.
5. Test Limits	NA
6. Expected Results	UE logs shall indicate pre-scheduled access grants.

1.	Test No.	**GR_TSTP_2.3.18_A**
2.	Test Details	To verify that eNodeB shall be able to control the mobility for terminals in active state
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring 2 eNodeB in operationally enabled state. 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the handover time. 4. Initiate HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6.	Test Limits	NA
7.	Expected Results	The file transfer shall complete successfully when UE moves to target eNodeB.

1. Test No.	**GR_TSTP_2.3.18_B1**
2. Test Details	To verify that eNodeB shall support Cell reselection procedures. Cell Re-selection based on: Broadcast priority indication
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Configure cell reselection priority indication on eNodeB-1 2. Bring eNodeB-1 in operationally enabled state. 3. Perform UE attach with eNodeB-1 4. Verify from UE logs that eNodeB is broadcasting configured priority indication. 5. Bring eNodeB-2 in operationally enabled state 6. When UE is in idle state, attenuate radio link of eNodeB-1 7. The UE shall reselect eNodeB-2 8. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The UE logs that eNodeB-1 is broadcasting priority indication as configured. The UE shall reselect eNodeB-2

1.	Test No.	**GR_TSTP_2.3.18_B2**
2.	Test Details	To verify that eNodeB shall support Cell reselection procedures. Cell Re-selection based on:Broadcast cell-specific reselection parameters.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Configure cell specific reselection parameters on eNodeB-1. 2. Bring eNodeB in operationally enabled state. 3. Perform UE attach with eNodeB-1 4. Verify from UE logs that eNodeB is broadcasting configured cell specific reselection parameters. 5. Bring eNodeB-2 in operationally enabled state. 6. When UE is in idle state, attenuate radio link of eNodeB-1 7. The UE shall reselect eNodeB-2 8. Verify through UE logs
6.	Test Limits	NA
7.	Expected Results	The UE logs that eNodeB-1 is broadcasting cell-specific reselection parameters as configured. The UE shall reselect eNodeB-2.

1.	Test No.	**GR_TSTP_2.3.18_B3**
2.	Test Details	To verify that eNodeB shall support Cell reselection procedures. Cell Re-selection based on : Broadcast cell-specific blacklists
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Configure cell specific black-list (eNodeB-2) on eNodeB-1. 2. Bring eNodeB in operationally enabled state. 3. Perform UE attach with eNodeB 4. Verify from UE logs that eNodeB is broadcasting configured cell specific black list. 5. Bring eNodeB-2 in operationally enabled state. 6. When UE is in idle state, attenuate radio link of eNodeB-1 7. The UE shall not reselect eNodeB-2 8. Verify through UE logs
6.	Test Limits	NA
7.	Expected Results	The UE logs that eNodeB-1 is broadcasting cell-specific black-list as configured. The UE shall not reselect eNodeB-2.

1. Test No.	**GR_TSTP_2.3.18_B4**
2. Test Details	To verify that eNodeB shall support Cell reselection procedures. Cell Re-selection based on: Access class baring parameters
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure access class barring on eNodeB. 2. Bring eNodeB in operationally enabled state. 3. Verify from UE logs that eNodeB is broadcasting configured access barring parameters. 4. Try to perform UE attach, the SIM class is barred at eNodeB. 5. UE attach shall not be successful
6. Test Limits	NA
7. Expected Results	The eNodeB is broadcasting configured access class barring parameters and UE shall not be able to perform attach.

1. Test No.	**GR_TSTP_2.3.18_C**
2. Test Details	To verify that eNodeB shall support Inter PLMN reselection
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 3
5. Test Procedure	**Pre-condition:** 1. Two eNodeB were configured with different PLMN. 2. Neighbour info added to serving cell **Procedure:** 1. UE was camped to PLMN A which corresponds to serving eNodeB 2. UE stays in Idle state. 3. Attenuate the serving cell. 4. UE perform reselection on the basis of cell reselection criteria 5. UE successfully reselects the cell corresponding to another eNodeB radiating on different PLMN B.
6. Test Limits	NA
7. Expected Results	The eNodeB shall broadcast configured information The UE shall attach to target eNodeB with different PLMN.

1. Test No.	**GR_TSTP_2.3.18_D**
2. Test Details	To verify that eNodeB shall support "connection re-establishment"
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach 3. Attenuate radio link such that radio connection with UE is lost. 4. Reduce attenuation. 5. UE shall initiate re-establishment procedure. 6. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall support connection re-establishment procedure.

1.	Test No.	**GR_TSTP_2.3.18_E1**
2.	Test Details	To verify that eNodeB shall support following types of Inter eNodeB handover : Intra frequency
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring 2 eNodeB in operationally enabled state. Both eNodeB are configured with same frequency. 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the h andover time 4. Initiate HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6.	Test Limits	NA
7.	Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO.

1. Test No.	**GR_TSTP_2.3.18_E2**
2. Test Details	To verify that eNodeB shall support following types of Inter eNodeB handover: Inter frequency - same and
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring 2 eNodeB in operationally enabled state. Both eNodeB are configured with frequency in same band. 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the h andover time 4. Initiate HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO.

1. Test No.	**GR_TSTP_2.3.18_E3**
2. Test Details	To verify that eNodeB shall support following types of Inter eNodeB handover: Inter frequency - different band
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring 2 eNodeB in operationally enabled state. Both eNodeB are configured with frequency in different bands 2. Perform UE attach procedure. 3. Initiate a large file data transfer that can span the h andover time 4. Initiate HO to the target eNodeB. 5. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO.

1. Test No.	**GR_TSTP_2.3.18_E4**
2. Test Details	To verify eNodeB shall support following types of Inter eNodeB handover : Over X2
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Both eNodeB are configured with frequency in same band. 2. Define eNodeB-2 as neighbour of eNodeB-1 and define X2 interface. 3. Bring 2 eNodeB in operationally enabled state. 4. Perform UE attach procedure. 5. Initiate a large file data transfer that can span the h andover time 6. Initiate HO to the target eNodeB. 7. Verify from UE logs that UE shall move to target eNodeB after successful Handover. 8. Verify through X2 Wireshark logs that handover procedure is executed.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at X2 interface shall indicate successful HO procedure.

1. Test No.	**GR_TSTP_2.3.18_E5**
2. Test Details	To verify eNodeB shall support following types of Inter eNodeB handover: Over S1
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Both eNodeB are configured with frequency in different bands. 2. X2 interface between the eNodeB is not defined. 3. Bring 2 eNodeB in operationally enabled state. 4. Perform UE attach procedure. 5. Initiate a large file data transfer that can span the h andover time 6. Initiate HO to the target eNodeB. 7. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at S1 interface shall indicate successful HO procedure.

1. Test No.	**GR_TSTP_2.3.18_E6**
2. Test Details	To verify eNodeB shall support following types of Inter eNodeB handover : Intra MME and SGW
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Both eNodeB are configured with frequency in different bands. 2. Both eNodeB are configured in same MME. 3. X2 interface between the eNodeB is not defined. 4. Bring 2 eNodeB in operationally enabled state. 5. Perform UE attach procedure. 6. Initiate a large file data transfer that can span the h andover time 7. Initiate HO to the target eNodeB. 8. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at S1 interface shall indicate successful HO procedure.

1. Test No.	**GR_TSTP_2.3.18_E7**
2. Test Details	To verify eNodeB shall support following types of Inter eNodeB handover: Inter MME
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 3
5. Test Procedure	1. Both eNodeB are configured with frequency in different bands. 2. Both eNodeB are configured in different MME. 3. X2 interface between the eNodeB is not defined. 4. Bring 2 eNodeB in operationally enabled state. 5. Perform UE attach procedure. 6. Initiate a large file data transfer that can span the h andover time 7. Initiate HO to the target eNodeB. 8. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at S1 interface shall indicate successful HO procedure.

1. Test No.	**GR_TSTP_2.3.18_E8**
2. Test Details	To verify eNodeB shall support following types of Inter eNodeB handover: Inter MME and SGW
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 3
5. Test Procedure	1. Both eNodeB are configured with frequency in different bands. 2. Both eNodeB are configured in different MME/SGW. 3. X2 interface between the eNodeB is not defined. 4. Bring 2 eNodeB in operationally enabled state. 5. Perform UE attach procedure. 6. Initiate a large file data transfer that can span the h andover time 7. Initiate HO to the target eNodeB. 8. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at S1 interface shall indicate successful HO procedure.

1. Test No.	**GR_TSTP_2.3.18_E9**
2. Test Details	To verify eNodeB shall support following types of Inter eNodeB handover: Inter SGW
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 3
5. Test Procedure	1. Both eNodeB are configured with frequency in different bands. 2. Both eNodeB are configured in different MME/SGW. 3. X2 interface between the eNodeB is not defined. 4. Bring 2 eNodeB in operationally enabled state. 5. Perform UE attach procedure. 6. Initiate a large file data transfer that can span the h andover time 7. Initiate HO to the target eNodeB. 8. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at S1 interface shall indicate successful HO procedure.

1.	Test No.	**GR_TSTP_2.3.18_E10**
2.	Test Details	To verify eNodeB shall support following types of Inter eNodeB handover: Inter mode (TDD / FDD)
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. eNodeB-1 is configured in TDD mode. 2. eNodeB-2 is configured in FDD mode. 3. Both eNodeB are configured in same MME. 4. X2 interface between the eNodeB is not defined. 5. Bring 2 eNodeB in operationally enabled state. 6. Perform UE attach procedure. 7. Initiate a large file data transfer that can span the h andover time 8. Initiate HO to the target eNodeB. 9. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6.	Test Limits	NA
7.	Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO. The Wireshark logs at S1 interface shall indicate successful HO procedure.

1. Test No.	**GR_TSTP_2.3.18_F**
2. Test Details	To verify eNodeB shall support interworking between FDD and TDD, including session continuity (applicable only when eNodeB supports both options of FDD & TDD, in a multi sector configuration)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. eNodeB-Sector-1 is configured in TDD mode. 2. eNodeB-Sector-2 is configured in FDD mode. 3. Bring both sectors in operationally enabled state. 4. Perform UE attach procedure. 5. Initiate a large file data transfer that can span the h andover time 6. Initiate HO to the target Sector-2 7. Verify from UE logs that UE shall move to target Sector-2 after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO. The file transfer shall be complete successfully after HO.

1.	Test No.	**GR_TSTP_2.3.18_G**
2.	Test Details	To verify eNodeB shall support data forwarding at Intra-LTE handover, both over X2 and S1 interfaces.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Both eNodeB are configured with frequency in different bands. 2. Bring 2 eNodeB in operationally enabled state. 3. Perform UE attach procedure. 4. Initiate a large file data transfer that can span the handover time 5. Initiate HO to the target eNodeB. 6. In Handover required eNodeB should indicate which bearer is subject to data forwarding. 7. Verify from UE logs that UE shall move to target eNodeB after successful Handover.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute data forwarding procedure during handover procedure.

1. Test No.	**GR_TSTP_2.3.18_H**
2. Test Details	To verify eNodeB shall support PS Handover to WCDMA Based on Coverage
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 8
5. Test Procedure	1. eNodeB is configured with WCDMA cell as neighbor 2. Bring eNodeB and WCDMA cell in operationally enabled state. 3. Perform UE attach procedure to eNodeB 4. Initiate HO to the target WCDMA cell. 5. Verify from UE logs that UE shall move to target WCDMA cell after successful Handover.
6. Test Limits	NA
7. Expected Results	The UE logs shall indicate successful HO.

1. Test No.	**GR_TSTP_2.3.18_I**
2. Test Details	To verify eNodeB shall support UTRAN/ GERAN session release with redirect information.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 4
5. Test Procedure	1. The IMS core is not present 2. eNodeB is configured with GERAN cell as neighbor 3. Bring eNodeB and GERAN cell in operationally enabled state. 4. Perform UE attach procedure to eNodeB 5. Initiate CS call 6. Verify that redirect information of UTRAN/GERAN comes in RRC connection release message 7. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall support session release with redirect information.

1.	Test No.	**GR_TSTP_2.3.19_A**
2.	Test Details	To verify eNodeB shall support Load control mechanisms that provides overload protection for cells with a highly loaded air interface, by throttling incoming handovers and initial accesses in the cell
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	**For throttling handovers** 1. Configure overload parameter threshold on target eNodeB. 2. Attach multiple UE's according to the set threshold. 3. Target eNodeB has reached maximum capacity of UE's. 4. A single UE was attached on serving eNodeB. 5. UE was then moved away from the serving area. 6. Handover was not performed due to overload threshold set at target. **For initial accesses in the cell** 1. Configure overload parameter threshold on serving eNodeB. 2. Attach multiple UE's according to the set threshold. 3. Serving eNodeB has reached maximum capacity of UE's. 4. More number of UE's were not able to attach. Verify through UE logs that handover and initial access requests are not admitted.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall not allow incoming handover and intial access procedures in case of overload.

