

Government of India
Ministry of Communications
Department of Telecommunications
Telecommunication Engineering Centre
K.L. Bhawan, Janpath, New Delhi-110 001.
(Transmission Division)

File No. 5-14/2025-Tx/TEC

Dated: 26.05.2025

Subject: Revision of Generic Requirements (GR) – inviting comments

The GRs for *PON Optical Time Domain Reflectometer (Type-A) (For FTTH Applications)* (GR No. TEC/GR/TX/OTD-04/01/APR-10 (or TEC 88170:2010)) and *PON Optical Time Domain Reflectometer (Type-B) (For FTTH Applications)* (GR No. TEC/GR/TX/OTD-05/01/APR-10 (or TEC 88180:2010)) are being taken up for revision.

2. In exercise of the powers conferred by rule 5(2) of the Telecommunications (Framework to Notify Standards, Conformity Assessment and Certification) Rules 2025, a draft Standard (Draft Standard No. TEC 88170:2025) titled "*PON Optical Time Domain Reflectometer (For FTTH Applications)*" is enclosed herewith (**Annexure-I**) for stakeholder consultation. A key proposal in this draft Standard is to incorporate the requirements of "*PON Optical Time Domain Reflectometer (Type-B) (For FTTH Applications)*" GR into the GR of "*PON Optical Time Domain Reflectometer (Type-A) (For FTTH Applications)*".

3. Kindly offer your inputs/comments in the template sheet enclosed herewith as **Annexure-II** through email to dirt2-tec-dot@gov.in , adet-tx-tec-dot@gov.in , ratx.tec-dot@nic.in at the earliest and latest within sixty days please.

Enclosures:

- (i) Draft Standard for GR of *PON Optical Time Domain Reflectometer (For FTTH Applications)* (Draft Standard No. TEC 88170:2025) (**Annexure-I**)
- (ii) Template/Format sheet for providing comments (**Annexure-II**)

Mudita Chandra
(Mudita Chandra)

ADG (Tx), TEC

Email ID: adet-tx-tec-dot@gov.in

To,

All Manufacturers & Stakeholders

Copy to:

1. Sr DDG TEC
2. AD(IT), TEC – with request for uploading on TEC website/Portal
3. AD(IMP&TEP), TEC – with request for uploading on TBT Enquiry Point



वर्गीय आवश्यकताओं के लिए मानक

सं: टीईसी ८८१७०:२०२५

(पूर्व सं: टीईसी/जीआर/टीएक्स/ओटीडी-०४/०१/अप्रैल-१० को अधिक्रमित करता है)

STANDARD FOR GENERIC REQUIREMENTS

No.: TEC 88170:2025(Draft)

(Supersedes No.: TEC/GR/TX/OTD-04/01/APR-10)

पोन ऑप्टिकल टाइम डोमेन रिफ्लेक्टोमीटर
(एफटीटीएच एप्लिकेशन के लिए)

PON OPTICAL TIME DOMAIN REFLECTOMETER
(For FTTH Applications)



ISO9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुरशीदलाल भवन, जनपथ, नई दिल्ली-११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE

KHURSHIDLAL BHAWAN, JANPATH, NEW DELHI- 110001, INDIA

www.tec.gov.in

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इस सर्वाधिकार सुरक्षित प्रकाशन का कोई भी हिस्सा, दूरसंचार अभियांत्रिकी केंद्र, नई दिल्ली की लिखित स्वीकृति के बिना, किसी भी रूप में या किसी भी प्रकार से जैसे -[इलेक्ट्रॉनिक्स](#), मैकेनिकल,[फोटोकॉपी](#), रिकॉर्डिंग, स्कैनिंग आदि रूप में प्रेषित, संग्रहीत या पुनरुत्पादित न किया जाए ।

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Release 2: Month , 2025

PON OPTICAL TIME DOMAIN REFLECTOMETER

**(TYPE-A)
(For FTTH Applications)**

GR NO. TEC/GR/TX/OTD-04/01/APR-10

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TEC

**TELECOMMUNICATION ENGINEERING CENTRE
KHURSHIDLAL BHAWAN, JANPATH
NEW DELHI 110001.**

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FOREWORD

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

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- 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 document pertains to Standard for Generic Requirements of PON Optical Time Domain Reflectometer for FTTH applications.

