PD IEC/TR 62627-04:2012

BSI Standards Publication

Fibre optic interconnecting devices and passive components

Part 04: Example of uncertainty calculation: Measurement of the attenuation of an optical connector

bsi.

...making excellence a habit.™

Document Sharing Hub

Full document details: PD IEC/TR 62627-04:2012

National foreword

This Published Document is the UK implementation of IEC/TR 62627-04:2012.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/2, Fibre optic interconnecting devices and passive components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2012

Published by BSI Standards Limited 2012

ISBN 978 0 580 78241 1

ICS 33.180.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 August 2012.

Amendments issued since publication

Amd. No.	Date	Text affected

Documents
Document Sharing Hub

Full document details: PD IEC/TR 62627-04:2012

IEC/TR 62627-04

Edition 1.0 2012-07

TECHNICAL REPORT

Fibre optic interconnecting devices and passive components – Part 04: Example of uncertainty calculation: Measurement of the attenuation of an optical connector

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE S

ICS 33.180.20

ISBN 978-2-83220-212-8

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

® Registered trademark of the International Electrotechnical Commission

Documents
Document Sharing Hub

Full document details: PD IEC/TR 62627-04:2012

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Measurement of attenuation 6
3.1 General 6
3.2 Attenuation measurement for optical connectors 7
3.3 Insertion loss measurement using a reference connector 8
4 Uncertainty estimation 8
4.1 General 8
4.2 Uncertainty calculation 9
4.3 Evaluation of uncertainty 9
4.4 Combined and expanded uncertainty 12
Annex A (informative) Uncertainty of measurements 14
Annex B (informative) The uncertainty budget for attenuation measurements 17
Bibliography 21

Figure 1 – Schematic representation of an attenuation measurement 7
Figure 2 – Measurement of P_{in} 7
Figure 3 – Measurement of P_{out} 8

Table 1 – Evaluation of the uncertainty contribution due to the power meter for the measurement of the attenuation of an optical connection 10
Table 2 – Evaluation of uncertainty contribution due to the light source for the measurement of the attenuation of an optical connection 11
Table 3 – Evaluation of uncertainty contribution due to the device under test for the measurement of the attenuation of an optical connector against reference connector (u_{ref} included) 11
Table 4 – Evaluation of uncertainty contribution due to the device under test for the measurement of the attenuation of an optical connection (u_{ref} excluded) 12
Table 5 – Evaluation of uncertainty contribution for the measurement of the attenuation of an optical connector against reference connector (u_{ref} included in u_{DUT}) 12
Table 6 – Evaluation of uncertainty contribution for the measurement of the attenuation of an optical connection (u_{ref} excluded in u_{DUT}) 13
Table 7 – Expanded combined uncertainty 13

Documents
Document Sharing Hub
Full document details: PD IEC/TR 62627-04:2012

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

Part 04: Example of uncertainty calculation: Measurement of the attenuation of an optical connector

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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62627-04, which is a technical report, has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

AVA Documents
Document Sharing Hub

Full document details: PD IEC/TR 62627-04:2012

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86B/3374/DTR	86B/3427/RVC

Full information on the voting for the approval of this technical report 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 the parts in the IEC 62627 series, published under the general title *Fibre optic interconnecting devices and passive components* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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 publication may be issued at a later date.

Documents
Document Sharing Hub

Full document details: PD IEC/TR 62627-04:2012

INTRODUCTION

The IEC 61300-3 series is a library of measurement methods for fibre optic passive components.

These standards describe the necessary equipment and procedures to measure a specific quantity. The uncertainty budget of every measurement is a key parameter, which should be determined by applying dedicated statistical methods as extensively presented in reference documents like ISO/IEC Guide 98-3:2008.

This technical report shows a possible simple application of these methods for the determination of the measurement uncertainty of optical low loss connector attenuation measurements as defined in IEC 61300-3-4. A detailed analysis of the main uncertainty contributions for single and for repeated measurements is shown, and a full mathematical development of the uncertainty budget is given in Annex B. The difference in uncertainty estimation for the measurement of an optical connection compared to the measurement of an optical connector against a reference connector is also discussed.

The reference document for general uncertainty calculations is ISO/IEC Guide 98-3:2008 and this report does not intend to replace it, it only represents an example and should be used in combination with ISO/IEC Guide 98-3:2008. A brief introduction to the determination of a measurement uncertainty according to ISO/IEC Guide 98-3:2008is given in Annex A.

Uncertainty calculations should preferably be performed using a linear representation of the relevant quantities. In this document all calculations are performed using linear scales but results are also presented in logarithmic scale, since logarithmic units such as dB or dBm are in common use in fibre optics. This analysis assumes uncorrelated quantities, which is usually an acceptable assumption when considering simple attenuation measurements.

All numbers presented in this document are related to this particular example and should not be taken as standard values.

Documents
Document Sharing Hub

Full document details: PD IEC/TR 62627-04:2012

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

Part 04: Example of uncertainty calculation: Measurement of the attenuation of an optical connector

1 Scope

This Technical Report represents a selected example that concerns the measurement of the attenuation of passive optical components (IEC 61300-3-4), particularly focussed on insertion method B for low-loss optical connectors assembled on SM optical fibre (according to IEC 60793-2-50, Type B1.3).

2 Normative references

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

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

IEC 61300-3-4, *Fibre Optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61755-1, *Fibre optic connector optical interfaces – Part 1: Optical interfaces for single mode non-dispersion shifted fibres – General and guidance*

IEC 61755-3-9, *Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces – Part 3-9: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical PC ferrule for reference connector, single mode fibre*

IEC 61755-3-10, *Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces – Part 3-10: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical APC ferrule for reference connector, single mode fibre*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement- Part 3 Guide to the expression of uncertainty in measurement (GUM)*

3 Measurement of attenuation

3.1 General

Attenuation measurement is intended to give a value for the decrease of useful power, expressed in decibels, resulting from the insertion of a device under test (DUT), within a length of optical fibre cable as shown in Figure 1.

Documents
Document Sharing Hub
Full document details: PD IEC/TR 62627-04:2012