वर्गीय अपेक्षाओं के लिए मानक

टीईसी ३३०१०:२०२५

STANDARD FOR GENERIC REQUIREMENTS

TEC 33010:2025

आई० ओ० टी० गेटवे

IoT Gateway

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन,जनपथ,नई दिल्ली-110001,भारत

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FOREWORD

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

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

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

ABSTRACT

This Standard on Generic Requirements pertains to IoT Gateway working on wired or wireless (cellular/ non cellular) communication technologies including Short range technologies (NFC, RFID etc.) used for translation from one protocol to another and accessing Cellular/Non-Cellular Communication Network. This standard is applicable to all such devices having similar functionality as of IoT Gateway like Data Concentrator Unit (DCU), Telematics Unit, etc. It covers requirements for Interoperability, Quality, Electromagnetic Compatibility, Safety and Security.

CONTENTS

History sheet

Sl. No.	*Standard/document No.*	*Title*	*Remarks*
1	TEC 33010:2025	Standard for Generic Requirement of IoT Gateway	

References

S. NO.	*Document No.*	*Title/Document Name*
a) TEC GRs/IRs		
1.	TEC/SD/DD/EMC-221/05/OCT-16 or TEC11016:2016	Electromagnetic Compatibility Standard For Telecommunication Equipment
b) IEEE Standards		
1.	IEEE 802.1q	IEEE standards for local and metropolitan area networks – Virtual Bridge local Area Networks
2.	IEEE 802.1x	Standards for Local and metropolitan area networks—Port-Based Network Access Control
3.	IEEE 802.11a	Supplement to IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: High-Speed Physical Layer in the 5 GHz Band
4.	IEEE 802.11b	IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications—Amendment 2: Higher-speed Physical

		Layer (PHY) extension in the 2.4 GHz band—Corrigendum1
5.	IEEE 802.11d	Information technology – Telecommunications and information exchange between systems – Local and metropolitan area network – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Specification for Operation in Additional Regulatory Domains
6.	IEEE 802.11g	IEEE standard for information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – specific requirements – Part 11: wireless LAN medium access control (MAC) and physical layer (PHY) specifications – Amendment 4: further higher – speed physical layer extension in the 2.4GHz band
7.	IEEE 802.11n	IEEE standard for information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – specific requirements – Part 11: Wireless LAN medium access control (MAC) and physical layer (PHY) specifications – Amendment 5: enhancements for higher throughput
8.	IEEE 802.11ac	IEEE Standard for Information technology – Telecommunications and

		information exchange between systems—Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications – Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz.
9.	IEEE 802.11 ax	IEEE Standard for Information technology – Telecommunications and information exchange between systems—Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment Enhancements for High efficiency WLAN
10.	IEEE 802.11i	IEEE Standard for Information technology – Telecommunications and information exchange between system – Local and metropolitan area networks Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications – Amendment 6: Medium Access Control (MAC) Security Enhancements
11.	IEEE 802.1AE	IEEE Standard for Local and metropolitan area network-Medium Access Control (MAC) Security
12.	IEEE 802.11u	IEEE standard for information technology – Telecommunications and information exchange between

		systems – Local and metropolitan area networks – specific requirements – Part 11: wireless LAN medium access control (MAC) and physical layer (PHY) specifications – Amendment 9: Interworking with External Networks
13.	IEEE 802.11r	IEEE Standard for Information technology – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 2: Fast Basic Service Set (BSS) Transition
14.	IEEE 802.3	Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific Requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
15.	IEEE 802.1X	IEEE Standard for Local and metropolitan area networks – Port-Based Network Access Control
16.	IEEE 802.3ba	IEEE standard for Media Access Control Parameters, Physical Layers, and Management Parameters for 40 Gb/s and 100 Gb/s Operation
17.	IEEE 802.3cn	Physical Layers and Management Parameters for 50Gb/s, 200Gb/s, and 400Gb/s Operation over Single-Mode Fiber
18.	IEEE 802.15.4	IEEE Standard for Low-Rate Wireless Networks

19.	IEEE 802.3u	Local and Metropolitan Area Networks: Supplement - Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100Mb/s Operation, Type 100BASE-T (Clauses 21-30)
c) IETF Standards		
1.	RFC 2460	IP version 6 (IPv6) is a new version of the Internet Protocol, designed as the successor to IP version 4 (IPv4) [RFC-791].
2.	RFC 8200	IP version 6 (IPv6) is a new version of the Internet Protocol (IP), designed as the successor to IP version 4 (IPv4) [RFC791].
3.	RFC 4213	Basic Transition Mechanisms for IPv6 Hosts and Routers
4.	RFC 791	Internet Protocol DARPA Internet Program Protocol Specification
5.	RFC 2818	Hypertext Transport Protocol Secure (HTTPS): HTTP over TLS
6.	RFC 7252	The Constrained Application Protocol (CoAP)
7.	RFC 6455	The WebSocket Protocol
8.	RFC 4122:	A Universally Unique IDentifier (UUID) URN Namespace
d) ETSI/EN Standards		
1.	ETSI EN 301 489- 1	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
2.	ETSI EN 301 489- 3	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions

		for Short Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz;
3.	ETSI EN 301 489- 7	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services;
4.	ETSI EN 301 489-17	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems;
5.	ETSI EN 301 489-24	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA and E-UTRA) for Mobile and portable (UE) radio and ancillary equipment
6.	ETSI EN 301 489-52	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication User Equipment (UE) radio and ancillary equipment; Harmonized Standard for Electromagnetic Compatibility
7.	ETSI EN 300 328	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonized Standard for access to radio spectrum
8.	ETSI EN 301 511	Global System for Mobile communications (GSM); Mobile

		Stations (MS) equipment; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
9.	ETSI EN 301 908-1	IMT cellular networks; Harmonized Standard for access to radio spectrum; Part 1: Introduction and common requirements Release 15
10.	ETSI EN 301 441	Satellite Earth Stations and Systems (SES); Harmonized Standard for Mobile Earth Stations (MES), including handheld earth stations, for Satellite Personal Communications Networks (S-PCN) operating in the 1,6 GHz/2,4 GHz frequency band under the Mobile Satellite Service (MSS) covering the essential requirements of article 3.2 of the Directive 2014/53/EU
11.	ETSI EN 300 220-2	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard for access to radio spectrum for nonspecific radio equipment
12.	ETSI EN 300 001	Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN
13.	ETSI EN 301 908-04	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS), Repeaters and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 4: Harmonized EN for IMT-2000, CDMA

		Multi-Carrier (cdma2000) and Evolved CDMA Multi-Carrier Ultra Mobile Broadband (UMB) (UE) covering the essential requirements of article 3.2 of the R&TTE Directive
14.	ETSI EN 301 908-13	IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)
15.	ETSI EN 300 330	Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU
16.	ETSI EN 301 893	5 GHz WAS/RLAN; Harmonised Standard for access to radio spectrum
e) Other Standards		
1.	IEC 61000-4-2 (2008)	Testing and measurement techniques of Electrostatic discharge immunity test
2.	CISPR 32 (2015)	Limits and methods of measurement of radio disturbance characteristics of Information Technology equipment
3.	IEC 61000-4-3 (2020)	Radiated RF Electromagnetic Field Immunity test
4.	IEC 61000-4-4 (2012)	Testing and measurement techniques of electrical fast transients/burst immunity test
5.	IEC 61000-4-5(2014) + A1:2017	Test & Measurement techniques for Surge immunity tests
6.	IEC 61000-4-	Immunity to conducted disturbances,

	6(2013) Or IEC 61000-4-6(2023)	induced by radio frequency fields
7.	IEC 61000-4-11 (2020)	Testing and measuring techniques – AC Voltage dips, short interruptions and voltage variations immunity test
8.	IEC 61000-4-29 (2000)	Testing and measuring techniques – DC Voltage dips, short interruptions and voltage variations immunity tests'
9.	IS 13252 part 1: 2010 (Amd: 2013 & Amd:2015)	Information Technology Equipment – Safety- Part 1: General Requirements
10	IEC 60950-1 {2005} (A1:2009 and A2:2013 in Annex to ER)	Information Technology Equipment – Safety- Part 1: General Requirements
11.	IEC 62368-1: 2018	Audio/video, information and communication technology equipment - Part 1: Safety requirements
12.	QM-333	Environmental Testing of Telecommunication Equipment
13.	3GPP TS 51 010-1	Mobile Station (MS) conformance specification; Part 1: Conformance specification
14.	3GPP TS 36.521-1	Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing
15.	3GPP TS 34.121-1	User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification

16.	3GPP TS 23.003	Numbering, addressing and identification.
17.	ITU-T Y.4101/Y.2067	Common requirements and capabilities of a gateway for Internet of things applications
18.	ITU-T Y.4418	Gateway functional architecture for Internet of things applications

Note: The latest versions of all standards referenced in this document shall be referred.

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CHAPTER-1

1.1 Introduction

1.1.1. This document specifies the Generic Requirements (GR) of IoT Gateway. It is used to communicate between IoT devices and external network (any network such as cloud, server, etc.) enabling data collection, actuation, processing, and transmission in IoT deployments.

1.1.2. Definitions:

IoT Gateway: As per ITU-T Y.4101/Y.2067, an IoT Gateway is a unit in the Internet of things which interconnects the devices with the communication networks. It performs the necessary translation between the protocols used in the communication networks and those used by devices.

Sensor: An electronic device that senses a physical condition and delivers an electronic signal proportional to the observed characteristic.

1.2 Functions of IoT Gateway

The functions of IoT Gateway include some or all of the functions below:

a) Communication with cloud/backend server/external network,

b) Device management and Communication with end devices,

c) Routing the Traffic,

d) Support multiple transfer protocols,

e) Isolation of sensor and/or actuators nodes,

f) Aggregation, Filtering and processing of the data,

g) Security and Authentication,

h) Local storage of data,.

i) Edge Computing and Analytics.

1.3 Description

1.3.1 Gateway functional architecture for IoT applications

As per the ITU-T Recommendation Y.4418, Figure 1 shows a full view of the gateway functional architecture for IoT applications. In the functional architecture, the application support functional entity is the core, which includes message-forwarding, local processing and resource openness capabilities. At least one of these three capabilities is provided in one gateway according to different IoT application scenarios. Besides the core functional entity, other functional entities in the functional architecture are often used.

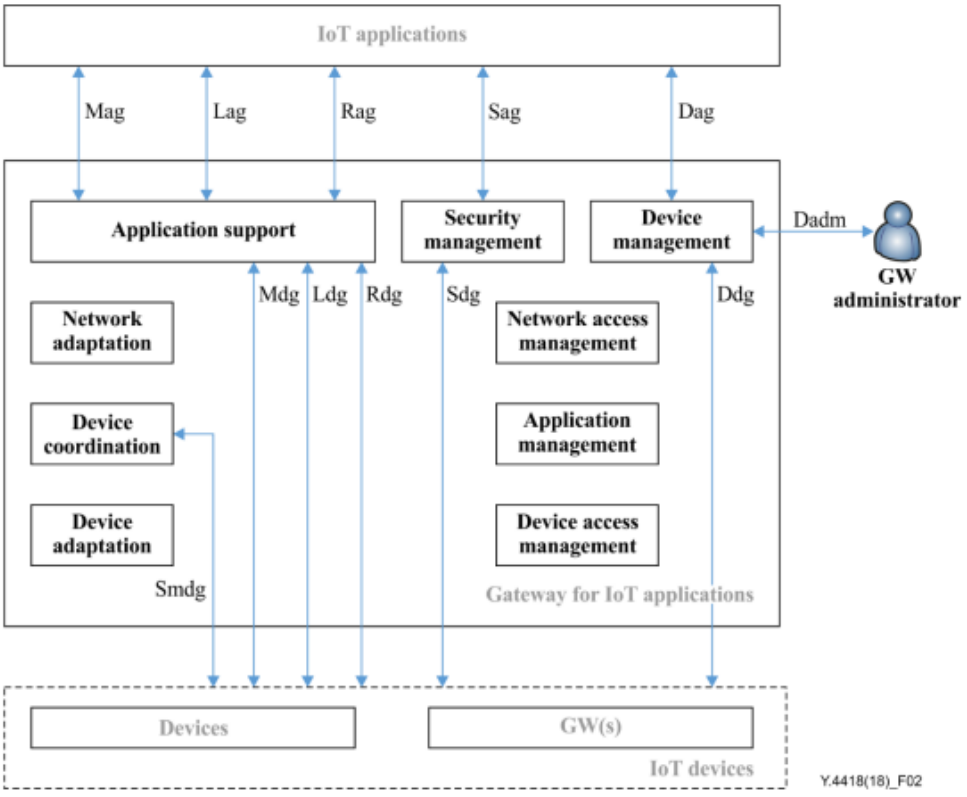


Figure 1: Gateway Functional Architecture for IoT Applications

The application support functional entity provides functions such as messages forwarding, local processing of application and resource openness with proper access control.

The network adaptation functional entity provides an adaptation function to different network technologies.

The device coordination functional entity provides functions such as interface abstraction, service discovery and service monitoring.

The device adaptation functional entity provides a connectivity adaptation function for the different types of device or other gateways that connect to the gateway.

The security management functional entity provides functions such as authentication and authorization, key management, as well as privacy protection.

The DM functional entity provides device-managing functions for devices connected to the gateway, other gateway(s) connected to the gateway and the gateway itself.

The network access management functional entity provides communication management functions between the gateway and IoT applications.

The application management functional entity provides core functional entity management functions, such as application deployment, application monitoring and application control, especially if several applications are running in one gateway.

The device access management functional entity provides communication management functions between devices and the gateway.

In the functional architecture, the gateway is connected with IoT applications, devices and other gateway(s) through reference points, as follows.

Reference points between the gateway and IoT applications:

1. Mag reference point: reference point between the gateway and IoT applications in support of message-forwarding functions;
2. Lag reference point: reference point between the gateway and IoT applications in support of local processing functions;
3. Rag reference point: reference point between the gateway and IoT applications in support of resource openness functions;
4. Sag reference point: reference point between the gateway and IoT applications in support of security management functions;
5. Dag reference point: reference point between the gateway and IoT applications in support of DM functions.

Reference points between the gateway and IoT devices:

NOTE – IoT devices here include the devices and gateway(s) connected to the gateway.

