SLOVENSKI STANDARD
oSIST prEN IEC 61300-3-3:2023

01-september-2023

Povezovalne naprave in pasivne komponente optičnih vlaken - Postopki osnovnega preskušanja in merjenja - 3-3. del: Preiskovanje in meritve - Aktivno nadzorovanje sprememb pri zmanjševanju in povračilu izgube

Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-3: Examinations and measurements - Active monitoring of changes in attenuation and return loss

Lichtwellenleiter - Verbindungselemente und passive Bauteile - Grundlegende Prüf- und Messverfahren - Teil 3-3: Untersuchungen und Messungen - Aufzeichnung der Änderung von Dämpfung und Rückflussdämpfung

Dispositifs d'interconnexion et composants passifs à fibres optiques - Méthodes fondamentales d'essais et de mesures - Partie 3-3: Examens et mesures - Contrôle actif des variations de l'affaiblissement et de l'affaiblissement de réflexion

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IEC SC 86B : FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS			
SECRETARIAT: Japan		SECRETARY: Mr Shigeru Tomita	
OF INTEREST TO THE FOLLOWING COMMITTEES:		PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.	
FUNCTIONS CONCERNED:			
☐ EMC	☐ ENVIRONMENT	☐ QUALITY ASSURANCE	☐ SAFETY
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.		☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING	

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TITLE:

Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-3: Examinations and measurements - Active monitoring of changes in attenuation and return loss

PROPOSED STABILITY DATE: 2029

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss

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International Standard IEC 61300-3-3 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This fourth edition cancels and replaces the third edition published in 2009. This edition constitutes a minor revision.

The changes with respect to the previous edition include harmonization with IEC 61300-3-4 and 61300-3-6 by revision of the requirements for the:

a) light source
b) launching condition
c) detector
d) temporary joint
e) as well as revision of normative references.

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

FDIS	Report on voting
86B/xxxxFDIS	86B/xxxxRVD

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 of IEC 61300 series, published under the general title *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures,*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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 INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss

1 Scope

This part of IEC 61300 describes the procedure to monitor changes in attenuation and/or return loss of a component, an interconnecting device, a fibre management system, or a protective housing, when subjected to an environmental or mechanical test. Such a procedure is commonly referred to as active monitoring. The procedure to monitor temporary changes (generally faster) during disruptive events is given in IEC 61300-3-28.

The procedure can be applied to measurements on single samples or to simultaneous measurements on multiple samples, both at single wavelengths and multiple wavelengths, by using branching devices and/or switches as appropriate.

2 Normative references

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

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examinations and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61300-3-28, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Transient loss*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Visual inspection of fibre optic connectorsl and fibre-stub transceivers*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions are given in IEC 60050-731 and IEC 61300-1.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp.

3.2 Abbreviations

BD	branching device
DUT	device under test
LED	light emitting diode
OTDR	optical time domain reflectometer
PDL	polarization dependent loss
TJ	temporary joint
WDM	wavelength-division multiplexing

4 General description

4.1 Measurement method

The procedure describes a number of active monitoring measurement methods. Method 1 describes the situation where a single sample is subject to mechanical or environmental stress testing. Methods 2 and 3 describe methods for monitoring changes in the optical performance of multiple samples. Methods 4 and 5 measure changes in the optical performance of samples using an OTDR. Methods 4 and 5 may be used only when the OTDR averaging time is much less than the variation time of the test conditions. Where there is any form of uncertainty over the measurement method used, method 1 shall be the reference method.

All methods are capable of being configured to monitor changes in attenuation and return loss at the same time. The required optical test parameters shall be defined in the relevant specification.

Where a group of samples is being monitored over a period of time, say several days or weeks, it is usual to employ some form of automated data acquisition. Also, since the changes in optical performance can be very small, it is important to ensure high measurement stability over time.

4.2 Precautions

The following requirements shall be met.

a) Precautions shall be taken to ensure that cladding modes do not affect the measurement as advised in IEC 61300-1.

b) Precautions shall be taken to prevent movement in the position of the fibres between the sample(s) and the test apparatus, to avoid changes in optical performance caused by bending losses.

c) The stability performance of the test equipment shall be ≤ 0,05 dB or 10 % of the attenuation to be measured, whichever is the lower value. The stability shall be maintained over the measurement time. The required measurement resolution for attenuation shall be 0,01 dB for both multimode and single-mode.

d) To achieve consistent results, clean and inspect all samples prior to measurement in accordance with the manufacturer’s instructions. Visual examination shall be undertaken in accordance with IEC 61300-3-1 and IEC 61300-3-35.

e) The power in the fibre shall be at a level that does not generate non-linear scattering effects (typically < 3 mW).

f) It is common to be monitoring changes in optical performance that are small in comparison with the polarization dependence of the components under test (DUT) and of parts of the test apparatus such as branching devices, switches and detectors. Since polarization along the fibres often changes over time, either an unpolarized or polarization scrambled source can be used to measure the polarization averaged attenuation, or the methods of IEC 61300-3-2 should be used to measure polarization dependent loss (PDL) and attenuation together.

g) Particularly, when measuring wavelength dependent components such as WDM devices, it is necessary to use a light source that does not emit light at extraneous wavelengths at levels that can affect the measurement uncertainty.

h) Reflected powers from the test apparatus shall be at a level that does not affect the measurement uncertainty.

i) Care shall be taken when using switches or branching devices for multimode measurements. In many cases, these devices will modify the launched mode power distribution or result in modal detection non-uniformity, which will give rise to additional measurement uncertainty.

5 Apparatus

5.1 Methods 1, 2 and 3

5.1.1 General

The apparatus used for methods 1, 2 and 3 of this procedure is shown in Figures 1, 2 and 3. The apparatus consists of elements listed in clauses 5.1.2 to 5.1.11.

5.1.2 Launch conditions (E) and source (S)

The launch conditions for light sources shall be in accordance with IEC 61300-1 and shall be measured at the output of the launch reference connector. For multimode fibre sources, a mode-conditioning device may be required to satisfy these conditions, as illustrated with device E in Figure 1 and the launch reference connector where the launch conditions are verified is at the temporary joint into the DUT.

The source unit consists of an optical emitter, the associated drive electronics and fibre pigtail (if any). Preferred source conditions are given in Table 1. The stability of the single-mode fibre source at 23 °C shall be ± 0,01 dB over the duration of the measurement. The stability of the multimode fibre source at 23°C shall be ± 0,05 dB over the duration of the measurement. The source output power shall be ≥ 20 dB above the minimum measurable power level.

There are a number of methods of performing measurements at multiple wavelengths. One method, illustrated in Figure 3, shows independent light sources joined by optical Switch 3.

Table 1 – Preferred source conditions

No.	Type	Central wavelength nm	Spectral width nm	Source type
S1	Multimode	660 ± 30	≥10	Monochromator or LED
S2	Multimode	780 ± 30	≥10	Monochromator or LED
S3	Multimode	850 ± 30	≥10	Monochromator or LED
S4	Multimode	1 300 ± 30	≥10	Monochromator or LED
S5	Single-mode	1 310 ± 30	To be reported	Laser diode, monochromator or LED
S6	Single-mode	1 550 ± 30	To be reported	Laser diode, monochromator or LED
S7	Single-mode	1 625 ± 30	To be reported	Laser diode, monochromator or LED

NOTE 1 It is recognized that some components, e.g. for CWDM, can require the use of other source types such as tunable lasers. In these cases, the preferred source characteristics are specified on the basis of the component to be measured.

NOTE 2 Central wavelength and spectral width are defined in IEC 61280-1-3.

NOTE 3 The interference of modes from a coherent source will create speckle patterns in multimode fibre. These speckle patterns give rise to speckle or modal noise and are observed as power fluctuations, since their characteristic times are longer than the resolution time of the detector. As a result, it can be impossible to achieve stable launch conditions using coherent sources for multimode measurements. Consequently, lasers are avoided in favour of LEDs or other incoherent sources for measuring multimode components.

5.1.3 Monitoring equipment

Where multiple sample measurements are made, suitable apparatus is required to permit monitoring of the light through the multiple paths.

In Figure 2, individual monitoring channels are established by dividing the light into N paths using a 1 × N branching device (BD). This method is practical for a small number of DUTs, since it requires a multiplicity of branching devices and detectors.

In Figure 3, active switching of the light paths through the DUTs is used. The apparatus consists of a directional branching device and two 1 × N computer-controlled optical switches. The channel number of these switches is sufficiently large to accommodate the DUTs under test, one or more reference lines, and a reference reflectance channel.

The design of systems to test multiple samples requires the trade-off of a number of factors such as cost and measurement capability. When testing multimode samples, for example, it may be inappropriate to use branching devices and/or optical switches, due to the problems surrounding modal losses and the associated cost of the test apparatus. However, optical switches may be cost-effective for testing single-mode samples, particularly when the cost of suitable sources and detectors and the measurement stability requirements are considered.

Switch parameters which shall be considered for this test include the following.

a) Repeatability

The switches shall be capable of good repeatability in per-channel insertion loss, since this parameter will directly detract from the accuracy of the measurement of attenuation or return loss of the DUT. The repeatability should be less than 1/10 of the attenuation change to be measured. Furthermore, since environmental tests are generally carried out over extended periods the switch repeatability shall be considered over the full duration of the test.

b) Return loss

The return loss characteristics of the switch shall be such that they do not unduly influence the measurement in methods 2 and 3.

c) Wavelength dependence

When undertaking multiple wavelength measurements, the wavelength dependence characteristics of the switch shall be taken into account, to ensure they do not unduly influence the measurement in methods 2 and 3.

5.1.4 Detector (D)

The detector consists of an optical detector, the means to connect to it, and associated electronics. The connection to the detector should either be with an adaptor that accepts a bare fibre or a connector plug of the appropriate design. The detector shall capture all light emitted by the fibre, so the sensitive area of the detector and the relative position between it and the fibre should be compatible with the numerical aperture of the fibre.