**Template for submitting comments/inputs on draft Test Guide titled "Route Tracer for Armoured Optical Fibre Cable"**

**(Draft Test Guide No. TEC 88311:2025)"**

**Name of Manufacturer/Stakeholder:**

**Organization:**

**Contact details:**

| Clause No. | Clause | Comments | Other Remarks, if any |
|---|---|---|---|
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**Note:** The comments/inputs on the draft Test Guide (Draft Test Guide No. TEC 88311:2025) 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**

सत्यमेव जयते

# अनंतिम टेस्ट गाइड
# टीईसी ८८३११:२०२५

# PROVISIONAL TEST GUIDE (DRAFT)
# TEC 88311:2025 (DRAFT)

## आर्मर्ड ऑप्टिकल फाइबर केबल के लिए रूट ट्रेसर
## (मानक सं.: टीईसी ८८३१०:२०२५)

## Route Tracer for Armoured Optical Fibre Cable
## (Standard No.: TEC 88310:2025)

ISO 9001:2015


दूरसंचार अभियांत्रिकी केंद्र
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Release 1: Month,2026

# 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 Centres (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

# ABSTRACT

This Test Guide of testing pertains to test schedule and procedure for evaluating conformance/functionality/requirements/performance of Standard for Generic Requirements of Route Tracer for Armoured Optical Fibre Cable.

# CONTENTS

# A. HISTORY SHEET

| *Sl.No.* | *TSTP / Document No.* | *Title* | *Remarks* |
|---|---|---|---|
| 1. | TEC 88311:2025 | Test Guide for Standard for Generic Requirements of Route Tracer for Armoured Optical Fibre Cable | Release 1 |

## B. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance/ functionality / requirements / performance of Route Tracer for Armoured Optical Fibre Cable as per Standard No. TEC 88310:2025.

## C. General information:

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

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

| Sno. | Name | Designation | Organization | Signature |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
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E. List of the Test Instruments:

| Sno. | Name of the test instrument | Make /Model *(to be filled by testing team)* | Validity of calibration *(to be filled by testing team)* |
|---|---|---|---|
| 1. | Variable Power Supply | | |
| 2. | | | |
| 3. | | | |

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

(a) <Equipment/product name> Configuration:

| S.No. | Item | Details | Remarks |
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*Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product*

(b) <Other equipment name> Configuration:

| S.No. | Item | Details | Remarks |
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*Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product*

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

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

## H. Clause-wise Test Type:

### Chapter 1

| *Clause No.* | *Clause* | *Type of Test / Test No. etc. ** |
|---|---|---|
| 1.0 | **Introduction :**<br>This document describes the Standard for Generic requirements of 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 bunch of cables for subsequent maintenance efforts viz. fault localization and route tracing and save the relevant Global Navigation Satellite System i.e. GNSS(GPS or NavIC etc.) coordinates and depth data. | Check as per the requirement of the clause. |
| 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. | Note and confirm the instrument capability of working continuously for very long hours. |

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| 2.2 | The instrument shall be able to perform satisfactorily without any degradation at an altitude up to 5000 meters above mean sea level. | Get a test certificate from the manufacturer. |
| 2.3 | All controls, switches, push buttons and indications shall be identifiable and clearly marked or labeled with an easy to understand symbol or keyword to indicate its intended use. The same shall also be indicated in the user/technical manual. | Check as per the requirement of the clause. |
| 2.4 | Visual indication to show power ON/OFF status shall be provided. | Verify whether any visual indication is provided to show the power ON/OFF condition. |
| 2.5 | The provision for self check of the instrument shall be provided. | Verify that the instrument supports the provision for self-check |
| 2.6 | The Transmitter and receiver shall be low powered, battery operated. Power cords shall have moulded plug. | Check as per the requirement of the clause and comment. |
| 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. | Note and record that the instrument supports the requirements specified in this clause. |
| 2.8 | The instrument shall provide error message information. | Check as per the requirement of the clause. |
| 2.9 | The instrument should have push button(s) or touch screen for manual | Check and verify as per the requirement of the clause. |