1. Smdg reference point: reference point between the gateway and IoT devices in support of service discovery related functions;
2. Mdg reference point: reference point between the gateway and IoT devices in support of message-forwarding functions;
3. Ldg reference point: reference point between the gateway and IoT devices in support of local processing functions;

4. Rdg reference point: reference point between the gateway and IoT devices in support of resource openness functions;
5. Sdg reference point: reference point between the gateway and IoT devices in support of security management functions;
6. Ddg reference point: reference point between the gateway and IoT devices in support of DM functions.

Reference point between the gateway and the gateway administrator:

1. Dadm reference point: reference point between the gateway and gateway administrator in support of DM functions.

1.4 Functional/Operational Requirements

1.4.1 Operating Frequency Range

The operating frequency of equipment shall be as per latest National Frequency Allocation Plan (NFAP) and published WPC GSRs (for delicensing) as specified below and further subject to, revision from time to time.

S. No.	Frequency Range	Title of the Rule	GSR No.	IND Remarks as per NFAP 2022
1.	50KHz to 200KHz	Use of very low power Radio Frequency devices or equipments including the Radio Frequency identification Devices, (Exemption from Licensing Requirement) Rules, 2009.	GSR No. 90 (E) dated 10th February 2009 and subsequent amendments, if any.	
2.	13.553 MHz to 13.567MHz	Use of very low power Radio Frequency devices, for indoor applications in the 13.553-13.567 MHz	GSR No. 884(E) dated 4th November 2010 and subsequent	

		frequency range (Exemption from Licensing Requirement) Rules, 2010.	amendments, if any.	
3.	865-868 MHz	Use of Low Power Equipment in the Frequency Band 865-868 MHz for Short Range Devices (Exemption from License) Rules, 2021.	GSR No. 853 (E) dated 10th December 2021 and subsequent amendments, if any.	
4.	2400-2483.5 MHz	Use of Low Power Equipment in the frequency band 2.4 GHz to 2.4835 GHz (Exemption from Licensing Requirement) Rules, 2005	GSR No. 1047 (E) dated 18 Oct 2018, and subsequent amendments, if any.	
5.	5150 - 5250 MHz 5250 - 5350 MHz 5470 - 5725 MHz 5725 - 5875 MHz	Use of Wireless Access Systems (WAS) including Radio Local Area Network (RLAN) in 5GHz (Exemption from Licensing Requirement) Rules, 2018	GSR No. 1048(E) dated 18- Oct. 2018 and subsequent amendments, if any.	IND 28

1.4.2 Power supply requirements

The equipment should be able to operate on AC/DC/PoE (Power over Ethernet).

a) **For AC Power Supply:**

The AC power supply shall be:

- For Single Phase Products – 230 V ± 10% /Frequency 50 Hz ± 2 Hz.
- For Three Phase Products – 440 V ± 10% /Frequency 50 Hz ± 2 Hz.

b) **For DC Power Supply:**

DC/PoE Supply shall be: 0 – 32 V DC, 48 – 54 V DC.

1.5 Interface Requirements

This section describes the interface requirements for the IoT Gateway. The IoT Gateway shall support any two or more from amongst the following interfaces. However, the number and type of interfaces in the gateway shall be mentioned by the procurer.

i. 1 G Optical Ethernet
ii. 10 G Optical Ethernet
iii. 40 G Optical Ethernet
iv. 100 G Optical Ethernet
v. 200 G Optical Ethernet
vi. 400 G Optical Ethernet
vii. Fast Ethernet Electrical
viii. Fast Ethernet Optical
ix. Gigabit Ethernet Electrical
x. SHDSL
xi. VDSLx
xii. ADSL
xiii. 5G NR (FR1)
xiv. 5G NR- FR1 and FR2 interworking with other Radios
xv. 5G NR (FR2)
xvi. CDMA
xvii. GSM or GPRS or EDGE
xviii. LTE or LTE-A
xix. WCDMA or HSPA
xx. NFC
xxi. 6LoWPAN (2.4 GHz)
xxii. 6LoWPAN (865 to 868 MHz)
xxiii. BLE
xxiv. ZigBee
xxv. WiFi
xxvi. LPWAN – LoRa
xxvii. LPWAN – SigFox
xxviii. NB-IoT

xxix. Wi-SUN

xxx. Geolocation Navigation Interface for IoT

1.5.1 Interface 1: 1 G Optical Ethernet

i. Average Launch Power for 1 GE Opt: As per IEEE 802.3 Sec-3 Cl 38.3.1 (Short Haul) and Cl 38.4.1 (Long Haul). Annex-A

ii. Receiver Sensitivity for 1 GE Opt: As per IEEE 802.3 Sec-3 Cl 38.3.2 (Short Haul) and Cl 38.4.2 (Long Haul). Annex-A

iii. Wavelength for 1 GE opt: As per IEEE 802.3z Cl.38, Short Haul and Long Haul. Annex-A

Note: Manufacturer shall declare the supported variant in the interface, e.g. SR/LR, SM/MM, wavelength, etc.

1.5.2 Interface 2: 10 G Optical Ethernet

i. Average Launch Power for 10 GE Opt: As per IEEE 802.3ae table 52-7 for SR, 52-12 for LR and 52-16 for ER. Annex-A

ii. Receiver Sensitivity for 10 GE Int: As per IEEE 802.3ae table 52-9 for SR, 52-13 for LR and 52-17 for ER. Annex-A

iii. Wavelength for 10 GE Int: As per IEEE 802.3ae Cl 52 (Short Haul and Long Haul) and IEEE 802.3 2018 (ER). Annex-A

Note: Manufacturer shall declare the supported variant in the interface, e.g. SR/LR, SM/MM, wavelength, etc.

1.5.3 Interface 3: 40 G Optical Ethernet

i. Average Launch power for 40 GE Opt: As per IEEE 802.3ba Cl. 86 87. Annex-A

ii. Receiver Sensitivity 40 GE Opt: As per IEEE 802.3ba Cl. 86 87. Annex-A

iii. Wavelength for 40 GE Opt: As per IEEE 802.3ba Cl. 86 87. Annex-A

Note: Manufacturer shall declare the supported variant in the interface, e.g. SR/LR, SM/MM, wavelength, etc.

1.5.4 Interface 4: 100 G Optical Ethernet

i. Average Launch power for 100 GE Opt: As per IEEE 802.3ba Cl. 86 88. Annex-A
ii. Receiver Sensitivity 100 GE Opt: As per IEEE 802.3ba Cl. 86 88. Annex-A
iii. Wavelength for 100 GE Opt: As per IEEE: As per 802.3ba Cl. 86 88. Annex-A

Note: Manufacturer shall declare the supported variant in the interface, e.g. SR/LR, SM/MM, wavelength, etc.

1.5.5 Interface 5: 200 G Optical Ethernet

i. Average Launch Power for 200 GE Opt: As per IEEE 802.3cn Cl 121 Cl 122
ii. Receiver Sensitivity for 200 GE Opt: As per IEEE 802.3cn Cl 121 Cl 122
iii. Wavelength for 200 GE Opt: As per IEEE 802.3cn Cl 121 Cl 122

Note: Manufacturer shall declare the supported variant in the interface, e.g. SR/LR, SM/MM, wavelength, etc.

1.5.6 Interface 6: 400 G Optical Ethernet

i. Average Launch Power for 400 GE Opt: As per IEEE 802.3cn Cl 122 Cl 124
ii. Receiver Sensitivity for 400 GE Opt: As per IEEE 802.3cn Cl 122 Cl 124
iii. Wavelength for 400 GE Opt: As per IEEE 802.3cn Cl 122 Cl 124

Note: Manufacturer shall declare the supported variant in the interface, e.g. SR/LR, SM/MM, wavelength, etc.

1.5.7 Interface 7: Fast Ethernet Electrical

i. Link Speed and Autonegotiation Test FE: As per IEEE 802.3 Annex-A

1.5.8 Interface 8: Fast Ethernet Optical

i. Average Launch power for FE Opt: As per IEEE 802.3u. Annex-A
ii. Receiver Sensitivity for FE Opt: As per IEEE 802.3u. Annex-A
iii. Wavelength for FE Opt: As per IEEE 802.3u. Annex-A

1.5.9 Interface 9: Gigabit Ethernet Electrical

i. Link Speed and Autonegotiation Test GE: As per IEEE 802.3. Annex-A

1.5.10 Interface 10: SHDSL

i. Insulation Resistance for SHDSL int: As per G.991.2. Annex-B
ii. LCL for SHDSL Interface: As per G.991.2. Annex-B
iii. PSD for SHDSL Int: As per G.991.2. Annex-B
iv. Return Loss for SHDSL: As per G.991.2. Annex-B
v. Throughput for SHDSL Interface: As per G.991.2. Annex-B
vi. Transmitted Power for SHDSL Int: As per G.991.2. Annex-B

1.5.11 Interface 11: VDSLx

i. Bit Rate for VDSLx Int: As per G.993.1 or G993.2. Annex-B
ii. Insulation Test for 2 wire Int: As per ETSI EN 300 001. Annex-C
iii. Line Port impedance for VDSLx Int: As per G.993.1 or G.993.2 Annex-B
iv. Loop resistance for VDSLx: As per ETSI EN 300 001. Annex-B
v. Profiles for VDSLx: As per G.993.1 or G.993.2 Annex-B
vi. PSD for VDSLx Int: As per G.993.1 (cl 6.2). G.993.2(cl 7.2) Ann-A B C. Annex-B
vii. Return Loss for VDSLx: As per G.993.1 or G.993.2 Annex-B
viii. Transmitted Power at ATU-C for VDSLx Int: As per G.993.1 or G.993.2 Annex-B

1.5.12 Interface 12: ADSL

i. Bit Rate for ADSLx Int: As per Annex-B
ii. Impulse Noise Protection for ADSL Int: As per Annex-B
iii. Insulation Test for ADSL Int: As per Annex-B
iv. Line Port impedance for ADSLx Int: As per Annex-B
v. Loop resistance for ADSLx: As per ETSI EN 300 001. Annex-B
vi. PSD for ADSLx Int: As per Annex-B
vii. Transmitted Power At ATU-C for ADSLx Int: As per Annex-B

1.5.13 Interface 13: 5G NR (FR1)

i. Additional spectrum emission mask for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.2.3
ii. Additional spectrum emission mask- Transmitter: As per 3GPP TS 38.521-1 Clause 6.5.2.3
iii. Additional spurious emissions: As per 3GPP TS 38.521-1 Clause 6.5.3.3
iv. Additional spurious emissions for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.3.3
v. Adjacent channel selectivity: As per 3GPP TS 38.521-1 Clause 7.5
vi. Adjacent channel selectivity for 2DL CA: As per 3GPP TS 38.521-1 Clause 7.5A.1
vii. Adjacent channel selectivity for UL-MIMO: As per 3GPP TS 38.521-1 Clause 7.5D
viii. General spurious emissions for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.3.1
ix. General spurious Emissions-Transmitter: As per 3GPP TS 38.521-1 Clause 6.5.3.1
x. Inband Blocking: As per 3GPP TS 38.521-1 Clause 7.6.2
xi. In-band Blocking for CA-2DL CA: As per 3GPP TS 38.521-1 Clause 7.6A.2.1
xii. Inband blocking for UL-MIMO: As per 3GPP TS 38.521-1 Clause 7.6D.2
xiii. Minimum output power: As per 3GPP TS 38.521-2 Clause 6.3.1
xiv. Narrow band blocking: As per 3GPP TS 38.521-1 Clause 7.6.4
xv. Narrow band blocking for CA-2DL CA: As per 3GPP TS 38.521-1 Clause 7.6A.4.1
xvi. Narrow band blocking for UL-MIMO: As per 3GPP TS 38.521-1 Clause 7.6D.4
xvii. NR ACLR: As per 3GPP TS 38.521-1 Clause 6.5.2.4.1
xviii. NR ACLR for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.2.4.1
xix. Out-of-band blocking: As per 3GPP TS 38.521-1 Clause 7.6.3
xx. Out-of-band blocking for UL-MIMO: As per 3GPP TS 38.521-1 Clause 7.6D.3
xxi. Reference sensitivity power level: As per 3GPP TS 38.521-1 Clause 7.3.2
xxii. Reference sensitivity power level for 2DL CA without exception: As per 3GPP TS 38.521-1 Clause 7.3A.1
xxiii. Reference sensitivity power level for UL- MIMO: As per 3GPP TS 38.521-1 Clause 7.3D.2
xxiv. Spectrum Emission Mask-5G NR FR1: As per 3GPP TS 38.521-1 Clause 6.5.2.2
xxv. Spectrum emission Mask for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.2.2
xxvi. Spurious emission for 2DL CA: As per 3GPP TS 38.521-1 Clause 7.9A.1
xxvii. Spurious emission for UE co-existence: As per 3GPP TS 38.521-1 Clause 6.5.3.2
xxviii. Spurious emission for UE co-existence for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.3.2

xxix. Spurious emissions-5G NR FR1: As per 3GPP TS 38.521-1 Clause 7.9
xxx. Spurious response: As per 3GPP TS 38.521-1 Clause 7.7
xxxi. Spurious response for 2DL CA: As per 3GPP TS 38.521-1 Clause 7.7A.1
xxxii. Spurious response for UL-MIMO: As per 3GPP TS 38.521-1 Clause 7.7D
xxxiii. UE Maximum Output Power: As per 3GPP TS 38.521-1 Clause 6.2.1
xxxiv. UE maximum output power for UL-MIMO: As per 3GPP TS 38.521-1 Clause 6.2D.1
xxxv. UE maximum output power reduction for UL- MIMO: As per 3GPP TS 38.521-1 Clause 6.2D.2
xxxvi. UTRA ACLR: As per 3GPP TS 38.521-1 Clause 6.5.2.4.2
xxxvii. UTRA ACLR for UL MIMO: As per 3GPP TS 38.521-1 Clause 6.5D.2.4.2
xxxviii. Wide band Intermodulation: As per 3GPP TS 38.521-1 Clause 7.8.2
xxxix. Wide band Intermodulation for CA-2DL CA: As per 3GPP TS 38.521-1 Clause 7.8A.2.1
xl. Wide band Intermodulation for UL-MIMO: As per 3GPP TS 38.521-1 Clause 7.8D.2