1.	Test No.	**GR_TSTP_2.3.19_B**
2.	Test Details	To verify eNodeB shall support load based Handover to GERAN/UTRAN/E-UTRAN
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2, 4
5.	Test Procedure	1. GERAN cell is added as neighbor to eNodeB 2. E-UTRAN cell is added as neighbor to eNodeB 3. At eNodeB threshold is configured 4. Attach multiple UEs. 5. Threshold reached for serving cell. 6. Now eNodeB will perform handover to GERAN / E-UTRAN cell 7. Verify through UE / Wireshark logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall handover UE to GERAN /E-UTRAN in case of overload.

1. Test No.	**GR_TSTP_2.3.20**
2. Test Details	To verify eNodeB shall support CS Fallback to UTRAN and GERAN as primary CS service for traditional voice traffic if IP Multimedia Subsystem (IMS) for Voice over IP (VoIP) services are not available.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 4
5. Test Procedure	1. GERAN cell are configured in E-UTRAN (neighbor info) 2. IMS is disabled at EPC 3. UE attached to E-UTRAN network 4. CS service initiated from UE which does not support Voice over LTE. 5. Fallback to GERAN shall be triggered 6. The CS call shall be successful 7. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall support CS fall back

1. Test No.	**GR_TSTP_2.3.21**
2. Test Details	To verify if CSFB is opted for voice services, the eNodeB shall be able to handle Emergency Calls during CS Fallback. The eNodeB should offer the operator the possibility to apply separate priorities for CS Fallback for emergency calls as compared to CS Fallback for ordinary voice calls.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 4
5. Test Procedure	1. GERAN cell are configured in E-UTRAN (neighbor info) 2. IMS is disabled at EPC 3. UE attached to E-UTRAN network 4. Emergency call initiated from UE which is not VoLTE supported. 5. CS fallback shall be triggered to a GERAN cell that is configured as priority cell for emergency calls. 6. Emergency call shall be successful 7. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall redirect CS emergency call to a priority cell.

1.	Test No.	**GR_TSTP_2.3.22_A**
2.	Test Details	To verify that eNodeB supports LTE-FDD Carrier Aggregation upto 5 component carriers.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation support including five components carriers as per eNodeB capability. 2. Perform UE attach. 3. Perform downlink and uplink data transfer. 4. Verification through UE logs.
5.	Test Limits	NA
6.	Expected Results	UE logs shall indicate configuration of carrier aggregation for UE, with up to five component carriers as per UE capability.

1.	Test No.	**GR_TSTP_2.3.22_B**
2.	Test Details	To verify that eNodeB supports Inter-Band CA between various standardized FDD bands (not applicable for TDD system)
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation including component carriers from different LTE-FDD bands as per eNodeB capability. 2. Perform UE attach. 3. Perform downlink and uplink data transfer. 4. Verification through UE logs.
5.	Test Limits	NA
6.	Expected Results	UE logs shall indicate configuration of carrier aggregation for UE, with component carriers from different LTE-FDD bands as per UE capability.

1.	Test No.	**GR_TSTP_2.3.22_C**
2.	Test Details	To verify that eNodeB supports Intra-Band contiguous and non-contiguous CA
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation including intra band non-contiguous component carriers as per eNodeB capability. 2. Perform UE attach. 3. Perform downlink and uplink data transfer. 4. Verification through UE logs.
5.	Test Limits	NA
6.	Expected Results	UE logs shall indicate configuration of carrier aggregation for UE, with intra band non-contiguous component carriers as per UE capability.

1. Test No.	**GR_TSTP_2.3.22_D**
2. Test Details	To verify that eNodeB supports CA between FDD and TDD (applicable only when eNodeB supports both options of FDD & TDD)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation, including component carriers from supported FDD and TDD bands as per eNodeB capability. 2. Perform UE attach. 3. Perform downlink and uplink data transfer. 4. Verification through UE logs.
5. Test Limits	NA
6. Expected Results	UE logs shall indicate configuration of carrier aggregation for UE, with carrier components from both FDD and TDD based on UE capability.

1. Test No.	**GR_TSTP_2.3.22_F**
2. Test Details	To verify that eNodeB supports Uplink Carrier aggregation
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation as per eNodeB capability. 2. Perform UE attach. 3. Perform downlink and uplink data transfer. 4. Verification through UE logs.
5. Test Limits	NA
6. Expected Results	UE logs shall indicate configuration of uplink carrier aggregation for UE.

1. Test No.	**GR_TSTP_2.3.22_G**
2. Test Details	To verify that eNodeB supports Dynamic selection of Secondary frequency when having multiple cell carriers for CA
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation supported as per eNodeB capability. 2. Perform UE attach. 3. Adjust the radio conditions for different cell carriers for UE. 4. Perform downlink and uplink data transfer. 5. Verification through UE logs.
6. Test Limits	NA
7. Expected Results	UE logs shall indicate configuration of carrier aggregation for UE and dynamic change of secondary frequency based on radio conditions.

1. Test No.	**GR_TSTP_2.3.22_H**
2. Test Details	To verify that eNodeB supports considering CA users during Load Balancing to avoid losing CA capabilities and to avoid congestion because of CA activation
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation supported as per eNodeB capability. 2. Perform UE attach and ensure carrier aggregation is enabled for the UE. 3. Ensure the load balancing is triggered at eNodeB 4. Verification through the UE logs.
1. Test Limits	NA
2. Expected Results	1. UE logs shall indicate UE is not losing the CA capabilities due to load balancing

1.	Test No.	**GR_TSTP_2.3.22_I**
2.	Test Details	To verify that eNodeB supports carrier aggregation scenario, where it is possible to aggregate carriers where different Transmission Modes (TM) are used in the aggregated cells
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state with carrier aggregation supported as per eNodeB capability. 2. Perform UE attach. 3. Adjust radio condition of different aggregated cells for the UE, resulting in different transmission modes in the aggregated cells. 4. Perform downlink and uplink data transfer. 5. Verification through UE logs.
6.	Test Limits	NA
7.	Expected Results	UE logs shall indicate configuration of carrier aggregation for UE with different transmission modes configured in the aggregated cells.

1.	Test No.	**GR_TSTP_2.3.23_A**
2.	Test Details	The MCE shall be supported logically within the eNodeB and should support all associated interfaces: M2, M3 and M1
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	MCE stands for Multicast Co-ordination Entity MCE interfaces are as follows M1 – Interface between MCE and MBMS GW-eNB (User plane interface and IP multicast used for point to multipoint delivery of data packets.) M2 – Interface between MCE and eNodeB (Session Control Signaling and Radio Configuration data) M3 – Interface between MCE and MME (Session Control Signaling on E-RAB level (e.g., MBMS Session Start/Stop) 1. Verify that the eNodeB is operationally enabled. 2. Verify that MCE exists as a logical entity within the eNodeB. 3. Verify that MBSFN configuration is done at eNodeB via CLI / EMS. 4. From eNodeB / wireshark logs, verify that all applicable interfaces M1, M2 and M3 are operational. 5. Initiate downlink data transfer for multiple MBMS capable UEs (from a compatible application at UE such as watching live streaming of audio or video) OR appropriate procedure from the simulator such that MBFSN transfer is initiated. 6. Verify at UE side that all UEs should be able to receive broadcast / multicast data successfully at once without any loss.
6.	Test Limits	NA
7.	Expected Results	Broadcast / Multicast data is successfully received by all UEs

1.	Test No.	**GR_TSTP_2.3.23_B**
2.	Test Details	The eNodeB shall support Multicast Channel (MCH) and associated Physical Multicast Channel (PMCH)
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Verify that the eNodeB is in operationally enabled state. 2. Verify that MBSFN configuration is done at eNodeB via CLI / EMS. 3. Ensure that all logical interfaces from MCE i.e. M1, M2 and M3 are operational. 4. Initiate downlink data transfer for multiple MBMS capable UEs (from a compatible application at UE such as watching live streaming of audio or video) OR appropriate procedure from the simulator such that MBFSN transfer is initiated. 5. Verify from UE logs that for MBFSN transfer MCH is used as a transport channel. 6. Verify from UE logs that for MBFSN transfer PMCH is used as a physical channel (channel through which actual data transfer takes place).
6.	Test Limits	NA
7.	Expected Results	eNodeB supports MCH and PMCH as transport and physical channels respectively.

1. Test No.	**GR_TSTP_2.3.23_C**
2. Test Details	The eNodeB shall support extended cyclic prefix
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 18
5. Test Procedure	1. Configure eNodeB to Extended Cyclic prefix configuration from CLI / EMS. 2. Verify that the eNodeB is in operationally enabled state. 3. Verify from UE logs that the eNodeB is operational with Extended Cyclic Prefix configuration. 4. Perform UE attach. Verify from logs that UE attach is successful.
6. Test Limits	NA
7. Expected Results	eNodeB shall support Extended Cyclic Prefix

1.	Test No.	**GR_TSTP_2.3.23_D**
2.	Test Details	The eNodeB shall support Multimedia Broadcast/Multicast Service over Multimedia Broadcast Single Frequency Network (MBSFN)
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Configure multiple eNodeBs in a service area. 2. Verify that MBSFN configuration is done at eNodeB via CLI / EMS. 3. Verify SIB 13 of all the eNodeBs which are part of the single service area. 4. Initiate downlink data transfer for multiple MBMS capable UEs (from a compatible application at UE such as watching live streaming of audio or video) OR appropriate procedure from the simulator such that MBFSN transfer is initiated. 5. Verify from UE logs that the UEs are able to receive the same data from all the eNodeBs that belong to the service area.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports MBMS over MBFSN

1.	Test No.	**GR_TSTP_2.3.23_E**
2.	Test Details	The eNodeB shall support SIB13. MBSFN control channel information and MBSFN Area specification are specified by SIB13
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Configure eNodeB to support MBFSN configuration via EMS / CLI. 3. Perform UE attach. 4. Verify from UE logs that eNodeB is broadcasting System Information Type 13. 5. Verify that SIB 13 includes MBFSN Service Area Information such as Area ID, MBFSN control channel Information (i.e. Repetition Period, Offset, Modification period, Signaling MCS etc.).
6.	Test Limits	NA
7.	Expected Results	eNodeB supports System Information Type 13

1.	Test No.	**GR_TSTP_2.3.23_F**
2.	Test Details	The eNodeB shall support up to 3 MBSFN Areas in the same location
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	**One eNodeB can be part of multiple service area (for different user services).** 1. Bring eNodeB operational with one service area. 2. From UE logs, verify the area information in SIB 13 3. Now add two more areas to this eNodeB 4. From UE logs, verify SIB 13 for the updated area information. 5. Perform UE attach procedure for multiple UE and verify that all UEs are successfully attached. 6. Now initiate different kinds of MBFSN transfers such that different service areas are utilized. 7. Verify from UE end and network logs that different kinds of MBFSN transfers are successful as per the service area.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports up to 3 MBSFN areas

1.	Test No.	**GR_TSTP_2.3.23_G**
2.	Test Details	The eNodeB shall support SIB16 which contains information related to GPS time and Coordinated Universal Time (UTC). The UE may use the time information for numerous purposes, e.g. to synchronize the UE clock **(to determine MBMS session start/ stop)**
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach. 3. Verify from UE logs that eNodeB is broadcasting System Information Type 16. 4. Verify that contents of SIB 16 are correct i.e. it is correctly carrying time related information.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports System Information Type 16

1.	Test No.	**GR_TSTP_2.3.23_H**
2.	Test Details	eMBMS should be supported in case of multiple carriers also, which means operator can choose to broadcast service on one of the carriers or both carriers simultaneously. The eNodeB shall support SIB15 which is broadcasted by RAN and it enables all cells to provide MBMS SAIs for the current frequency and also for neighboring frequencies where MBMS is provided
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Bring multiple eNodeB in operationally enabled state and all of them should belong to one serving area. 2. Initiate MBSFN transfer on MBFSN capable devices in such a way that data transfer is done on single carrier. 3. Verify that data transfer is successful. 4. Initiate MBSFN transfer on MBFSN capable devices in such a way that data transfer is done on multiple carriers 5. Verify that data transfer is successful. 6. Verify from UE logs that SIB 15 is broadcasted successfully. 7. Also verify that SIB 15 contains service area information for the current frequency and for neighboring frequencies also.
6.	Test Limits	NA
7.	Expected Results	MBMS transfer is supported both for single / multiple carrier frequency.