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| | operation. | |
| 3.0 | Operational Requirements | |
| 3.1 | The instrument shall trace Armoured OFC, GI pipes and other metallic underground utilities. | Check as per the requirement of the clause. |
| 3.2 | The instrument shall identify a particular cable from the bunch of cables in a congested route. | Check as per the requirement of the clause. Record the observations. |
| 3.3 | The instrument shall indicate the depth of the buried underground Optical Fibre cable being traced directly in a digital display in metres (with upto 2 decimal digits) or in centimetres. The instrument shall be able to display live/continuous depth measurement in real time during route tracing process. | Check as per the requirement of the clause. Record the observations. |
| 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 audio-visual indications. | Check and verify as per the requirement of the clause. |
| 3.5 | Audio-visual indications shall be provided during route tracing. The audible indication should be through the loudspeaker of the receiver. The visual indication should be provided through the receiver display. The receiver should have a multi-step | Check and verify as per the requirement of the clause. |

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| | volume control, including a mute function. | |
| 3.6 | 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. | Check as per the requirement of the clause. Record the observations. |
| 3.7 | The instrument shall have a provision to indicate the presence of live power cables near or adjacent to the optical fibre cable under test. | Check as per the requirement of the clause. Record the observations. |
| **4.0** | **Technical Requirements:** | |
| 4.1 | The Cable Route Tracer set shall consist of:<br>a) Transmitter, b) Receiver and c) All accessories. | Check as per the requirement of the clause. |
| 4.2 | **Modes of operation of Route Tracer**<br>**(a) Active mode** : The receiver unit shall work with the transmitter and shall detect the frequencies induced by the transmitter unit.<br><br>**(b) Passive mode**: The receiver unit shall be capable of operating without the transmitter and shall detect the frequencies (not transmitted by Transmitter), like 50Hz for power cables, and RF frequencies. | Check as per the requirement of the clause. |
| 4.3 | **Transmitter:** | |
| 4.3.1 | Modes of operation of Transmitter: | Check as per the requirement of the |

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| | a) Direct Connection mode or Conductive Mode,<br>b) Induction mode (with inductive clamp or without inductive clamp) | clause. |
| 4.3.2 | The Transmitter shall generate and transmit current at suitable frequency to excite the cable under test. Transmitter should have the capability to apply minimum of 20 active frequencies within the frequency range of 200Hz to 200 kHz or higher. This includes at least 3 number of frequencies from the low frequency range(200 Hz to 1 kHz), at least 2 number of frequencies from the medium frequency range(1 kHz to 10 kHz) and at least 2 number of frequencies from the high frequency range(above 10 kHz). The instrument should contain at least 3 dual frequency/current direction frequency options. The manufacturer/supplier should specify the frequencies they are offering. | Check and verify as per the requirement of the clause. Record the observations. Note down all the frequencies being offered. |
| 4.3.3 | The frequency so selected should be such that it causes minimum interference to the neighboring working pairs/cables in the route. | Check and verify as per the requirement of the clause. |
| 4.3.4 | Transmitter should have voltage booster option to improve output | Check and verify as per the requirement of the clause. |

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| | current on high resistance utilities. | |
| 4.3.5 | Insulation piercing pair clips shall be provided. | Check and verify as per the requirement of the clause. |
| 4.3.6 | Indications in display:<br>The Transmitter should support LCD or LED or better display. The Transmitter display should provide at least the following information:<br>(i) Output voltage<br>(ii) Loop current<br>(iii) Output power level of transmitter<br>(iv) Loop Resistance/Impedance<br>(v) Operating modes<br>(vi) Battery indicator<br>(vii) Operating Frequencies | Check and verify as per the requirement of the clause. |
| 4.4 | Receiver: | |
| 4.4.1 | The receiver shall respond to passive mode, active mode and dual frequency/current direction frequencies to achieve desired results. | Check as per the requirement of the clause. |
| 4.4.2 | During operation of the instrument, either Null, Peak, Simultaneous Null & Peak, Broad Peak antenna operation modes of 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/ | Check and verify as per the requirement of the clause. |

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| | Deflection shall be at highest in "PEAK" reception mode while it shall be weak or cancelled in "NULL" reception mode. | |
| 4.4.3 | The receiver should have<br>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.<br>b) Compass for providing orientation /line direction. | Check and verify as per the requirement of the clause. |
| 4.4.4 | **Indications in display**<br>The Receiver should support LCD or LED or better display. The receiver display should provide at least the following information:<br>(i) Locating Mode Indication<br>(ii) Operating frequencies<br>(iii) Left/Right Arrows<br>(iv) Signal Strength<br>(v) Simultaneously depth and current readout<br>(vi) Line orientation (compass)<br>(vii) Antenna operating mode<br>(viii) Battery indicator<br>(ix) Shallow depth utility warning <=0.3 mtr<br>(x) Indicator for cable identification from bunch of cables | Check and verify as per the requirement of the clause. |
| 4.5 | **Route Tracer accessories**: | Check as per the requirement of the |

