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Edition 2.0 2013-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Fibre optic communication subsystem basic test procedures –
Part 1-1: Test procedures for general communication subsystems – Transmitter output optical power measurement for single-mode optical fibre cable

Procédures d'essai de base des sous-systèmes de télécommunication à fibres optiques –
Partie 1-1: Procédures d'essai des sous-systèmes généraux de télécommunication – Mesure de la puissance optique des émetteurs couplés à des câbles à fibres optiques unimodales

IEC 61280-1-1:2013-05(en-fr)

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International Standard IEC 61280-1-1 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 1998. This second edition constitutes a technical revision. The significant technical change with respect to the previous edition is the inclusion of Annex A on how to account for uncertainties. There are editorial corrections throughout the document and updates to references.

This bilingual version (2014-03) corresponds to the monolingual English version, published in 2013-05.

The text of this standard is based on the following documents:

CDV	Report on voting
86C/1065/CDV	86C/1098/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61280 series, published under the general title *Fibre optic communication subsystem basic test procedures*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

FIBRE OPTIC COMMUNICATION SUBSYSTEM BASIC TEST PROCEDURES –

Part 1-1: Test procedures for general communication subsystems – Transmitter output optical power measurement for single-mode optical fibre cable

1 Scope and object

This part of IEC 61280 applies to fibre optic general communication subsystems. The object of this part is to measure the optical power coupled from the output of a transmitter under test into single-mode optical fibre cable containing dispersion-unshifted fibre or dispersion-shifted fibre.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Fibre optic connector endface visual and automated inspection*

IEC 61315, *Calibration of fibre-optic power meters*

3 Apparatus

3.1 Optical power meter

The optical power meter shall be capable of measuring the range of power at wavelengths provided by the transmitter. The optical power meter shall have a resolution of at least 0,1 dB. The meter shall have a detecting surface of sufficient size to capture all the power coming from the fibre that is put into it.

3.2 Input signal source

The input signal source is a signal generator at the appropriate signal rate of the system interface.

3.3 Test cord

A length of single-mode optical fibre cable, which is known to remove cladding modes, shall be used. The optical fibre (cable) shall be terminated at both ends with appropriate connectors. The ends for connection to the fibre optic transmitter and to the optical power meter shall be terminated with appropriate connector plugs. These plugs and any adapters necessary to produce the connections shall be such that the performance can be specified by the manufacturer of the equipment or the connectors. Values for the insertion loss repeatability shall be known.

3.4 Calibration

The optical power meter shall be configured and calibrated for the test wavelength. The optical power meters shall be calibrated in accordance with IEC 61315.

The equipment used shall have a valid calibration certificate in accordance with the applicable quality system for the period over which the testing is done.

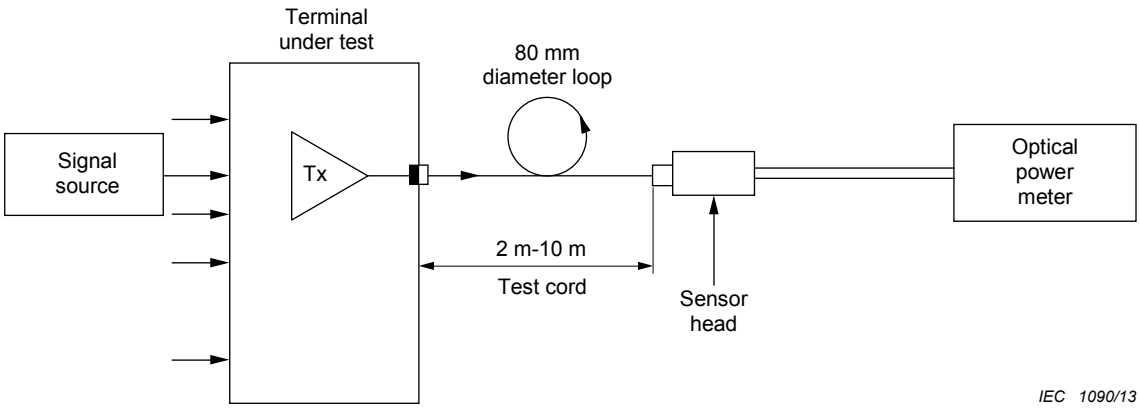

Figure 1 – Transmitter output power measurement configuration

4 Test sample

The test sample shall be a specified single-mode fibre optic transmitter, including all signal conditioning and multiplexing equipment used in the system in normal operation. The electrical inputs and outputs shall be those normally available to the user for interfacing with other transmission equipment.