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HISTORY SHEET

<u><i>SN</i></u>	<u><i>GR No.</i></u>	<u><i>Title</i></u>	<u><i>Remarks</i></u>
<u>1.</u>	<u>TEC/GR/TX/OTD-04/01/APR-10</u>	<u>Generic Requirements for PON Optical Time Domain Reflectometer(Type-A)</u> <u>(For FTTH Applications)</u>	<u>First issue</u>
<u>2.</u>	<u>TEC 88170:2025</u>	<u>Standard for Generic Requirements of PON Optical Time Domain Reflectometer (For FTTH Applications)</u>	<u>second issue</u>

REFERENCES

<u>S.No</u>	<u>Document No.</u>	<u>Title/Document Name</u>
<u>1.</u>	<u>QM-333 {Latest issue}</u>	<u>Standard for Environmental Testing of Telecommunication Equipment</u>
<u>2.</u>	<u>TEC/SD/DD/EMC-221/05/OCT-16</u>	<u>Electromagnetic Compatibility Standard for Telecommunication Equipment</u>
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Draft

REFERENCES

TEC STANDARDS

1. ~~TEC/EMI/TEL 001/01/FEB-09~~ EMC standard for Telecommunication Equipment.

BSNL QA DOCUMENTS

1. ~~QM 333 {Latest issue}~~ Specification for environmental testing of electronic equipment for transmission and switching use.
2. ~~QM 115 {Latest issue}~~ Reliability Methods and predictions.
3. ~~QM 118 {May 2002}~~ Quality and Reliability in product Design.
4. ~~QM 205 {June 2002}~~ Guidelines for Standard of Workmanship for Printed Boards.
5. ~~QM 206 {July 2002}~~ Guidelines for Standard of Workmanship for Printed Board Assemblies.
6. ~~QM 210 {July 2002}~~ Guidelines for Standard of Workmanship for Surface Mounted Devices.
7. ~~QM 301 {May 2002}~~ Transmission Equipment General Documentation.

OTHER STANDARDS (IEC/CISPR/ISO/ITU/Telcordia)

1. ~~CISPR 22 {2005}~~ Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment.
2. ~~IEC 61000 4 2 {2001}~~ Testing and measurement techniques of Electrostatic discharge immunity test.
3. ~~IEC 61000 4 3 {2006}~~ Testing and measurement techniques — Radiated RF Electromagnetic Field Immunity test.
4. ~~IEC 61000 4 4 {2004}~~ Testing and measurement techniques of electrical fast transients/ burst immunity test.
5. ~~IEC 61000 4 5 {2005}~~ Testing & Measurement techniques for Surge immunity tests.
6. ~~IEC 61000 4 6 {2003}~~ Testing & Measurement techniques — Immunity to conducted disturbances induced by radio frequency fields.
7. ~~IEC 61010 1 {2001}~~ Safety requirements for Electrical Equipment for Measurement, Control & laboratory use.
8. ~~IEC 825-1~~ Optical safety Requirements
9. ~~IEC 60529~~ Degree of protection provided by enclosures (IP code)
10. ~~ISO 9001:2000~~ International Quality Management System.
11. ~~SR 4731~~ Telcordia document
12. ~~ASTM D 2794 & D 2197~~ Test Method for surface finish
13. ~~ITU T Rec. G. 652.B, G.652.D~~ Type of fibre
~~— G.655, G.656, G.657~~

BIS STANDARDS

1. ~~IS 8437 {1993}~~ Guide on the effects of current passing through the human body” [equivalent to IEC 60479-1{1984}].

PART I – TECHNICAL SPECIFICATIONS CHAPTER - 1

1.0 Introduction:

This document describes the Standard for generic-Generic requirements of PON optimised Optical Time Domain Reflectometer (Type-A) for FTTH applications. The instrument allows the testing of fibre through splitters with various split ratios (upto 1:64128). The instrument is shall be capable of dark fibre monitoring of FTTH networks as well as active fibre monitoring of FTTH networks. The instrument is intended for to be used for locating faults and irregularities on single mode optical fibre cable during Installation and service activation of Fiber to the Home networks etc. The instrument is intended to also be used for troubleshooting & maintenance of live Fiber (in-service troubleshooting) of FTTH networks at 1650nm. The instrument is essentially used to measure Splice loss, Connector loss, Fibre attenuation, Reflectance of points, Link optical return loss and distance to fibre events through the active and passive network elements. It can also be used for estimating the length of O.F. cable and attenuation attributed by the same. This instrument is envisaged to be handy and lightweight. The instrument shall have provision of filter port for live fibre testing.