1.5.14 Interface 14: 5G NR- FR1 and FR2 interworking with other Radios

i. Additional Spectrum emissions mask for inter-band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.5B.2.3.2
ii. Additional Spurious emissions for inter-band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.5B.4.3
iii. Adjacent channel leakage ratio for Inter-band EN-DC including FR2 2CCs: As per 3GPP TS 38.521-3 Clause 6.5B.2.4.3
iv. Adjacent channel leakage ratio for inter-band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.5B.2.3.3
v. Adjacent channel selectivity for inter-band EN-DC within FR1 2CCs: As per 3GPP TS 38.521-3 3GPP TS 38.521-3 Clause 7.5B.3
vi. Adjacent channel selectivity for intra-band contiguous EN-DC 2CCs: As per 3GPP TS 38.521-3 Clause 7.5B.1
vii. General spurious emissions for inter-band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.5B.3.3.1
viii. General spurious emissions for intra-band contiguous EN-DC: As per 3GPP TS 38.521-3 Clause 6.5B.3.1.1
ix. Inband blocking for inter-band EN-DC within FR1-2CCs: As per 3GPP TS 38.521-3 Clause 7.6B.2.3

x. Inband blocking for intra-band contiguous EN-DC in FR1-2CCs: As per 3GPP TS 38.521-3 Clause 7.6B.2.1

xi. Minimum output power for EN-DC Inter-band including FR2: As per 3GPP TS 38.521-3 Clause 6.3B.1.4

xii. Minimum Output Power for intra-band contiguous EN-DC: As per 3GPP TS 38.521-3 Clause 6.3B.1.1

xiii. Minimum output power for intra-band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.3B.1.3

xiv. Narrow band blocking for inter band EN DC within FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.6B.4.3

xv. Narrow band blocking for intra band contiguous EN DC in FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.6B.4.1

xvi. Out-of-band blocking for inter-band EN-DC within FR1-2CCs: As per 3GPP TS 38.521-3 Clause 7.6B.3.3

xvii. Out-of-band blocking for intra-band contiguous EN-DC in FR1-2CCs: As per 3GPP TS 38.521-3 Clause 7.6B.3.1

xviii. Reference sensitivity for EN-DC within FR1 3CCs: As per 3GPP TS 38.521-3 Clause 7.3B.2.3_1.1

xix. Reference sensitivity for inter-band EN-DC including FR2: As per 3GPP TS 38.521-3 Clause 7.3B.2.4

xx. Reference sensitivity for inter-band EN-DC within FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.3B.2.3

xxi. Reference sensitivity for intra-band contiguous EN-DC 2CCs: As per 3GPP TS 38.521-3 Clause 7.3B.2.1

xxii. Spectrum emissions mask for inter-band EN- DC including FR2 (2 CCs): As per 3GPP TS 38.521-3 Clause 6.5B.2.4.1

xxiii. Spectrum emissions mask for inter- band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.5B.2.3.1

xxiv. Spurious emission band UE co-existence for intra-band contiguous EN-DC: As per 3GPP TS 38.521-3 Clause 6.5B.3.1.2

xxv. Spurious emissions band UE co-existence for inter-band within FR1: As per 3GPP TS 38.521-3 Clause 6.5B.3.3.2

xxvi. Spurious Emissions for EN DC within FR1 3CCs: As per 3GPP TS 38.521-3 Clause 7.9B.3 1.1

xxvii. Spurious Emissions for inter band EN DC within FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.9B.3

xxviii. Spurious emissions for intra band contiguous EN DC in FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.9B.1

xxix. Spurious Response for inter band EN DC within FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.7B.3

xxx. Spurious Response for intra band contiguous EN DC in FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.7B.1

xxxi. UE Maximum Output Power for Inter-Band EN-DC including FR2 - EIRP and TR: As per 3GPP TS 38.521-3 Clause 6.2B.1.4.1

xxxii. UE Maximum Output Power for Inter-Band EN-DC including FR2 - Spherical Coverage: As per 3GPP TS 38.521-3 Clause 6.2B.1.4.2

xxxiii. UE Maximum Output Power for Inter-Band EN-DC within FR1: As per 3GPP TS 38.521-3 Clause 6.2B.1.3

xxxiv. UE Maximum Output Power for Intra-Band Contiguous EN-DC: As per 3GPP TS 38.521-3 Clause 6.2B.1.1

xxxv. Wideband Intermodulation for inter band EN DC in FR1 2CCs: As per 3GPP TS 38.521-3 Clause 7.8B.2.3

xxxvi. Wideband Intermodulation for intra band contiguous EN DC in FR1: As per 3GPP TS 38.521-3 Clause 7.8B.2.1

1.5.15 Interface 15: 5G NR (FR2)

i. Adjacent channel leakage ratio: As per 3GPP TS 38.521-2 Clause 6.5.2.3

ii. Minimum Output power -Transmitter: As per 3GPP TS 38.521-1 Clause 6.3.1

iii. Reference sensitivity power level: As per 3GPP TS 38.521-1 Clause 7.3.2

iv. Spectrum Emission Mask-5G NR FR2: As per 3GPP TS 38.521-2 Clause 6.5.2.1

v. UE maximum output power-EIRP and TRP: As per 3GPP TS 38.521-2 Clause 6.2.1.1

vi. UE maximum output power reduction: As per 3GPP TS 38.521-2 Clause 6.2.2

vii. UE maximum output power -Spherical coverage: As per 3GPP TS 38.521-2 Clause 6.2.1.2

viii. UE maximum output power with additional requirements: As per 3GPP TS 38.521-2 Clause 6.2.3

1.5.16 Interface 16: CDMA

i. CDMA Int Parameters: As per 1xS0011 or EN 301 908-04 CDMA. Annex-D

ii. Operating Frequency for CDMA Int: As per NFAP. Annex-E

1.5.17 Interface 17: GSM or GPRS or EDGE

i. Int Parameters for GSM or GPRS or EDGE: As per 3GPP TS 51 010-1 or EN 301 511. Annex-F
ii. Operating Frequency for GSM or GPRS or EDGE Int: As per NFAP. Annex-E

1.5.18 Interface 18: LTE or LTE-A

i. Int Parameters for LTE or LTE-A: As per 3GPP TS 36.521-1 or EN 301 908-13. Annex-G
ii. Operating Frequency for LTE or LTE-A Int: As per NFAP. Annex-E

1.5.19 Interface 19: WCDMA or HSPA

i. Operating Frequency for WCDMA or HSPA Int: As per NFAP. Annex-E
ii. WCDMA or HSPA Int Parameters: As per 3GPP TS 34.121-1 or EN 301 908-2. Annex-H

1.5.20 Interface 20: NFC

i. Basic RF Requirements for NFC – Int: As per Annex-I (I.2 to I.13). ETSI EN 300 330 V2.1.1
ii. Frequency of Operation for NFC Int: As per Latest NFAP. Annex-I (I.1)

1.5.21 Interface 21: 6LoWPAN (2.4 GHz)

i. Basic RF Requirements for 6LowPAN Interface: As per Annex J (J.4 to J.15). ETSI EN 300 328 V2.2.2.
ii. EIRP for 6LowPAN Interface: As per WPC GSR 45(E). Annex-J (J.2)
iii. Frequency of operation for 6LowPAN Interface: As per Latest NFAP Annex-J (J.1)
iv. Maximum Transmitted Power for 6LowPAN Int: As per WPC GSR 45(E). Annex-J (J.3)

1.5.22 Interface 22: 6LoWPAN (865 to 868 MHz)

i. Basic RF Requirements for 6LoWPAN Interface (865 to 868 MHz): As per Annex-K (K.4 to K.18). ETSI EN 300 220-2 V3.2.1
ii. ERP for 6LoWPAN Interface (865 to 868 MHz): As per WPC GSR 853(E). Annex-K (K.2)
iii. Frequency of Operation for 6LoWPAN Interface (865 to 868 MHz): As per Latest NFAP. Annex-K (K.1)
iv. Maximum Transmitted Power for 6LoWPAN Interface (865 to 868 MHz): As per WPC GSR 853 (E). Annex-K (K.3)
v. Duty Cycle for 6LoWPAN interface 865-868 MHz: as per GSR 853 (E) Annexure – K (K.7)

1.5.23 Interface 23: BLE

i. Basic RF Requirements for BLE Interface: As per Annex J (J.4 to J.15). ETSI EN 300 328 V2.2.2.
ii. EIRP for BLE Interface: As per WPC GSR 45(E). Annex-J (J.2)
iii. Frequency of Operation for BLE Interface: As per Latest NFAP. Annex-J (J.1)
iv. Maximum Transmitted Power for BLE Int: As per WPC GSR 45(E). Annex-J (J.3)

1.5.24 Interface 24: ZigBee

i. Basic RF Requirements for ZigBee Interface: As per Annex-J (J.4 to J.15). ETSI EN 300 328 V2.2.2.
ii. EIRP for ZigBee Interface: As per WPC GSR 45(E). Annex-J (J.2)
iii. Frequency of Operation for ZigBee Interface: As per Latest NFAP. Annex-J (J.1)
iv. Maximum Transmitted Power for ZigBee Int: As per WPC GSR 45(E). Annex-J (J.3)

1.5.25 Interface 25: WiFi

i. 2.4 GHz WiFi Radio Conformance: As per ETSI EN 300 328 or FCC CFR47 pt 15.247 or FCC CFR47 pt 15.249. Annex-L

ii. 5 GHz WiFi Radio Conformance: As per ETSI EN 301 893 and or ETSI EN 302 502 or FCC CFR47 pt 15.407 or FCC CFR47 pt 15.249. Annex-L
iii. EIRP for WiFi Interface: As per Latest NFAP and GSRs issued by DoT WPC. Annex-M
iv. Frequency for WiFi equipments: As per DoT WPC GSR No. 45(E) 1048(E). Annex-N

1.5.26 Interface 26: LPWAN – LoRa

i. Basic RF Requirements for LPWAN-LoRA: As per Annex-K (K.4 to K.18). ETSI EN 300 220-2 V3.2.1
ii. ERP LoRa: As per WPC GSR 853(E). Annex-K (K.2).
iii. Frequency of Operation for LoRa Int: As per Latest NFAP. Annex-K (K.1)
iv. Maximum Transmit Power LoRa: As per WPC GSR 853(E). Annex-K (K.3).

1.5.27 Interface 27: LPWAN – SigFox

i. Basic RF Requirements for LPWAN – SigFox: As per Annex-K (K.4 to K.18). ETSI EN 300 220-2 V3.2.1.
ii. ERP SigFox: As per WPC GSR 853(E). Annex-K (K.2).
iii. Frequency of Operation for SigFox Int: As per Latest NFAP. Annex-K (K.1)
iv. Maximum Transmit Power SigFox: As per WPC GSR 853(E). Annex-K (K.3).

1.5.28 Interface 28: NB-IoT

i. Frequency Error -NB-IoT: As per 3GPP TS 36.521-1 Clause 6.5.1F
ii. Maximum output power-NB-IoT: As per 3GPP TS 36.521-1 Clause 6.2.2F
iii. Operating Frequency-NB-IoT-Device Equp. shall be capable of operating in at least one of the frequency bands as per the latest NFAP National Freq. Allocation plan: As per National Frequency Allocation Plan - 2018 Frequency Allocation Table (IND 16)
iv. Power Control Absolute Power Tolerance- NB-IoT: As per 3GPP TS 36.521-1 Clause 6.3.5F.1
v. Receiver Adjacent Channel Selectivity (ACS) -NB-IoT: As per 3GPP TS 36.521-1 Clause 7.5F

vi. Receiver In-band blocking-NB-IoT: As per 3GPP TS 36.521-1 Clause 7.6.1F
vii. Receiver Reference Sensitivity level-NB-IoT: As per 3GPP TS 36.521-1 Clause 7.3F
viii. Receiver spurious emission-NB-IoT: As per 3GPP TS 36.521-1 Clause 7.9F
ix. Spectrum emissions mask-NB-IoT: As per 3GPP TS 36.521-1 Clause 6.6.2.1F
x. Spurious emissions-NB-IoT: As per 3GPP TS 36.521-1 Clause 6.6.3F.1-6.6.3F.2

1.5.29 Interface 29: Wireless Smart Utility Network (Wi- SUN) Field Area Network (FAN)

i. Basic RF Requirements for Wi-SUN: As per Annex-K (K.4 to K.18). ETSI EN 300 220-2
ii. ERP Wi-SUN: As per WPC GSR 853(E). Annex-K (K.2).
iii. Frequency of Operation for Wi-SUN Int: As per Latest NFAP. Annex-K (K.1)
iv. Maximum Transmit Power Wi-SUN: As per WPC GSR 853(E). Annex-K (K.3).

1.5.30 Interface 30: Geolocation Navigation Interface for IoT

One or more of the following:
i. GNSS for IoT: As per Annex-O
ii. NavIC for IoT: As per Annex-O

1.6 Quality Requirements

1.6.1 The manufacturer shall have a valid ISO 9001:2015 or any other equivalent ISO certificate.

1.6.2 The equipment shall meet the environmental requirements as per ‘Category B-2’ (in case of Indoor equipment) and ‘Category D’ (in case of Outdoor equipment) of QM-333 (latest version) Standard for Environmental Testing of Telecommunication Equipment.

1.6.3 The MTBF (Mean Time between Failure) and MTTR (Mean Time To Repair) predicted shall be provided and the manufacturer shall furnish observed values.

1.7 EMI/EMC Requirements

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report from accredited test lab shall be furnished from a test agency.

General Electromagnetic Compatibility (EMC) Requirements:

The equipment shall conform to the EMC requirements of class “A” as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from a ISO 17025/ NABL/TEC accredited LAB.

1.7.1 Conducted and radiated emission (applicable to telecom equipment):

Name of EMC Standard: “– CISPR 32 (2015) with A1(2019)/EN 55032 “Electromagnetic compatibility of multimedia equipment – Emission requirements "
Limits: -

i) To comply with Class A of CISPR 32 (2015) with A1 (2019).
ii) The values of limits shall be as per relevant tables under CISPR 32 (2015) with A1 (2019).
iii) Test Methods as per clause 8.1 – 8.4 of TEC11016:2016.

1.7.2 Immunity to Electrostatic discharge:

Name of EMC Standard: IEC 61000-4-2 {2008} Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test

i) Test Levels: -
   a) For Contact discharge- ±2KV and ± 4 kV or higher voltage;
   b) For Air discharge- ± 2 kV and ± 4kV and ± 8 kV or higher voltage;
ii) For Test Methods and other details, please refer clause 9.1 of TEC11016:2016.
iii) Performance Criteria as per Table 3 of TEC11016:2016.