1.	Test No.	**GR_TSTP_2.3.23_I**
2.	Test Details	The eNodeB shall be able to support unicast traffic and eMBMS services simultaneously. Unicast traffic should not be affected by eMBMS traffic and vice versa.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Configure eNodeB with MBFSN configuration via CLI / EMS. 3. Perform UE attach procedure for multiple UE. 4. Initiate downlink data transfer for multiple MBMS capable UEs (from a compatible application at UE such as watching live streaming of audio or video) OR appropriate procedure from the simulator such that MBFSN transfer is initiated for a set of UEs. 5. While this MBMS transfer is ongoing from this eNodeB, initiate unicast downlink data transfer towards a UE which does not belong to MBSFN group. 6. Verify from UE side that unicast data transfer is successful 7. Verify that both multicast and unicast data transfer is successful at one time. 8. Now stop both multicast and unicast data. 9. Now first initiate unicast data transfer, this to be followed by multicast data transfer. 10. Verify that both unicast and multicast data transfer is successful at one time.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports both unicast and eMBMS data transfer simultaneously.

1.	Test No.	**GR_TSTP_2.3.23_J**
2.	Test Details	The seamless mobility for eMBMS shall be supported in both RRC_IDLE state as well as RRC_CONNECTED state
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 18
5.	Test Procedure	1. Bring two eNodeBs A and B in operationally enabled state. 2. Configure both eNodeBs with MBFSN configuration via CLI / EMS in one service area. 3. Perform UE attach procedure for multiple UE at eNodeB A. 4. Initiate downlink data transfer for multiple MBMS capable UEs (from a compatible application at UE such as watching live streaming of audio or video) OR appropriate procedure from the simulator such that MBFSN transfer is initiated. 5. Verify at UE side that MBFSN transfer is successful on all devices i.e. each device is able to receive the broadcast / multicast data. 6. Move the UEs away from eNodeB A towards the coverage area of eNodeB B. 7. Verify that handover is successful to eNodeB B and the MBFSN transfer continues successfully after handover. 8. Detach the UEs and perform UE attach for multiple UEs at eNodeB A. 9. Now make the UEs to enter into RRC_IDLE state from RRC_CONNECTED state (For e.g.: By the means of Inactivity timer). 10. Move the UEs away from eNodeB A towards the coverage area of eNodeB B such that cell reselection is triggered to eNodeB B. 11. Initiate downlink MBSFN data transfer towards multiple MBMS capable UEs such that the paging procedure is performed. 12. Verify at UE side that MBFSN transfer is successful on all devices i.e. each device is able to receive the broadcast / multicast data.
6.	Test Limits	NA
7.	Expected Results	Seamless mobility for eMBMS is supported both in RRC IDLE and RRC CONNECTED states.

1.	Test No.	**GR_TSTP_2.3.24**
2.	Test Details	To verify eNodeB shall support Cell ID Based Location Support where the cell ID for a specific UE is transferred to MME upon request
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. UE is camped on a cell. 2. MME sends location control message to eNodeB. 3. Initiate the location reporting for MME by sending location reporting control 4. Verify that eNodeB is subsequently reporting the current location of UE by sending cell ID in location report message 5. Verify through Wireshark logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute cell id based location support.

1. Test No.	**GR_TSTP_2.3.25_A1**
2. Test Details	Verify that eNodeB shall support location determination based on Enhanced Cell ID (ECID) by providing the following information: Geographical coordinates of its serving eNodeB
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 9
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Attach UE-1 3. Trigger DOWNLINK UE ASSOCIATED LPPTA TRANSPORT message containing E-CID Measurement Initiation Request from EPC simulator to eNodeB. 4. Verify eNodeB sends UPLINK UE ASSOCIATION LPPA TRANSPORT message containing E-CID Measurement Initiation Response. 5. Verify the E-CID Measurement report in E-CID Measurement Initiation response from the Wireshark logs. 6. Verify E-UTRAN Access Point position from the Wireshark logs.
6. Test Limits	NA
7. Expected Results	The eNodeB shall support location determination based on Enhanced Cell ID (ECID) with geographical coordinates of its serving eNodeB.

1. Test No.	**GR_TSTP_2.3.25_A2**
2. Test Details	The eNodeB shall support location determination based on Enhanced Cell ID (ECID) by providing the following information: Additional UE and radio resource measurements
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 9
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Attach UE-1 3. Trigger DOWNLINK UE ASSOCIATED LPPTA TRANSPORT message containing E-CID Measurement Initiation Request from EPC simulator to eNodeB. 4. Verify eNodeB sends UPLINK UE ASSOCIATION LPPA TRANSPORT message containing E-CID Measurement Initiation Response. 5. Verify the E-CID measurement report in the E-CID measurement Initiation response from the Wireshark logs. 6. Verify value Timing Advance Type 2, Result RSRP and Result RSRQ from the Wireshark logs.
6. Test Limits	NA
7. Expected Results	The eNodeB shall support location determination based on Enhanced Cell ID (ECID) with UE and radio resource measurements.

1. Test No.	**GR_TSTP_2.3.25_B1**
2. Test Details	To verify eNodeB supports the OTDOA i. The eNodeB can optionally support Positioning Reference Signal (PRS) to improve the accuracy and performance of the OTDOA methods for location determination by UE
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring up multiple eNodeBs in operationally enabled state with support for LPPa and PRS. 2. Perform UE attach. 3. Verification through UE logs and eNodeB wireshark logs.
4. Test Limits	NA
5. Expected Results	1. UE logs shall indicate - The LPP signalling between UE and location server. - UE measurements for location determination. 2. eNodeB wireshark logs shall indicate - The LPPa signalling between eNodeB and location server.

1. Test No.	**GR_TSTP_2.3.26_C**
2. Test Details	To verify that eNodeB shall support coordinated scheduling in downlink &uplink between all cells of the same logical eNodeB whereby interference between neighbour cells is minimized via scheduling of resources in a dynamic and coordinated way. Applicable to multi sector (split architecture) eNodeBs only
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring two eNodeB sectors in operationally enabled state. Ensure both eNodeB sectors radiating on same frequency 2. Ensure X2 interface is up between the two eNodeBs 3. Attach 1 UE to each eNodeB 4. Perform DL/UL data for both UEs 5. Verify from Wireshark logs, eNodeBs exchange Load information message on X2 interface to coordinate the radio resource scheduling
6. Test Limits	NA
7. Expected Results	The eNodeB shall exchange load information message on X2 interface.

1.	Test No.	**GR_TSTP_2.3.27_A**
2.	Test Details	The eNodeB shall support self-configuration
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB up and radiating. 2. Verify that the eNodeB comes up successfully with the offline profile stored at OMC.
6.	Test Limits	NA
7.	Expected Results	The eNodeB will support configuration as per offline profile.

1. Test No.	**GR_TSTP_2.3.27_B**
2. Test Details	To verify that eNodeB SON shall support Automatic PCI planning
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 10
5. Test Procedure	1. Bring multiple eNodeB up and radiating. 2. Verify the S1AP link is up for eNodeB' s. 3. Verify that PCI is selected through NMM procedure.
6. Test Limits	NA
7. Expected Results	The eNodeB SON shall support Automatic PCI selection.

1. Test No.	**GR_TSTP_2.3.27_C**
2. Test Details	To verify the eNodeB shall support Automatic Neighbor Relations (ANR) based on UE Measurement Report
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring 2 eNodeB' s up and radiating. eNodeB1 does not have eNodeB2 configured as its neighbour. 2. Verify the S1AP link is up for eNodeB' s. 3. Attach UE on eNodeB1. 4. Make UE to report measurement reports of eNodeB2. 5. The eNodeB1 shall update neighbour relation for eNodeB2. 6. Verify through UE / Wireshark logs.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully update neighbor relations.

1. Test No.	**GR_TSTP_2.3.27_D**
2. Test Details	The eNodeB shall support power saving functionality
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Schedule power saving of eNodeB via OMC. 3. Verify that the eNodeB goes into power saving mode at the scheduled time.
6. Test Limits	NA
7. Expected Results	The eNodeB shall implement power saving has per OMC configuration.

1.	Test No.	**GR_TSTP_2.3.28_A**
2.	Test Details	The eNodeB shall support PCI collision detection and resolution
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring two eNodeBs A and B in operationally enabled state with different PCI values. 2. Post this, for first eNodeB I.e. A, configure a list of PCI values such that the list contains the PCI of the other eNodeB I.e. B also. 3. Now restart the eNodeB A. 4. Verify from logs that eNodeB A selects a PCI that is different from eNodeB B. 5. eNodeB A shall not pick up the PCI of eNodeB B. 6. Verify that eNodeB reports appropriate alarm for PCI collision. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB supports PCI collision, detection and resolution.

1.	Test No.	**GR_TSTP_2.3.28_B**
2.	Test Details	The eNodeB SON shall support Automatic Root Sequence Index (RSI) allocation for PRACH planning
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Verify SIB 2 in UE logs. Verify the value of Root Sequence Index broadcasted in SIB 2. 3. Simulate a condition where multiple RACH collisions take place (from UE simulator). 4. Verify the eNodeB supports automatic change in Root Sequence Index value i.e. it changes the value of RSI. 5. Again verify the value of Root Sequence Index in SIB 2. This should be updated to the automatic value given by eNodeB. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB supports Automatic Root Sequence Index allocation

1.	Test No.	**GR_TSTP_2.3.28_C**
2.	Test Details	The eNodeB shall support automated configuration of best neighbor relations for Intra-RAT load management
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Configure two eNodeBs A and B. 2. No Intra RAT neighbor should be defined on eNodeB A. 3. Configure the load thresholds at eNodeB A. 4. Generate high traffic at eNodeB A as per the load thresholds so that condition for load-based handoff is satisfied. 5. Ensure that radio conditions are appropriate. 6. Verify that neighbor is detected through ANR (Automatic Neighbor Relation I.e. based on UE measurements). 7. Verify the same is updated in the neighbor list at eNodeB. 8. Verify from UE and network logs that the handover is successful to the new detected neighbor. 9. Offload to eNodeB B should be successful as per load thresholds. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB supports automated configuration of neighbor for Intra-RAT load management

1.	Test No.	**GR_TSTP_2.3.28_D**
2.	Test Details	It shall be possible to black list and exclude neighbors that have a low handover success rate, from the neighbor list
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring two eNodeBs A and B in operationally enabled state. 2. Perform UE attach at eNodeB A. 3. Move the UE away from eNodeB A and towards the coverage area of eNodeB B. 4. Verify that the neighbor is detected through ANR procedure and the handover to eNodeB B is successful. 5. Also verify the entry for the neighbor is updated in the neighbor list at eNodeB. 6. Now attempt multiple handovers from eNodeB A to B in such a manner that most of the handovers fail from eNodeB A to B for a specific duration in time. 7. Verify that eNodeB marks the eNodeB B as blacklisted at run time. 8. After the neighbor has been marked as blacklisted, verify from logs that further handovers are not attempted towards eNodeB B. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	Neighbor for which the handover success rate is low shall be marked as blacklisted neighbor.

1.	Test No.	**GR_TSTP_2.3.28_E**
2.	Test Details	The eNodeB shall support Mobility Robustness Optimization (MRO) related to Too-early, Too-late or Handovers to Wrong Cell
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring two eNodeB A and B in operationally enabled state. 2. Perform attach for multiple UEs. 3. Initiate handovers from eNodeB A to B and vice-versa in such a way that lot of handovers fail in a specified duration of time. 4. Simulate the scenario in such a way that there are less number of successful handovers and more of failed handovers that can be classified to "Too-early handovers" OR "Too-late handovers" OR "Handovers to Wrong Cell". 5. Verify from eNodeB logs that the eNodeB optimizes the parameters such as Hysteresis, Time to Trigger, CIO etc. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB supports Mobility Robustness Parameters.

1.	Test No.	**GR_TSTP_2.3.28_F**
2.	Test Details	The eNodeB shall support Mobility Load Balancing (MLB)
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring two eNodeB A and B in operationally enabled state. 2. Ensure that eNodeB B is defined as neighbor to eNodeB A. 3. Generate traffic on eNodeB A in such a way that the cell becomes highly loaded. Multiple failures for RRC establishment, E-RAB establishment, UE context release due to congestion situation will take place. 4. Verify from eNodeB logs that in such a case eNodeB will perform mobility load balancing i.e. offloading the subscribers to eNodeB B. This will be achieved by auto tuning of cell reselection and handover parameters such as QOffset, Cell Individual Offset etc. by eNodeB. 5. Ensure that the handovers take place to offload eNodeB A while radio conditions are appropriate for the UEs to stay oneNodeB A. 6. Verify from logs that appropriate cause is included in the Handover Request. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB shall support Mobility Load Balancing

1.	Test No.	**GR_TSTP_2.3.28_G**
2.	Test Details	The system shall support soft lock of cells making it possible to take cells out of traffic with minimal impact on ongoing traffic
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 6
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach of multiple UEs and initiate data transfer session / calls on them. 3. Initiate soft lock of cell from EMS. 4. Verify that the attached subscribers in the cell are not impacted abruptly. 5. Also verify that eNodeB does not admit any new subscriber. 6. After configured time period for soft lock cell lock procedure is initiated. 7. Verify that the status of the cell is updated at the EMS.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports soft lock of cells.

