TRANSMISSION
Issue: NOV-2013

OPTICAL POWER METER
(TYPE-A & TYPE-B)

GENERIC REQUIREMENTS

NO. TEC/GR/TX/OPM-001/04/NOV-13

(Supersedes GR No. GR/OPM-01/03. JAN 2005)

TELECOMMUNICATION ENGINEERING CENTRE
KHURSHIDLAL BHAWAN, JANPATH
NEW DELHI - 110001

HISTORY SHEET

Name of the Generic Requirements	No. of the Generic Requirements	Remarks
1. Optical Power Meter (Precision) 2. Optical Power Meter (Handy)	G/OPM-01/01 JAN94 G/OPM-02/01 JAN94	First issue First issue
1. Optical Power Meter (Type –A) 2. Optical Power Meter (Type- B)	G/OPM -01/02 NOV 98 G/OPM -02/02 NOV98	Second Issue Second Issue
Optical Power Meter (Type –A & Type –B)	GR/OPM-01/03. JAN2005	Third Issue (Keeping in view the advancement of technology, GR's of the both types of power meters are upgraded to meet the requirements of field units. Both types of power meters have been merged into a single GR. A vender can have the approval for any type (A or B) or for both types of the instrument.)
Optical Power Meter (Type –A & Type –B)	TEC/GR/TX/OPM-001/04/NOV-13	Fourth Issue (GR for both types of Power meters has been upgraded with additional wavelength (1490nm) required for testing of Passive Optical Networks (PON) for FTTH applications)

CONTENTS

REFERENCES

TEC STANDARDS

1. TEC/EMI/TEL-001/01/FEB-09 EMC Standard for Telecommunication Equipment
2. SD: QM-333 (March 2010) Standards for Environmental Testing of Telecommunication Equipment.

OTHER STANDARDS (BIS/ CISPR / IEC/ ISO/ASTM etc.)

1. IS 8437 (1993) Guide on the effects of current passing through the human body (equivalent to IEC publication 60479-1 {1984).
2. CISPR 11 (2004) Industrial Scientific and Medical (ISM) radio frequency Equipment – Electromagnetic disturbance characteristics-Limits and methods of measurement ";
3. IS 9858 {1981} and IEC 61010-1(2001) with corrigendum 1 (2002) and corrigendum 2 (2003) Safety requirements for Electrical Equipment for Measurement, Control and laboratory use
4. IEC 61000-4-2 (2001) Testing and measurement techniques of Electrostatic discharge immunity test"
5. IEC 61000-4-3 (2006) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"
6. IEC 61000-4-4 (2004) Testing and measurement techniques of and electrical fast transients/burst immunity test"
7. IEC 61000-4-5 (2005) “Testing & Measurement techniques for Surge immunity test"
8. IEC 61000-4-11 (2004) “Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests”
9. IEC 825-1 Optical safety Requirements
10. ISO 9001-2008 International quality standards
11. D 2794 and D2197 ASTM Standards

PART 1 - TECHNICAL SPECIFICATION

1.0 Introduction:

This document describes the generic requirements for Optical Power Meter (Type-A & Type-B). Type-A Power meter is used to measure high optical power (≥ +28dBm) whereas Type –B Power meter is used to measure optical power ≥ + 3dBm. These meters are to be used for measuring the Output power of active Optical devices and Insertion loss/Attenuation of passive Optical devices, Optical transmission links during installation and maintenance at all wavelengths (1310nm, 1550nm & 1625nm). These meters can also be used for testing the Passive Optical Networks (PON) at all three wavelengths (1490nm and 1550nm downstream and 1310nm upstream) for FTTH applications. Type-A Power meter can also be used to measure the Optical power of Erbium doped fibre Amplifiers.

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 in the sleep mode disabled condition.

2.2 The manufacturer shall guarantee the satisfactory performance of the instrument without any degradation at an altitude up to 5000 metres above mean sea level. A Test certificate from the manufacturer shall be acceptable

2.3 Power cord shall have moulded plug.

2.4 Visual indication to show power ON/OFF status shall be provided.

2.5 Provision for self-check of the instrument shall be provided. The instrument shall be shipped with a certificate of calibration.

2.6 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 leap year etc.

2.7 The instrument shall provide an out-of-range information.

2.8 All controls shall be clearly marked or labelled with an easy to understand symbol or key word to indicate its intended use.

2.9 Sleep mode: Auto power off function shall be selectable with the operation of a key by the user.

2.10 The expected life of detector shall not be less than 10 years and to be supported by manufacturing statistical data.

3.0 Technical Requirements of Power Meter (Type - A):

3.1	Wavelength Range	:	1100 nm to 1650 nm
3.2	Wavelength calibrated	:	1310nm, 1480nm, 1490nm, 1550nm & 1625nm
3.3	Measurement Range		
	i) Max. measurable power	:	$\geq$ + 28dBm
	ii) Min. measurable power	:	$\leq$ - 50dBm

Note: The instrument shall be protected against high optical input power up to + 30dBm.