1.7.3 Immunity to radiated RF:

Name of EMC Standard: IEC 61000-4-3 {2020} Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test

i) Test Levels:-

80 MHz to 6.0 GHz: Test level 2 {Test field strength of 3 V/m}

ii) For Test Methods and other details, please refer clause 9.2 of TEC11016:2016.

iii) Performance Criteria as per Table 3 of TEC11016:2016.

1.7.4 Immunity to fast transients (burst):

Name of EMC Standard: IEC 61000-4-4:2012 Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test

i) Test Levels:- Test Level 2 i.e.

a) 1 kV for AC/DC power lines;

b) 0. 5 kV for signal / control / data / telecom lines;

ii) For Test Methods and other details, please refer clause 9.3 of TEC11016:2016.

iii) Performance Criteria as per Table 3 of TEC11016:2016.

1.7.5 Immunity to surges:

Name of EMC Standard: IEC 61000-4-5{2014}, A1:2017 Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test

i) Test Levels:-

- For mains power input ports :

  (a) 2 KV peak open circuit voltage for line to ground coupling

  (b) 1 KV peak open circuit voltage for line to line coupling

- For telecom ports:

  (a) +/- 2KV peak open circuit voltage for line to ground

  (b) +/- 2KV peak open circuit voltage for line to line coupling.

ii) For Test Methods and other details, please refer clause 9.4 of TEC11016:2016.

iii) Performance Criteria as per Table 3 of TEC11016:2016.

1.7.6 Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC Standard: IEC 61000-4-6{2013} Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields

i) Test Levels

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.

ii) For Test Methods and other details, please refer clause 9.5 of TEC11016:2016.

iii) Performance Criteria as per Table 3 of TEC11016:2016.

1.7.7 Immunity to voltage dips & short interruptions (AC Power Ports)

(applicable to only ac mains power input ports, if any):

Name of EMC Standard: IEC 61000-4-11:2020 Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase

i) Test Limits:-

a) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms(i.e. 70 % supply voltage for 500 ms)

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.

ii) For Test Methods and other details, please refer clause 9.6 of TEC11016:2016.

iii) Performance Criteria as per Table 3 of TEC11016:2016.

1.7.8 Immunity to voltage dips & short interruptions (DC power ports)

(applicable to only dc power input ports, if any)

Name of EMC Standard: IEC 61000-4-29:2000 Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests

i) Test Limits:

a) A Voltage Interruption with 0% of supply for 10ms.

b) A Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms

c) A Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms

d) A Voltage dip corresponding to 40% & 70% of supply for 100ms, 300ms and 1000 ms

e) A Voltage variations corresponding to 80% and 120% of supply for 100 ms to 10s

ii) Performance Criteria as per Table 3 of TEC11016:2016.

Note: - For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC EMI/EMC Standard No. TEC 11016:2016 and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (g) and TEC EMI/EMC Standard No. TEC 11016: 2016. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	Euro Norm	IS Standards (BIS)
CISPR 32	EN 55032	IS CISPR 32
IEC 61000-4-2	EN 61000-4-2	IS 14700:Part 4:Sec 2
IEC 61000-4-3	EN 61000-4-3	IS 14700:Part 4:Sec 3
IEC 61000-4-4	EN 61000-4-4	IS 14700:Part 4:Sec 4
IEC 61000-4-5	EN 61000-4-5	IS 14700:Part 4:Sec 5
IEC 61000-4-6	EN 61000-4-6	IS 14700:Part 4:Sec 6
IEC 61000-4-11	EN 61000-4-11	IS 14700:Part 4:Sec 11
IEC 61000-4-29	EN 61000-4-29	

1.8 SAFETY REQUIREMENTS

The equipment shall conform to:

- IS 13252 part 1: 2010 (Amd 2013 & Amd 2015) “Information Technology Equipment – Safety – Part 1: General Requirements” or equivalent.
- IEC standard –IEC 60950- 1:2005+A1:2009+A2:2013 “Information Technology Equipment – Safety- Part 1: General Requirements.

Additional Requirement:

• For Outdoor Nodes-

- IEC 60950-22

OR

- IEC 62368-1:2018 or latest version

Additional Requirement:

- For Outdoor Nodes- IEC 60950-22, if the Indoor testing has been done as per IEC 62368-1 Edition 2.

OR

- For Outdoor Nodes- Annexure Y of IEC 62368-1 Edition 3.

1.9 Security Requirements

Note: Security requirements as per the Indian Telecommunication Security Assurance Requirement (ITSAR) of IoT Gateway, as and when notified.

1.10 Other Requirements

1.10.1 Identification of Equipment

i) Equipment shall be marked with supplier’s or manufacturer’s name, address and logo.

ii) The Model No., Serial No., Month and year of manufacturing shall be indicated by screen printing on the body of equipment or by tamper-proof sticker/bar code/QR code pasted on the body of equipment.

iii) Equipment Identifier (MAC/IMEI/ESN/etc.) shall be mentioned on the equipment/packaging box/console/manual/document provided along with the equipment.

iv) Equipment identifier should also be stored digitally on the gateway and made available digitally.

v) Power Supply requirements shall be indicated on the body.

vi) Above markings shall be legible, indelible, digitally/electronically readable and easily visible.

1.10.2 Documentation

Detailed documentation in English or Hindi shall be provided, including:

i. Self-explanatory user manual giving details of all functions, facilities and procedures
ii. Set-up and configuration parameters and procedures
iii. Trouble shooting guide including fault dictionary.
iv. Repair manual (Optional)

1.10.3 IoT Dev - Non-0 IMEI or MEID or Unique MAC

As per GSMA official document IMEI Allocation & Approval Process (for IMEI / MEID). Test Procedure: Device manufacturer shall mention the suitable procedure for testing IMEI/ MEID/ MAC address/ any other unique ID by connecting device to smart phone/ tablet/ PC and without using any specialized test equipment.

1.10.4 Dual IP Parameters

The Dual IP Parameters shall be compliant with clauses of RFC 4213 as per Annex-P.

1.10.5 IPv4 Parameters

The IPV4 Parameters shall be compliant with clauses of RFC 791 as per Annex-P.

1.10.6 IPv6 Parameters

The IPv6 Parameters shall be compliant with clauses of RFC 2460/8200 as per Annex-Q.

1.10.7 IoT Gateway may preferably support firmware over the air updates.

1.10.8 IoT Gateway may preferably support time synchronization using NTP

1.10.9 IoT Gateway may preferably be oneM2M compliant.

1.10.10 IoT device may preferably support device Management using any of the following

– TR069, LWM2M, oneM2M service layer, OMA-DM etc.

1.10.11 IoT Gateway shall support at least one of the following communication protocols

i. HTTPs
ii. MQTT
iii. CoAP
iv. Websocket

1.10.12 IoT Gateway may support the following serialization protocols

i. XML
ii. JSON
iii. CBOR (Concise Binary Object Representation)

CHAPTER-2

2.1 Information for the procurer of product

(Note: Requirements according to IoT Gateway has to be specified by the procurer)

a) For procurement purposes, number and type of Interfaces to be specified by the procurer.
b) Procurer may specify AC/DC power supply requirements
c) Procurer may specify MTBF (Mean Time between Failure) and other parameters.

ABBREVIATIONS

3GPP	3rd Generation Partnership Project
AC	Alternating Current
ADSL	Asymmetric Digital Subscriber Line
AES	Advanced Encryption Standard
API	Application Program Interface
ATU-C	ADSL Transceiver Unit Central
BCC	Block check character
BLE	Bluetooth Low Energy
BSS	Business Support System
CD	Compact Disc
CDMA	Code Division Multiple Access
CISPR	Comittee International Special des Perturbations Radioelectriques
CPE	Customer Premises Equipment
DAPRA	Defence Advanced Research Project Agency
DAT	Digital Audio Tape
dBM	Decibel Mili-watts
DC	Direct Current
DDoS	Distributed Denial of Service
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Service
DSSS	Direct Sequence Spread Spectrum
E-UTRA	Evolved Universal Terrestrial Radio Access Network
EAP	Extensible Authentication Protocol
EDGE	Enhanced Data Rates for GSM Evolution
EIRP	Effective Isotropic Radiated Power
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMS	Electronic Message Service
EN	European Standard
ENISA	European Network and Information Security Agency
ETSI	European Telecommunication Standards Institute

FAN	Field Area Network
FDD	Frequency Division Duplex
FE	Fast Ethernet
GB	Giga Byte
GE	Gigabit Ethernet
GHz	Giga Hertz
GPRS	General Packet Radio Service
GR	Generic Requirements
GSM	Global System for Mobile Communications
GSMA	Global System for Mobile Communication Association
GSR	General Statutory Rules
GUI	Graphic User Interface
HE	High Efficiency
HNAP	Home Network Administration Protocol
HSPA	High Speed Packet Access
HTTP	Hypertext Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
ID	Identification Data
ID	Identity Document
IEC	International Electro-technical Commission
IEEE	Institute of Electrical & Electronics Engineers
IETF	Internet Engineers Task Force
IMDA	Infocomm Media Development Authority
IMEI	International Mobile Equipment Identity
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IR	Interface Requirements
ISATAP	Intra-Site Automatic Tunnel Addressing Protocol
ISO	International Standards Organisation
ITU	International Telecommunication Union
KHz	Kilo Hertz
kV	Kilo Volt
LAN	Local Area Network
LCL	Longitudinal Conversion Loss

LDAP	Lightweight Directory Access Protocol
LED	Light Emitting Diode
LoRa	Long Range
LowPAN	Low Power Wireless Personal Area Network
LTE	Long Term Evolution
MAC	Media Access Control
MCS	Modulation and coding scheme
MEID	Mobile Equipment Identifier
MHz	Mega Hertz
MIB	Management Information Base
MIMO	Multiple-input and Multiple-output
ms	Mili Second
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
MU	Multi-unit
mW	Milli watts
NAT	Network Address Translator
NAT – PMP	Network Address Translation Port Mapping Protocol
NavIC	Navigation with Indian Constellation
NB-IoT	Narrowband – IoT
NE	Network Element
NFAP	National Foundation for American Policy
NFC	Near Field Communication
NOC	Network Operation Centre
OFDM	Orthogonal Frequency Division Multiplexing
OS	Operating System
PCP	Port Control Protocol
PDO	Public Data Office
POE	Power over Ethernet
PPDU	Physical layer Packet Data Unit
PPP	Point-to-Point Protocol
PPPoE	Point to Point Protocol over Ethernet
PSD	Power Spectral Density
QA	Quality Assurance
QM	Quality Manual

RADIUS	Remote Authentication Dial In User Service
RAM	Random Access memory
RF	Radio-Frequency
RFC	Request For Comment
RIP	Routing Information Protocol
RISC	Reduced Instruction Set Computer
RLAN	Radio Local Area Network
RP	Radio Paging
SHDSL	Single pair High speed Digital Subscriber Line
SIM	Subscriber Identity Module
SNMP	Simple Network Management Protocol
SSH	Secure Shell
TEC	Telecommunication Engineering Centre
UE	User Equipment
UL	Unified License
UPnP	Universal Plug and Play
UTRA	Universal Terrestrial Radio Access Network
VDSLx	Very high bit rate Digital Subscriber Line
WAN	Wide Area Network
WAS	Wireless Access Systems
WCDMA	Wideband Code Division Multiple Access
Wi- SUN	Wireless Smart Utility Network
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WPA	Wi-Fi Protected Access
WPC	Wireless Planning and Coordination
WPS	Wi-Fi Protected Setup

Annexures

Annex-A: Ethernet Interface Parameters Parameter Group: Ethernet Interface (INTETH)

Note: DUT needs to be tested only for those interface ranges (SR, LR, ER, FR, etc) which are mentioned in the Bill of Materials (BOM) submitted by applicant.

The new additional proposed ranges have been highlighted below

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
A.1	Gigabit Ethernet Electrical or 10 100 1000 Base T Ethernet	Link Speed and AutoNegotiation GE	IEEE 802.3		Appendix-II, Test 4	
A.2	Fast Ethernet Electrical or 10/100 Base T Ethernet	Link Speed and AutoNegotiation GE	IEEE 802.3		Appendix-II, Test 4	
A.3	Gigabit Ethernet Optical	Average Launch Power for 1 GE Opt	clause 38.3.1 Transmitter optical specifications of IEEE 802.3 2018 Sec-3, Short	Max shall be lesser of hazard level 1 safety limit as def by 38.7.2 or avg receive power (max) def by table		

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
			Haul	38-4Min = -9.5 dBm		
			clause 38.4.1 Transmitter optical specifications of IEEE 802.3 2018 Section-3, Long Haul	Max = -3 dBm Min = -11.5 dB m for 62.5 µm MMF, - 11.5 dBm for 50 µm MMF, - 11.0 dBm for SMF		
A.4	Gigabit Ethernet Optical	Wavelength for 1 GEopt	IEEE 802.3z CL.38, Short Haul	770 – 860 nm		
			IEEE 802.3z CL.38, Long Haul	1270 – 1355 nm		
A.5	Gigabit Ethernet Optical	Receiver Sensitivity for 1GE Opt	clause 38.3.2 Receiver optical specifications of IEEE 802.32018 Section-3, short haul	-17 dBm		
			38.4.2, long haul	-19 dBm		
A.6	10 Gigabit Ethernet	Wavelength for 10	IEEE 802.3ae Cl 52, Short Haul	840 - 860 nm		

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
	Optical	GEInt	IEEE 802.3ae Cl 52, Long Haul	1260 – 1355 nm		
			IEEE 802.3 2018, ER	1530 – 1565 nm		
A.7	10 Gigabit Ethernet Optical	Receiver Sensitivity for 10GE Int	table 52-9 for SR, 52-13 for LRand 52-17 for ER of IEEE 802.3ae specifications, SR	-11.1 dBm		
			LR	-12.6 dBm		
			ER	-14.1 dBm		
A.8	10 Gigabit EthernetOptical	Average Launch Power for 10 GE Opt	table 52-7 for SR, 52-12 for LR and 52-16 for ER of IEEE 802.3ae specifications,Short Haul	Max shall be lesser of the hazardlevel 1 safety limit as def by 52.10.2 or the avg receive power(max) def by table 52-9 Min = -7.3 dBm		
			Long Haul	Max = 0.5 dBm Min = -8.2 dBm		