5 Procedure

5.1 Unless otherwise specified, standard operating conditions apply. The ambient or reference point temperature shall be specified.

5.2 Apply appropriate terminal input voltage to the system under test. Apply standard (or extended) operating conditions. Allow sufficient time (30 min, unless otherwise specified in the detail specification) for the system under test to reach a steady-state temperature and performance condition.

5.3 Turn the optical power meter on, and allow the manufacturer's recommended warm-up and settling time to achieve the rated measurement performance level.

5.4 All connector end faces shall be inspected to verify that they are clean and essentially free of defects in accordance with IEC 61300-3-35. If necessary, connectors should be cleaned in accordance with IEC/TR 62627-01 and re-inspected to verify that the cleaning has been effective. The appropriate performance selection must be selected.

5.5 Remove higher order modes. For example, use a test cord between 2 m and 10 m long and with an 80 mm diameter loop, as shown in Figure 1.

5.6 Connect one end of the test cord to the transmitter connector and the other end to the sensor head of the optical power meter, as shown in Figure 1.

5.7 Observe the optical power reading.

If the meter reading fluctuates more than 0,4 dB, the transmitter power output power is not stable, and the reading should be disregarded. When the meter reading indication is stable, record the reading.

5.8 Disconnect the fibre test cord from the transmitter connector, clean the test cord connector again, and reconnect to the transmitter.

5.9 Repeat steps 5.7 and 5.8 until five stable readings are obtained. If it is impossible to obtain five stable readings, or five readings with a maximum deviation less than the stated repeatability for the transmitter connector, from 10 attempted measurements, then the fibre optic transmitter and the test cord shall be rejected.

6 Calculation

Calculate the average of the five readings, and record as the average effective transmitter output power.

7 Test results

7.1 Required information

- Date and title of the test
- Transmitter identifications
- Identification of test methods, specific operating conditions (standard or extended) and procedures used
- Results of the tests, including ambient or reference point temperature

7.2 Available information

- Identification of test equipment used
- Measurement uncertainty due to measurement inaccuracy and display resolution
- Details of the fibre test cord and connectors
- Insertion loss repeatability of the connectors, including the worst case random mated insertion loss
- Optical power meter uncertainties
- Names of test personnel
- Supply voltages and/or currents
- Rate and input signal characteristics
- Optical output measurement conditions: wavelength, transmitter mating connector model number
- Warm-up time applied for temperature stabilization
- Extended operating conditions, if applicable

Annex A
(informative)

Taking into account uncertainties

A.1 Using optical power meter calibration report

If the optical power has been calibrated according to IEC 61315, the calibration report should include the correction factor, *CF*, defined as the numerical factor by which the uncorrected result of a measurement is multiplied to compensate for systematic error:

$$CF = \frac{P_{\text{ref}}}{P_{\text{DUT}}} \qquad \text{(A.1)}$$

It is recommended to compensate the optical power reading properly.

$$P_{\text{reported}} = CF \times P_{\text{read}} \qquad \text{(A.2)}$$

A.2 Taking into account uncertainties

If the optical power measurement is used for a pass/fail test, the uncertainties of measurement and calibration should be used to set the test limits properly.

As an example, if the minimum power expected from the transmitter is 1 mW, and if the calibration uncertainties and measurement uncertainties are respectively 3 % and 2 %, the pass/fail limit should be increased by the accumulated uncertainties.

$$PassFail_{\text{L}} = P_{\text{expected}} + P_{\text{expected}} \times \sqrt{(U_{\text{cal}})^2 + (U_{\text{measure}})^2} = 1 + \sqrt{0{,}03^2 + 0{,}02^2} = 1{,}036 \text{ mW} \qquad \text{(A.3)}$$

Bibliography

IEC/TR 62627-01, *Fibre optic interconnecting devices and passive components – Part 01: Fibre optic connector cleaning methods*

ISO/IEC GUIDE 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

EIA/TIA-526-2:1989, *OFSTP-2: Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable*