SLOVENSKI STANDARD
oSIST prEN IEC 61300-3-45:2022

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Optični spojni elementi in pasivne komponente - Osnovni preskusni in merilni postopki - 3-45. del: Preiskave in meritve - Slabljenje naključno spojenih večvlakenskih konektorjev

Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-45: Examinations and measurements - Attenuation of random mated multi-fibre connectors

Lichtwellenleiter - Verbindungselemente und passive Bauteile - Grundlegende Prüf- und Messverfahren - Teil 3-45: Untersuchungen und Messungen - Dämpfung von zufällig gesteckten Mehrfachsteckverbindern

Dispositifs d'interconnexion et composants passifs à fibres optiques - Méthodes fondamentales d'essais et de mesures - Partie 3-45: Examens et mesures - Affaiblissement dû à l'accouplement de connecteurs quelconques multifibres

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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	
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TITLE:

Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-45: Examinations and measurements - Attenuation of random mated multi-fibre connectors

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NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVECOMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

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International Standard IEC 61300-3-45 Ed. 2.0 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Addition of sample size for >12 fibre connector measurement

b) Inclusion of guidance for multimode measurement

The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

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

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

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

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVECOMPONENTS –BASIC TEST AND MEASUREMENT PROCEDURES –

Part 3-45: Examinations and measurements - Attenuation of random mated multi-fibre connectors

1 Scope

The purpose of this part of IEC 61300 is to describe the procedure required to measure the statistical distribution and mean attenuation for random mated optical connectors with physical contact (PC) and angled physical contact (APC) polished multi-fibre rectangular ferrules as defined in the IEC 61754 series. This measurement method is applicable to cable assemblies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61300-3-35, *Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-35: Examinations and measurements - Visual inspection of fibre optic connectors and fibre-stub transceivers*

IEC 61754 (all parts), *Fibre optic connector interfaces*

IEC 63267-2-2, *Fibre optic interconnecting devices and passive components - Connector optical interfaces - Part 2-2: Connection of 50 µm core diameter multimode physically contacting fibres - Non-angled for reference connector application, at wavelength of 850 nm using selected A1-OM2 to A1-OM5 fibre only*

3 Terms and definitions

No terms and definitions are listed in this document.

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

4 General description

4.1 Test methods

Two test methods are described for measuring the attenuation of random mated optical connectors. Both provide an estimate of the expected average performance that a group of cable assemblies (including an adaptor, if applicable) will exhibit when used in an optical system.

The device under test (DUT) is a cable assembly with on one side a plug with pins (pinned plug) and on the other side a plug without pins (unpinned plug). The cable assemblies, and any adaptors, shall be chosen at random to ensure that the measurements provide a statistically unbiased estimate.

Method 1 describes the procedure using a sample of cable assemblies and adaptors specified in Table 1. In this case the pinned plugs are used as “reference” plugs and the unpinned plugs are tested against them sequentially. The results, based on the number of measurements specified in Table 1, are recorded in the test matrix shown in Figures 3 to 5.

Method 2 describes a procedure for the measurement of a sample of cable assemblies specified in Table 2. Three cable assemblies are selected from the sample as “reference” cable assemblies. Firstly, the pinned plugs of the “reference” cable assemblies are used as reference and the unpinned plugs of the other test cable assemblies are tested against them sequentially. Then the unpinned plugs of the “reference” cable assemblies are used as reference and the pinned plugs of the other test cable assemblies are tested. This produces the number of measurements specified in Table 2 and the results are recorded in the test matrix shown in Figures 10 to 12.

Method 1 is intended to be part of a design approval exercise that may involve one or more suppliers. It is recognised that the number of measurements required by Method 1 may be excessive for day-to-day routine checking of either in-house or supplier produced products. In this case, once approval is achieved, Method 2 would be relied on to maintain process control as an alternative option. However, in the event of a dispute, Method 1 shall act as the reference measurement method.

NOTE In this measurement method, the terms “reference” plug or “reference” cord are used to define those components chosen at random from the sample, against which a number of comparative measurements are made. It is not intended that the terms imply specially chosen or manufactured components, such as those used, for example, in screen testing.