2.0 Functional Requirements:

- 2.1 The instrument shall be equipped with controls that enable the signature (fibre trace) to be expanded with respect to the return power and distance axis. It shall be able to locate an event easily. There shall be provision for zoom on event and full span zoom of the fibre on X and Y Axis.
- 2.2 The instrument shall be capable of "Real-time" operation during which it shall display the current fibre trace and the current 2-point loss between two user selected points. There shall be provision for comparison of a main trace with respect to the reference trace. There shall be provision to add new events to the reference trace. The instrument shall be capable of saving multi-wavelength

traces. The instrument must have the possibility to save under Bellcore 2.0 format for universal use

- 2.3 The instrument shall provide controls, processing and output to determine the reflectance of fibre events such as connectors and splices and to determine the optical return loss of the user selected portion of the fibre link to which the OTDR is connected.
- 2.4 On connecting the fibre by the user and by actuating a single control to start the measurement, the test set shall automatically measure the attenuation coefficient of all continuous sections of fibre separated by discrete loss discontinuities plus sum of the cumulative loss to each discontinuity for the entire span, within the instrument's measurement range. It shall list all events of the fibre under measurement and shall provide the results in tabular form, which shall include distance to events, splice position, splice loss, return loss, end of fibre distance, fault position, section loss, total span ORL, macro-bend location and other items including total loss calculation etc.
- 2.5 If the instrument encounters a case for which the reflectance is clipped (the reflective pulse saturates the test set detector), the test set shall report the measurement as the lower bound reflectance for the point.
- 2.6 The instrument shall provide out-of-range information of the event being searched that has not been found as the measurement range of the instrument has been exhausted.
- 2.7 The instrument shall provide an indication that the end of the fibre has been found if it detects a break in the fibre or if the attenuation at a point exceeds a user-selectable loss threshold. The instrument shall be able to detect a reflective end of the fiber even if the noise ratio is too high for user information only. The analysis must be performed in a range where the SNR is sufficient in order to provide valuable results.

- |
- 2.8 The manufacturer shall provide the test report of the instrument and the optical output power shall be mentioned in the said report. The manufacturer shall also provide the detail method to check the level of optical power launched into the fibre giving the details of the set up and the instrument required.
 - 2.9 All licence free Software (Emulation software) shall be provided for all applications of personal computers for recalling stored trace information and doing trace analysis.
 - 2.10 The instrument should locate all fibre events with respect to convenient reference and relative marking facility.
 - 2.11 Data storage system should be available for the instrument, to store in internal as well as external memory the complete trace information and settings.
 - 2.12 The instrument should be equipped with the necessary software, and/or hardware to read, write, and interact with the OTDR data standard as per Telecordia document No.SR-4731 (latest issue).
 - 2.13 Equipment suppliers should provide supplementary software to the end user of the test set that will convert files from the suppliers existing file output format to the OTDR data standard as per Telecordia document No.SR-4731 (latest issue).
 - 2.14 The software function shall provide waveform display; manual measurement, auto search auto zoom, event editing, printing, waveform comparison, waveform difference and both end measurements.
 - 2.15 It shall have facility to measure splice loss in Auto and Manual modes.
 - 2.16 It shall have provision of storing the relevant screen content.
 - 2.17 It shall incorporate facility to take measurement through a PROGRAM and shall have menu driven setup.

- 2.18 It shall have facility to label the characteristic of the fibre traces on the screen and file name, titles, header and event comments and calendar, clock etc.
- 2.19 It shall have HELP mode and facility to interact with the instrument without the help of instrument manual.
- 2.20 It shall have the facility to compare the two traces (display of 2 waveforms simultaneously).
- 2.21 It shall have sufficient number of markers for marking the events, distance and loss measurements.
- 2.22 It shall protect the detector overload and fast ageing of detector resulting in high accuracy and improved resolution. It shall warn the user of a possible damage to the detector in case the tests are performed on live fibre to protect the input port.
- 2.23 All controls shall be clearly marked or labelled with an easy to understand symbol or key word to indicate its intended use
- 2.24 Spectral width for each source shall be specified by manufacturer.
- 2.25 Relative Distance Measurement facility shall be provided.
- 2.26 The instrument should have the function to automatically find and locate macro-bend to speed up construction (splicing) and troubleshooting.