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| | The route tracer should have all necessary standard accessories required for locating and tracing the underground armoured Optical Fibre Cable as below:<br>(a) Direct Connection Leads<br>(b) Ground rod<br>(c) 10 meter earth extension lead<br>(d) Neodymium Connecting Magnet<br>(e) Transmitter clamp (>=3 inch inner Diameter)<br>(f) Receiver clamp (optional or if required by the purchaser/user)<br>(g) Carry bag | clause. Note and record all the Route Tracer accessories provided. |
| 4.6 | **Route tracing length** : at least 4 km under suitable conditions. | Undertaking may be obtained as per the requirement of the clause. The undertaking taken in this respect should be explicitly mentioned under remarks column in the approval certificate issued, if any, against this Standard for Generic Requirements (GR). |
| 4.7 | **Dynamic Range**: 120dB or better | Test Method-1 |
| 4.8 | **Maximum sensitivity** : 5uA (5 micro Ampere) at 1m distance (at 33 KHz) or better | Test Method-2 |
| 4.9 | **Depth measurement** : at least 10 metres | Undertaking may be obtained as per the requirement of the clause. The undertaking taken in this respect should be explicitly mentioned under remarks |

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| | | column in the approval certificate issued, if any, against this Standard for Generic Requirements (GR). |
| 4.10 | **Locating cable route** : upto 1 metre either side from the centre of the underground cable | Check as per the requirement of the clause. Note down the distance, either side from the centre of the underground cable. |
| 4.11 | **Locating depth up to 10 metres** : ± 5% accuracy | The manufacturer shall be asked to submit a test certificate.<br>Test Method-4 |
| 4.12 | **GNSS:**<br>a) Instrument should have built in GNSS (GPS or NavIC etc.) capability.<br>b) GNSS(GPS or NavIC etc.) data is automatically acquired during the route tracing process.<br>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 bend, tapping, joints etc.)<br>d) Indication should be present on the instrument to show GNSS(GPS or NavIC etc.) connectivity. | Check and verify as per the requirement of all sub-clauses. Note down the GNSS method (GPS or NavIC etc.) |
| 4.13 | **Power Supply:** | a) Check the working of |

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| | a) The instrument shall recharge from an AC adapter without any degradation with input voltage from 150V to 250V, 50Hz ± 2Hz. The manufacturer shall furnish the output DC voltage of the AC adapter and safe operating input voltage for the instrument.<br><br>b) The instrument shall be supplied along with a suitable rechargeable battery capable of working continuously on a single charge for at least 8 hours for Transmitter and for at least 24 hours for Receiver. Indication of low battery shall be provided and the unit shall be protected against battery reversals, overvoltage, short circuit, overload etc.<br><br>c) The power consumption shall be minimal and its consumption shall be furnished by the manufacturer. | instrument without any degradation with AC power supply as per the requirement of the Clause. In cases where the equipment requires operating on AC mains, check that the equipment is able to function without any degradation in performance within the voltage range of 150 – 250 volts.<br><br>b) Check the continuous operation of instrument on a single charge for at least 8 hours for Transmitter and for at least 24 hours for Receiver. Check for charging facility, Low battery indication, Battery charging indicator and protection against battery reversals, overvoltage, short circuit, overload as per the requirement of the clause & comment.<br><br>c) Check that the power consumed by the instrument is minimal. Record the power consumption of the instrument furnished by the manufacturer. |
| 4.14 | Data logging<br>a) The instrument should have data logging of >= 1000 individual logs<br>b) It should be possible to download data in .csv format | Check and verify as per the requirement of all sub-clauses. |

