IEC 61300-3-4

Edition 4.0 2023-05
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –
Part 3-4: Examinations and measurements – Attenuation



IEC 61300-3-4:2023-05 RLV(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC 61300-3-4

Edition 4.0 2023-05
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –
Part 3-4: Examinations and measurements – Attenuation

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.20

ISBN 978-2-8322-7021-9

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms, definitions and abbreviated terms 7
3.1 Terms and definitions 7
3.2 Abbreviated terms 7
4 General description 7
4.1 General 7
4.2 Precautions 8
5 Apparatus 8
5.1 Launch conditions and light source (~~S~~LS) 8
5.2 Optical power meter (~~D~~PM) 9
5.3 Temporary joint (TJ) 10
5.4 Fibre 10
5.5 Reference plug (RP) 10
5.6 Reference adaptor (RA) 10
5.7 Termination 10
6 Procedure 11
6.1 Preconditioning 11
6.2 Visual inspection 11
6.3 DUT configuration types and test methods 11
6.4 Attenuation measurements with a ~~power meter~~ LSPM 13
6.4.1 General 13
6.4.2 Cutback method 13
6.4.3 Substitution method 13
6.4.4 Insertion method (A) 14
6.4.5 Insertion method (B) with direct coupling to power meter 15
6.4.6 Insertion method (C) with additional test patchcord 15
6.4.7 Insertion method (D) with additional test patchcord 16
6.5 Attenuation measurements with an OTDR 17
6.5.1 Measurement description 17
6.5.2 Bidirectional measurement 18
6.5.3 Measurement method 19
6.5.4 Evaluation procedure 19
7 Details to be specified and reported 20
Annex A (informative) Consideration of multicore fibre 21
A.1 General 21
A.2 Additional apparatus 21
A.2.1 Optical switch (OSW) 21
A.2.2 Fan-in/fan-out device (FIFO) 21
A.3 Test setup and procedure – LSPM 21
A.4 Test setup and procedure – OTDR 22
Bibliography 23

Figure 1 – Cutback method – Type 1, type 2 and type 3 DUT 13
Figure 2 – Substitution method – Type 4, type 7, and type 8 DUT 14

Figure 3 – Insertion method (~~C1~~A) – Type 2 DUT 15
Figure 4 – Insertion method (~~C2~~B) – Type 5 and type 6 DUT 15
Figure 5 – Insertion method (~~C3~~C) – Type 4, type 5, type 7 and type 8 DUT 16
Figure 6 – Insertion method (D) – Type 4, type 5, type 7 and type 8 DUT 16
Figure 7 – Method 1 – One launch section 17
Figure 8 – Method 2 – Two launch sections 18
Figure 9 – Non-reflective event evaluation 19
Figure 10 – Reflective event evaluation 20
Figure A.1 – FIFO device example 21
Figure A.2 – Insertion method B – Type 5 MCF DUT 22
Figure A.3 – Method 1 – One launch section MCF DUT 22

Table 1 – Preferred source conditions 9
Table 2 – Preferred power meter parameters 10
Table 3 – DUT configuration types 12

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 3-4: Examinations and measurements – Attenuation

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61300-3-4:2012. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 61300-3-4 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2012. This edition constitutes a technical revision.

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

a) addition of Clause 3 containing terms, definitions and abbreviated terms;
b) addition of a new LSPM measurement method, insertion method (D);
c) addition of Annex A describing attenuation measurement of multicore fibre;
d) changed reference test method to insertion C and alternative test method to substitution or insertion D for power meter and type 4 DUT.

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

Draft	Report on voting
86B/4656/FDIS	86B/4675/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all the parts in 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 document will remain unchanged until the stability date indicated on the IEC website under 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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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

Part 3-4: Examinations and measurements – Attenuation

1 Scope

This part of IEC 61300 describes the various methods available to measure the attenuation of optical components. ~~It is not, however, applicable to dense wavelength division multiplexing (DWDM) components, for which IEC 61300-3-29 should be used.~~ It is not, however, applicable to random mate attenuation measurements as described in IEC 61300-3-34 and IEC 61300-3-45 nor for attenuation measurements of dense wavelength division multiplexing (DWDM) devices as described in IEC 61300-3-29.

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 60793-2, *Optical fibres – Part 2: Product specifications – General*~~

IEC 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 61300-1~~:2011~~, *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 61300-3-35, *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 61755 (all parts), *Fibre optic interconnecting devices and passive components – Connector optical interfaces for single-mode fibres*

~~IEC/TR 62316, *Guidance for the interpretation of OTDR backscattering traces*~~

IEC 63267 (all parts), *Fibre optic interconnecting devices and passive components – Connector optical interfaces for enhanced macro bend loss multimode fibres*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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 Abbreviated terms

ATM	alternative test method
C	passive optical component
CWDM	coarse wavelength division multiplexing
D	optical detector
DUT	device under test
FIFO	fan-in/fan-out device
LED	light emitting diode
LS	optical light source
LSPM	optical light source and power meter
MCF	multicore fibre
OSW	optical switch
OTDR	optical time domain reflectometer
PDL	polarization dependent loss
PM	optical power meter
RA	reference adaptor
RP	reference plug
RTM	reference test method
SCF	single core fibre
TJ	temporary joint

4 General description

4.1 General

Attenuation is intended to give a value for the decrease of ~~useful~~ optical power, expressed in decibels, resulting from the insertion of a DUT, within ~~a length of optical fibre cable~~ an optical link. The term "insertion loss" is sometimes used in place of "attenuation".

The DUT may have more than two optical ports. However, since an attenuation measurement is made across only two ports, the DUT in this document shall be described as having two ports. ~~Eight different DUT configurations are described. The differences between these configurations are primarily in the terminations of the optical ports. Terminations may consist of bare fibre, a connector plug, or a receptacle.~~

~~The reference method for measuring attenuation is with an optical power meter. Optical time domain reflectometry (OTDR) measurements are presented as an alternative method. Three variations in the measurement of attenuation with a power meter are presented. The reference and alternative methods to be used for each DUT configuration are defined in Table 3. Different test configurations and methods will result in different accuracies of the attenuation being measured. In cases of dispute, the reference test method should be used.~~

The reference method for measuring attenuation is with an LSPM. OTDR measurements are presented as an alternative method. Three variations in the measurement of attenuation with a LSPM are presented.

4.2 Precautions

The power in the fibre and DUT shall not be at a level high enough to generate non-linear scattering or DUT overloading effects.

The position of the fibres in the test should be fixed between the measurement without the DUT, P_0, and with the DUT inserted, P_1, to avoid changes in attenuation due to bending loss.

In multimode measurements, a change in modal distribution in the measurement system due to fibre disturbance~~, will~~ can affect the attenuation measurement.

Components with PDL will show different attenuation depending on the input state of polarization from the source. If the component PDL can exceed the acceptable uncertainty in the attenuation measurement, then either an unpolarized or polarization scrambled source ~~can~~ should be used to measure the polarization averaged attenuation, or the methods of IEC 61300-3-2 should be used to measure PDL and attenuation together.

The laser safety recommendations in IEC 60825-1~~, Safety of laser products, should~~ shall be followed.

5 Apparatus

5.1 Launch conditions and light source (~~S~~LS)

The launch condition for LSPM and OTDR shall be ~~specified~~ in accordance with IEC 61300-1~~:2011~~ and shall be measured at the output of the launch reference connector.

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 from the initial value over the duration of the measurement. The stability of the multimode fibre source at 23 °C shall be ±0,05 dB from the initial value over the duration of the measurement. The source output power shall be greater than or equal to 20 dB above the minimum measurable power level.