Table 1 – Sample size for Method 1

Connectors (n-fibre connector)	Sample sizes		
	Cords and adaptors	Measurements	Fibres
2-fibre connector	15	210	420
4-fibre connector	12	132	528
8-fibre connector	10	90	720
10-fibre connector	10	90	900
12-fibre connector	10	90	1080
>12-fibre connector	10	90	90*n

Table 2 – Sample size for Method 2

Connectors (n-fibre connector)	Sample sizes					
	Cords			Adaptors	Measurements	Fibres
	Total	Reference	Test			
2-fibre connector	12	3	9	3	54	108
4-fibre connector	8	3	5	3	30	120
8-fibre connector	6	3	3	3	18	144
10-fibre connector	6	3	3	3	18	150
12-fibre connector	6	3	3	3	18	216
>12-fibre connector	6	3	3	3	18	18*n

4.2 Precautions

The following test requirements shall be met.

a) Precautions shall be taken to ensure that the cladding modes do not affect the measurement. Cladding modes shall be stripped as a function of the fibre coating. For multimode measurement the recommended length of the DUT is 4 to 5 meters.

b) Precautions shall be taken to ensure that the position of the fibres in the test remains fixed between the reference cord measurement and the corresponding test cord measurements to avoid changes in attenuation due to 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 and operational temperature range. The required measurement resolution shall be 0,01 dB for both multimode and single-mode.

d) To achieve consistent results, inspect all connectors and adaptors prior to the setup of the measurement system and if contaminated clean them. During measurement steps, inspect all connectors and adaptors except those in the unchanged connections and if contaminated clean them before mating. Visual examination shall be undertaken in accordance with IEC 61300-3-1 and IEC 61300-3-35.

NOTE A cladding mode stripper usually comprises a material having a refractive index equal to or greater than that of the fibre cladding.

5 Apparatus

5.1 Launch conditions and light source (LS)

The source unit consists of an optical emitter, the associated drive electronics and fibre pigtail (if any). Preferred source conditions are given in Table 3. 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.

Table 3 – Preferred source conditions

No.	Type	Central wavelength nm	Spectral width (RMS) 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. It is therefore recommended in these cases that 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.

The launch condition shall be specified in accordance with IEC 61300-1. In case the specified launch condition is not obtained by the original light from the source, appropriate apparatus for launch condition control (E) shall be used.

The interference of modes from a coherent source will create speckle patterns in multimode fibres. 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 cannot achieve stable launch conditions using coherent sources for multimode measurements. Consequently, lasers, including optical time domain reflectometer (OTDR) sources, should be avoided in favour of LEDs or other incoherent sources for measuring multimode components.

5.2 Detector (D)

The detector consists of an optical detector, the means to connect to it and associated electronics. The connection to the detector will be an adaptor that accepts a connector plug of the appropriate design. The detector shall capture all light emitted by the connector plug.

In addition to meeting the stability and resolution requirements, the detector shall have the following characteristics:

– Linearity of multimode, ≤ ±0,25 dB (over −5 dBm up to −60 dBm);

– Linearity of single-mode, ≤ ±0,1 dB (over −5 dBm up to −60 dBm).

The detector linearity should be referenced to a power level of −23 dBm at the operational wavelength.

Where the connection to the detector is broken between the reference cord measurement and the corresponding test cord measurements, the measurement repeatability shall be within 0,05 dB or 10 % of the attenuation to be measured, whichever is the lower value. A large sensitive area detector may be used to achieve this.

The precise characteristics of the detector shall be compatible with the measurement requirements. The dynamic range of the detector shall be capable of measuring the power level exiting from the device under test (DUT) at the wavelength being measured.

6 Procedure

6.1 Method 1

a) Randomly select the sample number of cable assemblies specified in Table 1. Sequentially label the plugs under test as shown in Figures 3 to 5.

b) Randomly select the sample size of adaptors as specified in Table 1. Sequentially label the adaptors under test as shown in Figures 3 to 5.

c) Set up the measurement system as shown in Figure 1, with cord 1 as the “reference” cord and with plug 1 (pinned) as the “reference” plug. Measure power P_{1-1} to P_{1-n} for all fibres in the cord. For multimode measurement, tight tolerance fibre and tight tolerance plug as specified in Annex A shall be used for the launch plug. The launch condition at the launch plug shall comply with IEC 61300-1.