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| | including GNSS(GPS or NavIC etc.) logs, frequency used for route tracing and depth.<br>c) The receiver should locate live data that can be transferred to a PC/laptop etc. through Bluetooth or USB or SD card and live data must be visible on the map using GNSS(GPS or NavIC etc.) coordinates. | |
| 4.15 | **Data export formats:**<br>The instrument shall provide data output in any recognized international format, such as .csv for databases and spreadsheets, .xls/.xlsx for Excel and .kml file for digital Maps visualization. | Check and verify as per the requirement of the clause. |
| 4.16 | **Storage:**<br>(a) Instrument should have minimum inbuilt internal storage of 2 GB.<br>(b) Data/ measurement export: Bluetooth/USB/SD Card. | Check and verify as per the requirement of all sub-clauses.<br>Note down the internal storage capacity and data measurement export functionalities. |
| 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. | For information only. |
| 5.2 | All connectors and cables shall be of | Check as per the requirement of the |

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| | low loss, suitably shielded, reliable and of standard type to ensure failure free operation over long periods and under specified environmental conditions. | clause. |
| 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. | Check as per the requirement of the clause. |
| 5.4 | All switches and push buttons should be reliable and to ensure failure free operation over long periods under specified environmental conditions. | Check as per the requirement of the clause. |
| 5.5 | 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. | Check that important Do's and Don'ts are clearly indicated on the instrument. |
| 5.6 | **Dimensions and Weights**<br><br>The instrument (transmitter and receiver) shall be portable, compact and robust. No dimension of the transmitter shall be more than 450 mm. Transmitter weight shall be less than 4 kg (inclusive of battery). No dimension of the receiver shall be more than 800 mm. Receiver weight | Check and verify as per the requirement of the clause.<br>Note and record the actual dimensions and weight of the transmitter and receiver. Verify that the dimensions and the weight comply with requirements of the clause. |

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| | shall not be more than 2.5 kg (inclusive of battery). 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. | Check and note down the MTBF and MTTR values furnished by the manufacturer. |
| 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. | Check as per the requirement of the clause and comment. Verify the validity of ISO certificate. |
| 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 | Environmental tests as per this clause 7.1 shall be carried out. Test reports from any TEC recognized lab (Conformity Assessment Body(CAB)), shall be acceptable. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the |

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| | "D", including Fall, Vibration (instrument kept in carrying case) and Corrosion – salt test. | test reports. |
| 7.2 | The instrument shall be able to work without any degradation in coastal areas and should be protected against corrosion. | Check as per the requirement of the clause. |
| 7.3 | The Transmitter and Receiver unit shall comply with Ingress Protection Rating IP 65 as per IEC 60529. | Get a test certificate from the manufacturer. |
| 8.0 | **Maintenance Requirements:** | |
| 8.1 | The calibration of the instrument, if any, shall be valid minimum for one year. | Confirm and record that the calibration if any, of the instrument is valid for at least one year, |
| 8.2 | The instrument shall have easy access for servicing and maintenance. | Ensure that the instrument has easy access for servicing and maintenance |
| 8.3 | Ratings and types of fuses used are to be indicated by the supplier. | Confirm and record from the instrument manuals that the ratings and types of fuses used are indicated by the supplier. |
| 8.4 | The manufacturer/supplier shall furnish the list of recommended spares for three years of maintenance. | Check and verify the list furnished by manufacturer /supplier |
| 8.5 | The supplier shall have maintenance/repair facility in India. | Guidelines for supplier. |
| 8.6 | Supplier should guarantee the spares as long as the instrument is in service. The purchaser would like to | Guidelines for manufacturer /supplier. |

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| | 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. | For information and guideline to the manufacturer /supplier |
| 9.0 | **Electromagnetic Compatibility (EMC) Requirements**<br>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. | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |
| a) | **Conducted and radiated emission:**<br>**Name of EMC Standard:** CISPR 11 (2024) {latest issue} – "Industrial, scientific and medical equipment radio-frequency disturbance characteristics- Limits and methods of measurement"<br>**Limits:**<br>i) To comply with Class B of CISPR 11(2024) {latest issue} with amendments for indoor | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |

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| | deployments and Group 1 of Class B of CISPR 11(2024) with amendments for outdoor deployments. | |
| b) | **Immunity to Electrostatic discharge:**<br><br>**Name of EMC Standard:** IEC 61000-4-2 (2025) {latest issue} - "Testing and measurement techniques of Electrostatic discharge immunity test"<br><br>**Limits:**<br>i) Contact discharge level 2 {± 4 kV} or higher voltage;<br>ii) Air discharge level 3 {± 8 kV} or higher voltage; | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |
| c) | **Immunity to radiated RF:**<br>**Name of EMC Standard:** IEC 61000-4-3 (2020) {latest issue} - "Testing and measurement techniques- Radiated RF Electromagnetic Field Immunity test"<br>**Limits:-**<br>**For Telecom Equipment and Telecom Terminal Equipment with Voice interfaces (s)**<br>Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |

