Comments on draft standard for *"Route Tracer for Armoured Optical Fibre Cable"*
(Draft Standard No. TEC 88310:2025)

Name of Manufacturer/Stakeholder:

Organization:

Contact details:

Clause No.	Clause	Comments	Other Remarks, if any

Note: The comments on the draft Standard for "Route Tracer for Armoured Optical Fibre Cable" (Draft Standard No. TEC 88310:2025) may be provided in the above format vide email to **dirt2-tec-dot@gov.in** , **adet-tx-tec-dot@gov.in** and **ratx.tec-dot@nic.in**

वर्गीय आवश्यकताओं के लिए मानक

सं: टीईसी ८८३१०:२०२५

STANDARD FOR GENERIC REQUIREMENTS

No. TEC 88310:2025(Draft)

Route Tracer for Armoured Optical Fibre Cable

आर्मर्ड ऑप्टिकल फाइबर केबल के लिए रूट ट्रेसर

ISO 9001:2015

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Release 1: Month , 2025

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 describes the Standard for Generic Requirements of Route Tracer for Armoured Optical Fibre Cable

CONTENTS

HISTORY SHEET

SN	*GR No.*	*Title*	*Remarks*
1.	TEC 88310:2025	Generic Requirements for Route Tracer for Armoured Optical Fibre Cable	First issue

REFERENCES

S. No.	*Document No.*	*Title/Document Name*
1.	TEC/SD/DD/EMC-221/05/OCT-16	Electromagnetic Compatibility Standard for Telecommunication Equipment
2.	QM-333 (or TEC 14016:2010) { Latest issue}	Standard for Environmental Testing of Telecommunication Equipment
2.	IEC 60529	Testing & measurement techniques for the intrusion of dust and liquids
3.	CISPR 11	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
4.	IEC 61000-4-2	Testing and measurement techniques of Electrostatic discharge immunity test
5.	IEC 61000-4-3	Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test
6.	IEC 61000-4-4	Testing and measurement techniques of electrical fast transients/burst immunity test
7.	IEC 61000-4-5	Testing & Measurement techniques for Surge immunity test
8.	IEC 61000-4-6	Testing and measurement techniques-Immunity to conducted disturbances, induced by radio frequency fields
9.	IEC 61000-4-11	Testing & measurement techniques-voltage dips, short interruptions and voltage variations immunity tests
10.	IEC 61000-4-29	Testing & measurement techniques-voltage dips, short interruptions and

		voltage variations on d.c. input power port immunity tests
11.	IS 8437	Guide on the effects of current passing through the human body [equivalent to IEC publication 60479].
11	IEC 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use
12	ISO 9001:2015 or latest issue	International Quality Management System
13	ASTM D 2794 and ASTM D 2197	ASTM Standards
14	TEC/SD/DD/EMC-221/05/OCT-16	Electromagnetic Compatibility Standard for Telecommunication Equipment
15	QM-333 { Latest issue}	Standard for Environmental Testing of Telecommunication Equipment

Chapter-I

1.0 INTRODUCTION:

This document describes the Standard for Generic requirements of the Optical Fibre Cable Route Tracer to specifically trace and map the path of the underground Armoured Optical Fibre cable, measure its depth and identify the same from a bunch of cables for subsequent maintenance efforts viz. fault localization and route Tracing and save the GPS coordinates and depth data for future reference.

2.0 Functional Requirements:

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

~~2.2 The instrument shall be able to perform satisfactorily without any degradation at an altitude up to 5000 meters above mean sea level. A test certificate in this respect shall be acceptable.~~

2.3 All controls, switches , push buttons and indications shall be identifiable and clearly marked or labelled with an easy to understand symbol or key word to indicate its intended use.

2.4 Visual indication to show power ON/OFF status shall be provided. Alternatively, provision for ON/OFF switch shall be clearly visible on the instrument.

2.5 The provision for self check of the instrument shall be provided.

2.6 Power cord shall have moulded plug.

2.7 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 leap year etc.

2.8 The instrument shall provide error message information.

2.9 Marking of the push buttons shall be such that their functions are clear in both the extended and depressed position.

2.10 It is desirable to have recessed push buttons or touch screen to avoid damage.

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

3.0 Operational Requirements:

3.1 The instrument shall trace Armoured OFC, GI pipes and other metallic underground utilities.

3.2 The instrument shall identify a particular cable from the bunch of cables in a congested route.

3.3 The instrument shall indicate the depth of the buried underground Optical Fibre cable being traced directly in a digital display in ~~centimetres~~ /meter/feet upto 2 decimal. The instrument shall be able to display live/continuous depth measurement in real time during route tracing process.