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
			ER	Max = 4.0 dBmMin = -4.7 dBm		
A.9	40 Gigabit EthernetOptical	Average Launch Power for 40 GE Opt	Table 86-6 for SR4 and 87-7for LR4, ER4 of IEEE 802.3ba specifications, SR4	Max = 2.4 dBm Min = -7.6 dBm		
			IEEE 802.3ba LR4	Max = 2.3 dBm Min = -7 dBm		
			IEEE 802.3ba ER4	Max=4.5 dBm Min=-2.7 dBm		
A.10	40 Gigabit EthernetOptical	Wavelength for 40GE opt	IEEE 802.3ba, SR4	840 – 860 nm		
			IEEE 802.3ba, LR4, ER4	1264.5 to 1277.5 nm 1284.5 to 1297.5 nm 1304.5 to 1317.5 nm 1324.5 to 1337.5 nm		
A.11	40 Gigabit EthernetOptical	Receiver Sensitivity for 40GE Opt	Table 86-8 for SR4 and 87-8for LR4 of IEEE 802.3ba specifications, SR4	-5.4 dBm		
			LR4	-11.5 dBm		
			ER4	-19 dBm		

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
A.12	100 Gigabit EthernetOptical	Average Launch Power for 100 GE Opt	Table 86-6 for SR10, 88-7 forLR4/ER4 of IEEE 802.3ba specifications, SR10	Max = 2.4 dBm Min = -7.6 dBm		
			SR4	Max = 2.4dBm Min = -8.4dBm	Table 95-6 of IEEE Std 802.3-2022	
			LR4	Max = 4.5 dBmMin = - 4.3 dBm		
			ER4	Max=2.9 dBmMin=-2.9 dBm	.	
A.13	100 Gigabit EthernetOptical	Wavelength for 100 GE Opt	IEEE 802.3ba, SR10	840 – 860 nm		
			SR4	840 to 860 nm	Table 95-6 of IEEEStd 802.3-2022	
			LR4/ER4	1294.53 to 1296.59 nm 1299.02 to 1301.09 nm 1303.54 to 1305.63 nm 1308.09 to 1310.19 nm	Test may be carried out against any ofthe specified wavelength range	

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
			FR1, Table 140.6 of IEEE 802.3cu	1304.5 to 1317.5 nm		
A.14	100 Gigabit EthernetOptical	Receiver Sensitivity for 100GE Opt	Table 86-8 for SR10, 88-8 forLR4/ER4 of IEEE 802.3ba specifications, SR10	-5.4 dBm		
			SR4	-5.2 dBm (Stressed)	Table 95-7 of IEEE Std 802.3-2022	
			LR4	-8.6 dBm		
			ER4	-21.4 dBm		
			FR1, Table 140.7 of IEEE802.3cu	-4.5 dbm for TECQ<1.4dbm / -5.9dBm+TECQ for 1.4dB<=TECQ<=3.4dB m		
A.15	Fast Ethernet Optical	Average Launch Power for FE Opt	IEEE 802.3 (2018), 100BASE-LX10, Table 58-3 (Long Wavelength)	-8 dBm (Max.) -15 dBm (Min.)		
			IEEE 802.3 (2018), 100BASE-BX10 Table 58-5 (Bi-directional	-8 dBm (Max.) -14 dBm (Min.)		

S.No.	Interface Name	Parameter Name	Standard	Limits / Values	Applicability / Remarks	Feedback points
			Long Wavelength)			
A.16	Fast Ethernet Optical	Wavelength forFE opt	IEEE 802.3 (2018), 100BASE-LX10, Table 58-3 (Long Wavelength)	1260 to 1360 nm		
			IEEE 802.3 (2018), 100BASE-BX10 Table 58-5 (Bi-directionalLong Wavelength)	1480 to 1580 nm (100BASE-BX10-D) 1260 to 1360 nm (100BASE-BX10-U)		
A.17	Fast Ethernet Optical	Receiver	IEEE 802.3 (2018), 100BASE-	-25 dBm		
		Sensitivity for FEOpt	LX10, Table 58-4 (Long Wavelength)			
			IEEE 802.3 (2018), 100BASE-BX10 Table 58-6 (Bi-directionalLong	-28.2 dBm		

			Wavelength)		
A.18	25 Gigabit EthernetOptical	Average Launch Power for 25 GE Opt	Table 114-6 for LR of IEEE 802.3- 2018	Max=2 dBm Min=-7 dBm	
			SR	Max = 2.4dBm Min = -8.4dBm	Table 95-6 as mentioned in
					Section 112.6.1 of IEEE Std 802.3-2022
			ER	Max=6 dBm Min=-3 dBm	
A.19	25 Gigabit EthernetOptical	Wavelength for 25GE Opt	LR	1295-1325 nm	
			SR	840 to 860 nm	Table 95-6 as mentioned in Section 112.6.1 of IEEE Std802.3-2022
			ER	1295-1310 nm	
A.20	25 Gigabit EthernetOptical	Receiver Sensitivity for 25GE Opt	LR	-12 dBm	
			SR	-5.2 dBm (Stressed)	Table 95-7 as mentioned in Section 112.6.2 of IEEE Std802.3-2022
			ER	-19 dBm	

A.21	50 Gigabit EthernetOptical	Average Launch	As per table 139.6 of IEEE 802.3cn,	Max = 3 dbm, Min = -4.1 dbm	
		Power for 50 GE Opt	FR		
			SR	Max=4dBm Min=-6.5dBm	Table-138-8 of IEEE 802.3-2022
			LR	Max = 4.2 dbm, Min = -4.5 dbm	
			ER	Max = 6.6 dbm, Min = 0.4 dbm	
A.22	50 Gigabit EthernetOptical	Receiver Sensitivity for 50GE Opt	As per table 139.7 of IEEE802.3cn, FR	= max (–6.9, SECQ – 8.3) (dBm)	
			SR	= max (–6.5, SECQ – 7.9) (dBm)	Table-138-9 of IEEE802.3-2022
			LR	= max (–8.4, SECQ – 9.8) (dBm)	
			ER	= max (–15.1, SECQ – 16.5) (dBm)	
A.23	50 Gigabit Ethernet Optical	Wavelength for50 GE Opt	As per table 139.6 of IEEE 802.3cn SR	1304.5 to 1317.5 nm (for FR, LR &ER cases) 840 to 860 nm	Table-138-8 of IEEE802.3-2022

A.24	200 Gigabit EthernetOptical	Average Launch Power for 200 GE Opt	Table-121-6 for DR-4, 122-9 for LR4 and FR4 of IEEE 802.3cn ,DR4 SR 4 LR4 FR4	Max=3 dBm Min=-5.1 dBmMax=4dBm Min=-6.5dBm Max=5.3 dBmMin=-3.4 dBm Max=4.7dBm Min=-4.2 dBm	Table-138-8 of IEEE802.3-2022
A.25	200 Gigabit EthernetOptical	Wavelength for 200 GE Opt	DR4	1304.5 to 1317.5 nm	
			SR4	840 to 860 nm	Table-138-8 of IEEE802.3-2022
			LR4	1294.53 to 1296.59 nm 1299.02 to 1301.09 nm 1303.54 to 1305.63 nm 1308.09 to 1310.19 nm	Test may be carried out against any ofthe specified wavelength range
			FR4	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 Units (nm) to bementioned 1324.5 to 1337.5	Test may be carried out against any ofthe specified wavelength range
A.26	200 Gigabit	Receiver	Table 121–7 IEEE 802.3cn,DR4	Max= 3dBm Min= -8.1dBm	= max(–6.1, SECQ – 7.5) as per Table 121-7

	EthernetOptical	Sensitivity for 200GE Opt Average launch power, each lane(max)	SR4	= Max(–6.5, SECQ – 7.9)	Table 138-9 IEEE 802.3-2022
			Table 122–11 IEEE 802.3cn, LR4	Max= 5.3dBm Min= -9.7dBm	= max (–7.2, SECQ – 8.6) as per table 122- 11
			Table 122–11 IEEE 802.3cn, FR4	Max= 4.7dBm Min= -8.2dBm	= Max(–5.5, SECQ – 6.9) as per table 122- 11
A.27	400 Gigabit EthernetOptical	Average Launch Power for 400 GE Opt Average launchpower, each lane	Table-124-6 for DR-4, 122-10 for LR8 and FR8 of IEEE 802.3cn ,DR4	Max=4 dBm Min=-2.9 dBm	
			SR8	Max=4dBm Min=-6.5dBm	Table-138-8 of IEEE802.3-2022
			LR8	Max=5.3 dBm Min=-2.8 dBm	
			FR8	Max=5.3 dBmMin=-3.5 dBm	
A.28	400 Gigabit EthernetOptical	Wavelength for 400GE Opt	Table-124-6 for DR4, 122-10 for LR8 and FR8, DR4	1304.5 to 1317.5 nm	

			SR8	840 to 860 nm	Table-138-8 of IEEE 802.3-2022
			LR8 and FR8	1272.55 to 1274.54 nm 1276.89 to 1278.89 nm 1281.25 to 1283.27 nm 1285.65 to 1287.68 nm 1294.53 to 1296.59 nm 1299.02 to 1301.09 nm 1303.54 to 1305.63 nm 1308.09 to 1310.19 nm	Test may be carried out against any ofthe specified wavelength range
A.29	400 Gigabit EthernetOptical	Receiver Sensitivity for 400GE Opt	Table 124–7 IEEE 802.3cn, DR4	Max= 4dBm Min= -5.9dBm	= max(–3.9, SECQ – 5.3) as per Table 124- 7
			SR8	= Max(–6.5, SECQ – 7.9)	Table 138-9 IEEE 802.3-2022
			Table 122–12 IEEE 802.3cn,LR8	Max= 5.3dBm Min= -9.1dBm	= max(–6.6, SECQ – 8) as per Table 122- 12
			Table 122–12 IEEE 802.3cn,FR8	Max= 5.3dBm Min= -7.5dBm	= max(–4.8, SECQ – 6.2) as per Table 122-12

Annex-B: xDSL Interface Parameters

Parameter Group: DSL Interface (INTDSL)

S. No.	Interface Name	Parameter Name	Standard	Limit/Value	Remarks
B.1	ADSLx	Loop resistance for ADSLx	ETSI EN 300 001 Table 2.3		
B.2	ADSLx	PSD for ADSLx Int	ITU G.992.2 Annex-II OR,G.992.1(anne- A) OR, G.992.3 OR, G.992.5.		
B.3	ADSLx	Bit Rate for ADSLx Int	ANSI T1.413- Issue 2 OR,ITU G.992.2 OR, ITU G.992.1 OR, ITU G.992.1 Annex A OR, ITU G.992.1 Annex B OR, ITU G.992.3 Annex L OR, ITU G.992.3 OR, ITU G.992.4		

S. No.	Interface Name	Parameter Name	Standard	Limit/Value	Remarks
			OR,ITU G.992.5 OR, ITU G.992.5 Annex M.		
B.4	ADSLx	Insulation Test for ADSLx Int	ETSI EN 300 001 Cl. 2.2 ORG.992.3		
B.5	ADSLx	Impulse Noise Protection for ADSLx Int	G.992.3 Appendix V	Better than 2	
B.6	ADSLx	Transmitted Power At ATU-C forADSLxInt	G.992.3 Annexure-P		
B.7	ADSLx	Line Port impedance for ADSLxInt	G.992.3		
B.8	VDSLx	Insulation Test for VDSLx Int	ETSI EN 300 001		
B.9	VDSLx	Loop resistance for VDSLx	ETSI EN 300 001		
B.10	VDSLx	Profiles for VDSLx	G.993.1 OR G.993.2 Cl. 7.2		
B.11	VDSLx	Return Loss for VDSLx	G.993.1 Cl. 6.5 OR G993.2		
B.12	VDSLx	PSD for VDSLxInt	G.993.1 Cl. 6.2 OR G.993.2 Cl. 7.2		
B.13	VDSLx	Line Port impedance for VDSLxInt	G.993.1 OR G993.2		

S. No.	Interface Name	Parameter Name	Standard	Limit/Value	Remarks
B.14	VDSLx	Transmitted Power At ATU-C for VDSLxInt	G.993.1 OR G993.2		
B.15	VDSLx	Bit Rate for VDSLxInt	G.993.1 OR G993.2		
B.16	G.FAST	PPPoE for G.FAST Int	RFC 2516 Functional Test		Annex-P11
B.17	G.FAST	PVC Support for G.FAST Int	G.9700		
B.18	G.FAST	VPI-VCI Support for G.FAST Int	G.9700		
B.19	G.FAST	Loop Resistance for G.FAST IntSLx	ETSI EN 300 001		
B.20	G.FAST	Insulation Test for G.FAST Int	G.9700		
B.21	G.FAST	Impulse Noise Protection for G.FAST Int	G.9700		
B.22	G.FAST	Throughput Test for G.FAST Int	G.9700		
B.23	G.FAST	Profiles for G.FAST Int	G.9700		
B.24	G.HN	Profiles for G.HN Int	G.9960		
B.25	G.HN	PSD for G.HN	G.9964		
B.26	SHDSL	PSD for SHDSL Int	G.991.2 Annex B	<-30dBm	
B.27	SHDSL	Return Loss for SHDSL	G.991.2 Annex B	Min 14dB over frequency band of 20KHz to 2MHz at input/output of interface	
B.28	SHDSL	Transmitted Power for SHDSL Int	G.991.2 Annex B	+14.5+/-0.5dBm for data	

S. No.	Interface Name	Parameter Name	Standard	Limit/Value	Remarks
				rate >2048kb/s +13.5+/-0.5dBm for data rate <2048kb/s	
B.29	SHDSL	Insulation Resistance for SHDSL int	G.991.2	>5 M Ohm	
B.30	SHDSL	Throughput for SHDSL Interface	G.991.2	64Kbps to 2048Kbps	
B.31	SHDSL	LCL for SHDSL Interface	G.991.2 Annex B	>40dB over frequency rangeof 5KHz to 2MHz	SHDSL interface having a metallic termination of 135ohm and a longitudinal
					termination of 33.8 ohm
B.32	MG.FAST	Differential port impedance for MG.FAST Int	G.9711	Ratio at different interval satisfy <0.20	Clause 14.2
B.33	MG.FAST	Longitudinal conversion loss for MG.FAST Int	G.9711	greater than or equal to 38 dB in the frequency band	Clause 14.1.1

				upto 12 MHz.	
B.34	MG.FAST	Loop Resistance for MG.FAST Int	EN 300 001.		
B.35	MG.FAST	PSD for MG.FAST Int	G.9710.		
B.36	MG.FAST	Profiles for MG.FAST Int	G.9711		Clause 6.0, Table-P1 of G.9711
B.37	MG.FAST	Throughput Test for MG.FAST Int	G.9711	an aggregate (sum of upstream and downstream)data rate of up to 8 Gbit/s;	