2.27 The ITU-T/CISPR/IEC/EN etc. standards and recommendations referred to in this document shall imply their latest versions.

3.0 Technical Requirements of PON OTDR ~~(Type-A)~~:

3.1 Type of Fibre : Single Mode as per ITU-T G.652.B, G.652.D, G.655, G.656 & G.657

3.2 Central Wavelength : a) $1310 \pm 20\text{nm}$
b) $1550 \pm 20\text{nm}$
c) $1650 \pm 20\text{nm}$

Note: The instrument shall be switch-able to any of the two sources through a switch.

3.3 Dynamic Range : a) $\geq 37\text{ dB}$ (one way) at 1310nm
b) $\geq 35\text{ dB}$ (one way) at 1550nm
c) $\geq 28\text{ dB}$ (one way) at 1650nm

Note: The dynamic range shall be as measured at SNR = 1. Pulse width is to be defined by manufacturer for PON optimized OTDR which have high dynamic range at short pulse width.

3.4 Near end Dead Zone : $\leq \text{5m} / \text{4m}$ (at 45dB reflectance)
(Back Scattered Dead Zone) (To be decided by purchaser)
(pulse width to be defined by manufacturer)

3.5 Event Dead Zone : $\leq \text{4m} / \text{0.5m}$ (at 45dB reflectance)
(Fresnel reflection) (pulse width to be defined by manufacturer)

3.6 Distance Measurement

a) Distance Range : Settable
(Horizontal Scale settings) (To be specified by manufacturer)

b) Sampling Resolution : $\leq \text{5} / \text{4 cm}$

c) Accuracy

- i) Up to 1 Km: $< \pm 1$ Meter
- ii) Up to 20 Km: $\leq \pm 1.5$ Meter

d) Readout resolution (Best case) : ≤ 5 cm

e) Data sampling point : $\geq \underline{256,000}$ ~~50,000~~

New clauses proposed to be added on:

Pulse Width: 3ns to 20 μ s

Optical Distance Accuracy:

Measurement Accuracy:

3.7 Attenuation Measurement : LSA, 2 points

- a) Vertical scale : Settable (To be specified by manufacturer)
- b) Readout (Display) resolution : 0.001 dB
- c) Accuracy : 0.04 dB/dB

New Clause proposed to be added on: Repeatability

3.8 Refractive Index : 1.40000 to 1.60000
(Adjustable in steps of 0.00001)

3.9 Reflectance measurement accuracy : ± 2.0 dB for reflectance better than -40dB

3.10 Nominal pulse duration : To be specified by manufacturer

3.11 Averaging time update : ≤ 180 seconds in auto mode

3.12 Auto Measurements

Measurements Items : Event distance, Loss, return loss, Loss from near end and total return loss

a) Threshold

i) Connection loss : 0.01 to 5.0 dB (in suitable steps)

ii) Return loss : 20 to 60 (in suitable steps)

b) Automatic setting : Pulse width, distance range averaging times

c) Event registration : Registration of event points, section Loss, return loss etc. for event points shall be measured and shall be used to create the event table.

d) Connection check : On / Off switchable

e) Testing through Splitters (upto 1:64128) : The instrument should be able to test the fiber through splitters without misreading the same as fiber break.

f) Two splice measurement range : It shall allow two splice measurement range for measuring two non-reflective events of 0.5dB loss spaced by 75m even after splitter.

New Clause propose to be added on: Live Fiber Testing and Port :

3.13 Manual measurements : Real time sweeping, point to point distance / loss measurement, point to point loss measurement per unit length, Return loss measurement, Splice / connection loss

measurement and the total return loss with selectable averaging time

- 3.14 Calendar Clock : Display of year, month, day, hour, minute (power back up).

Note: The software/hardware in instrument shall not pose any problem in normal functioning of the instrument due to changes in date and time caused by events such as leap year etc.

- 3.15 Distance unit : Meters / Kilometers

- 3.16 Display size : > 6.3.5 inches (diagonally)

- 3.17 Display of Results : It should display :

- Fibre signature for viewing
- Attenuation between two selected points
- Distance between two selected points
- Loss due to connector/connectors in the section
- Loss due to splice/splices in the section
- Average loss/Km. & total loss in the fibre
- Reflection of each events & its location, total return loss
- A break in fibres & location of break
- End of fibre & length of fibre

Note: The actual display content should be same as in the stored information and data should be transferred in non-editable format.