1.	Test No.	**GR_TSTP_2.3.28_H**
2.	Test Details	The eNodeB shall support Coverage and Capacity optimization features thus ensuring optimum tradeoff between coverage, capacity and quality as well as handling load imbalance
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 2
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform attach of multiple UE and initiate different services from them. 3. Simulate conditions in such a manner that the system performance goes down i.e. multiple radio link failures occur, handover failures occur, RRC connection re-establishments take place for a certain duration of time. 4. In such conditions, verify that the eNodeB supports Coverage and Capacity optimization features such as eNodeB should attempt to modify the Max TX Power OR it should attempt to modify the antenna tilts to minimize failures. 5. Verify from EMS the modified value of Max TX Power OR appropriate alarm is raised for antenna tilt with valid parameters. 6. Verify from logs and utilities at eNodeB that failures as RLF, HO failures, RRC re-establishments are minimized and success percentage is increased. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB supports Coverage and Capacity Optimization features

1.	Test No.	**GR_TSTP_2.3.28_I**
2.	Test Details	The eNodeB shall support Self-Healing procedures
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 6
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Induce a fault condition in the system for e.g. By killing a process from the command line. 3. Verify that the eNodeB is able to recover by itself. 4. After recovery procedure verify that the eNodeB is operational. 5. All services such as UE attach, calls, data transfer are successful.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports Self-Healing procedure

1.	Test No.	**GR_TSTP_2.3.28_J**
2.	Test Details	The eNodeB shall have capability to supervise all cells. It should able to detect sleeping cells and supports self-healing by automatically trying to recover the suspected sleeping cells
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 19
5.	Test Procedure	1. Bring all cells of an eNodeB in operationally enabled state. 2. Induce a software fault in one of the cell in such a manner that the cell becomes a sleeping cell. (Sleeping cell is a cell that is operationally enabled but it is not able to serve any services due to some fault conditions, also such fault conditions are not reported to O&M). E.g.: It is not able to serve RACH requests due to fault conditions. 3. Verify that eNodeB is able to detect such a cell and perform auto recovery of such a cell. 4. After recovery verify that UE attach is successful on the cell and services are resumed successfully. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB shall be able to detect the sleeping cells and take appropriate recovery action for the affected cells.

1.	Test No.	**GR_TSTP_2.3.28_K**
2.	Test Details	The eNodeB shall support micro sleep in the Downlink enabling discontinuous transmission to save energy during low traffic. The TX in the eNodeB shall be able to mute transmission during empty OFDM symbols
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Do not perform any UE attach i.e. keep the eNodeB idle for some specified amount of time. 3. When the eNodeB is in idle state i.e. when it is not serving any user, then verify that eNodeB should be able to enter the micro sleep mode. 4. Verify from eNodeB logs that DTX has been activated. 5. Also verify when the DTX is activated, eNodeB remains accessible i.e. it remains in “IN_SERVICE” state. 6. The transmission of cell specific reference signals, PBCH and the PSS/SSS will continue as earlier. **** Procedure as per Distributed SON functionality**
6.	Test Limits	NA
7.	Expected Results	eNodeB supports micro sleep mode when there is no traffic.

1.	Test No.	**GR_TSTP_2.3.28_L**
2.	Test Details	The eNodeB shall be able to automatically reconfigure the antenna system from MIMO to SIMO mode and back based on traffic load in the eNodeB order to lower the power consumption
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 6
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Ensure that the transmission mode configured at eNodeB is TM2 or higher. 3. Perform UE attach and initiate downlink data transfer. Verify from eNodeB logs / utilities that both antennas are used for data in downlink. 4. Now perform attach for one more UE. 5. Ensure that VoLTE is enabled for both the handsets. 6. Initiate VoLTE call from first user to another. 7. Verify that the VoLTE call is established successfully 8. Verify from eNodeB logs / utilities that only the first antenna is utilized for voice traffic in downlink. 9. Disconnect the VoLTE call. 10. Again initiate downlink data on one UE. 11. Verify that again downlink data is sent on both the antennas.
6.	Test Limits	NA
7.	Expected Results	eNodeB shall be able to switch from MIMO to SIMO and vice-versa depending on the traffic.

1.	Test No.	**GR_TSTP_2.3.28_M**
2.	Test Details	The system shall support advanced monitoring of the antenna system in order to be able to indicate problems related to the antenna system, e.g. mismatched antenna pair Rx diagrams, swapped or disconnected feeders and loss in RF path
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Verify that the eNodeB is accessible via EMS. 3. Ensure that multiple antennas are connected to the eNodeB as per the capacity e.g. 2,4 4. Remove / disconnect one or more antennas from eNodeB. 5. Verify that eNodeB is able to detect the same and report an alarm for the same to EMS.
6.	Test Limits	NA
7.	Expected Results	eNodeB shall support monitoring of antenna system.

1.	Test No.	**GR_TSTP_2.3.28_N**
2.	Test Details	The system shall support means to monitor the CPRI link quality
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Verify that the eNodeB should have mechanism through which it should be able to monitor the CPRI link in case of fault conditions or otherwise also. 2. There should be a proper report indicating the link quality parameters.
6.	Test Limits	NA
7.	Expected Results	eNodeB should support CPRI link quality monitoring

1.	Test No.	**GR_TSTP_2.3.28_O**
2.	Test Details	The eNodeB shall support Minimization of Drive Test feature
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Make eNodeB trigger measurements from UE similar to the ones that are recorded in a physical drive test. Verify that eNodeB sends RRC "LoggedMeasurementConfiguration" to UE to instruct the UE to perform measurements and perform logging for them. 3. Verify the logged in measurements such as RSRP and RSRQ are reported from the UE to the eNodeB via the UE Information Request / Response procedures.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports Minimization of Drive Test Feature. UE shall report all the required measurements to the eNodeB.

1.	Test No.	**GR_TSTP_2.3.29_A**
2.	Test Details	The eNodeB shall Support UL intra-site CoMP
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 19
5.	Test Procedure	1. Bring all cells of eNodeB in operationally enabled state. Each cell in the eNodeB is termed as receiver. 2. Perform UE attach. 3. Initiate uplink data transfer from the UE 4. Verify from eNodeB logs / utilities that all cells receive the signal from the UE. UE is not aware that the signals are received at multiple cells. 5. Verify that the uplink data transfer is successful.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports intra site UL CoMP.

1.	Test No.	**GR_TSTP_2.3.29_B**
2.	Test Details	The eNodeB shall Support DL intra-site CoMP
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 19
5.	Test Procedure	1. Bring all cells of eNodeB in operationally enabled state. Each cell in the eNodeB is termed as transmission point (TP). 2. Perform UE attach. 3. Initiate downlink data transfer from the UE 4. In case joint transmission mode of DL CoMP is supported same data is transmitted to this UE from multiple TPs i.e. multiple cells. Verify from UE logs that UE is able to receive data from multiple cells at the same time. 5. In case CS / CB (coordinated scheduling / coordinated beamf orming) mode of DL CoMP is supported, multiple coordinated TPs i.e. multiple cells shares only CSI (Channel State Inf ormation) for UE and data packet that is destined to a U E is available only at one TP. TP is changed accordingly as per radio conditions.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports intra site DL CoMP

1.	Test No.	**GR_TSTP_2.3.29_C**
2.	Test Details	The eNodeB shall support at least one of the following methods: i) Joint Transmission: When two or more Tx point, transmit on a same frequency in the same subframe ii) Dynamic Transmission: When two or more Tx/Rx point ready to transmit but only scheduled from one Tx point in each subframe
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 19
5.	Test Procedure	1. Bring a set of multiple cells in operationally enabled state. Each cell is termed as a transmission point. 2. Perform UE attach and initiate data transfer. 3. Verify from UE logs / eNodeB logs that the eNodeB supports either Joint transmission mechanism OR Dynamic transmission scheme. 4. In case of joint transmission, verify from UE logs or network logs that all the transmission points transfer data at the scheduled subframe. 5. In case of dynamic transmission, verify from UE logs and network logs that one of the transmission points transfer data and the other points co-ordinate amongst themselves for the CoMP operation for making decisions regarding scheduling / beamforming. 6. Verify that the data transfer is successful in any of the above schemes.
6.	Test Limits	NA
7.	Expected Results	eNodeB shall support either Joint Transmission or Dynamic Transmission for CoMP.

1. Test No.	**GR_TSTP_2.3.30_A1**
2. Test Details	To verify that establishment of default QCI-5 bearer is successful. Verify the IMS signaling.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 6
5. Test Procedure	1. The IMS is enabled with EPC 2. User SIM is configured with "apn" for registration with IMS domain 3. Bring eNodeB in operationally enabled state 4. Perform UE Attach. The UE should attach with default bearer. 5. At the time of IMS registration by the UE, default bearer of QCI-5 shall be created. 6. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall create default QCI-5 default bearer for IMS signalling.

1. Test No.	**GR_TSTP_2.3.30_A2**
2. Test Details	To verify that establishment of dedicated QCI-1 bearer is successful on making a VoLTE call. Verify the IMS signaling.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 6
5. Test Procedure	1. The IMS is enabled with EPC 2. User SIM is configured with "apn" for registration with IMS domain 3. Bring eNodeB in operationally enabled state 4. Perform UE Attach. The UE shall also register with IMS. 5. Initiate VoLTE call. The eNodeB shall create dedicated bearer with QCI-1. 6. The call shall be successful. 7. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully create dedicated bearer with QCI-1.

1. Test No.	**GR_TSTP_2.3.30_A3**
2. Test Details	To verify that establishment of dedicated QCI-1 and QCI-2 bearer is successful on making a ViLTE call. Verify the IMS signaling.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 6
5. Test Procedure	1. The IMS is enabled with EPC 2. User SIM is configured with “apn” for registration with IMS domain 3. Bring eNodeB in operationally enabled state 4. Perform UE Attach. The UE shall also register with IMS. 5. Initiate ViLTE call. The eNodeB shall create dedicated bearer with QCI-2. 6. The call shall be successful. 7. Verify through UE and Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully create dedicated bearer with QCI-2.

1. Test No.	**GR_TSTP_2.3.30_B**
2. Test Details	The eNodeB shall support RLC UM (Unacknowledged Mode) for services that tolerate a higher packet loss rate but require lower latency, e.g. VoLTE.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 6
5. Test Procedure	1. The IMS is enabled with EPC 2. User SIM is configured with “apn” for registration with IMS domain 3. Bring eNodeB in operationally enabled state 4. Perform UE Attach. The UE shall also register with IMS. 5. Initiate VoLTE call. The eNodeB shall create dedicated bearer with QCI-1. 6. Verify through UE logs that RLC UM mode is used for VoLTE bearer (QCI1) in RRC Connection Reconfiguration message. 7. The call shall be successful.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully allocated QCI-1 bearer with RLC UM mode.

1. Test No.	**GR_TSTP_2.3.30_C**
2. Test Details	The eNodeB shall support Robust Header Compression (RoHC).
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 6
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Perform UE Attach. 3. Initiate VoLTE call 4. Verify through UE logs that RoHC is used
6. Test Limits	NA
7. Expected Results	eNodeB shall use RoHC during VoLTE call.

1. Test No.	**GR_TSTP_2.3.30_D**
2. Test Details	Verify that eNodeB shall support Single Radio Voice Call Continuity (SRVCC) handover to UTRAN/ GERAN. Voice calls (VoLTE) that have been established over LTE shall be able to continue if the user moves away from LTE coverage to areas with only WCDMA/GSM coverage while still on a call.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 4
5. Test Procedure	1. 2G neighbour is added as Static neighbour in eNodeB. 2. Attach a UE on eNodeB 3. Initiate VoLTE call 4. Move UE from the coverage of LTE eNodeB to coverage of 2G cell. 5. Handover to 2G shall be triggered 6. Verify through UE / Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute SRVCC procedure.

1. Test No.	**GR_TSTP_2.3.31**
2. Test Details	To verify that eNodeB supports SIB10/SIB11 for ETWS(PWS)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. eNodeB configured with SIB-10 / SIB-11 information so that those can be broadcasted. 2. Trigger ETWS message from MME 3. Verify through UE logs that it receives paging message with its "ETWS" IE present and UE is able to decode SIB-10/ SIB-11.
6. Test Limits	NA
7. Expected Results	eNodeB should broadcast Paging message with "ETWS IE present in it so that UE can read SIB-10 / SIB-11.