3.4 During tracing the route of the cable, identifying a particular cable from the bunch and measuring depth of the cable, it shall provide audible/visual indications.

3.5 The instrument shall be able to trace the cable and measure the depth within the required accuracy even in the presence of other metallic utilities in its vicinity.

3.6 The instrument shall have a provision to indicate the presence of any high voltage ~~(AC or DC)~~ power cables near or adjacent to the optical fibre cable under test.

4.0 Technical Requirements:

4.1 The Cable Route Tracer set shall be in two parts viz., a) Transmitter b) Receiver, c) All necessary accessories.

4.2 **Transmitter:**

4.2.1 The Transmitter shall be low ~~power, battery/AC~~ powered.

4.2.2 The Transmitter shall generate & transmit current at a~~of~~ suitable frequency to excite the cable under test. Transmitter should have the capability ~~contain facility~~ to apply minimum of 20 active frequencies within the ~~in the frequency~~ range 200Hz to 200 kHz or higher. Mandatory frequencies of 512Hz, 640Hz, 920Hz, 4Khz, 8kHz and 33kHz are required. ~~Additional >= 5 Frequencies should be user configurable/programmable as per the requirement.~~ The instrument should contain at least 3~~5~~ dual frequency and at least 2~~/~~current direction frequency (single or dual) options. The manufacturer/supplier should specify ~~mention~~ the frequencies they are offering.

4.2.3 Signal generator or transmitter must have voltage booster option to improve output current on high resistance utilities.

4.2.4 The frequency so selected should be such that it causes minimum interference to the neighboring working pairs/cables in the route.

4.2.5 Insulation piercing pair clips shall be provided.

4.2.6 **Indications:**

(a) Visual indication for ON/OFF status shall be provided in the transmitter.

(b) The Transmitter display shall provide the following information:

(i) output voltage

(ii) Loop current

(iii) Output power level of transmitter

(iv) Loop Resistance/Impedance

(v) Operating mode (Direct or conductive mode/ inductive clamp /induction mode)

(vi) Remaining battery life

(vii) LCD/LED Display

(viii) Overload warning

~~(ix)~~(i) ~~Compass Mode~~

~~(x)~~(ix) Dynamic overload protection

(x) Start-up time <1 second

(xi) Operating Frequency

4.3 **Receiver:**

4.3.1 The Receiver shall be low power, battery powered.

4.3.2 The receiver shall respond to passive, active & current direction frequencies (induced by the transmitter) to achieve desired results

4.3.3 During operation of the instrument either *Null, Peak, Simultaneous Null & Peak, Broad Peak* antenna operation modes reception shall be used to trace the route of the cable, identify the particular cable/pair from the bunch and record the depth of cables. The Tone/ Deflection shall be at highest in “PEAK” reception mode while it shall be weak or cancelled in “NULL” reception mode.

4.3.4 The receiver should have

a) left right arrow function to provide the visual indications of the presence of utility in the left or right side of the receiver unit

b) compass for providing orientation /line direction .

4.3.5 **Indications:**

(a) Audible/visual indications shall be provided during the route tracing. The Audible indication is through the loud speaker and visual indication is through the meter/display.

Note: Equipment should have volume control including in various steps including zero.

(b) Visual indication for ON/OFF status shall be provided in the receiver.

(c) The Receiver display shall provide the following information:

(i) Locating Mode Indication
(ii) Operating frequency
(iii) Volume
(iv) Left/Right Arrows
(v) Signal Strength
(vi) Simultaneously Depth and current readout
(vii) line orientation (compass)
(viii) Antenna operating mode: Peak, Null, Pinpoint /broad point
(ix) Battery indicator: Showing the battery life
(x) shallow depth utility warning <=0.3 mtr
(xi) Indicator for cable identification from bunch of cables
(xii) LED/LCD indicator indicating GPS connectivity
(xiii) Depth measurement
(xiv) Compass Mode
~~(xiii)~~(xv)

4.4 **Modes of operation** : Active mode and Direct or conductive mode

4.5 **Route tracing length** : Up to 20 KM under suitable conditions.

4.6 **Dynamic range** : 120dB or better

4.7 **Maximum sensitivity** : 5uA (5 micro Ampere) at 1m distance (at 33 KHz) or better

4.8 **Depth measurement** : at least 10 metres .

4.9 **Locating cable route** : ± 3%

4.10 **Locating depth up to 10 metres** : ± 5% accuracy

4.11 **Transmitter-Tone output** : Suitable Audio and Radio frequencies to be specified.

4.12 **Receiver** : Detects the audio and radio frequencies radiated by the cable under test.