3.4	Calibration	:	Automatic self-check
3.5	Resolution	:	0.01 dB
3.6	Accuracy (absolute) (At – 20 dBm at ambient for CW mode)	:	± 0.20 dB
3.7	Linearity for the entire range (At – 20 dBm at ambient for CW mode as reference)	:	± 0.05 dBm
3.8	Level Range Switching	:	Automatic and Manual
3.9	Stability/Repeatability	:	± 0.01 dB
3.10	Zero Adjustment (Zero adjust when sensor is blocked)	:	Automatic / Manual
3.11	Averaging	:	Automatic/Selectable
3.12	Sensor Type	:	To be defined by the manufacturer
3.13	Display	:	4½ digits excluding "±" sign or more digit wide angle LCD
3.14	Display parameters	:	Optical power in dBm, dB & dBr (dB relative), Measured wavelength, Out of range, Battery Charging, Low Battery indication and High optical power.
3.15	Optical Connector	:	Universal connector adapter suitable for FC-PC, SC-PC & LC type of connector (suitable for 1.25 mm and 2.5 mm ferrule) or as per order.

3.16 Interface : USB

3.17 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 50Hz ±2Hz.

or

The instrument shall work, without any degradation from AC/DC adapter with input voltage from 100V to 240V AC, 50Hz ± 2Hz. The manufacturer shall furnish the output DC voltage of the AC/DC adopter 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 hours 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

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

4.0 Technical Requirements of Power Meter (Type-B):

4.1	Wavelength Range	:	1100 nm to 1650 nm
4.2	Wavelength calibrated (Switchable)	:	Automatic (1310 ± 20nm, 1490 ± 20nm, 1550 ± 20nm, 1625 nm ± 20nm)
4.3	Measurement Range		
	i) Max. measurable power	:	$\geq$ + 3 dBm.
	ii) Min. measurable power	:	$\leq$ - 60 dBm

Note: The instrument shall have protection against high optical input power up to +10 dBm.

4.4	Calibration	:	Automatic self-check
4.5	Resolution	:	0.01 dB
4.6	Accuracy (absolute) (At – 20 dBm at ambient for CW mode)	:	± 0.20 dB
4.7	Linearity (At - 20 dBm at ambient for CW mode as reference)	:	± 0.05 dB
4.8	Level Range Switching	:	Automatic
4.9	Stability/Repeatability	:	± 0.1 dB
4.10	Zero Adjustment (Zero adjust when sensor is blocked)	:	Automatic
4.11	Averaging	:	Automatic/ Selectable
4.12	Sensor Type	:	To be defined by the manufacturer
4.13	Display	:	3½ digits excluding "±" sign or more digit wide angle LCD
4.14	Display Parameter	:	Optical Power in dBm, dB & dBr (dB relative), Measured Wavelength, Out of range, Battery Charging, Low Battery indication) and High optical power

4.15 Optical Connector : Universal connector adapters suitable for FC-PC, SC-PC & LC type of connector (suitable for 1.25 mm and 2.5 mm ferrule) or as per order.

4.16 Interface : USB

4.17 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 50Hz ±2Hz.

Or

The instrument shall work, without any degradation from AC/DC adapter with input voltage from 100V to 240V AC, 50Hz ± 2Hz. The manufacturer shall furnish the output DC voltage of the AC/DC adopter 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 hours 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

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

PART- II GENERAL REQUIREMENTS

5.0 Engineering Requirements:

5.1 The instrument shall be manufactured as per state of art technology.

5.2 The actual dimensions and weight of the instrument shall be specified 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. This shall be under specified environmental conditions.

5.4 All connectors and cables used shall be of low loss type and suitably shielded.

5.5 The instrument shall be compact and composite in construction. The mechanical design and construction of each card/unit shall be inherently robust and rigid under all conditions of installation, operation, adjustment, replacement, storage and transport and conforming to TEC document no. SD: QM 333 {March 2010} "Standards for Environmental Testing of Telecommunication Equipment".

5.6 The instrument shall have self-cooling arrangement including usage of internal fans, if required.

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 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 hours including fan.

6.2 The instrument shall be manufactured in accordance with international quality standards ISO 9001-2008 for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer should be submitted by the manufacturer.

6.3 Environmental Requirements:

6.3.1 The instrument shall conform to the requirements for Environment specified in TEC document SD: QM-333 (March 2010) "Standards for Environmental Testing of Telecommunication Equipment". The applicable tests shall be for environmental category "B2" including Drop, Topple, Vibration tests (instrument kept in carrying case) and Corrosion test.

6.3.2 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.

6.3.3 The instrument shall be able to work without any degradation in the performance in saline atmosphere near coastal areas & should be protected against corrosion

7.0 Maintenance Requirements:

7.1 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.

7.2 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.