1.	Test No.	**GR_TSTP_2.3.32_A**
2.	Test Details	Verify that eNodeB shall be capable of prioritization of calls (RRC establishment cause highPriorityAccess) by using dedicated resources in admission control during initial access
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state 2. Simulate eNodeB capacity is used up to configured threshold 3. Initiate new call with cause “highPriorityAccess” 4. The eNodeB shall pre-empt an existing RRC connection 5. The highPriorityAccess call shall be successful 6. Verify through UE logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully implement prioritization.

1. Test No.	**GR_TSTP_2.3.32_B**
2. Test Details	Verify that eNodeB shall have capability to prioritize paging messages in overload situations based on a priority provided by the MME.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Initiate several back to back low priority and one high priority paging messages with same sub group in this sequence. 3. The high priority paging message shall be transmitted earlier than atleast some of the low priority messages 4. Verify through UE logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall implement priority of paging messages.

1.	Test No.	**GR_TSTP_2.3.33_A**
2.	Test Details	To verify that eNodeB shall indicate the support of multiple operator
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 5
5.	Test Procedure	1. Configure 2 PLMN in eNodeB. 2. Bring eNodeB in operationally enabled state 3. Verify in UE logs that eNodeB is transmitting both PLMN in SIB1. 4. Verify through Wireshark logs that eNodeB initializes S1 interface towards both EPCs.
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully indicate support of multiple PLMNs.

1. Test No.	**GR_TSTP_2.3.33_B**
2. Test Details	To verify that eNodeB shall route operator specific traffic to its respective core network
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 5
5. Test Procedure	1. Configure 2 PLMN in eNodeB 2. Bring eNodeB in operationally enabled state. 3. Perform attach of UE1 for PLMN1 and UE2 for PLMN2 4. Attach of both UE shall be successful 5. Verify through Wireshark logs that eNodeB forwards Attach request for UE1 to MME1 and for UE2 to MME2.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute S1 procedures towards respective MME.

1.	Test No.	**GR_TSTP_2.3.34**
2.	Test Details	ePDCCH (Applicable for Category-1 only and optional) The eNodeB shall support Enhanced PDCCH (ePDCCH) capability that enable support of UE specific control signaling. ePDCCH can therefore be used to increase amount of downlink PDCCH capacity since the ePDCCH resource can be scheduled to the UEs in addition to traditional PDCCH resources.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Bring eNodeB in operationally enabled state. 2. Perform UE attach for multiple UEs. 3. Initiate data transfer from UEs in such a way that ePDCCH resources are allocated by eNodeB. (E.g. MU-MIMO). 4. Verify from UE logs that ePDCCH resources are allocated. 5. Also verify that the data transfer is successful.
6.	Test Limits	NA
7.	Expected Results	eNodeB supports Enhanced PDCCH

1. Test No.	**GR_TSTP_2.3.35_A**
2. Test Details	To verify the eNodeB supports "Overload Start" S1AP procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 9
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Initiate "Overload Start" S1AP procedure from EPC simulator with IE set to “reject RRC connection establishments for signalling” 3. Perform UE attach 4. eNodeB shall reject the RRC Connection Requests with cause “MO Signalling”. 5. Verify through UE and Wireshark logs.
6. Test Limits	NA
7. Expected Results	The eNodeB shall reject new RRC connections on receipt of MME overload indication.

1. Test No.	**GR_TSTP_2.3.35_B**
2. Test Details	To verify the eNodeB supports "Overload Stop" S1AP procedure
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 9
5. Test Procedure	1. Bring eNodeB in operationally enabled state 2. Initiate "Overload Start" S1AP procedure from EPC simulator with IE set to "reject RRC connection establishments for signalling" 3. Perform UE attach 4. eNodeB shall reject the RRC Connection Requests with cause "MO Signalling". 5. Initiate "Overload Stop" S1AP procedure from EPC simulator 6. Perform UE attach 7. The RRC connection shall be successful 8. Verify through UE and Wireshark logs.
6. Test Limits	NA
7. Expected Results	eNodeB will resume normal operation after receiving "OVERLOAD STOP"

1. Test No.	**GR_TSTP_2.3.37_A**
2. Test Details	Shall be able to support a round trip latency up to 800ms on the satellite backhaul (S1) interface
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Insert Round Trip Latency up to 800 ms using delay simulator tool on S1 Interface. 2. Bring eNodeB in operationally enabled state 3. Perform UE Attach/Detach Procedure 4. Verify that UE Successfully Attached and Detached from Network. 5. Verify through UE/Wireshark logs
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute Attach/Detach procedure with round trip latency up to 800ms.

1.	Test No.	**GR_TSTP_2.3.37_B**
2.	Test Details	Shall be able to support packet jitter of up to 100ms on the satellite backhaul (S1) interface
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Insert Jitter of upto 100ms using simulator tool on S1 Interface. 2. Bring eNodeB in operationally enabled state 3. Perform UE Attach/Detach Procedure 4. Verify that UE Successfully Attached and Detached from Network. 5. Verify through UE/Wireshark logs
6.	Test Limits	NA
7.	Expected Results	The eNodeB shall successfully execute Attach/Detach procedure with packet jitter of 100ms.

1. Test No.	**GR_TSTP_2.3.38.2_A**
2. Test Details	Rated output power (Prated,c), of the base station is the mean power level per carrier for BS operating in single carrier, multi-carrier, or carrier aggregation configurations that the manufacturer has declared to be available at the antenna connector during the transmitter ON period
3. Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.
4. Test Setup	Test Setup 11
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.2.4.2 of 3GPP36.141
6. Test Limits	≥ Declared BS Power ± 0.7 dB, f ≥ 3.0GHz ≥ Declared BS Power ± 1.0 dB, 3.0GHz < f ≥ 4.2GHz
7. Expected Results	Declared BS Power must be with in Test limits

1.	Test No.	**GR_TSTP_2.3.38.2_B**
2.	Test Details	The RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at maximum output power for a specified reference condition.
3.	Test Instruments Required	Same as GR_TSTP_2.3.28.2_F
4.	Test Setup	Same as GR_TSTP_2.3.28.2_F
5.	Test Procedure	GR_TSTP_2.3.28.2_F NOTE: No specific test or test requirements are defined for RE Power control dynamic range. The Error Vector Magnitude test, provides sufficient test coverage for this requirement.
6.	Test Limits	Same as GR_TSTP_2.3.28.2_F
7.	Expected Results	Same as GR_TSTP_2.3.28.2_F

<table>
<tr><td>1. Test No.</td><td>GR_TSTP_2.3.38.2_C</td></tr>
<tr><td>2. Test Details</td><td>The total power dynamic range is the difference between the maximum and the minimum transmit power of an OFDM symbol for a specified reference condition.
NOTE: The upper limit of the dynamic range is the OFDM symbol power for a BS at maximum output power. The lower limit of the dynamic range is the OFDM symbol power for a BS when one resource block is transmitted. The OFDM symbol shall carry PDSCH and not contain RS, PBCH or synchronization signals.</td></tr>
<tr><td>3. Test Instruments Required</td><td>Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.</td></tr>
<tr><td>4. Test Setup</td><td>Test Setup 11</td></tr>
<tr><td>5. Test Procedure</td><td>1. Make the setup as shown in Test Setup
2. Follow the procedure given in section 6.3.2.4.2 of 3GPP36.141</td></tr>
<tr><td>6. Test Limits</td><td>The downlink (DL) total power dynamic range for each E-UTRA carrier shall be larger than or equal to the level in Table Below:
<table>
<tr><th>E-UTRA channel bandwidth (MHz)</th><th>Total power dynamic range (dB)</th></tr>
<tr><td>5</td><td>13.5</td></tr>
<tr><td>10</td><td>16.5</td></tr>
<tr><td>15</td><td>18.3</td></tr>
<tr><td>20</td><td>19.6</td></tr>
</table></td></tr>
<tr><td>7. Expected Results</td><td>The total power dynamic range should be with in Specified Test Limits.</td></tr>
</table>

1. Test No.	**GR_TSTP_2.3.38.2_D**
2. Test Details	Transmitter OFF power is defined as the mean power measured over 70 us filtered with a square filter of bandwidth equal to the transmission bandwidth configuration of the BS centred on the assigned channel frequency during the transmitter OFF period. The purpose of this test is to verify the E-UTRA BS transmitter OFF power is within the limit of the minimum requirement.
3. Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.
4. Test Setup	Test Setup 12
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.4.2.4.2 of 3GPP36.141
6. Test Limits	Mean power spectral density shall be $<$ -83dBm/MHz for f $\geq$ 3.0GHz $<$ -82.5dBm/MHz for 3.0GHz $<$ f $\geq$ 4.2GHz.
7. Expected Results	Transmitter OFF power Should be with in specified Test Limits.

<table>
<tr><td>1. Test No.</td><td>GR_TSTP_2.3.38.2_E</td></tr>
<tr><td>2. Test Details</td><td>Frequency error is the measure of the difference between the actual BS transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.</td></tr>
<tr><td>3. Test Instruments Required</td><td>Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.</td></tr>
<tr><td>4. Test Setup</td><td>Test setup 11</td></tr>
<tr><td>5. Test Procedure</td><td>1. Make the setup as shown in Test Setup
2. Follow the procedure given in section 6.5.1.4 of 3GPP36.141</td></tr>
<tr><td>6. Test Limits</td><td>The modulated carrier frequency of each E-UTRA carrier configured by the BS shall be accurate to within the accuracy range given in Table Below observed over a period of one subframe (1ms).
<table>
<tr><th>BS class</th><th>Accuracy</th></tr>
<tr><td>Wide Area BS</td><td>± (0.05 ppm + 12 Hz)</td></tr>
<tr><td>Medium Range BS</td><td>± (0.1 ppm + 12 Hz)</td></tr>
<tr><td>Local Area BS</td><td>± (0.1 ppm + 12 Hz)</td></tr>
<tr><td>Home BS</td><td>± (0.25 ppm + 12 Hz)</td></tr>
</table></td></tr>
<tr><td>7. Expected Results</td><td>Frequency error Should be with in specified Test Limits.</td></tr>
</table>

<table>
<tr><td>1. Test No.</td><td>GR_TSTP_2.3.38.2_F</td></tr>
<tr><td>2. Test Details</td><td>The Error Vector Magnitude is a measure of the difference between the ideal symbols and the measured symbols after the equalization. This difference is called the error vector. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power expressed in percentage.</td></tr>
<tr><td>3. Test Instruments Required</td><td>Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.</td></tr>
<tr><td>4. Test Setup</td><td>Test Setup 11</td></tr>
<tr><td>5. Test Procedure</td><td>1. Make the setup as shown in Test Setup
2. Follow the procedure given in section 6.5.2.4.2 of 3GPP36.141</td></tr>
<tr><td>6. Test Limits</td><td>The EVM of each E-UTRA carrier for different modulation schemes on PDSCH shall be less than the limits in table:
<table>
<tr><th>Modulation scheme for PDSCH</th><th>Required EVM [%]</th></tr>
<tr><td>QPSK</td><td>18.5 %</td></tr>
<tr><td>16QAM</td><td>13.5 %</td></tr>
<tr><td>64QAM</td><td>9 %</td></tr>
<tr><td>256QAM</td><td>4.5%</td></tr>
<tr><td colspan="2">NOTE: The EVM requirement for 256QAM applies to Home BS, Local Area BS and Medium Range BS.</td></tr>
</table>
</td></tr>
<tr><td>7. Expected Results</td><td>Error Vector Magnitude Should be with in specified Test Limits.</td></tr>
</table>

1. Test No.	**GR_TSTP_2.3.38.2_G**
2. Test Details	Frames of the LTE signals present at the BS transmitter antenna port(s) are not perfectly aligned in time. In relation to each other, the RF signals present at the BS transmitter antenna port(s) experience certain timing differences. For a specific set of signals/transmitter configuration/transmission mode, time alignment error (TAE) is defined as the largest timing difference between any two signals.
3. Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, hybrid coupler.
4. Test Setup	Test Setup 13
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.5.3.4.2 of 3GPP36.141
6. Test Limits	TAE shall not exceed: 1. 90 ns for MIMO or TX diversity transmissions, at each carrier frequency. 2. 155 ns for intra-band contiguous carrier aggregation, with or without MIMO or TX diversity. 3. 285 ns for intra-band non-contiguous carrier aggregation, with or without MIMO or TX diversity. 4. 285 ns for inter-band carrier aggregation, with or without MIMO or TX diversity.
7. Expected Results	TAE Should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.3.38.2_H**
2. Test Details	For E-UTRA, DL RS power is the resource element power of Downlink Reference Symbol. The absolute DL RS power is indicated on the DL-SCH. The absolute accuracy is defined as the maximum deviation between the DL RS power indicated on the DL-SCH and the DL RS power of each E-UTRA carrier at the BS antenna connector
3. Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.
4. Test Setup	Test Setup 11
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.5.4.4.2 of 3GPP36.141
6. Test Limits	DL RS power of each E-UTRA carrier shall be: within ± 2.9 dB of the DL RS power indicated on the DL-SCH for carrier frequency f ≤ 3.0 GHz within ± 3.2 dB of the DL RS power indicated on the DL-SCH for carrier frequency 3.0GHz < f ≥ 4.2GHz.
7. Expected Results	DL RS Power Should be with in specified Test Limits.