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| | 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.<br><br>**For Telecom Terminal Equipment without voice interface (s)**<br>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):**<br>**Name of EMC Standard:** IEC 61000-4-4 (2012) {latest issue} - "Testing and measurement techniques of electrical fast transients/burst immunity test"<br>**Limits:-**<br>Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0.5 kV for signal / control / data / telecom lines. | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |
| e) | **Immunity to surges:**<br>**Name of EMC Standard:** (IEC 61000-4-5 (2014)+AMD1(2017)) {latest | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized |

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| | issue} – "Testing & Measurement techniques for Surge immunity test"<br>**Limits:-**<br>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 | lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |
| f) | **Immunity to conducted disturbance induced by Radio frequency fields:**<br>**Name of EMC Standard:** IEC 61000-4-6 (2023) {latest issue} - "Testing & measurement techniques-Immunity to conducted disturbances, induced by radio frequency fields"<br>**Limits:-**<br>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. | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be submitted along with the test reports. |
| g) | **Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any)**<br>**Name of EMC Standard:** IEC 61000-4-11 (2020) {latest issue} – "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests"<br>**Limits:-** | The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body (CAB)), for the compliance of EMC standard laid down in this clause. The copy of valid accreditation certificate and scope of accreditation of the respective lab/CAB should also be |

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| | i) A voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500 ms)<br>ii) A voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms (i.e. 40% supply voltage for 200ms)<br>iii) A voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.<br>iv) A voltage dip corresponding to reduction of the supply voltage of >95% for 10 ms<br><br>Note 1: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.<br><br>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 | submitted along with the test reports. |

<table>
<tr><td></td><td>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 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:<br><br><table><tr><th>IEC/CISPR</th><th>Euro Norm</th></tr><tr><td>CISPR 11</td><td>EN 55011</td></tr><tr><td>IEC 61000-4-2</td><td>EN 61000-4-2</td></tr><tr><td>IEC 61000-4-3</td><td>EN 61000-4-3</td></tr><tr><td>IEC 61000-4-4</td><td>EN 61000-4-4</td></tr><tr><td>IEC 61000-4-5</td><td>EN 61000-4-5</td></tr><tr><td>IEC 61000-4-6</td><td>EN 61000-4-6</td></tr><tr><td>IEC 61000-4-11</td><td>EN 61000-4-11</td></tr></table></td><td></td></tr>
<tr><td>10.0</td><td>Safety Requirements:</td><td></td></tr>
<tr><td>10.1</td><td>The instrument shall conform to the relevant clauses of the (IEC 61010-1:2010+AMD1:2016) {latest issue} "Safety requirements for Electrical</td><td>The manufacturer shall be asked to submit a certificate and the test results from any TEC recognized lab(Conformity Assessment Body</td></tr>
</table>

| | | |
|---|---|---|
| | Equipment for Measurement, Control and laboratory use" | (CAB)).The copy of valid accreditation certificate and scope of accreditation of the respective lab should also be submitted along with the test reports. |
| 10.2 | 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. | Check and verify as per the requirement of the clause. |
| 10.3 | The equipment should have feature to reject electromagnetic interference coming from overhead cables and buried parallel utilities to minimize distortions. | Undertaking may be obtained as per the requirement of the clause. The undertaking taken in this respect should be explicitly mentioned under remarks column in the approval certificate issued, if any, against this Standard for Generic Requirements (GR). |
| **11.0** | **Protection Requirements:** | |
| 11.1 | The instrument panel shall have a terminal for grounding the chassis if required. | Ensure that terminal for grounding the chassis is available (applicable only to metal body). |
| 11.2 | The plug-in units, if provided, shall have suitable protection to allow their removal/insertion while the instrument is in energized condition. | Check and verify as per the requirement of the clause. |
| 11.3 | Protection against short circuit and open circuit in the accessible points for measurement shall be provided. | Ensure that the protection against short circuit and open circuit in the accessible points for measurements shall be provided |
| 11.4 | Safe operational voltages are to be | Check and note down the operating |