- 3.18 Optical connector : Universal Connector adapters suitable for FC-PC, SC-PC, LC-APC or MPO & ~~LG~~

~~type of connector (suitable for 1.25 mm and 2.5 mm ferrule)~~ or as per order

3.19 Interface : a) 1USB port and 1USB/RJ45 port
b) Bluetooth and/or Wi-Fi

3.20 Storage:
Internal Memory : ≥ 1000 traces (printable and in native format)

3.21 Environment conditions : As per clause 7.3 of this document

3.22 Power Supply:

a) The instrument shall work, without any degradation from the single phase AC power supply with nominal 230V AC with voltage variation from 100V to 240V at $50\text{Hz} \pm 2\text{ Hz}$.

or

The instrument shall work, without any degradation from AC/DC adapter with input voltage from 100V to 240V AC, $50\text{Hz} \pm 2\text{Hz}$. The manufacturer shall furnish the output DC voltage of the AC/DC adapter and safe operating input voltage for the instrument.

Note: High voltage cut-off shall be provided for voltage beyond 240V AC.

b) The instrument shall also be operative continuously for a period of minimum Six from internal battery and shall have charging facility. Indication of low battery shall be provided at remaining 10% battery capacity. Battery Charge status indicator shall be provided. It shall be protected against battery reversals, overvoltage, short circuit, overload etc.

- c) The power consumption shall be minimal and its consumption shall be furnished by the manufacturer.

3.23 Additional measurement option:

- a) Fibre inspection Prob : 200 and/or 400x video inspection probe for inspection of UPC and APC connectors. Screens capture function for documentation

- b) In-built Visible Light Source : 635nm/650nm \pm 20 nm, CW,
Typical P_{out} : - 3 dBm \cdot 1 dBm.

Note: It should have port for visual fault locator for easy fiber identification and macro-bend location.

4.0 Additional Items to be supplied:

- a. AC/DC adapter : One no.
- b. Dummy Fibre /Launch Fibre : 500 metres length of tight jacket (900microns) FC-PC connectorised single mode fibre (as per ITU-T Rec. 657) in a suitable metallic box (hermitically sealed) with input & output connector-adapter mounted outside the box.
- c. Universal Connector adapter : Two nos. for each type of connector
- d. Pen drive / Flash Memory : 2 nos. (Each of minimum 4 GB)
- e. Bare fibre connector : 1 no. for each port
- f. Carrying case : 1 no.

~~PART II – GENERAL REQUIREMENTS~~

5.0 Engineering Requirements:

- 5.1 The instrument shall adopt state-of-the-art technology.
- 5.2 The instrument shall be of compact and composite construction. It shall be portable and light weight. The actual dimensions and weight of the instrument shall be furnished by the manufacturer
- 5.3 All connectors and switches shall be reliable and of standard type to ensure failure free operation over 5000 mating for connectors and 1000 on-off operations for switches under the specified environmental conditions.
- 5.4 All connectors and cables used shall be of low loss type and suitably shielded.
- 5.5 The mechanical design and construction of each unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport.
- 5.6 The instrument shall have self cooling arrangement including usage of internal fans, if required. On failure of internal fan, if used, an alarm or some status shall be indicated.
- 5.7 Important Do's and Don'ts about the operation of the instrument shall be clearly indicated at a convenient place on the instrument.

6.0 Operational Requirements:

- 6.1 The instrument shall be designed for continuous operation. The manufacturer shall indicate the period of continuous operation for which it shall be checked.

- 6.2 The manufacturer shall guarantee the satisfactory performance of the instrument without any degradation at an altitude up to 3000 metres above mean sea level. A Test certificate from the manufacturer shall be acceptable.
- 6.3 Power cord shall have molded plugs.
- 6.4 Visual indication to show power ON and OFF status shall be provided.
- 6.5 Provision for self-check of the instrument shall be provided.
- 6.6 The software/hardware in instrument shall not pose any problem in the normal functioning of the instrument due to changes in date and time caused by events such as changeover of leap year etc.
- 6.7 The instrument shall be able to work without any degradation in performance in saline atmosphere near coastal areas and should be protected against corrosion.