7.3 All parts used shall be capable of being repaired by the supplier with turnaround time of maximum 2 weeks from the date it is handed over to supplier. If this turnaround time cannot be met then a loaner unit should be provided for the duration of the repair period.

8.0 Accessories:

8.1 The supplier shall provide one complete set of:

a) All the necessary interfaces, connectors, connecting cables 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.

8.2 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.

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

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

9.0 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 manual shall also be provided. The manuals shall include the following:-

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**.**

10.0 Protection Requirements:

10.1 The instrument panel shall have a terminal for grounding the chassis, if required.

10.2 The plug-in units, if provided, shall have suitable protection to allow their removal/ insertion while the instrument is in energized condition

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

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

10.5 The instrument shall be adequately safeguarded to prevent entry of dust, insects and lizards etc. with IP rating 34 as per IEC-60529.

11.0 Safety requirements:

11.1 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}].

11.2 The instrument shall conform to IS 9858 {1981} and IEC 61010-1(2001) with corrigendum 1 (2002) and corrigendum 2 (2003) "Safety requirements for Electrical Equipment for Measurement, Control and laboratory use"

11.3 **Optical Safety Requirements:** The instrument shall meet the optical safety requirements as per 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.

11.4 **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.

12.0 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 {2004}- Industrial, scientific and medical (ISM) radio- frequency equipment-Electromagnetic disturbance characteristics-Limits and methods of measurement"

Limits:
i) To comply with the category of Group 1 of Class A of CISPR 11 {2004}
ii) The values of limits shall be as per clause No. 8.5.2 of TEC Standard No. TEC/EMI/TEL-001/01/FEB-09**.**

b) Immunity to Electrostatic discharge:

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

Limits:-
Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz

d) Immunity to fast transients (burst):

Name of EMC Standard: IEC 61000- 4- 4 {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:-
For mains power input ports : (a)1.0 kV peak open circuit voltage for line to ground coupling (b) 0.5 kV peak open circuit voltage for line to line coupling

f) Immunity to voltage dips & short interruptions:

Name of EMC Standard: IEC 61000-4-11 (2004) "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.

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

IEC/CISPR	Euro Norm
CISPR 11	EN55011
IEC 61000-4-2	EN61000-4-2
IEC 61000-4-3	EN61000-4-3
IEC 61000-4-4	EN61000-4-4
IEC 61000-4-5	EN61000-4-5
IEC 61000-4-11	EN61000-4-11

13.0 Surface finish, Marking, Packaging and Shipping:

13.1 Marking:

13.1.1 The instrument, its carrying case and tool kit 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

13.2 Surface finish:

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

13.2.2 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 ASTM D 2794 or any other equivalent International Standard.

13.2.3 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.

13.2.4 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. In particular the surface shall not be affected by the following:

a) Cable Filling compound
b) Isopropyl Alcohol
c) Cable cleaning solutions.

13.3 Packaging & shipping:

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

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

13.4 Portability

13.4.1 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.

13.4.2 The instrument shall be compact and light weight in order to provide a reasonable degree of portability and simplicity of operation.

Note:

1. The manufacturer can take the approval either for Type-A or Type-B separately or for both Types (A & B) together. It shall be mentioned specifically in the Approval Certificate.

2. Manufacturers/Traders having approval certificate against existing TEC GR No. GR/OPM-01/03.APR.2005 can apply for approval certificate against revised TEC GR No. TEC/GR/TX/OPM-001/04/NOV-13 but the period of validity shall remain the same as applicable for the earlier certificate. In case there is no change in Hardware/Software and Make & Model No. of the instrument remains the same then all the tests may not be repeated in next approvals and tests will be conducted only for the modified/inserted clauses. However, if the Manufacturer/Trader has made any Hardware/Software changes then the case will be considered for fresh Approval against the new GR.

GUIDELINES FOR THE PURCHASER

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

a) 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.
b) The manufacturer/supplier shall furnish the list of recommended spares for three years maintenance.
c) The supplier shall have maintenance/repair with calibration facility in India.
d) Supplier shall guarantee the supply of spares so long as the instrument is in service, at least for seven 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.
e) Purchaser may ask for Type-A & Type-B Power meter separately or both types together.

ABBREVIATIONS

AC	-	Alternating Current
ASTM	-	American Society for Testing Materials
CISPR	-	International Special Committee on Radio Interference
BSNL	-	Bharat Sanchar Nigam Limited
EMC	-	Electromagnetic Compatibility
FC/PC	-	Physical Contact Type of Optical Connector
IEC	-	International Electro -Technical Commission
IS	-	Indian Standards
ISO	-	International Standard Organisations
ITU	-	International Telecommunication Union
LCD	-	Liquid Crystal Diode
MTBF	-	Mean Time Between Failure
MTTR	-	Mean Time to Restore Service
OF	-	Optical Fibre
QA	-	Quality Assurance
QM	-	Quality Manual

---------- End of Document ----------