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| | specified by the manufacturer. | voltage. |
| 11.5 | All switches and controls on front panel shall have suitable safeguards against accidental operation. | Ensure that all switches/controls on front panel are having suitable safeguards against accidental operation i.e., operation of any wrong key would not cause any problem in the functioning of the instrument. |
| 11.6 | The instrument shall be adequately safeguarded to prevent entry of dust, insects and lizards. | Note that the instrument is compact built and there is no provision of any entry of dust, insects and lizards. |

| Clause No. | Clause | Type of Test / Test No. etc. * |
|---|---|---|
| 12.0 | Other Accessories: | |
| 12.1 | The supplier shall provide one complete set of:<br><br>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.<br><br>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 or return to the service centre, if required. | Note and record that the instrument is provided with the necessary interfaces, connectors, connecting cables and accessories required for satisfactory and convenient operation and that they are of approved quality.<br><br>Ensure that the arrangement to load the software at site is provided. |
| 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. | Ensure that Special tools, extender boards, extender cables and accessories essential for installation, operation and maintenance of the instrument are provided during supply of the instrument. |
| 12.3 | The source of the components/accessories, | Manufacturer shall submit the |

| | | |
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| | from where these have been procured, is also to be submitted by the manufacturers. | source of the components/ accessories, from where these have been procured. |
| 12.4 | Detailed information for components/module accessories used shall be clearly indicated. | Manufacturer shall clearly indicate detailed information for components/module accessories used. |
| 12.5 | For ease of transportation and safety of the instrument, suitable carrying case shall be supplied. | Check and verify as per the requirement of the clause. |
| **13.0** | **Documentation:**<br>Technical literature in English language shall be provided in hard copy as well as soft copy. All aspects of installation, operation, maintenance and repair shall be covered in the manuals. The soft copy or hard copy of the manuals may also be provided in Hindi language, if feasible. The manuals shall include the following:- | Check as per the requirement of the clause. |
| 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. | Ensure that the safety measures have been listed for handling the equipment. |
| | b) Precautions for setting up, measurements and basic maintenance. | Ensure that the precautions for setting up, measurements and maintenance are given in the manual. |
| | c) Test equipment required for routine | Ensure that the Test |

| | | |
|---|---|---|
| | maintenance and calibration including their procedures. | equipment required for routine maintenance and calibration including their procedures are given. |
| | d) Illustration of internal and external mechanical parts. | Internal and external mechanical parts are illustrated. |
| | e) The detailed description about the operation of the software used in the equipment including its configuration procedure, installation, loading and debugging etc. | Ensure that the detailed description about the operation and procedure for software download, installation and debugging etc. are given |
| **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:<br>a) The name of the product, manufacturer's model and serial number.<br>b) The name of the supplier / manufacturer<br>c) Month/year of manufacturing<br>d) Any other relevant information | Note that the carrying-case and tools-kits of the instrument are clearly marked with the name of the products, model and serial number, name of the supplier / manufacturer, date of manufacturing etc. |
| **14.2** | **Packaging & Shipping:** | |
| 14.2.1 | A carrying case (suitable for air, Rail & Road transport) for the instrument shall be provided. | Ensure that carrying case for the instrument is provided. |
| 14.2.2 | 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. | Check as per the requirement of the clause. |

| | | |
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| 14.2.3 | The shipping container and packaging of the instrument shall be reusable recyclable and biodegradable.. | Note that the packaging of the instrument is such that no damage shall occur under shipping, handling and storage. Also check proper protection against bumps is ensured |
| **15.0** | **Guidelines for the Purchaser:**<br>Following guidelines are for the reference of the purchaser only, and are not to be tested during Evaluation/Testing:<br>(a) Cable Route Tracer with better technical characteristics and parameters may be available. Purchaser may procure better instrument as per their requirement of specifications.<br>(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. | Guidelines are for the reference of the purchaser only |

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

## Test Method-1

## Test Procedure for Dynamic Range

**1. Objective:** This test evaluates the span between the minimum signal level that the receiver can detect (noise floor) and the maximum signal level it can handle without distortion or overload.