Annex-C: Parameters for 2-wire PSTN Lines, Trunks lines and CPEs connected thereon (INT2W & CPE2W)

Parameter Group: 2-Wire Interface (INT2W) and CPEs connected on 2-Wire (CPE2W)

S. No.	Equipment Name	Parameter Name	Standard	Limits/ Values	Applicability/ Remarks
C.1	2-Wire CPEs and Interfaces	Longitudinal/ Transverse Conversion Loss	Q.552 Clause 2.2.2 & Figure 2 / TBR.21 Clause 4.4.3	As in Figure 2, Annexure-D4	**Refer Note 1**
C.2	2-Wire CPEs and Interfaces	Return Loss	Q.552 Clause 2.2.1.2 and Figure1	As in Figure 1,Annexure-D4	
C.3	2-Wire CPEs and Interfaces	Over Voltage/ Over CurrentProtection	K.21	Compliance	Compliance ofthis test only ifport is connected to external lines e.g. in case ofxDSL lines.
C.4	2-Wire CPEs and Interfaces	Maximum Loop Current	ETSI EN 300 001	< 60 mA	
C.5	2-Wire CPEs and Interfaces	Idle State Current	ETSI EN 300 001	< 40 µA/ 130µA	Without/ withCLIP

S. No.	Equipment Name	Parameter Name	Standard	Limits/ Values	Applicability/ Remarks
					display
C.6	2-Wire CPEs and Interfaces	Insulation Test	ETSI EN 300 001	> 5 MΩ	Refer Note 1
C.7	2-Wire CPEs and Interfaces	Resistance to Earth	TBR-21 Clause 4.4.4	> 10 MΩ	
C.8	2-wire Trunk Line	DC Resistance	ETSI TBR-21 Clause 4.4.1	> 1 MΩ	
C.9	2-wire Trunk Line	Minimum Current on MGWTrunk Line	ETSI EN 300 001	≥ 60 µA	
C.10	Telephones/ Fax with Handset	Acoustic Shock Absorption	P.360 Clause 4.1	Compliance	
C.11	Audio Conferencing Equipment	Voice Conference Verification	Functional Test	Compliance	
C.12	Fax, Modem	Transmit Power for FaxMachine/ Modem	T.4 Clause 6	-3dBm to -15 dBm	
C.13	Fax	Receiver Sensitivity for FAX	T.4 Clause 7	> -43 dBm	
Note 1: This test is exempted provided an undertaking should be submitted by the supplier that 2-wire equipment is not intended to beconnected to Earth. In case the 2- wire equipment is intended to be connected to Earth by any supplier then the test would be required					
C.14	Modem	Receiver Signal for Modem	V.34 (para 6.6)	> -43 dBm ON < -48 dBm OFF	
C.15	2-wire line and trunk	Transmission of DTMF Signals	Q.23 Clause 6 and 7	Compliance	
C.16	2- Wire Trunk	Current on Junction/ TrunkLine in PABX		< 60 mA	

Annex – D: Radio Conformance Test for Devices having Cellular Wireless Interface using CDMA2000 Technology

Parameter Group: Cellular (CELLULAR)

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
D.1	CDMA Int Parameters	Transmitter Maximum outputpower	1x: S0011 Clause 4.4.5	EN 301 908-04 (CDMA) Clause 4.2.3	Test setup and test procedure along with the equipment required to conduct test must be included as available for Test 39otherwise evaluation of applications of Labs for CAB/CB accreditation not possible.
D.2		Transmitter Spectrum emissionsmask	1x: S0011 Clause 4.5.1	EN 301 908-04 (CDMA) Clause 4.2.2	Same as above
D.3		Transmitter spurious emissionsin active mode (Conducted)	1x: S0011 Clause 4.5.1	EN 301 908-04 (CDMA) Clause 4.2.2	Same as above
D.4		Receiver spurious emission inidle mode (Conducted)	1x: S0011 Clause 3.6	EN 301 908-04 (CDMA) Clause 4.2.5	Same as above

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
D.5		Receiver Adjacent ChannelSelectivity (ACS)		EN 301 908-04 (CDMA) Clause 4.2.8	Same as above
D.6		Receiver In-band blocking		EN 301 908-04 (CDMA) Clause 4.2.6	Same as above
The following parameter "Frequency Stability" and "Power control Absolute Power Tolerance" shall be applicable for End Point Devices forEnvironmental Mentoring only.					
D.7		Frequency Stability	1x: S0011 4.1	EN 301 908-04(CDMA)	Compliance to given Standard Test setup and test procedure along with the equipment required to conduct test must be included as available for Test 39otherwise evaluation of applications of Labs for CAB/CB accreditation notpossible.

Annex-E: Frequency of Operation for Cellular Wireless Interfaces and Equipment

Parameter Group: Cellular (CELLULAR)

S. No.	Technology	Parameter Name	Standard	Limits/ Values	Applicability/ Remarks	Test Procedure
E.1	CDMA2000	Frequency of Operation		Latest NFAP issued byWPC.		Appendix - IITest 36
E.2	2G/ GSM/ GPRS/ EDGE	Frequency of Operation		Latest NFAP issued byWPC.		Appendix - IITest 36
E.3	3G/ WCDMA/ HSPA	Frequency of Operation		Latest NFAP issued byWPC.		Appendix - IITest 36
E.4	4G/ LTE/ LTE-A	Frequency of Operation		Latest NFAP issued byWPC.		Appendix - IITest 36
E.5	BTS with MSR	BTS with MSR Operating Frequency		Latest NFAP issued byWPC.		Appendix - IITest 36
E.6	BTS with AAS	BTS with AAS Operating Frequency		Latest NFAP issued byWPC.		Appendix - IITest 36

Annex-F: Radio Conformance Test for Devices having Cellular Wireless Interface using GSM/GPRS/ EDGE Technology

Parameter Group: Cellular (CELLULAR)

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
F.1	GSM Int Parameters	Transmitter Maximum output power	3GPP TS 51 010-1 Clause 13.3	EN 301 511 (GSM) Clause 4.2.5	GSM Test setup and test procedure along with the equipment required to conduct test must be included as available for Test 39 otherwise evaluation of applications of Labs for CAB/CB accreditation not possible.

F.2		Transmitter Maximum output power	3GPP TS 51 010-1 Clause 13.16.2	EN 301 511 (GSM) Clause 4.2.10	GPRS/ EDGE Same as above.
F.3		Output RF Spectrum	3GPP TS 51 010-1 Clause 13.4	EN 301 511 (GSM) Clause 4.2.6	GSM Same as above.
F.4		Output RF Spectrum	3GPP TS 51 010-1 Clause 13.16.3	EN 301 511 (GSM) Clause 4.2.11	GPRS/ EDGE Same as above.

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
F.5		Spurious emissions (MS allocated achannel)	3GPP TS 51 010-1 Clause 12.1.1	EN 301 511 (GSM) Clause 4.2.12	GSM Same as above.
F.6		Spurious emission (MS in idle mode)	3GPP TS 51 010-1 Clause 12.1.2	EN 301 511 (GSM) Clause 4.2.13	GSM Same as above.
F.7		Frequency Error and phase error	3GPP TS 51 010-1 Clause 13.1	EN 301 511 (GSM) Clause 4.2.1	GSM Same as above.
F.8		Frequency Error and phase error	GPRS:3GPP TS 51 010-1 Clause 13.16.1	EN 301 511 (GSM) Clause 4.2.4	GPRS/ EDGE Same as above.
F.9		Reference sensitivity level(speech channels)	3GPP TS 51 010-1 Clause 14.2.1	EN 301 511 (GSM) Clause 4.2.42	GSM Same as above.
F.10		Adjacent Channel Rejection (speechchannels)	3GPP TS 51 010-1 Clause 14.5.1	EN 301 511 (GSM) Clause 4.2.38	GSM Same as above.

F.11		Receiver blocking	3GPP TS 51 010-1 Clause 14.7.1	EN 301 511 (GSM) Clause 4.2.20	GSM Same as above.

Annex – G: Radio Conformance Test for Devices having Cellular Wireless Interface using LTE/LTE – A Technology

Parameter Group: Cellular (CELLULAR)

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
G.1	LTE Int Parameters	Maximum output power	3GPP TS 36.521-1 Clause 6.2.2	EN 301 908-13 (LTE) Clause 4.2.2	Test setup and test procedure along with the equipment required to conduct test must be included as available for Test 39 otherwise evaluation of applications of Labs for CAB/CB accreditation not possible.
G.2		Spectrum emissions mask	3GPP TS 36.521-1 Clause 6.6.2.1	EN 301 908-13 (LTE) Clause 4.2.3	Same as above
G.3		Spurious emissions	3GPP TS 36.521-1 Clauses 6.6.3.1, 6.6.3.2, 6.6.3.3	EN 301 908-13 (LTE) Clause 4.2.4	Same as above
G.4		Receiver spurious emission	3GPP TS 36.521-1 Clause 7.9	EN 301 908-13 (LTE) Clause 4.2.10	Same as above

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
G.5		Receiver Reference Sensitivity level	3GPP TS 36.521-1 Clause 7.3	EN 301 908-13 (LTE) Clause 4.2.12	Same as above
G.6		Receiver Adjacent Channel Selectivity (ACS)	3GPP TS 36.521-1 Clause 7.5	EN 301 908-13 (LTE) Clause 4.2.6	Same as above
G.7		Receiver In-band blocking	3GPP TS 36.521-1 Clause 7.6.1	EN 301 908-13 (LTE) Clause 4.2.7	Same as above
The following parameter “Frequency Stability” and “Power control Absolute Power Tolerance” shall be applicable for End Point Devices for Environmental Mentoring only.					
G.8		Frequency Stability	3GPP TS 36.521-1 6.5	EN 301 908-13 (LTE)	Compliance to given Standard.
G.9		Power control Absolute PowerTolerance	3GPP TS 36.521-1 6.3.5.1	EN 301 908-13 (LTE)	Compliance to given Standard.

Annex-H: Radio Conformance Test for Devices having Cellular Wireless Interface using WCDMA/ HSPA Technology

Parameter Group: Cellular (CELLULAR)

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
H.1	WCDMA Int Parameters	Transmitter Maximum output power	3GPP TS 34.121-1 Clause 5.2	EN 301 908-2 (UMTS) Clause4.2.2	Test setup and test procedure along with theequipment required to conduct test must be included as available for Test 39 otherwise evaluation of applications of Labs for CAB/CB accreditation not possible.
H.2		Transmitter Spectrum emissions mask	3GPP TS 34.121-1 Clause 5.9	EN 301 908-2 (UMTS) Clause4.2.3	Same as above

S. No.	Parameter Name	Individual Parameter Name	Standard		Applicability/Remarks
H.3		Transmitter spurious emissions	3GPP TS 34.121-1 Clause 5.11	EN 301 908-2 (UMTS) Clause4.2.4	Same as above
H.4		Receiver spurious emission	3GPP TS 34.121-1 Clause 6.8	EN 301 908-2 (UMTS) Clause4.2.10	Same as above
H.5		Transmitter Minimum Output Power	3GPP TS 34.121-1 Clause 5.4.3	EN 301 908-2 (UMTS) Clause4.2.5	Same as above
H.6		Receiver Reference sensitivity level	3GPP TS 34.121-1 Clause 6.2	EN 301 908-2 (UMTS) Clause4.2.13	Same as above
H.7		Receiver Adjacent Channel Selectivity (ACS)	3GPP TS 34.121-1 Clause 6.4	EN 301 908-2 (UMTS) Clause4.2.6	Same as above
H.8		Receiver In-band blocking	3GPP TS 34.121-1 Clause 6.5.2.1	EN 301 908-2 (UMTS) Clause4.2.7	Same as above
The following parameter "Frequency Stability" shall be applicable for End Point Devices for Environmental Mentoring only.					
H.9		Frequency Stability	3GPP TS 34.121-1 5.3	EN 301 908-2 (UM3GPP TS)	Compliance to givenStandard.

Annex-I RFID/ NFC working in frequency bands 50KHz to 200KHz or 13.553 MHz to 13.567MHz

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
I.1	Frequency of Operation ofInterface	Latest NFAP Annexure-1	50KHz to 200KHz (As per WPC GSR 90 (E)) And / OR 13.553 MHz to 13.567MHz(As per WPC GSR 884(E))	Test as per ETSI EN 300330 V2.1.1 (2017-02) clause 6.2.2.
I.2	Permitted range of operatingfrequencies	Latest NFAP Annexure-1	50KHz to 200KHz And / OR 13.553 MHz to 13.567MHz	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.1, the permitted rangeof operating frequencies used by

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
				the EUT shall be declared by the manufacturer.
I.3	Modulation bandwidth	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.3	Test as per ETSI EN 300330 V2.1.1 (2017-02) clause 6.2.3.
I.4	Transmitter H-fieldrequirements	ETSI EN 300 330 V2.1.1 (2017-02)	50KHz to 200KHz (As per WPC GSR 90 (E)) OR 13.553 MHz to 13.567MHz(As per WPC	Test as per ETSI EN 300330 V2.1.1 (2017-02) clause 6.2.4.

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
			GSR 884(E)) (Ref: ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.4)	
I.5	Transmitter RF carrier current	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.5 (Only for equipment under class 3 in clause 6.1.2)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.2.5.

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
I.6	Transmitter radiated E-field	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.6 (Only for equipment under class 3 in clause 6.1.2)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.2.6.
I.7	Transmitter conducted spurious emissions	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.7 (Only for equipment under class 3 in clause 6.1.2)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.2.7.
I.8	Transmitter radiated spurious domain emission limits < 30 MHz	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.8	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.2.8.

