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

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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.

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- withdrawn,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.

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.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

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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)*