4.13 **GPS:**

a) Instrument should have built in Satellite based GPS : it shall operate with or without using any cellular data.

b) GPS data is automatically acquired during the route tracing process.

c) Selective log : shall have capability of Selective logging to save coordinates of the specific location along with depth information. (log for specific locations like bending, Tapping, joints etc)

d) Indication should be present on the instrument to show GPS connectivity.

e) The GPS Accuracy shall be 1 to 3 metres or better

4.14 **Power Supply:**

a) The instrument shall recharge ~~work~~ from an AC ~~adopter~~ adapter without any degradation with input voltage from 150V to 250~~270~~V, 50Hz ± 2Hz. The manufacturer shall furnish the output DC voltage of the AC ~~adopter~~ adapter and safe operating input voltage for the instrument~~.~~

b) The instrument shall be supplied along with a suitable in-built/external rechargeable battery capable of working continuously on a single charge for at least twelve hours. Indication of low battery shall be provided and the unit 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.

4.15 **Data logging**

a) The instrument should have data logging of >= 1000 individual logs

b) It should be possible to download data in .csv format including GPS logs, frequency used for route tracing and depth.

c) The receiver should locate live data that can be transferred to a PC or laptop through Bluetooth or USB/SD card and live data must be visible on the map using GPS coordinates.

d) the instrument should create automatic data logs to check the history of locator and locating in last 365 days

4.16 **Storage:**

(a) Instrument should have minimum inbuilt internal storage of 4GB .

(b) Data/ measurement export: Bluetooth/USB/SD Card.

4.17 **Data export formats:**

.kml for Google maps, .csv for database and spreadsheets and .xls/.xlsx for Microsoft excel

4.18 **Accessories**:

The route tracer should have all necessary standard accessories required for locating and tracing the underground armoured Optical Fibre Cable as below:

(a) Direct Connection Leads
(b) Ground rod
(c) 10 meter earth extension lead
(d) Neodymium Connecting Magnet
(e) Transmitter clamp
(f) Receiver clamp
(g) Carry bag

5.0 Engineering Requirements:

5.1 The Optical Fibre Cable Route Tracer (CRT) Instrument shall be fully solid state and field proven employing the state of the art technology.

5.2 All connectors and cables shall be of low loss, suitably shielded, reliable and of standard type to ensure failure free operation over long periods and under specified environmental conditions.

5.3 The mechanical design and construction of each card or unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport.

5.4 All switches shall be reliable and of standard type to ensure failure free operation over 1000 on-off operations for switches. This shall be under specified environmental conditions.

5.5 The instrument shall have self cooling arrangement without use of fans.

5.6 Important Do's and Don'ts about the operation of the instrument shall be mentioned in the instrument manuals or be clearly indicated at a convenient place on the instrument.

5.7 **Dimensions and Weights**

The instrument (transmitter and receiver) shall be portable, compact and robust. No dimension shall be more than 600 mm. Transmitter weight shall be less than 3 kg. No dimension of the receiver shall be more than 1000 mm. Receiver weight shall not be more than 3 kg. The actual dimensions and weight of the instrument shall be furnished by the manufacturer. Cabinet/casting should be rugged, rigid and made of ABS Plastic or better.

6.0 QUALITY REQUIREMENTS:

6.1 The manufacturer shall furnish the MTBF and MTTR values and warranty for a period of minimum 1 year with free repair and replacement unless otherwise specified in tender. The minimum value of MTBF shall be 10,000 hrs

6.2 The instrument shall be manufactured in accordance with international quality standards ISO 9001:2015 or latest issue for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer would be required to be submitted by the manufacturer.

7.0 Environmental Requirements

7.1 The instrument shall conform to the requirements for Environment specified in TEC document SD: QM-333 (or TEC 14016:2010) {latest issue} "Standard for Environmental Testing of Telecommunication Equipment". The applicable tests shall be for environmental category "D" including Drop, Topple, Fall, Rain, Dust, High Altitude test, Vibration tests (instrument kept in carrying case) and Corrosion test (salt mist), if applicable.

7.2 The instrument shall be able to work without any degradation in coastal areas & should be protected against corrosion.

7.3 The Transmitter and Receiver unit shall comply with Ingress Protection Rating IP 65 as per IEC 60529(2013) or latest.

8.0 MAINTENANCE REQUIREMENTS:

8.1 The calibration of the instrument, if any, shall be valid minimum for one year.

8.2 The instrument shall have easy access for servicing and maintenance.

8.3 Ratings and types of fuses used are to be indicated by the supplier.

8.4 The manufacturer/supplier shall furnish the list of recommended spares for three years of maintenance.

8.5 The supplier shall have maintenance/repair facility in India.

8.6 Supplier should guarantee the spares as long as the instrument is in service,. 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.