7.0 Quality Requirements:

- 7.1 The manufacturer shall furnish the MTBF values. Minimum value of MTBF shall be 10000 hours including fans. The calculation shall be based on the guidelines in either QA document No QM-115 (latest issue) "Reliability Methods and predictions" or any other international standard.
- 7.2 The instrument shall be manufactured in accordance with international quality management system ISO 9001: 2015 or latest issue~~2000~~ for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system, being followed by the manufacturer, should be submitted

And

The instrument shall meet the latest QA Guidelines indicated in Quality Manuals QM-118 (Quality and Reliability in product Design), QM-205 (Guidelines for Standard of Workmanship for Printed Boards), QM-206 (Guidelines for Standard of Workmanship for Printed Board Assemblies), QM-210 (Guidelines for Standard of Workmanship for Surface Mounted Devices) and QM-301 (Transmission Equipment General Documentation), if manufactured in India. The supplier shall furnish a certification from the manufacturer to this effect, which shall be verified at the time of technical evaluation/testing.

7.3 Environmental Requirements:

- a) The instrument shall conform to the requirements for Environment specified in QA-TEC document SD:QM-333 {latest issue} "Standard for Environmental Testing of Telecommunication Equipment". ~~"Specification for environmental testing of electronic equipments for transmission and switching use for operation, transportation and storage"~~. The applicable tests shall be for environmental category "B2" including Drop, Topple, Vibration tests (instrument kept in carrying case) and Corrosion test, if applicable.
- b) The instrument is required to work in Indoor environments like Central offices, equipment huts and outside environments like manhole, open trench and a splicing van. It is required to work in bright sunlight, poorly lit or dark areas.

8.0 Maintenance Requirements:

- 8.1 The instrument shall have facility for power on self-test. All the calibration parameters shall be valid for a minimum calibration period of one year.
- 8.2 The instrument shall have easy access for servicing and maintenance. It may be specifically noted that replacement of fuses etc. can be done quickly and conveniently. This is essential as these items may go faulty during operation and quick replacement helps in early restoration.

Note: Rating and types of fuses, if used, are to be indicated by the manufacturer.

9.0 Accessories:

9.1 The supplier shall provide one complete set of:

- a) All the necessary interfaces, connectors, connecting cables (including power cord) and accessories required for satisfactory and convenient operation of the instrument. Types of connectors, adapters to be used and the accessories of the approved quality shall be clearly indicated in the operating manuals.
- b) Software (if any), along with software version and the arrangement to load the software at site. Any updating of software shall be supplied free of cost. (Additional sets may be ordered optionally). This upgrade shall be done at the site via internet, if required.

9.2 Special tools, extender boards, extender cables and accessories essential for installation, operation and maintenance of the instrument shall be clearly indicated and supplied along with the instrument.

9.3 The source of the components/ accessories, from where these have been procured, is also to be submitted by the manufacturers.

9.4 Detailed information for components/module accessories used shall be clearly indicated.

10.0 Documentation:

Technical literature in English language shall be provided. All aspects of installation, operation, maintenance and repair including the illustration of external mechanical parts shall be covered in the manuals. The soft copy as well as hard copy of the manuals shall also be provided. The manuals shall include the following: -

- i) **Installation, operation and maintenance manual** - This manual shall include the following in addition to other details:
 - a) Safety measures to be observed in handling the Testing Instrument.
 - b) Precautions for setting up, measurements and maintenance.
 - c) Test equipment required for routine maintenance and calibration including their procedures.
 - d) Illustration of internal and external mechanical parts.
 - e) The detailed description about the operation of the software used in the equipment including its configuration procedure, installation, loading and debugging etc.

11.0 Protection Requirements

- 11.1 The instrument panel shall have a terminal for grounding the chassis, if required.
- 11.2 The plug-in units, if provided, shall have suitable protection to allow their removal/ insertion while the instrument is in energized condition
- 11.3 All switches and controls on front panel shall have suitable safeguards against accidental operation.
- 11.4 The instrument shall be adequately covered to safeguard against entry of even dust, insects etc with Ingress Protection Rating IP ~~rating~~ 34 as per IEC-60529.
- 11.5 Protection against short circuit and open circuit in the accessible points for measurements shall be provided.

12.0 Safety requirements:

- 12.1 The operating personnel should be protected against shock hazards as per IS 8437 {1993} "Guide on the effects of current passing through the human body" [equivalent to IEC publication 60479-1 {1984}] or international standard.