1.	Test No.	**GR_TSTP_2.2.38.2_I**
2.	Test Details	The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the total mean transmitted power. The requirement applies during the transmitter ON period.
3.	Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.
4.	Test Setup	Test Setup 11
5.	Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.6.1.4.2 of 3GPP36.141 for vendor specified channel bandwidths.
6.	Test Limits	Test limits for the Occupied BW is as defined in Section 5.6 of 3GPP36.141.
7.	Expected Results	Occupied BW Should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.3.38.2_J**
2. Test Details	Adjacent Channel Leakage Power Ratio (ACLR) is the ratio of the filtered mean power centered on the assigned channel frequency to the filtered mean power centered on an adjacent channel frequency.
3. Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.
4. Test Setup	Test Setup 11
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.6.2.4.2 of 3GPP36.141
6. Test Limits	Test limits for the ACLR is < 44.2 dB
7. Expected Results	ACLR Should be with in specified Test Limits.

1.	Test No.	**GR_TSTP_2.3.38.2_K**
2.	Test Details	Unless otherwise stated, the Operating band unwanted emission limits are defined from 10 MHz below the lowest frequency of each supported downlink operating band up to 10 MHz above the highest frequency of each supported downlink operating band.
3.	Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, EF Attenuator, 50Ω Termination, Reference clock generator.
4.	Test Setup	Test Setup 11
5.	Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.6.3.4.2 of 3GPP36.141
6.	Test Limits	Test limits for the Operating band unwanted emission is as defined in Section 6.6.3.5 of 3GPP36.141
7.	Expected Results	Operating band unwanted emission should be with in Specified Test Limits.

<table>
<tr><td>1. Test No.</td><td>GR_TSTP_2.3.38.2_L</td></tr>
<tr><td>2. Test Details</td><td>Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, inter modulation products and frequency conversion products, but exclude out of band emissions. This is measured at the base station antenna connector.
The transmitter spurious emission limits apply from 9 kHz to 12.75 GHz, excluding the frequency range from 10 MHz below the lowest frequency of the downlink operating band up to 10 MHz above the highest frequency of the downlink operating band.</td></tr>
<tr><td>3. Test Instruments Required</td><td>Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.</td></tr>
<tr><td>4. Test Setup</td><td>Test Setup 14</td></tr>
<tr><td>5. Test Procedure</td><td>a) Make the setup as shown in Test Setup
b) Follow the procedure given in section 6.6.4.4.2 of 3GPP36.141</td></tr>
<tr><td>6. Test Limits</td><td>Ref 3GPP TS 36.141 Table 6.6.4.5.2-1
<table>
<tr><th colspan="3">BS Spurious emissions limits</th></tr>
<tr><th>Frequency range</th><th>Maximum Level</th><th>Measurement Bandwidth</th></tr>
<tr><td>9 kHz ~ 150 kHz</td><td>-36dBm</td><td>1 kHz</td></tr>
<tr><td>150 kHz ~ 30MHz</td><td>-36dBm</td><td>10 kHz</td></tr>
<tr><td>30MHz ~ 1 GHz</td><td>-36dBm</td><td>100 kHz</td></tr>
<tr><td>1 GHz ~ 12.75 GHz</td><td>-30dBm</td><td>1MHz</td></tr>
</table></td></tr>
<tr><td>7. Expected Results</td><td>Spurious emissions Should be with in specified Test Limits.</td></tr>
</table>

1. Test No.	**GR_TSTP_2.3.38.2_M**
2. Test Details	The transmit inter modulation requirement is a measure of the capability of the transmitter to inhibit the generation of signals in its nonlinear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna. The requirement applies during the transmitter ON period and the transmitter transient period. The transmit inter modulation level is the power of the inter modulation products when an EUTRA signal of channel bandwidth 5 MHz as an interfering signal is injected into an antenna connector at a mean power level of 30 dB lower than that of the mean power of the wanted signal.
3. Test Instruments Required	Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Circulator, Signal Generator with LTE software.
4. Test Setup	Test Setup 15
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 6.7.4.2 of 3GPP36.141
6. Test Limits	Test limits for the Transmitter intermodulation is as defined in Section 6.7.5 of 3GPP36.141
7. Expected Results	Transmitter intermodulation Spurious emissions should be with in specified Test Limits.

<table>
<tr><td>1. Test No.</td><td>GR_TSTP_2.3.38.3_A</td></tr>
<tr><td>2. Test Details</td><td>The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the BS receiver antenna connector. The requirements apply to all BS with separate RX and TX antenna ports.</td></tr>
<tr><td>3. Test Instruments Required</td><td>Power supply, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator.</td></tr>
<tr><td>4. Test Setup</td><td>Test Setup 14</td></tr>
<tr><td>5. Test Procedure</td><td>1. Make the setup as shown in Test Setup
2. Follow the procedure given in section 7.7 of 3GPP36.141</td></tr>
<tr><td>3. Test Limits</td><td>Limits as per section 7.7.5 of 3GPP36.141
Table 7.7-1: General spurious emission test requirement
<table>
<tr><th>Frequency range</th><th>Maximum level</th><th>Measurement Bandwidth</th><th>Note</th></tr>
<tr><td>30MHz - 1 GHz</td><td>-57 dBm</td><td>100 kHz</td><td></td></tr>
<tr><td>1 GHz - 12.75 GHz</td><td>-47 dBm</td><td>1 MHz</td><td></td></tr>
<tr><td>12.75 GHz - 5th harmonic of the upper frequency edge of the UL operating band in GHz</td><td>-47 dBm</td><td>1 MHz</td><td>Applies only for Bands 22, 42 and 43.</td></tr>
<tr><td colspan="4">NOTE: The frequency range between 2.5 * $BW_{Channel}$ below the first carrier frequency and 2.5 * $BW_{Channel}$ above the last carrier frequency transmitted by the BS, where $BW_{Channel}$ is the channel bandwidth according to Table 5.6-1, may be excluded from the requirement. However, frequencies that are more than 10 MHz below the lowest frequency of the BS downlink operating band or more than 10 MHz above the highest frequency of the BS downlink operating band (see Table 5.5-1) shall not be excluded from the requirement.</td></tr>
</table></td></tr>
<tr><td>4. Expected Results</td><td>Spurious emissions Should be with in specified Test Limits.</td></tr>
</table>

1.	Test No.	**GR_TSTP_2.3.38.3_B**
2.	Test Details	The blocking characteristics is a measure of the receiver ability to receive a wanted signal at its assigned channel in the presence of an unwanted interferer, which are either a 1.4MHz, 3MHz or 5MHz EUTRA signal for in-band blocking or a CW signal for out-of-band blocking. The test stresses the ability of the BS receiver to withstand high-level interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.
3.	Test Instruments Required	Power supply, Signal Generator, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Combiner, Circulator.
4.	Test Setup	Test Setup 16
5.	Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 7.6.4.2 of 3GPP36.141
6.	Test Limits	Test limits for the Blocking is as defined in Section 7.6.5 of 3GPP36.141
7.	Expected Results	Blocking results should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.2.38.3_C**
2. Test Details	Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Inter modulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal. Interfering signals shall be a CW signal and an EUTRA signal.
3. Test Instruments Required	Power supply, Signal Generators with LTE software, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Combiner, Circulator.
4. Test Setup	Test Setup 17
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 7.8.4.2 of 3GPP36.141
6. Test Limits	Test limits for the Rx Intermodulation is as defined in Section 7.8.5 of 3GPP36.141
7. Expected Results	Rx Intermodulations results should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.3.38.3_D**
2. Test Details	Adjacent channel selectivity (ACS) is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an adjacent channel signal with a specified center frequency offset of the interfering signal to the band edge of a victim system.
3. Test Instruments Required	Power supply, Signal Generators with LTE software, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Combiner, Circulator.
4. Test Setup	Test Setup 16
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 7.5.4.2 & 7.5.4.3 of 3GPP36.141
6. Test Limits	Test limits for the ACS & Narrow Band Blocking is as defined in Section 7.5.5 of 3GPP36.141
7. Expected Results	ACS & Narrow Band Blocking results should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.3.38.3_E**
2. Test Details	The reference sensitivity power level PREFSENS is the minimum mean power received at the antenna connector at which a throughput requirement shall be met for a specified reference measurement channel.
3. Test Instruments Required	Power supply, Signal Generators with LTE software, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Combiner, Circulator.
4. Test Setup	Test Setup 16
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 7.2.4.2 of 3GPP36.141
6. Test Limits	Test limits for the Reference sensitivity level is as defined in Section 7.2.5 of 3GPP36.141
7. Expected Results	Reference sensitivity level results should be with in Specified Test Limits.

1. Test No.	**GR_TSTP_2.3.38.3_F**
2. Test Details	The dynamic range is specified as a measure of the capability of the receiver to receive a wanted signal in the presence of an interfering signal inside the received channel bandwidth. In this condition a throughput requirement shall be met for a specified reference measurement channel. The interfering signal for the dynamic range requirement is an AWGN signal.
3. Test Instruments Required	Power supply, Signal Generators with LTE software & AWGN, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Combiner, Circulator.
4. Test Setup	Test Setup 16
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 7.3.4.2 of 3GPP36.141
6. Test Limits	Test limits for the dynamic range level is as defined in Section 7.3.5 of 3GPP36.141
7. Expected Results	Dynamic range results should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.3.38.3_G**
2. Test Details	In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations in the presence of an interfering signal received at a larger power spectral density. In this condition a throughput requirement shall be met for a specified reference measurement channel.
3. Test Instruments Required	Power supply, Signal Generators with LTE software, Spectrum analyzer, PC, LAN cable, Console cable, RF cables, BNC cables, RF Attenuator, 50Ω Termination, Reference clock generator, Combiner, Circulator.
4. Test Setup	Test Setup 16
5. Test Procedure	1. Make the setup as shown in Test Setup 2. Follow the procedure given in section 7.4.4.2 of 3GPP36.141
6. Test Limits	Test limits for the In-channel selectivity is as defined in Section 7.4.5 of 3GPP36.141
7. Expected Results	In-channel selectivity results should be with in specified Test Limits.

1. Test No.	**GR_TSTP_2.4.1**
2. Test Details	eNB shall allow subscribers capacity to be pooled between all sectors. Baseband subscriber capacity shall be pooled over all sectors. (applicable to split architecture)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	The vendor to specify total baseband UE capacity and number of sectors supported. 1. Configure eNodeB with maximum supported sectors 2. Enable only one sector 3. Perform attach/detach of total baseband capacity UEs in one sector 4. The attach / detach shall be successful 5. Now enable maximum sectors 6. Perform attach/detach of equal number of UEs in each sector. Total number of UEs being equals to baseband capacity. 7. The attach / detach shall be successful 8. Verify through Wireshark logs
6. Test Limits	NA
7. Expected Results	The distributed eNodeB shall allow pooling of baseband UE capacity across sectors.

1. Test No.	**GR_TSTP_2.4.2**
2. Test Details	eNodeB shall be able to support at least 32 simultaneously scheduled subscribers (up to 8 users per TTI: 4 users in UL and 4 users in DL). A scheduled subscriber has data to be sent in the uplink or downlink and is queued in the scheduler.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Perform attach for 32 UEs. Check that all UEs are attached successfully to the network. 2. Start uplink/downlink data from all 32 UEs. 3. Verify from UE logs that up to 4 users per TTI in UL and 4 users per TTI in DL are scheduled simultaneously.
6. Test Limits	NA
7. Expected Results	The eNodeB shall support transfer of downlink/uplink data of 32 UEs.

1. Test No.	**GR_TSTP_2.4.3**
2. Test Details	eNodeB shall be able to support 32 simultaneous RRC connected subscribers.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Perform attach for 32 UEs. Check that all UEs are attached successfully to the network. 2. Verify from Wireshark logs.
6. Test Limits	NA
7. Expected Results	eNodeB shall successfully support attach of 32 simultaneous UEs.

