IEC 61300-3-34

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –
Part 3-34: Examinations and measurements – Attenuation of random mated connectors

Dispositifs d'interconnexion et composants passifs à fibres optiques – Méthodes fondamentales d'essais et de mesures –
Partie 3-34: Examens et mesures – Affaiblissement dû à l'accouplement de connecteurs quelconques

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CONTENTS

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

Part 3-34: Examinations and measurements – Attenuation of random mated connectors

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International Standard IEC 61300-3-34 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2001. It constitutes a technical revision. Changes from the previous edition of the document are to reconsider launch conditions for multimode fibres.

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

FDIS	Report on voting
86B/2767/FDIS	86B/2800/RVD

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

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

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

Part 3-34: Examinations and measurements – Attenuation of random mated connectors

1 Scope

This part of IEC 61300 describes the procedure required to measure the statistical distribution and mean attenuation for random mated optical connectors.

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*

3 General description

3.1 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 patchcords (including adaptors, if applicable) selected from a batch will exhibit when utilised in an optical system. The patchcords, and any adaptors, must be chosen at random to ensure that the measurements provide a statistically unbiased estimate.

Method 1 describes the procedure based on the use of 10 patchcords (20 optical connectors) and 10 adaptors. In this case all of the plugs are sequentially used as “reference” plugs and all of the remaining plugs are tested against them. The result is based on 360 measurements as indicated in the test matrix shown in Figure 3.

Method 1 is intended to be part of a design approval exercise that may involve one or more suppliers. Once approval is achieved, Method 2 would be relied on to maintain process control. However, in the event of a dispute, Method 1 shall act as the reference measurement method.

Method 2 describes a procedure based on the measurement of 15 patchcords.

Five patchcords are selected as “reference” patchcords, with one plug on each of the patchcords being nominated as a “reference” plug. All plugs of the remaining 10 patchcords are then tested against each of the five “reference” plugs. This produces 100 measurements as indicated in the test matrix shown in Figure 6.

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, as indicated above, Method 2 may be used as an alternative option.

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

3.2 Precautions

The following test requirements shall be met:

3.2.1

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.

3.2.2

Precautions shall be taken to ensure the position of the fibres in the test remains fixed between the measurement of P_1 and P_2 to avoid changes in attenuation due to bending losses.

3.2.3

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 singlemode.

3.2.4

To achieve consistent results, clean and inspect all connectors and adaptors prior to measurement. Visual examination shall be undertaken in accordance with IEC 61300-3-1.

3.2.5

The power in the fibre shall be at a level that does not generate non-linear scattering effects.

4 Apparatus

4.1 Source (S)

The source consists of an optical emitter, the means to connect to it and associated drive electronics. In addition to meeting the stability and power level requirements, the source shall have the following characteristics:

Centre wavelength: as detailed in the performance and product standard;

Spectral width: filtered LED ≤150 nm FWHM;

Spectral width: LD <10 nm FWHM.

For multimode fibres, broadband sources such as an LED shall be used.

For singlemode fibres either an LED or LD may be used.

NOTE 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 may be impossible to achieve stable launch conditions using coherent sources for multimode measurements. Consequently, lasers, including OTDR sources, should be avoided in favour of LED's or other incoherent sources for measuring multimode components.

4.2 Launch conditions (E)

The launch condition shall be specified in accordance with Annex B of IEC 61300-1.

4.3 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: multimode ≤ ±0,25 dB (over –5 dBm to –60 dBm);

singlemode ≤ ±0,1 dB (over –5 dBm to –60 dBm).

NOTE The power meter linearity shall be referenced to a power level of –23 dBm at the operational wavelength.

Where the connection to the detector is broken between the measurement of P_1 and P_2, 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 power meter shall be capable of measuring the power level exiting from the DUT at the wavelength being measured.

5 Procedure

5.1 Method 1

5.1.1

Randomly choose 10 patchcords for testing. Label the plugs under test sequentially from 1a through to 10b (i.e. 1a – 1b, 2a – 2b, 3a – 3b.........10a – 10b).

5.1.2

Randomly choose 10 adaptors. Label each adaptor sequentially 1 through 10.

5.1.3

Insert patchcord 1a – 1b into the measurement system as shown in Figure 1. Using plug 1a as the “reference” plug, measure the power P_1.

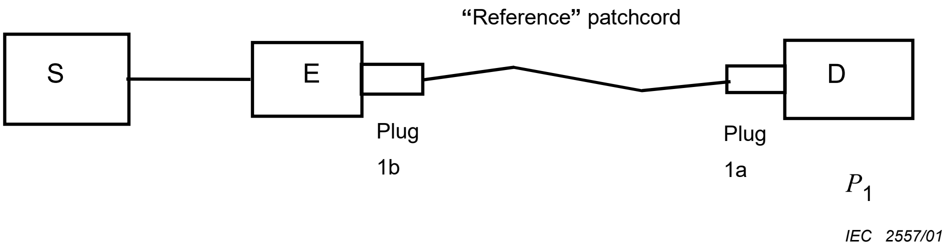

Figure 1 – "Reference" patchcord measurement – Method 1

5.1.4

Insert test patchcord 2a – 2b and adaptor 1 into the system as shown in Figure 2 and measure the transmitted power P_2.