8.7 Software updates should be made available for online upgradation free of charge.

9.0 Electromagnetic Compatibility (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 shall be furnished from an accredited test agency.

a) Conducted and radiated emission:

Name of EMC Standard: CISPR 11 (20242019) – "Industrial, scientific and medical equipment radio- frequency disturbance characteristics- Limits and methods of measurement"

Limits:

i) To comply with Class B of CISPR 11(20242019) with amendments for indoor deployments and Group 1 of Class B of CISPR 11(20242019) with amendments for outdoor deployments.

b) **Immunity to Electrostatic discharge:**

Name of EMC Standard: IEC 61000-4-2 (20252008) - "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 (2020) - "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"

Limits:-

For Telecom Equipment and Telecom Terminal Equipment with Voice interfaces (s)

i) Under Test level 2 {Test field strength of 3 V/m} for general purposes infrequency range 80 MHz to 1000 MHz

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 GHz 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) - "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 ~~(2014)~~ *(2014)+AMD1(2017)* – "Testing & Measurement techniques for Surge immunity test"

Limits:-

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

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

Name of EMC Standard: IEC 61000-4-6 (2023) - "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.

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

Note 2: 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)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 (h) and TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16 (or latest release). The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	Euro Norm
CISPR 11	EN 55011
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
IEC 61000-4-11	EN 61000-4-11
IEC 61000-4-29	EN 61000-4-29

10.0 SAFETY REQUIREMENTS:

10.1 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]

10.2 The instrument shall conform to the relevant clauses of the IEC 61010-1:2017 "Safety requirements for Electrical Equipment for Measurement, Control and laboratory use"

10.3 ~~The instrument shall conform to the relevant clauses of IS 10437:2019/ IEC 60215:2016 on "Safety requirements for radio transmitting equipment - General requirements and terminology"~~

10.4 The instrument should follow proper construction practice to minimize unintended radiation due to leakage from any gap or monitoring points. All unused ports and monitoring points should be terminated

10.5 The equipment should have feature to reject electromagnetic interference coming from overhead cables and buried parallel utilities to minimize distortions.

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 Protection against short circuit and open circuit in the accessible points for measurement shall be provided.

11.4 Safe operational voltages are to be specified by the manufacturer.

11.5 All switches and controls on front panel shall have suitable safeguards against accidental operation.

11.6 The instrument shall be adequately safeguarded to prevent entry of dust, insects and lizards.

CHAPTER-2

12.0 ACCESSORIES:

12.1 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, adopters 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.

12.2 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.

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

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

12.5 For ease of transportation and safety of the instrument, suitable carrying case shall be supplied

13.0 DOCUMENTATION:

Technical literature in English language shall be provided. All aspects of installation, operation, maintenance and repair 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 :-

13.1 **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.

13.2 **Repair Manual**

a) List of replaceable parts used including their sources and the approving Authority for procurement to be provided.

b) Detailed ordering information for all the replaceable parts shall be listed to facilitate reordering of spares as and when required.

c) Procedure for basic trouble shooting of instrument shall be provided. Test fixtures and accessories required for repair shall also be indicated. Systematic trouble shooting charts (fault tree) if any to be followed, shall be given for the probable faults with their remedial actions

14.0 Marking, Packaging and Shipping:

14.1 Marking:

14.1.1 The instrument and its carrying case 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) Month/year of manufacturing
d) Any other relevant information

14.2 Packaging & Shipping:

14.2.1 A suitable hard rugged moulded carrying case (suitable for air, Rail & Road transport) for the instrument shall be provided. The carrying case used for transporting the instrument to a field location shall be equipped with carrying handle so that it may be carried with one hand.

14.2.2 It is desirable that the cable route tracer system be packaged as a single unit

14.2.3 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. The supplier shall also ensure proper protection against bumps etc.

14.2.4 The shipping container and packaging of the instrument shall be reusable recyclable and biodegradable.

15.0 Guidelines for the Purchaser

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

(a) Cable Route Tracer with better technical characteristics and parameters may be available. Purchaser may procure better instrument as per their requirement of specifications

(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.

ABBREVIATIONS

AC	- Alternating Current
ASTM	- American Society for Testing and Materials
CISPR	- International Special Committee on Radio Interference
EMC	- Electromagnetic Compatibility
GR	- Generic Requirement
IEC	- International Electro -Technical Commission
IS	- Indian Standards
ISO	- International Organization for Standardization
ITU-T	- International Telecommunication Union –Telecommunication Standardisation Sector
MTBF	- Mean Time Between Failure
MTTR	- Mean Time to Restore Service
OTDR	- Optical Time Domain Reflectometer
QA	- Quality Assurance
QM	- Quality Manual