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
I.9	Transmitter radiated spurious domain emission limits > 30 MHz (NA)	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.9 (For equipment under class 1, 2 and 4 in clause 6.1.2)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.2.9
I.10	Transmitter Frequency stability	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.3.10 (Only for channelized systems)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.2.10
I.11	Receiver spurious emissions	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.4.2 (Does only apply to receivers which a not co-located with transmitters)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.3.1
I.12	Adjacent channel selectivity	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.4.3 (Only for channelized systems in clause 4.4.1)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.3.2

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
I.13	Receiver blocking or desensitization	ETSI EN 300 330 V2.1.1 (2017-02)	As per ETSI EN 300 330 V2.1.1 (2017-02) clause 4.4.4 (Not for tagging systems in clause 4.4.1)	Test as per ETSI EN 300 330 V2.1.1 (2017-02) clause 6.3.3

Annex-J Bluetooth Low Energy (BLE)/ ZigBee/6LowPAN working frequency band 2.400 to 2.4835 GHz

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
J.1	Frequency of Operation of Interface	Latest NFAP Annexure-1	2.4 GHz to 2.4835 GHz (As per WPC GSR 45(E))	Test Setup No. 41
J.2	EIRP for Interface	ETSI EN 300 328V2.2.2 (2019-07)	≤ 4W (36 dBm) As per WPC GSR 45(E)	Test Setup No. 42 (Test as per ETSI EN 300328 V2.2.2 (2019-07) clause 5.4.2.2)
J.3	Maximum Transmit Power / RF OuputPower of Interface	ETSI EN 300 328V2.2.2 (2019-07)	≤ 1 W (30dBm) As per WPC GSR 45(E) (ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.2 or 4.3.2.2 may be referred)	Test Setup No. 42 (Test as per ETSI EN 300328 V2.2.2 (2019-07)clause 5.4.2.2)
J.4	Power Spectral Density	ETSI EN 300 328V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.2.3 (*Only for non-FHSS equipment)*	(Test as per ETSI EN 300328 V2.2.2 (2019-07)clause 5.4.3)

J.5	Duty cycle, Tx-Sequence, Tx-gap	ETSI EN 300 328V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.3 or 4.3.2.4 *(Only for non-Adaptive equipment)*	(Test as per ETSI EN 300328 V2.2.2 (2019-07)clause 5.4.2)
J.6	Accumulated Transmit time, FrequencyOccupation & Hopping Sequence	ETSI EN 300 328V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.4 *(Only for FHSS equipment)*	(Test as per ETSI EN 300328 V2.2.2 (2019-07)clause 5.4.4)
J.7	Hopping Frequency Separation	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.5 (Only for FHSS equipment)	(Test as per ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.5)
J.8	Medium Utilization (MU) factor	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.6 or 4.3.2.5 (Only for non-Adaptive equipment)	(Test as per ETSI EN 300 328 V2.2.2 (2019-07)clause 5.4.2)
J.9	Adaptivity	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.7 or 4.3.2.6 (Only for Adaptive equipment)	(Test as per ETSI EN 300 328 V2.2.2 (2019-

				07)clause 5.4.6)
J.10	Occupied Channel Bandwidth	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.8 or 4.3.2.7	(Test as per ETSI EN 300 328 V2.2.2 (2019-07)clause 5.4.7)
J.11	Transmitter unwanted emission in the OOB domain	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.9 or 4.3.2.8	(Test as per ETSI EN 300 328 V2.2.2 (2019-07)clause 5.4.8)
J.12	Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.10 or 4.3.2.9	(Test as per ETSI EN 300 328 V2.2.2 (2019-07)clause 5.4.9)
J.13	Receiver spurious emissions	ETSI EN 300 328 V2.2.2	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.11 or 4.3.2.10	(Test as per ETSI EN 300 328 V2.2.2 (2019-

		(2019-07)		07)clause 5.4.10)
J.14	Receiver Blocking	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.12 or 4.3.2.11	(Test as per ETSI EN 300 328 V2.2.2 (2019-07)clause 5.4.11.2)
J.15	Geo-location capability	ETSI EN 300 328 V2.2.2 (2019-07)	As per ETSI EN 300 328 V2.2.2 (2019-07) clause 4.3.1.13 or 4.3.2.12 (Only for equipment with geo-location capability)	

Annex-K LoRa/ SigFox/ RFID / RF Mesh/6LoWPAN/Wi-SUN working in frequency band 865 MHz to 868 MHz

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
K.1	Frequency of Operation of Interface	Latest NFAP Annexure-1	865 MHz to 868 MHz (As per WPC GSR 853 (E)	
K.2	ERP for Interface	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per WPC GSR 853 (E)	Test as per ETSI EN 300220-1 V3.1.1 clause 5.2.2
K.3	Maximum Transmit Power	ETSI EN 300 220-2 V3.2.1 (2018-06)	Devices falling under “Non Specific Short Range Devices” i.e. Table 1 of WPC GSR 853 (E): 25 mW Devices falling under “Tracking, Tracing and Data Acquisition Devices” i.e. Table 2 of WPC GSR 853 (E): 500 mW	Test as per ETSI EN 300220-1 V3.1.1 clause 5.2.2
K.4	Unwanted emissions in the spuriousdomain	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.2.2	Test as per ETSI EN 300220-1 V3.1.1 clause

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
				5.9.3
K.5	TX effective radiated power	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.1	Test as per ETSI EN 300220-1 V3.1.1 clause 5.2.2
K.6	TX Maximum e.r.p spectral density	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.2 *(Applies to EUT using annex B bands I, L. Applies to EUT using DSSS or wideband techniques other than FHSS modulation, using annex C band X.)*	Test as per ETSI EN 300220-1 V3.1.1 clause 5.3.2
K.7	TX Duty cycle	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.3 (Not applicable to EUT with polite spectrum access where permitted in annex B, table B.1 or annex C, table C.1 or any NRI.) Devices falling under “Non Specific Short Range Devices” i.e. Table 1 of WPC GSR 853 (E): 1%.	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.5.2

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
			Devices falling under “Tracking, Tracing and Data Acquisition Devices” i.e. Table 2 of WPC GSR 853 (E): ≤ 10% (for network access points) otherwise ≤ 2.5%	
K.8	TX Occupied bandwidth / Carrier bandwidth	ETSI EN 300 220-2 V3.2.1 (2018-06)	Devices falling under “Non Specific Short Range Devices” i.e. Table 1 of WPC GSR 853 (E): ≤ 50 kHz for 58 or more hop channels. Devices falling under “Tracking, Tracing and Data Acquisition Devices” i.e. Table 2 of WPC GSR 853 (E): ≤ 200 kHz (Ref : ETSI EN 300 220-2 V3.2.1 clause 4.3.4)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.6.3
K.9	TX out of band emissions	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.5 (Applies to EUT with OCW > 25 kHz.)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.8.3
K.10	TX Transient	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.6	Test as per ETSI EN 300 220-1 V3.1.1 clause

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
				5.10.3
K.11	TX Adjacent channel power	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.7 (Applies to EUT with OCW ≤ 25 kHz)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.11.3
K.12	TX behaviour under low voltage conditions	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.8 (Applies to battery powered EUT.)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.12.3
K.13	TX Adaptive power control	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.9 (Applies to EUT with adaptive power control using annex C band AA.)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.13.3
K.14	TX FHSS	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.10 (Applies to FHSS EUT)	Declaration to be made by Manufacturer as per ETSI EN 300 220-2

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
				V3.1.1 clause 4.3.10.3
K.15	TX Short term behaviour	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.3.11 (Applies to EUT using annex C bands Y, Z, AA, AB, AC, AD)	Test as per ETSI EN 300 220-1 clause 5.5.2
K.16	RX sensitivity	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.4.1 (Applies to EUT with polite spectrum access.)	Test as per ETSI EN 300 220-1 clause 5.14.3
K.17	Clear channel assessment threshold	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.5.2 (Applies to EUT with polite spectrum access.)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.21.2.3
K.18	Polite spectrum access timing parameters	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.5.3 (Applies to EUT with polite spectrum access.)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.21.3.2

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
K.19	RX Blocking	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.4.2	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.18.6
K.20	Adaptive Frequency Agility	ETSI EN 300 220-2 V3.2.1 (2018-06)	As per ETSI EN 300 220-2 V3.2.1 clause 4.5.4 (Applies to EUT with AFA.)	Test as per ETSI EN 300 220-1 V3.1.1 clause 5.21.4

Annex – L: Parameters for Radio Interfaces for Equipment operating in delicensed Frequency Bands

Parameter Group: Radio Conformance (RANCONF)

S. No.	Parameter Name	Standard/ Parameter	Applicability/Limits/ Values	Remarks
L.1	Radio Conformance for all Wi-Fi equipment operating in 2.4 GHz	ETSI EN 300 328 or FCC CFR47 Part15.247 or FCC CFR47Part 15.249	**Refer in ETSI EN 300 328:-** **Clause 4.2** -Applicable category of equipment on basis of FHSS and non FHSS **Clause 4.3 and sub clauses**– Conformance tests asper category in clause 4.2 with limits in sub clauses**Clause 5** – Test methods For equipment conforming to FCC CFR 47 Part 15.247 / FCC CFR 47 Part 15.249 Radio Conformance shall be taken as indicated inthe Standard therein. However, the test method shall be as per clause 5 ofETSI EN 300 328.	Wi-Fi Interface & PTP/PMP WirelessAccess Equipment in 2.4 GHz ***Note:*** *Radio conformance requirements/limits, mentioned in NFAP and GSR 45 (E) issued by WPC, which inter alia include effective radiated power, output power of transmitter, shall supersede the requirements listed here or in aforementioned*

				Internationa Istandards. *However, for Test methods corresponding to such quantities, ETSI EN 300 328 standard shall be applicable*
L.2	Radio Conformance for RLAN/WLAN Wi-Fi equipment operating in 5 GHz	ETSI EN 301 893 Or FCC CFR47 Part 15.407	Test requirements and limits as per EN 301 893 forfrequency bands i.e. 5.150-5.250 GHz, 5.250-5.350 GHz 5.470-5.725 GHz and 5.725-5.875 GHz*. Or	Wi-Fi Interface ***Note:*** *Radio conformanc e requirements/limits, mentioned inNFAP and GSR 1048 (E) issued*

			Test requirements and limits as per FCC CFR 47Part 15.407 for 5.150-5.250 GHz, 5.250- 5.350 GHz, 5.470-5.725 GHz and 5.725-5.875 GHz	*by WPC, which inter alia include EIRP, power spectral density, conducted output power, bandwidth, out of band emission, shall supersede the requirements listed here or in aforementioned Internationa Istandards.* *However, for Test methods corresponding to such quantities, aforementioned standards shall be applicable*
L.3	Radio Conformance for PTP/PMP Wireless Access Equipment operating in 5 GHz	ETSI EN 301 893 or ETSI EN 302 502, as	Test requirements and limits as per EN 301 893 for frequency band 5.150- 5.250 GHz, 5.250-5.350 GHz, 5.470-5.725 GHz Test requirements and limits as per EN 302	PTP/PMP Wireless Access Equipment or PTP/PMP Fixed Radio system in 5 GHz. Note:

		applicable or FCC CFR47 Part 15.249 Or FCC CFR47 Part 15.407	502 for frequency band 5.725-5.875 GHz Except clauses 4.2.4, 4.2.6 and 4.2.8 of EN 302 502 in 5.725-5.875 GHz band) or Test requirements and limits as per FCC CFR 47 Part 15.407 for 5.150-5.250 GHz, 5.250- 5.350 GHz, 5.470-5.725 GHz and 5.725 - 5.875 GHz Or Test requirements and limits as per FCC CFR47 Part 15.249 for 5.725-5.875 GHz	Radio conformance requirements/limits, mentioned in NFAP and GSR 1048 (E) issued by WPC, which inter alia include EIRP, power spectral density, conducted output power, bandwidth, out of band emission, shall supersede the requirements listed here or in aforementioned international standards. However, for Test methods corresponding to such quantities, aforementioned standards shall be applicable.

***Note – Standard ETSI EN 301 893 doesn't directly refer to frequency band 5.725-5.875 GHz for WLAN/RLAN equipment but the same may be referred for conformance testing for 5.725-5.875 GHz band as well.**

Annex – M: Parameters for Radio Interfaces for Equipment operating in delicensed Frequency Bands

Parameter Group: Radio Conformance (RANCONF)

S. No.	Parameter Name	Standard/ Parameter	Limits/ Values	Remarks
M.1	EIRP for all equipment operating in 2.4 GHz	As per Latest NFAP and GSRs issued by DoT WPC	≤ 4 W (36dBm) Maximum output power of transmitter ≤ 1W (30 dBm) in spread of 10 MHz or higher. (As per GSR 45(E).	Wifi Interface & PTP/PMP Wireless Access Equipment in 2.4 GHz Testing as per EN 300 328 or Appendix-II Test-1

M.2	EIRP for RLAN/ WLAN equipment operating in 5 GHz	Latest NFAP and GSRs issued by DoT WPC	Maximum conducted output power and Antenna Gain as per limits mentioned in WPC GSR 1048(E) based on type of equipment, its operational/deployment characteristics and specific condition related to Antenna Gain for different frequency bands i.e. 5.150- 5.250 GHz, 5.250- 5.350 GHz and 5.470-5.725GHz and 5.725-5.875 GHz. EIRP limit = Maximum conducted output power + Antenna Gain	Wifi Interface Testing as per EN 301893 or EN302 502 as applicable; or Appendix-II Test-1

M.3	EIRP for PTP/ PMP fixed Radio systems operating in 5 GHz	Latest NFAP and GSRs issued by DoT WPC	Maximum conducted output power and Antenna Gain as per limits mentioned in WPC GSR 1048(E) based on type of equipment, its operational/deployment characteristics and specific condition related to Antenna Gain for different frequency bands i.e. 5.150- 5.250 GHz, 5.250- 5.350 GHz and 5.470-5.725 GHz and 5.725-5.875 GHz. EIRP limit = Maximum conducted output power + Antenna Gain	PTP/PMP Wireless Access Equipment in 5 GHz Testing as per EN 301 893 or EN 302 502, as applicable ; or Appendix-II Test-1

Annex – N: Parameters for Radio Interfaces for Equipment operating in delicensed Frequency Bands

Parameter Group: Radio Conformance (RANCONF)

S. No.	Parameter Name	Standard/ Parameter	Limits/ Values	Applicability/Remarks
N.1	Frequency for WiFi equipment	DoT WPC GSR No. 45(E), 1048(E)	**2.4 GHZ Band:** 2.4-2.4835 GHz as per WPCGSR 45(E) **5 GHz Band:** 5.150-5.250 GHz, 5.250-5.350 GHz, 5.470-5.725 GHz, 5.725-5.875 GHz as per WPC GSR1048(E)	Wifi Interface Test procedure as per Appendix-II Test-1
N.2	Frequency for PTP/ PMP Fixed RadioInterface	DoT WPC GSR No. 45(E), 1048(E)	**2.4 GHZ Band:** 2.4-2.4835 GHz as per WPCGSR 45(E) **5 GHz Band**: 5.150- 5.250 GHz, 5.725-5.875GHz as per WPC GSR 1048(E)	PTP/ PMP Wireless Access Equipment Test procedure as per Appendix-II Test-1

Annex-O: Geolocation Navigation Interface for IoT

Annex-R-A1-Freq	As per Part – 1, Table I. Testing as per Test Setup I in Part – 2.
Annex-R-A1-Navigation	1. GPS 2. NavIC (Regional GNSS system of India) Testing as per As per Test Setup II in Part – 2.
Annex-R-A1-Radio_conformance	As per Part – 3

Part – 1

Table 1 for Frequency Allocation *

Frequency Bands		Applications
L band I	1164MHz to 1300 MHz	GNSS
L band II	1559 MHz to 1610 MHz	
S band	2483.5 MHz to 2500MHz	

Note: 1

i. The equipment may operate in part of the bands or cover the full bands listed in Table 1 above.

ii. The above-mentioned frequencies are for the purpose of prescribing technical specifications and don't specify the actual allocation of above-mentioned services in India. The actual allocation w.r.t to any services will be as per license conditions/regulations of Government of India.

iii. All the frequency bands mentioned in the table above, may be revised as per the "National Frequency Allocation Plan (NFAP)" in force.