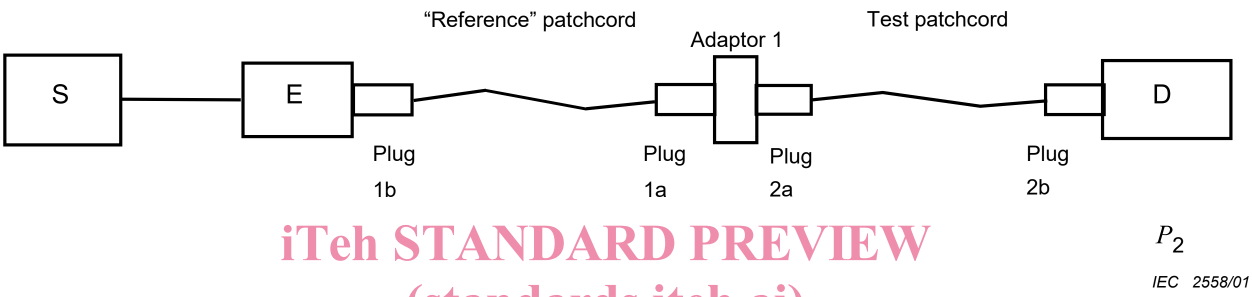

Figure 2 – Test patchcord measurement – Method 1

5.1.5

Calculate the loss of the mated connector pair 1a/2a and adaptor 1, using the following equation:

$$\text{Insertion loss} = [10 \times \log (P_1/P_2)] - (A \times L) \quad (1)$$

where

A is fibre attenuation per kilometre;

L is length of the test patchcord in km.

NOTE The product $A \times L$ may be ignored for both singlemode and multimode [50/125 µm and 62,5/125 µm] where the patchcord length is small, i.e. <10 m.

5.1.6

Enter the insertion loss value into the test matrix shown in Figure 3.

5.1.7

Reverse the test patchcord 2a – 2b and measure the transmitted power P_2 to obtain the insertion loss of the mated connector pair 1a/2b, using adaptor 1.

5.1.8

Repeat step 5.1.6.

5.1.9

Maintaining plug 1a and adaptor 1 as the "reference" configuration, replace test patchcord 2a – 2b by patchcord 3a – 3b.

5.1.10

Measure the transmitted power P_2.

5.1.11

Repeat steps 5.1.9 and 5.1.10 until all of the plugs of the remaining test patchcords have been tested against the "reference" plug 1a.

5.1.12

When step 5.1.11 has been completed, reverse the "reference" patchcord so that plug 1b becomes the "reference" plug.

5.1.13

Measure the insertion loss of all test plugs against the "reference" plug 1b and adaptor 1.

5.1.14

When step 5.1.13 has been completed, replace the "reference" plug and adaptor so that plug 2a and adaptor 2 becomes the "reference" configuration.

5.1.15

Measure the insertion loss of all test plugs against "reference" plug 2a and adaptor 2.

5.1.16

Repeat step 5.1.12 making plug 2b the "reference".

5.1.17

Continue this process until all of the plugs have been sequentially used as "reference" plugs and the remaining patchcords and adaptors have been tested against them.

5.1.18

Enter the attenuation results into the test matrix as shown below.

"Reference" configuration		Patchcord under test																			
		1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	10a	10b
Adaptor 1	1a	-	-																		
	1b	-	-																		
Adaptor 2	2a			-	-																
	2b			-	-																
Adaptor 3	3a					-	-														
	3b					-	-														
Adaptor 4	4a							-	-												
	4b							-	-												
Adaptor 5	5a									-	-										
	5b									-	-										
Adaptor 6	6a											-	-								
	6b											-	-								
Adaptor 7	7a													-	-						
	7b													-	-						
Adaptor 8	8a															-	-				
	8b															-	-				
Adaptor 9	9a																	-	-		
	9b																	-	-		
Adaptor 10	10a																			-	-
	10b																			-	-
Average																					
Maximum value																					
Standard deviation																					

Summary statistics	*Average*	*Maximum value*	*Standard. deviation*

IEC 2291/08

Figure 3 – Test matrix for measurement method 1

5.2 Method 2

5.2.1

Randomly choose 15 patchcords and five adaptors for testing.

5.2.2

From these 15, choose five patchcords at random and label one plug on each patchcord (i.e. 1, 2, 3, 4, 5). These will be the "reference" plugs. Similarly, label the adaptors 1 to 5. Finally, label the remaining plugs sequentially from 1a through to 10b (i.e. 1a – 1b, 2a – 2b, 3a – 3b........10a –10b).