1. Test No.	**GR_TSTP_2.4.4**
2. Test Details	eNodeB shall be able to support Omni and multi-sector (applicable to split architecture only) configurations
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Configure eNodeB in Omni site mode. 2. Perform UE attach and initiate data transfer. 3. Verify that data transfer is successful. 4. Configure eNodeB in multi sector site mode (applicable to split architecture only). 5. Perform UE attach and initiate data transfer in each sector. 6. Verify that data transfer is successful in each sector
6. Test Limits	NA
7. Expected Results	eNodeB shall support omni configuration. The split architecture eNodeB shall support multi sector configuration

1. Test No.	**GR_TSTP_2.4.5**
2. Test Details	eNodeB shall provide VLAN separation for O&M and X2/S1 traffic. Two separate VLANs on a common physical interface
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Perform various activities on the system in such a manner that both O&M and X2/S1 traffic is generated. 2. Verify from Wireshark logs that O&M, X2/S1 traffic is sent on to the corresponding VLAN interface.
6. Test Limits	NA
7. Expected Results	eNodeB shall send traffic on configured VLAN interface.

1. Test No.	**GR_TSTP_4.1.1**
2. Test Details	To verify that eNodeB supports eDRX function
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Verify that EPC is eDRX capable, S1 link is working 2. eNodeB is sync with Phase mode 3. UE tracer is connected 4. From UE change the eDRX cycle to 20.48 seconds 5. Power on an eDRX CATM UE to do attach or trigger UE ot do a tracking area update
6. Test Limits	NA
7. Expected Results	On UE tracer, Check SIB1 and MSB message. Validate hyperSFN IE is included. Check attach request message, validate the “Extended DRX parameters” IE is included. Check the attach accept message, validate the “Extended DRX parameters” IE is included. And the eDRX value is 20.48 seconds.

1. Test No.	**GR_TSTP_4.1.3**
2. Test Details	To verify that eNodeB supports ATTACH_without_PDN_connectivity
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. The ENB is installed at least 1 cell. 2. ENB is connected to real cloud EPC or EPC simulator (ePC sim)
6. Test Limits	NA
7. Expected Results	1. SIB1-NB is broadcasted with PLMN-IdentityInfo-NB-r13 with attachWithoutPDN-Connectivity-r13 IE set to 'true' 2. UE establishes RRC Connection and sends RRC Connection Setup Complete -NB with NAS message CONTROL PLANE SERVICE REQUEST (where NAS PDU Data is encapsulated) and attachWithoutPDN-Connectivity-r13 IE set to true 3. eNB sends S1AP: INITIAL UE MESSAGE with NAS PDU Data to MME 4. There's no DL NAS PDU Data to be sent on the downlink by the MME and MME sends S1AP: CONNECTION ESTABLISHMENT INDICATION followed by S1AP: UE CONTEXT RELEASE COMMAND to the eNB. RRC Connection is released and eNB responds with S1AP: UE CONTEXT RELEASE COMPLETE.

1. Test No.	**GR_TSTP_4.2.1.1**
2. Test Details	To verify that eNodeB supports CAT-M
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE /UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser, Application Server connected to SGi interface, Application PCs for UEs Variable Step Attenuators, UE supporting CAT-M
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. LTE cell must be configured 2. All of the involved network elements of the LTE/SAE system (eNB, MME, SAE-GW) are in service state without any alarms. 3. The Client Application PC (connected to the UE) should support of UDP and FTP traffic as client/ server. 4. The CAT-M UE used in test should be connected to eNB antenna using a separate RF attenuator to adjust RF channel condition independently according to Table 1. 5. EPS-subscribed QoS profile of UE used in test is configured as non-GBR QCI 9 bearer in HSS.
6. Test Limits	NA
7. Expected Results	1. MIB, SIB1-BR, SIB2-BR broadcast messages are successfully decoded by CAT-M UE. 2. UE is in RRC Connected state 3. CAT-M UE is in ECM-Connected state after completion of NAS authentication and attach complete procedure. 4. Throughput in DL on the CAT-M UE is measured as approx. 73.5 Kbps (application layer). 5. In case of simultaneous UL + DL data transfer: throughput in downlink is measured as 41 Kbps throughput in uplink is measured as 44 Kbps 6. Throughput in UL on the CAT-M UE is measured as

	approx. 98 Kbps. Note: Measured throughput figures in half-duplex mode for CAT-M1 UE in UL direction using MCS=9 satisfies the calculated throughput results which are calculated by System Architecture using MATHLAB simulation. 7. UE receives RRC Connection Release message from the eNB after initiation detach procedure.

1.	Test No.	**GR_TSTP_4.2.1.2**
2.	Test Details	To verify that eNodeB supports CAT-M coexistence with existing cell
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser, Application Server connected to SGi interface, Application PCs for UEs Variable Step Attenuators, UE supporting CAT-M
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	**For LTE Cell:** Power on the legacy LTE UE and initiate attach procedure using the connection manager. · Initiate maximum U-Plane UDP traffic in UL and DL (for 10 MHz cell) using IPerf tool and check the received throughput in UL / DL **For CAT-M cell:** Power on the CAT-M UE and initiate attach procedure using the connection manager. · Initiate 100 Kbps U-Plane UDP traffic in 1) UL only 2) in DL only 3) both in UL + DL using IPerf tool and check the received throughput in UL / DL · Verify peak throughput of Legacy LTE UE while CAT-M UE is in RRC Connected state
6.	Test Limits	NA
7.	Expected Results	**For LTE Cell:** • Legacy LTE UE is in ECM-Connected state. • Maximum throughput figures in UL and DL on Legacy LTE-UE is achieved. i.e. application layer throughput is measured as approx. 68.8 Mbps in DL and 23.4 Mbps in

	UL. **For CAT-M cell:** • CAT-M UE is in ECM-Connected state. • CAT-M UE throughput in UL and DL are measured as 44 Kbps and 41 Kbps respectively (please refer to RRM.170040_LTE3128 Basic CAT-M call setup.docx for details) while Legacy LTE call is ongoing. • Measured peak throughput on the Legacy LTE-UE is degraded as follows: • Downlink throughput in application layer is degraded from 68.8 Mbps to 65.4 Mbps as 6 PRBs in DL are used for CAT-M narrowband. • Uplink throughput is degraded from approx. 23.4 Mbps to 16.6 Mbps (maximum PRBs can be assigned to one Legacy UE is reduced from 38 PRBs to 32 PRBs after deduction of 6 PRBs for MPUSCH, 2 PRBs for MPUCCH)

1. Test No.	**GR_TSTP_4.2.2.3**
2. Test Details	Verification of NB-IoT multi-tone and single-tone simultaneous UL transmission
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser, UE supporting IOT
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach UE#1 (multi-tone capable) under MCL feasible for multi-tone transmission 2. Attach UE#2 (single-tone only capable) under MCL feasible for multi-tone transmission 3. Start UE#1 UL traffic (to reach maximum throughputs) 4. Start UE#2 UL traffic (to reach maximum throughputs)
6. Test Limits	NA
7. Expected Results	1. UE successfully attaches to the cell 2. UE successfully attaches to the cell 3. NPUSCH F1 is scheduled in multi-tone fashion Maximum throughput is achieved 4. NPUSCH F1 is scheduled in single-tone fashion

1. Test No.	**GR_TSTP_5.2.2**
2. Test Details	Verification of MCPTT support on eNodeB
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser, GCS AS, UE supporting PTT
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach a Public Safety capable UE in the serving cell. 2. The UE is attached to the network. A default bearer is established (e.g. QCI9). Optional additional bearer might be established. This depends on the subscriber configuration in the HSS. 3. Start a Public Safety application and establish a Public Safety Push To Talk voice call to a second terminal.
6. Test Limits	NA
7. Expected Results	1. If not present a QCI69 bearer is establish for call setup signaling. Then a QCI 65 or QCi66 bearer is establish to set up the Public Safety PTT voice call. 2. QoS information in E-RAB Setup Request can be seen

1. Test No.	**GR_TSTP_7.1.1**
2. Test Details	To verify eNodeB provides users a facility for high speed data & voice. eNodeB shall have facilities for automatic roaming, locating and updating mobile subscribers.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Bring 2 eNodeBs in operationally enabled state. eNodeB2 should be configured with TAC and PLMN value different from eNodeB1 2. Attach UE1 and UE2 on First eNodeB 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 eNodeB2 7. Verify that UE1 performs Tracking area update
6. Test Limits	NA
7. Expected Results	The eNodeB1 shall successfully transport UL and DL data. The eNodeB1 shall successfully support voice call The eNodeB2 shall successfully support roaming of UE1.

1. Test No.	GR_TSTP_7.3.2
2. Test Details	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.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	This requirement is applicable to eNodeB 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 eNodeB 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.
6. Test Limits	NA
7. 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.

1. Test No.	**GR_TSTP_7.3.3**
2. Test Details	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.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Change the date and time at eNodeB 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. Perform UE attach. 4. Verify that attach is successful.
6. Test Limits	NA
7. Expected Results	There should be no impact at eNodeB when the date is changed to a year which is a leap year.

1. Test No.	**GR_TSTP_7.4.1**
2. Test Details	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.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	**Prevention of loss/alteration of contents:** The vendor to specify data/files that are present on persistent storage. 1. Bring eNodeB in operationally enabled state 2. Verify vendor specified data/files 3. Perform UE attach 4. Switch-off the power supply 5. Wait for 1 minute 6. Switch on the power supply 7. Bring eNodeB in operationally enabled state 8. Verify that vendor specified data/files are intact 9. Perform UE attach **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 eNodeB in inconsistent state. 2. Bring eNodeB in operationally enabled state. The procedure shall fail. 3. Now follow vendor specified restoration procedure

	4. Bring eNodeB in operationally enabled state 5. Perform UE attach
6. Test Limits	NA
7. Expected Results	The specified file/data shall not be altered/lost at power-off. The eNodeB shall come to normal state and attach shall be successful.

1. Test No.	**GR_TSTP_7.5.1**
2. Test Details	To verify that system shall provide facilities for system test, control and alarm indication at OMC.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Trigger diagnostics tests for eNodeB. Verify the test reports at OMC/EMS/Command line. 2. Lock the eNodeB through OMC/EMS (i.e. Make the eNodeB out of service from OMC). Verify that the relevant alarms are raised. 3. Make some changes in the eNodeB configuration through OMC/EMS . 4. Unlock the eNodeB through OMC/EMS (i.e. Make the eNodeB in service from OMC/EMS). Verify that the relevant alarms are raised.
6. Test Limits	NA
7. Expected Results	The eNodeB shall successfully execute vendor specified diagnostic procedure. The eNodeB shall indicate alarms to OMC/EMC for vendor specified events. The eNodeB shall allow configuration of vendor specified parameters through OMC/EMS.

1. Test No.	**GR_TSTP_7.5.2**
2. Test Details	To verify that Input / output terminals shall be capable of transmitting/ receiving characters as per ITU standards
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Input/output terminals will refer to the serial console for accessing the eNodeB as well as the OMC client for operations and management of eNodeB through EMS. 2. Check that the serial console/OMC client shall have the English keyboard.
6. Test Limits	NA
7. Expected Results	Input / output terminals shall be capable of transmitting/ receiving characters of a subset of the ITU-T No.5 alphabet

1.	Test No.	**GR_TSTP_7.5.3**
2.	Test Details	To verify that adequate number of man-machine interfaces shall be provided by the system.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	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 eNodeB.
6.	Test Limits	NA
7.	Expected Results	System shall support adequate number of man machine interfaces.

1. Test No.	**GR_TSTP_7.5.4**
2. Test Details	To verify that reliability of the data links towards remote terminal does not affect the reliability of the eNodeB
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Break the ethernet connectivity between the eNodeB and the OMC. 2. Check that the un-reachability status of the eNodeB is updated at the OMC. 3. Also check that the eNodeB operations are not affected. In case some alarms are raised in this time, they are stored at eNodeB.
6. Test Limits	NA
7. Expected Results	Reliability of the data links towards remote terminals shall not impact the reliability of the eNodeB.

1. Test No.	**GR_TSTP_7.5.5**
2. Test Details	To verify that a suitable alarm and display system at OMC shall be provided for a continuous indication of the system status.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. This is a generic clause. Verify that the OMC gives you a provision to check the alarms as and when they are raised 2. It should basically provide you with the complete view of the system status. The alarm view should be clear enough to get a clear picture of the system status.
6. Test Limits	NA
7. Expected Results	Alarm and display system is present at OMC.