***Note**

(i) 1164 to 1215MHz allocated to AERONAUTICAL RADIONAVIGATION, AERONAUTICAL RADIONAVIGATION (Earth-to-space) as per NFAP 2018

(ii) 1215 to 1240 Fixed Mobile Radiolocation as per NFAP 2018.

(iii) 1240 to 1300 MHz Fixed Mobile Radionavigation Earth Exporation – Satellite (Space to Earth) as per NFAP 2018.

(iv) 1300 to 1350 MHz allocated to AERONAUTICAL RADIONAVIGATION, AERONAUTICAL RADIONAVIGATION (Earth-to-space) as per NFAP 2018.

(v) 1350 to 1400 MHz Fixed Mobile Radiolocation as per NFAP 2018.

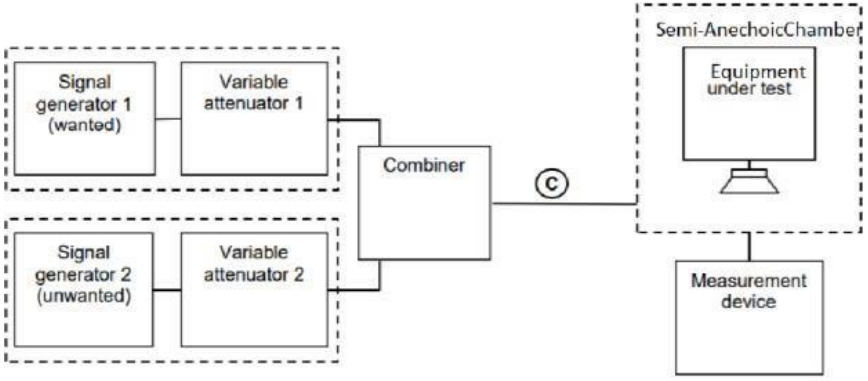
(vi) 2483.5 to 2500 MHz – Fixed Mobile, Fixed mobile satellite (Space to Earth) Radio location Radio Termination – Satellite

Part – 2

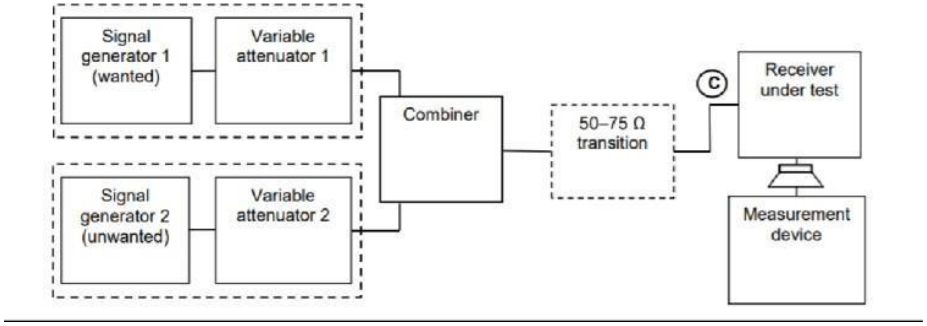
Test Setup I: To verify the frequency of operation of the ET (as per applicability defined in standard ETSI EN 303 345-1)

The setups are representative and may vary depending on the equipment under test and specific test methodology.

I. General Test requirement – Radiated Measurements



II. General Test requirement – Conducted Measurements



Test Setup II: To verify support for GNSS

1.1.3. To verify support for GPS/NaVIC

Parameter Name	Support for geolocation through GPS/NaVIC
Test Details	Test for facility of identifying the location through satellite- based GPS/NaVIC
Test instruments required	None
Test Setup	Powered on EUT (Equipment Under Test)
Test Procedure	i. Power on the EUT.

	ii. If the EUT is SIM enabled, then deactivate the SIM. iii. Go to Settings through appropriate menu in the device to enable GPS/NaVIC functionality. iv. Locate the settings to turn Location “ON”.
Expected Result	Verify that the device is able to display location using satellite based GPS/NaVIC, when SIM (if present) is deactivated.

Part – 3

Conformance to the following latest in force/valid versions of standards as applicable:			
S. No	Standard	Applicability	Test results and certificate from TEC Designated CAB shall be submitted for compliance.
1.	ETSI EN 403 413	Applicable to Radio broadcast receiversintended for reception of GNSS signals	

Annex-P: IP Conformance Parameters – IPV4 and Dual Stack – RFC 791 and RFC 4213

Parameter Group: IP Conformance (CONFIP) (For IoT devices / gateways: - IPv4 / Dual IP parameters will be tested if feature is available.)

(For IP Terminals: - Dual IP layer operation: DNS parameters will be tested if the feature is available.)

Note : *Applicable for ONT Product variant in ER on PON family: The Test parameters i.e. (i) Dual IP Layer Operation RFC 4213 – Address, (ii) Dual IP Layer Operation RFC 4213 – DNS, will not be applicable for products which supports only bridge mode. In such case, non-blocking of IPv4/IPv6 shall be verified with testreport for throughput with IPv4 and IPv6 traffic. Refer Test Case No. 43*

S. No.	Parameter Name	Individual Parameter Name	IETF RFC	Clause/ Section	Applicability/ Remarks
P.1	IPV4 Parameters Set-A	Model of operation	RFC 791	Clause 2.2	MGW, SGW, PABX
P.2	IPV4 Parameters Set-A	Internet Header Format	RFC 791	Clause 3.1	MGW, SGW, PABX, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch
P.3	IPV4 Parameters Set-A	Addressing	RFC 791	Clause 3.2	MGW, SGW, PABX
P.4	IPV4 Parameters Set-B	Model of operation	RFC 791	Clause 2.2	SBC
P.5	IPV4 Parameters Set-B	Gateways	RFC 791	Clause 2.4	SBC, IoT Gateway
P.6	IPV4 Parameters Set-B	Interfaces	RFC 791	Clause 3.3	SBC

P.7	IPV4 Parameters Set-C	Function Description	RFC 791	Clause 2.3	SOFT SWITCH,
P.8	IPV4 Parameters Set-C	Gateways	RFC 791	Clause 2.4	SOFT SWITCH
P.9	IPV4 Parameters Set-C	Interfaces	RFC 791	Clause 3.3	SOFT SWITCH
P.10	Dual IP layer operation: Address	Dual IP layer operation: Address Configuration	RFC 4213	Clause 2.1	WiFi Access Point, WiFi CPE, DSL NT Modem, ONU, ONT, SBC, IP Terminal, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch Product should demostrate support to all IPv6 services through respective RFCs and clause numbers
P.11	Dual IP layer operation: DNS	Dual IP layer operation: DNS	RFC 4213	Clause 2.2	SBC, IP Terminal, PON ONT Product should demostrate support to all IPv6 services

					through respective RFCs and clause numbers.
P.12	Dual IP layer operation: Tunnelling	Dual IP layer operation: Tunnelling	RFC 4213	Clause 3	WiFi Access Point, WiFi CPE, DSL NT Modem, ONU, ONT, OLT, MGW, LMGW, PABX, SBC, Mobile Device, CCNProduct should demostrate support to all IPv6 services through respective RFCs and clause numbers.
P.13	Dual IP layer operation: Tunnelling	Dual IP layer operation: Tunnelling	RFC 4213	Clause 3.2.1	IoT Gateway,
P.14	Dual IP layer operation: Decapsulation	Dual IP layer operation: Decapsulation	RFC 4213	Clause 3.6	IoT Gateway,
P.15	Dual IP layer operation: Link Local Address	Dual IP layer operation: Link Local Address	RFC 4213	Clause 3.7	IoT Gateway,
P.16	Dual IP Layer Operation RFC 4213 - Static Tunnel	Dual IP Layer Operation RFC 4213 - Static Tunnel MTU	RFC 4213	Clause No. 3.2.1	

	MTU				
P.17	Dual IP Layer Operation RFC 4213 - Decapsulation	Dual IP Layer Operation RFC 4213 - Decapsulation	RFC 4213	Clause No. 3.6	
P.18	Dual IP Layer Operation RFC 4213 - Link-Local Addresses	Dual IP Layer Operation RFC 4213 - Link-Local Addresses	RFC 4213	Clause No. 3.7	
P.19	Dual IP Layer Operation RFC 4213 - Neighbor Discovery over Tunnels	Dual IP Layer Operation RFC 4213 - Neighbor Discovery over Tunnels	RFC 4213	Clause No. 3.8	
P.20	Dual IP Layer Operation RFC 4213 - Security Considerations	Dual IP Layer Operation RFC 4213 - Security Considerations	RFC 4213	Clause No. 5	

Annex-Q: IPv6 Conformance Parameters

Parameter Group: IP Conformance (CONFIP) (For IoT devices / gateways:- IPv6 parameters will be tested if feature is available.)

Note: *Applicable for ONT Product variant in ER on PON family: The Test parameters i.e. (i) IPV6 Header Parameters, (ii) IPV6 Extn Header Parameters, will notbe applicable for products which supports only bridge mode. In such case, non-blocking of IPv4/IPv6 shall be verified with test report for throughput with IPv4 andIPv6 traffic. Refer Test Case No. 43.*

S. No.	Parameter Name	Individual Parameter Name	IETF RFC	Clause/ Section	Applicability/ Remarks
Q.1	IPV6 Header Parameters	Header: Version Field	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, MobileDevice, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch

Q.2	IPV6 Header Parameters	Header: Traffic Class	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, MobileDevice, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch
Q.3	IPV6 Header Parameters	Header: Flow Label	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, MobileDevice, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch

Q.4	IPV6 Header Parameters	Header: Payload Length	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, Mobile Device, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch
Q.5	IPV6 Header Parameters	Header: No next header after IPv6 Header	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, Mobile Device, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch

Q.6	IPV6 Header Parameters	Header: Hop Limit	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, Mobile Device, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch
Q.7	IPV6 Header Parameters	Header: Source and Destination Address	RFC 2460 / RFC 8200	Clause 3	SIP Terminal, SBC, Mobile Device, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch

Q.8	IPV6 Extn. Header Parameters	IPv6 Extension Header Order	RFC 2460 / RFC 8200	Clause 4.1	Mobile Device, ONU, ONT, OLT, CCN, IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch
Q.9	IPV6 Extn. Header Parameters	IPv6 Extension Header Options	RFC 2460 / RFC 8200	Clause 4.2	Mobile Device, ONU, ONT, OLT, CCN
Q.10	IPV6 Extn. Header Parameters	IPv6 Extension Header Hop by Hop Options	RFC 2460 / RFC 8200	Clause 4.3	Mobile Device, ONU, ONT, OLT, CCN
Q.11	IPV6 Extn. Header Parameters	IPv6 Extension Header Routing	RFC 2460 / RFC 8200	Clause 4.4	Mobile Device, ONU, ONT, OLT,CCN, IoT Gateway, Feedback device, Smart Electricity

					meter, Tracking device, Smart camera, Smart Watch
Q.12	IPV6 Extn. Header Parameters	IPV6 Extn. Header Fragment Header	RFC 8200	Clause 4.5	IoT Gateway, Feedback device, Smart Electricity meter, Tracking device, Smart camera, Smart Watch
Q.13	IPV6 Packet Size Issues parameter	IPV6 Packet Size Issues	RFC 8200	Clause 5	IoT Gateway
Q.14	IPV6 Extension Header Order	IPV6 Extension Header Order	RFC 2460 / RFC 8200 Clause No. 4.1 RFC 4213	Clause No. 4, 5 Annexure-P7	

Q.15	IPV6 Options	IPV6 Options	RFC 2460 / RFC 8200	Clause No. 4.2 Annexure-P7	
Q.16	IPV6 Routing Header	IPV6 Routing Header	RFC 2460 / RFC 8200	Clause No. 4.4 Annexure-P7	
Q.17	IPV6 Fragment Header	IPV6 Fragment Header	RFC 2460 / RFC 8200	Clause No. 4.5 Annexure-P7	
Q.18	IPV6 Destination Options Header	IPV6 Destination Options Header	RFC 2460 / RFC 8200	Clause No. 4.6 Annexure-P7	
Q.19	IPV6 No Next Header	IPV6 No Next Header	RFC 2460 / RFC 8200	Clause No. 4.7 Annexure-P7	

Q.20	IPV6 Packet Size Issues	IPV6 Packet Size Issues	RFC 2460 / RFC 8200	Clause No. 5 Annexure-P7	
Q.21	IPV6 Upper-Layer Checksums	IPV6 Upper-Layer Checksums	RFC 2460 / RFC 8200	Clause No. 8.1 Annexure-P7	
Q.22	IPV6 Responding to Packets Carrying Routing Headers	IPV6 Responding to Packets Carrying Routing Headers	RFC 2460 / RFC 8200	Clause No. 8.4 Annexure-P7	