12.2 The instrument shall conform to the relevant clauses of the IEC 61010-1:~~2017(2001) with corrigendum 1 (2002) and corrigendum 2 (2003)~~ "Safety requirements for Electrical Equipment for Measurement, Control and laboratory use"

12.3 Optical Safety Requirements: The instrument shall meet the optical safety requirements as per IEC 60825-1:2014 Safety of laser products - Part 1: Equipment classification and requirements (latest addition). ~~IEC-825-1 (latest addition)~~.—The instrument shall have visual warnings and controls ensuring danger free operation.

1. Markings: (LASER PRODUCT)

2. Controls: It shall have auto-blocking shutter/ blocking cap (attached to the instrument so that it is not lost in any case.) for the optical input / output port when no fibre is connected.

12.4 Optical Access Port:

a) The optical access ports shall be easy to clean by the operator.

b) The optical access ports should be designed to protect themselves against the entry of dust when they are not occupied by an external fibre optic connection.

c) The optical access ports should be designed with minimum reflectance.

13.0 General Electromagnetic Compatibility (EMC) Requirements:

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

a) Conducted and radiated emission:

Name of EMC Standard: "CISPR ~~22-11~~ {20052015} and CISPR 32 with amendment 1 (2005) & amendment 2 (2006) - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment".

Limits:-

- i) To comply with Class A as per the specific requirement of CISPR ~~22-11~~ {20052015} and CISPR 32 with amendment 1 (2005) & amendment 2 (2006).
- ii) ~~The values of limits shall be as per TEC Standard No. TEC/EMI/TEL-001/01/FEB-09~~

b) Immunity to Electrostatic discharge:

Name of EMC Standard: IEC 61000-4-2(2008) ~~{2001}~~—"Testing and measurement techniques of Electrostatic discharge immunity test".

Limits: -

- i) Contact discharge level 2 { ± 4 kV} or higher voltage;
- ii) Air discharge level 3 { ± 8 kV} or higher voltage;

c) Immunity to radiated RF:

Name of EMC Standard: IEC 61000-4-3 (~~2006~~2020) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"

Limits:-

- i) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz, and
- ii) Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 to 6.0 GHz.

For Telecom Terminal Equipment without voice interface (s)

Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz, and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) Immunity to fast transients (burst):

Name of EMC Standard: IEC 61000- 4- 4(2012) ~~{2004}~~—"Testing and measurement techniques of electrical fast transients/burst immunity test"

Limits:-

Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0. 5 kV for signal / control / data / telecom lines;

e) Immunity to surges:

Name of EMC Standard: IEC 61000-4-5 (2005) "Testing & Measurement techniques for Surge immunity test"

Limits:-

- i) For mains power input ports : (a) ~~1.0~~ 2 kV peak open circuit voltage for line to ground coupling (b) ~~0.5~~ 1 kV peak open circuit voltage for line to line coupling
- ii) For telecom ports : (a) ~~0.5~~ ± 2 kV peak open circuit voltage for line to ground (b) ~~0.5 kV~~ ± 2 kV peak open circuit voltage for line to line coupling.

f) Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC Standard: IEC 61000-4-6 (~~2003~~2023) ~~with amendment 1 (2004) & amd. 2 (2006)~~—"Testing & measurement techniques-Immunity to conducted disturbances"

induced by radio- frequency fields. "

Limits:-

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.

~~Note-1: The equipment shall satisfy Class A limits.~~

g) Immunity to voltage dips & short interruptions(applicable to only ac mains power input ports, if any)

Name of EMC Standard: IEC 61000-4-11 (2020) - "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests"

Limits:-

- i) A voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500 ms)
- ii) A voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms (i.e. 40% supply voltage for 200ms)
- iii) A voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.
- iv) A voltage dip corresponding to reduction of the supply voltage of >95% for 10 ms

h) Immunity to voltage dips & short interruptions(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 & measurement techniques- voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests

Limits:-

- i) A voltage interruption with 0% of supply for 10ms

ii) A voltage interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms

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

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

v) A voltage variation corresponding to 80% and 120% of supply for 100ms to 10s

Note-2: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.