1. Test No.	**GR_TSTP_7.6.2**
2. Test Details	The equipment shall have natural cooling arrangement which shall not involve any forced cooling, such as by using fans etc., either inside or outside the equipment. However, in case this is unavoidable, and the fans are to be used, these shall be DC operated and shall not impact on the MTBF of the equipment.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	1. Natural Cooling: No test required. Check from physical construction if cooling of eNodeB is achieved naturally, i.e. without using any forced cooling through active components like fans etc. 2. Forced Cooling: If forced cooling is used (inside or outside the equipment), 3. Note the MTBF of fans; MTBF of overall system; and MTBF of overall system excluding the fans. Ensure that the MTBF of overall system and MTBF of overall system excluding the fans is nearly same. 4. Check that the fans are DC operated. 5. Note the mechanisms employed to avoid impact on overall MTBF viz Fan or Fan tray hot swappability, Fan or Fan Tray redundancy etc. 6. Perform specific tests against each of such mechanism (noted in step 3) employed in design.
6. Test Limits	NA
7. Expected Results	Natural cooled eNodeB passes based on its construction. Forced cooled eNodeB passes based on the data and tests conducted which substantiate no impact on equipment MTBF.

1. Test No.	**GR_TSTP_7.6.4**
2. 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.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	1. Non-Inflammable/Self-extinguishable: No test required. Check compliance of eNodeB as per the Clause 8.6: eNodeB Safety Requirements. 2. Topicalization: No test required. Check compliance of eNodeB as per Clause 8.4: Environmental Test Conditions. Check compliance of eNodeB as per Clause 7.7.2.
6. Test Limits	NA
7. Expected Results	eNodeB components and materials are non-inflammable/self-extinguishable. eNodeB has been tropicalized as per the requirements.

1. Test No.	**GR_TSTP_7.6.6**
2. Test Details	The buses, if any, shall be suitably protected against electrical and magnetic interference from neighboring systems (like electromechanical systems, fluorescent tubes, motors, etc.).
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	No test required. Check eNodeB compliance for Clause 8.7: eNodeB Electromagnetic Compatibility.
6. Test Limits	NA
7. Expected Results	eNodeB is suitably protected against electrical and magnetic interferences.

1. Test No.	**GR_TSTP_7.6.8**
2. Test Details	The requirement at the external interface against induced voltages and currents due to lightning, high power system, etc. shall be indicated.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	No test required. Supplier to indicate (list) the external interfaces which will need external/additional protection mechanism, when induced voltages and currents (due to lightning, high power system, etc) exceed limits applied in Clause 8.7: eNodeB Electromagnetic Compatibility.
6. Test Limits	NA
7. Expected Results	List of external interfaces is provided by supplier.

1.	Test No.	GR_TSTP_7.6.9
2.	Test Details	The system shall provide for human isolation and protection from accidental high voltage power contact.
3.	Test Instruments Required	NA
4.	Test Setup	NA
5.	Test Procedure	No test required. Compliance shall be achieved based on the test report against Clause 8.6: eNodeB Safety Requirements.
6.	Test Limits	NA
7.	Expected Results	System complies with the safety and protection requirements.

1.	*Test No.*	**GR_TSTP_7.7.1**
2.	*Test Details*	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.
3.	*Test Instruments Required*	NA
4.	*Test Setup*	NA
5.	*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.
6.	*Test Limits*	NA
7.	*Expected Results*	Undertaking of compliance and list of proprietary components is furnished by the supplier.

1. Test No.	**GR_TSTP_7.7.2**
2. Test Details	All the equipment shall have a tropical finish and coated to protect against saline atmosphere.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	1. Compliance to be checked against Clause 8.4 Environmental Test Conditions. 2. Supplier to provide detail of tropical finish/coating of outdoor equipment. No test required.

6. Test Limits	NA
7. Expected Results	Equipment have necessary protection against saline atmosphere.

1. Test No.	**GR_TSTP_7.8.2.1**
2. 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.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Install the software release on the eNodeB 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.
6. Test Limits	NA
7. Expected Results	Installation and normal operations in the system are easy to perform.

1. Test No.	**GR_TSTP_7.8.2.6**
2. Test Details	To verify that test programs are implemented for fault tracing, detection and localization of system faults.
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Check that utilities/test programs are available at the eNodeB for fault tracing. 2. Whenever a critical event is detected, system should go for an auto recovery procedure.
6. Test Limits	NA
7. Expected Results	Test programs available for debugging purposes. Also check that the system can initiate auto recovery procedure in case of critical events.

1.	Test No.	**GR_TSTP_7.10.1**
2.	Test Details	eNode B DoS (Denial of Service) Attack Protection. The eNodeB shall provide the protection against DOS attack
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Configure some value to limit PRACH in eNodeB 2. Attach multiple UE till that value 3. Verify that system will not handle PRACH after reaching that value
6.	Test Limits	NA
7.	Expected Results	Verify that system will not handle PRACH after reaching that value

1.	Test No.	**GR_TSTP_8.1.1.1**
2.	Test Details	To verify that the system is capable of reporting different events/alarms to the EMS such that the state of the system can be evaluated.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Verify that the alarms are reported by the eNodeB 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.
6.	Test Limits	NA
7.	Expected Results	Provision exists in the system to allow both system qualities check and fault indication as a fault arises

1.	Test No.	**GR_TSTP_8.1.1.2**
2.	Test Details	To verify that the system shall be able to recover automatically from a software fault. In case auto recovery is not successful manual-reloading shall be possible.
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	1. Simulate a process crash at eNodeB by using appropriate command. Check that the eNodeB is able to recover by itself. 2. In case where the auto recovery cannot be done, check that eNodeB 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
6.	Test Limits	NA
7.	Expected Results	eNodeB shall be able to recover from faults automatically. If unable to do so, manual loading is supported.

1. Test No.	**GR_TSTP_8.1.2**
2. Test Details	The targeted relative speed between the eNodeB and the mobil e stations may be chosen from the following categories 1. Stationary (0 km/h) 2. Pedestrian (up to 10 km/h) 3. Typical vehicular (up to 100 km/h) 4. High speed vehicular (up to 120 km/h) 5. High Speed train (up to 300 km/h)
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Attach UE 2. Run Iperf Application to Download data 3. Verify that at all above mentioned speed, Data Downloading is working
6. Test Limits	NA
7. Expected Results	Verify that at all above mentioned speed, Data Downloading is working

1. Test No.	**GR_TSTP_8.2.1**
2. Test Details	To verify that various eNodeBs can be managed via a centralized OMC
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 2
5. Test Procedure	1. Connect multiple eNodeBs with the EMS. 2. Check that operations and maintenance tasks can be performed for each eNodeB via OMC. 3. Operations carried out on one eNodeB are mutually exclusive 4. Check that alarms for different eNodeBs are reflected at the OMC. They are identifiable for each eNodeB by a unique field. 5. Also verify that the eNodeBs are accessible by OMC client and operations and maintenance activities can be done remotely.
6. Test Limits	NA
7. Expected Results	System shall provide facility for introduction of centralized maintenance control (OMC).

1. Test No.	**GR_TSTP_8.2.2**
2. Test Details	The maintenance spares supplied shall take into account the MTBF and MTTR.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	Spare calculations factoring MTBF and MTTR values shall be provided by supplier. No test required.
6. Test Limits	NA
7. Expected Results	Spares calculation is provided.

1.	Test No.	**GR_TSTP_8.3.1**
2.	Test Details	To verify that eNodeB supports diagnostic test for eNodeB to monitor system performance
3.	Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4.	Test Setup	TEST SETUP 1
5.	Test Procedure	Execute the diagnostic test at eNodeB. Verify that test execution is successful and a valid report is generated.
6.	Test Limits	NA
7.	Expected Results	Diagnostic report generated successfully.

1. Test No.	**GR_TSTP_8.3.2**
2. Test Details	To verify auto restart method of eNodeB in case of severe fault conditions
3. Test Instruments Required	eNodeB, EPC/EPC Emulator, RF cables and attenuators, PC, UE/UE simulator, Network Performance Measurement Tool (such as iPerf), Wireshark Network Protocol Analyser.
4. Test Setup	TEST SETUP 1
5. Test Procedure	1. Simulate a process crash at eNodeB by using appropriate command. Check that the eNodeB 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.
6. Test Limits	System may go in for an auto restart for recovery mechanism.
7. Expected Results	System is able to recover automatically from the faults.

1. Test No.	**GR_TSTP_8.4**
2. Test Details	Environmental Test Conditions Indoor eNodeB: Category A SD: QM-333 Outdoor eNodeB, BBU & RRH: Category D SD: QM-333 and IP65 Antenna & Feeders: Category E as per SD: QM-333
3. Test Procedure	1. Check indoor eNodeB as per QM-333 standard Category A. 2. Check outdoor eNodeB, BBU & RRH as per QM-333 standard category D and for IP65. 3. Check Antenna & Feeders as per QM-333 standard category E. 4. Test can be performed in Factory or in any certified Lab.
4. Test Limits	NA
5. Expected Results	Test certificate/report to be attached with compliance to the respective requirements.

1.	Test No.	**GR_TSTP_8.5.1**
2.	Test Details	The supplier/manufacturer shall conform to ISO 9001:2008 certifications. A quality plan describing the quality assurance system followed by the manufacturer shall be required to be submitted.
3.	Test Procedure	No test required. Supplier/Manufacturer to provide ISO 9001 certification details and Quality Plan.
4.	Test Limits	NA
5.	Expected Results	Supplier/Manufacturer to provide ISO 9001 certification and Quality Plan.

1. Test No.	**GR_TSTP_8.5.2**
2. Test Details	For a Distributed eNodeB, the failure of any component/sub-system in the system shall not result in the failure of complete system.
3. Test Instruments Required	NA
4. Test Setup	NA
5. Test Procedure	Details of compliance to be submitted by supplier.
6. Test Limits	NA
7. Expected Results	Distributed eNodeB has suitable provisions.

1.	Test No.	**GR_TSTP_8.6**
2.	Test Details	eNodeB Safety Requirements: The equipment shall conform to IS 13252 part 1:2010- “Information Technology Equipment – Safety- Part 1: General Requirements” [equivalent to IEC 60950-1 {2005} “Information Technology Equipment –Safety- Part 1: General Requirements”; Amendment 2:2013 Or IEC 62368-I:2014 IEC 60215 (1987)) Safety requirements of radio transmitting equipment (for Radio equipment only)
3.	Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4.	Test Limits	NA
5.	Expected Results	Test certificate/reports from any certified lab should be submitted.

1.	Test No.	**GR_TSTP_8.7_1**
2.	Test Details	Conducted and Radiated Emission Standard: CISPR 22 (2008) OR CISPR 32; Class-A (These requirements shall be as per TEC Standard No.TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3.	Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4.	Test Limits	NA
5.	Expected Results	Test certificate/reports from any certified lab should be submitted.

1.	Test No.	**GR_TSTP_8.7_2**
2.	Test Details	Immunity to Electrostatic discharge: Contact discharge level 2 {± 4 kV} a) Standard: IEC-61000-4-2 b) Performance Criteria-B, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3.	Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4.	Test Limits	NA
5.	Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_3**
2. Test Details	Immunity to Electrostatic discharge: Air discharge level 3 {± 8 kV} a) Standard: IEC-61000-4-2 b) Performance Criteria-B, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_4**
2. Test Details	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 d) Standard: IEC 61000-4-3 (2010); e) Performance Criteria-A, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_5**
2. Test Details	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. c) Standard: IEC 61000- 4- 4 {2012); d) Performance Criteria-B, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_6**
2. Test Details	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 c) Standard: IEC 61000-4-5 (2014) d) Performance Criteria-B, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_7**
2. Test Details	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. c) Standard: IEC 61000-4-5 (2014) d) Performance Criteria-C, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_8**
2. Test Details	Immunity to conducted disturbance induced by Radio frequency fields: 1. 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. Standard: IEC 61000-4-6 (2013) 2. Performance Criteria-A, Clause 9 (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1. Test No.	**GR_TSTP_8.7_9**
2. Test Details	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. Standard: IEC 61000-4-11 (2004): a) Performance Criteria B for Reduction of Supply 30% for 500ms or Dip to reduction of 60% for 100ms b) Performance Criteria C for Reduction of 60% for 200ms c) Performance criteria C for Voltage Interruption>95% for 5 s d) (Note: In case of Battery back-up performance criteria A is applicable). e) Performance Criteria B for Voltage Interruption >95% duration :10ms (Note: In case of Battery back-up Performance Criteria A is applicable for above conditions.) (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3. Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4. Test Limits	NA
5. Expected Results	Test certificate/reports from any certified lab should be submitted.

1.	Test No.	**GR_TSTP_8.7_10**
2.	Test Details	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. Standard: IEC 61000-4-29(2000) a) Applicable Performance Criteria shall be B. b) Applicable Performance Criteria shall be C. c) Applicable Performance Criteria shall be B. d) Applicable Performance Criteria shall be C. e) Applicable Performance Criteria shall be B. (These requirements shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05.OCT-16 as modified/ amended from time to time)
3.	Test Procedure	eNodeB to be tested in accordance with the test procedure of relevant standards. Testing to be done at certified lab.
4.	Test Limits	NA
5.	Expected Results	Test certificate/reports from any certified lab should be submitted.

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'.***