### 2. Required Test Setup & Equipment

#### 2.1 Core Equipment

- **Device under test(DUT) – Cable Route Tracer Set:**
  - Cable Route Tracer Receiver Unit
  - Matching Transmitter/Signal Generator for LF/HF modes
- Adjustable Attenuator (0–120 dB, step size ≤1 dB)
- Load Cable / Simulation Loop (50 m–200 m depending on spec)
- Terminated Dummy Cable or spool for uniform test conditions
- EM Shielded Area (to reduce external noise)

#### 2.2 For Antenna Response Verification

- Near-field magnetic field loop generator
- Calibrated H-field probe (for cross-reference)
- Signal Analyser / Oscilloscope with magnetic antenna input
- Reference Receiver (to validate repeatability)

**Note:** Record the equipment list. Also note their calibration(if any)

### 3. Test Procedure (Step-by-Step)

**3.1** Set Up the Test Environment

(i) Lay test cable straight or place cable spool at fixed distance.

(ii) Connect transmitter → cable → termination.

(iii) Keep receiver test line free of metal/EM interference.

**3.2** Determine Noise Floor / Minimum Detectable Signal

(i) Start transmitter at lowest output level.

(ii) Introduce attenuator between transmitter and cable.

(iii) Reduce signal gradually until the receiver just loses stable signal indication (audio + directional + numeric reading).

(iv) Note this value: Minimum Detectable Level (MDL).

**3.3** Determine Maximum Undistorted Input Level

(i) Set transmitter to maximum output.

(ii) Reduce or remove attenuation.

(iii) Increase signal until the receiver shows overload, non-linearity, or tone distortion.

(iv) Note this value: Maximum Input Level (MIL).

**3.4** Compute Dynamic Range

Dynamic Range (dB) = MIL – MDL.

**4.0 Conclusion:**

The computed dynamic range should be greater than 120dB.

## Test Method-2

### Test Procedure for Sensitivity

### 1. Objective

This procedure defines the method to verify the sensitivity of a cable route tracer receiver at the specification threshold (e.g., 5 μA at 1 meter at 33 kHz). The test determines the minimum detectable signal current on a conductor at a fixed lateral distance.

### 2. Required Equipment

- Device under test(DUT) – Cable Route Tracer Set:
    - Transmitter/Signal Generator (33 kHz output capability, low-distortion)
    - Receiver Under Test (RUT)
- Precision Resistor Bank (10 kΩ – 500 kΩ)
- True RMS Microammeter capable of measuring AC current at 33 kHz
- Reference Test Cable (10–20 m insulated copper wire)
- Distance Measurement Tape or calibrated jig
- Helmholtz Coil or calibrated magnetic field source for antenna verification
- EM Shielded Area (to reduce external noise)

**Note:** Record the equipment list. Also note their calibration(if any)

### 3. Test Setup

- Lay a 10–20 m insulated copper wire straight on the floor or on non-metallic supports.
- Ensure no large metallic objects are within 2 m of the test line.

- Connect the Transmitter/signal generator in series with the resistor bank and microammeter.
- Set the generator frequency to 33 kHz ± 10 Hz.
- Mark the 1-meter lateral distance from the test cable.

## 4. Test Procedure (Step-by-Step)

- Start with a higher injection current (50 µA). Verify the receiver detects and displays a stable signal at 1 m.
- Reduce the current gradually to 20 µA, then 10 µA, observing signal stability.
- Approach the specification threshold: test at 7 µA, then 5 µA.
- At 5 µA, the receiver must provide a stable, clearly identifiable peak response at 1 m.
- Optionally test beyond the spec (4 µA → 2 µA) to evaluate sensitivity margin.
- Verify response at 0.8 m, 1.0 m, and 1.2–1.5 m to confirm correct sensitivity slope.
- Record the injected current values, observed response levels, environmental conditions

## 5. Acceptance Criteria

- The receiver passes if it provides a stable, distinguishable signal peak at 1 meter with 5 µA injected current at 33 kHz. The signal response must not be ambiguous or lost in noise.

## I. SUMMARY OF TEST RESULTS

TEC Standard No._____

TEC Test Guide No._____

Equipment name & Model No._____

| *Clause No.* | *Compliance (Complied /Not Complied / Submitted/Not Submitted / Not Applicable)* | *Remarks / Test Report Annexure No.* |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

*[Add as per requirement]*

*Date:*

*Place:* *Signature & Name of TEC testing Officer /*

** Signature of Applicant / Authorized Signatory*

** Section J as given above is also to be submitted by the Applicant/ Authorised signatory as part of in-house test results along with Form-A. The Authorised signatory shall be the same as the one for Form 'A'.*