

INTERNATIONAL STANDARD

**Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –
Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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 Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

**Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –
Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

CONTENTS

| | |
|---|----|
| FOREWORD..... | 4 |
| 1 Scope..... | 6 |
| 2 Normative references | 6 |
| 3 Abbreviations and acronyms..... | 6 |
| 4 General..... | 8 |
| 4.1 General description | 8 |
| 4.2 Spectral conditions..... | 9 |
| 4.3 Definition..... | 9 |
| 4.3.1 Attenuation..... | 9 |
| 4.3.2 Return loss..... | 10 |
| 4.4 Device under test..... | 10 |
| 4.5 Measurement methods | 11 |
| 4.5.1 Method A – Broadband light source (BBS)..... | 11 |
| 4.5.2 Method B – Tuneable narrowband light source (TLS)..... | 12 |
| 4.5.3 Method C – Set of multiple fixed narrowband light sources (NLS)..... | 12 |
| 4.5.4 Method D – Tuneable OTDR..... | 13 |
| 4.5.5 Reference method..... | 13 |
| 5 Apparatus..... | 13 |
| 5.1 Wavelength source..... | 13 |
| 5.1.1 Method A – Broadband light source | 13 |
| 5.1.2 Method B – Tuneable narrowband light source | 13 |
| 5.1.3 Method C – Set of N narrowband light sources | 14 |
| 5.1.4 Method D – Tuneable OTDR..... | 14 |
| 5.1.5 Depolarizer..... | 14 |
| 5.2 Detection system..... | 15 |
| 5.2.1 Method A, Method B.2 and Method C.2 tuneable narrowband detection spectrum | 15 |
| 5.2.2 Method B.1 and Method C.1 broadband detection spectrum | 15 |
| 5.3 Branching devices | 15 |
| 5.4 Termination | 16 |
| 6 Procedure | 16 |
| 6.1 Method A – broadband light source | 16 |
| 6.1.1 Attenuation-only | 16 |
| 6.1.2 Return-loss-only | 17 |
| 6.1.3 Attenuation and return loss..... | 18 |
| 6.2 Method B – Tuneable narrowband light source | 19 |
| 6.3 Method C – Set of multiple fixed narrowband light sources | 20 |
| 6.3.1 Attenuation-only | 20 |
| 6.3.2 Return-loss-only | 22 |
| 6.3.3 Attenuation and return loss..... | 23 |
| 6.4 Test results | 25 |
| 7 Details to be specified | 25 |
| 7.1 Source | 25 |
| 7.1.1 Broadband source | 25 |
| 7.1.2 Tuneable or discrete narrowband light source..... | 26 |
| 7.1.3 Depolarizer..... | 26 |

| | | |
|--|----------------------------------|----|
| 7.2 | Detection system..... | 26 |
| 7.2.1 | Optical power meter | 26 |
| 7.2.2 | Optical spectrum analyser | 26 |
| 7.3 | Reference branching device | 26 |
| 7.4 | Termination | 26 |
| Annex A (informative) Device under test configurations, terminations and product types | | 27 |
| Annex B (informative) Typical light source characteristics | | 29 |
| Figure 1 – Wavelength dependence of attenuation and return loss | | 10 |
| Figure 2 – Method A – Attenuation-only measurement | | 17 |
| Figure 3 – Method A – Return-loss-only measurement | | 18 |
| Figure 4 – Method A – Attenuation and return loss measurement..... | | 19 |
| Figure 5 – Method C – Attenuation-only measurement | | 21 |
| Figure 6 – Method C Return-loss-only measurement | | 22 |
| Figure 7 – Method C – Attenuation and return loss measurement | | 24 |
| Figure 8 – Wavelength dependent attenuation | | 25 |
| Table 1 – Test methods and characteristics | | 11 |
| Table 2 – Wavelength dependent attenuation and return loss | | 25 |
| Table A.1 – Device under test configurations/terminations | | 27 |
| Table A.2 – Possible types of passive optical components (POC) | | 27 |
| Table B.1 – Types of broadband light source (BBS) and main characteristics | | 29 |
| Table B.2 – Types of tuneable light source (TLS) and main characteristics | | 30 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES
AND PASSIVE COMPONENTS –
BASIC TEST AND MEASUREMENT PROCEDURES –****Part 3-7: Examinations and measurements –
Wavelength dependence of attenuation
and return loss of single mode components**

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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.

International Standard IEC 61300-3-7 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 2000. It constitutes a technical revision.

Changes from the previous edition of this standard are to reflect changes made to IEC 61300-1 and covers unidirectional and bi-directional methods of measurement.

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

| FDIS | Report on voting |
|---------------|------------------|
| 86B/2771/FDIS | 86B/2803/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

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

A bilingual version of this standard may be issued at a later date.

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

Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components

1 Scope

This part of IEC 61300-3 describes the various methods available to measure the wavelength dependence of attenuation $A(\lambda)$ and return loss $RL(\lambda)$, of single-mode passive optical components (POC) used in fibre-optic (FO) telecommunications. It is not, however, applicable to dense wavelength division multiplexing (DWDM) devices. Measurement methods of wavelength dependence of attenuation of DWDM devices are described in IEC 61300-3-29. Definition of WDM device types is given in IEC 62074-1.

Three measurement cases are herein considered:

- Measurement of $A(\lambda)$ only;
- Measurement of $RL(\lambda)$ only;
- Measurement of $A(\lambda)$ and $RL(\lambda)$ at the same time.

These measurements may be performed in one direction (unidirectional) or bi-directionally.

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 (including any amendments) applies.

IEC 61300-3-29, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-29: Examinations and measurements – Measurement techniques for characterising the amplitude of the spectral transfer function of DWDM components*

IEC 62074-1, *Fibre optic WDM devices – Part 1: Generic specification*

3 Abbreviations and acronyms

For the purposes of this document, the following abbreviations and acronyms apply:

| | |
|--------------|----------------------------------|
| A | attenuation |
| $A(\lambda)$ | wavelength dependent attenuation |
| ASE | amplified spontaneous emission |
| BBD | broadband detection |
| BBS | broadband source |