~~Alternatively, EMC test report from a non-accredited test lab, which is audited by an accredited lab / accrediting authority for the availability of all the essential facilities (test equipment, test chamber, calibrations in order, test instructions, skilled personnel etc.), required for performing the tests according to the EMC test methods audited, may be acceptable.~~

~~However, such accredited lab / accrediting authority should take responsibility of the test results of the “non accredited lab” along with indication of period of such delegation and the submitted test report should be of such valid period of delegation. The audit report, mentioning above facts, should be provided along with EMC test report.~~

Note-3: For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16(or latest release)~~TEC/EMI/TEL-001/01/FEB-09~~ 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 (f) and TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16(or latest

release)TEC/EMI/TEL-001/01/FEB-09. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	Euro Norm
CISPR 22	EN 55022
IEC 61000-4-2	EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3
IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6

14.0 Surface finish, Marking, Packaging and Shipping:

14.1 Marking:

14.1.1 The carrying case and tool kit of the instrument shall be marked for the following and shall be legible:

- a) The name of the product, manufacturer's model and serial number.
- b) The name of the supplier / manufacturer.
- c) The date of manufacture.
- d) Any other relevant information

14.2 Surface finish:

14.2.1 The inside and out side surfaces shall have uniform colour and texture.

14.2.2 The painted finish on metallic surfaces shall be resistant to impact and shall not exhibit radial cracking when subjected to 2.8 N-meter load and tested as per ASTM D 2794 or any other equivalent International Standard.

14.2.3 The finish and markings shall adhere to the base metal and shall not show any separation of coats when tested as per ASTM D 2197 or any other equivalent

International Standard.

14.2.4 The surface finish and markings shall be resistant to chemicals that are normally found in the telephone plant and shall not exhibit any perceivable changes when exposed to ultra violet light.

14.3 Packaging & shipping:

14.3.1 Packaging of the instrument shall be adequate to ensure that no damage will occur under normal shipping, handling and storage in reasonably dry unheated quarters.

14.3.2 Shipping container and packaging of the instrument shall be reusable recyclable and biodegradable.

14.3.3 A suitable carrying case (suitable for air, rail & road transport) for the instrument shall be provided

15.0 Guidelines for Purchaser:

Following guidelines are for the reference of the purchaser only, and are not to be tested during Evaluation/Testing.

- a) The tenderer may ask the supplier to provide the end user with software that will convert files from the OTDR data standard to the suppliers existing file format as per Telecordia document No.SR-4731 (latest issue), if needed.
- b) As and when bugs are found/determined in the software, the manufacturer shall provide patches and firmware replacement if involved free of cost for three years. Modified documents wherever applicable shall also be supplied free of cost.
- c) The manufacturer/supplier shall furnish the list of recommended spares.
- d) The supplier shall have maintenance/repair with calibration facility in India.
- e) Supplier shall guarantee the supply of spares so long as the instrument is in service, at least for ten years from the date of supply. The purchaser would

like to stock spares as and when the supplier decides to close down the production of the offered instrument. In such an event, supplier shall give a two years notice to the purchaser so as to stock the spares.

f) Printer: Manufacturer shall supply in-built or external printer along with suitable connecting cables as per the requirement of purchaser.

~~g) Type-A OTDR is meant for installation & testing of PON through high-port-count splitters whereas Type-B OTDR is specifically meant for troubleshooting & maintenance of live Fiber (in-service troubleshooting) of FTTH networks.~~

g) Purchaser can order additional measurement options separately.

h) Purchaser may ask for PON OTSR with in-built PON power meter also.

ABBREVIATIONS

APC	-	Angled Physical Contact
ASTM	-	American Society for Testing Materials
CISPR	-	International Special Committee on Radio Interference
EMC	-	Electromagnetic Compatibility
FC/PC	-	Physical Contact type of fibre Connector
FTTH	-	Fibre to the home
IEC	-	International Electro -Technical Commission
IS	-	Indian Standards
ISO	-	International Standard Organisations
ITU	-	International Telecommunication Union
LC	-	Lucent connector
LSA	-	Least Square Approximation
MTBF	-	Mean Time Between Failure
MTNL	-	Mahanagar Telecom Nigam limited
MTTR	-	Mean Time to Restore Service
ORL	-	Optical Return Loss
OTDR	-	Optical Time Domain Reflectometer
QA	-	Quality Assurance
QM	-	Quality Manual
PON	-	Passive optical network
RJ	-	Registered Jack
SC – PC	-	Standard connector
SNR	-	Signal to Noise Ratio
UPC	-	Ultra Physical Contact
USB	-	Universal Serial Bus

==== End of the document =====

Draft

Comments on Draft Standard titled “PON Optical Time Domain Reflectometer(For
FTTH Applications)”

(Draft Standard No. TEC 88170:2025)

Name of Manufacturer/Stakeholder :

Organization:

Contact details:

Clause No.	Clause	Comments	Other Remarks, if any