

REDLINE VERSION



**Fibre optic communication system design guidelines –
Part 14: Determination of the uncertainties of attenuation measurements in fibre
plants**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	2
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and abbreviated terms	9
3.1 Terms and definitions.....	9
3.2 Abbreviated terms.....	11
4 Overview of uncertainty	11
4.1 What is uncertainty?	11
4.2 Origin of uncertainties.....	12
4.3 What may not be considered as uncertainty?	12
5 Fibre cabling attenuation measurement	12
5.1 Measurement Test methods.....	12
5.2 Sources of uncertainty to be considered	12
5.2.1 Analysis.....	12
5.2.2 Uncertainties due to the environment.....	15
5.2.3 Uncertainties due to operator skills.....	15
5.2.4 Uncertainties due to measurement test methods.....	15
5.2.5 Uncertainties due to measuring instruments	15
5.2.6 Uncertainties due to the setup	17
5.2.7 Uncertainties due to cabling.....	17
6 Uncertainties estimation	18
6.1 Measurement model.....	18
6.2 Accumulation of uncertainties	20
7 General representation of the equation using sensitivity coefficients.....	20
8 Calculation	24
8.1 Combined standard uncertainty.....	24
8.2 Expanded uncertainty	24
8.3 Determination of the coverage factor k	24
8.3.1 General approach	24
8.3.2 Discussion.....	24
8.3.3 Typical values of degree of freedom	25
Annex A (normative informative) Mathematical basis	27
A.1 General.....	27
A.2 Type A evaluation of uncertainty	27
A.3 Type B evaluation of uncertainty	28
A.4 Determining the combined standard uncertainty.....	28
A.5 Reporting	29
Annex B (informative) Measurement Test methods	30
B.1 Measurement Test methods as per IEC 61280-4-1 and 61280-4-2	30
B.1.1 General	30
B.1.2 Measurement configuration.....	30
B.1.3 One-cord reference configuration	30
B.1.4 Two-cord reference configuration	31
B.1.5 Three-cord reference configuration	31

B.2	Measurement Test methods as per defined in methods defined in ISO/IEC 14763-3:2014	31
B.2.1	General	31
B.2.2	Channels	32
B.2.3	Links.....	33
Annex C	(normative informative) Uncertainties evaluation.....	34
C.1	Type A uncertainties	34
C.1.1	General	34
C.1.2	Evaluation of optical source instability and associated uncertainties	34
C.2	Type B uncertainties	34
C.2.1	General	34
C.2.2	Evaluation of the power meter noise	34
C.2.3	Elements to be considered for power meter stability analysis.....	35
C.2.4	Evaluation of the centre wavelength dependence	35
C.2.5	Spectral width dependence.....	37
C.2.6	Evaluation of the uncertainties due to MM launch conditions	37
C.2.7	Evaluation of the PDL.....	38
C.2.8	Uncertainty of absolute power measurement	39
Annex D	(normative informative) Typical values of uncertainties	40
Annex E	(informative) Linear to dB scale conversion of uncertainties.....	42
E.1	Definition of decibel	42
E.2	Conversion of relative uncertainties	42
Bibliography	43
Figure 1	– Fishbone analysis	14
Figure 2	– Measurement model.....	18
Figure B.1	– Measurement configuration.....	30
Figure B.2	– One-cord reference measurement.....	30
Figure B.3	– Two-cord reference measurement.....	31
Figure B.4	– Three-cord reference measurement	31
Figure B.5	– Measurement on channel.....	32
Figure B.6	– Channel reference measurement	32
Figure B.7	– Link measurement configuration	33
Figure B.8	– Link reference measurement.....	33
Figure C.1	– Typical spectral response of a fibre	36
Figure C.2	– Uncertainties due to the launch conditions for a given loss	38
Table 1	– Source of uncertainty (raw list).....	13
Table 2	– Uncertainties due to measuring instruments	16
Table 3	– Uncertainties due to the setup.....	17
Table 4	– Uncertainties due to cabling	17
Table 5	– Sensitivity coefficients for IEC 61280-4-1 and IEC 61280-4-2 methods.....	22
Table 6	– Sensitivity coefficients for ISO/IEC 14763-3:2014 methods.....	23
Table 7	– Values of k_{95} for different values of ν	25
Table 8	– Typical values of ν_i	26

Table C.1 – Spectral attenuation coefficients	36
Table C.2 – Sensitivity coefficients	37
Table D.1 – Typical values of uncertainties	40

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC COMMUNICATION SYSTEM DESIGN ~~GUIDES~~ GUIDELINES –

Part 14: Determination of the uncertainties of attenuation measurements in fibre plants

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.
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This Redline version is not an official Standard and is intended to provide the user with an indication of what changes have been made to the previous version. Only the IEC International Standard provided in this package is to be considered the official Standard.

This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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 61282-14, which is a Technical Report, has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This publication contains an attached file titled "Supplemental Data for Section 8" in the form of an Excel spread sheet. This file is intended to be used as a complement and does not form an integral part of the standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

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

- a) in the title: replacement of "guide" by "guidelines";
- b) text adaptation to allow both standard grade B and reference grade connectors for termination of test cords;
- c) addition of values needed for calculation of uncertainties, when standard grade connectors are used, to Annex D;
- d) correction of minor inconsistencies in Equation (18) and after.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
86C/1572/DTR	86C/1584/RVDTR

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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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INTRODUCTION

The determination of the uncertainty of every measurement is a key activity, which should be performed by applying dedicated methods as extensively presented in reference documents such as ISO/IEC Guide 98-3:2008, *Guide to the uncertainty of measurement (GUM)*.

This document shows a practical application of these methods for the determination of the measurement uncertainty of the attenuation of fibre optic cabling using optical light sources and power meters as defined in IEC 61280-4-1 and IEC 61280-4-2.

It includes the review of all contributing factors to uncertainty (such as launch conditions, spectral width, stability of source, power meter polarization, resolution, linearity, quality of test cord ~~reference connectors, etc.~~) to determine the overall measurement uncertainty. This part of IEC 61282 applies to the measurement of single mode or multimode fibres without restrictions to the fibre parameters, including mode field diameter, core diameter and numerical aperture. However, numerical values given in Clause C.2 and typical values given in Annex D are not valid for multimode fibres types A2, A3 and A4.

The list of uncertainties presented in this document is related to this particular application and should be reconsidered if measurement conditions are not compliant to measurement requirements defined by IEC 61280-4-1 and IEC 61280-4-2.

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

This document is associated with a calculation spreadsheet (Excel) containing practical calculations.

FIBRE OPTIC COMMUNICATION SYSTEM DESIGN **GUIDES** **GUIDELINES** –

Part 14: Determination of the uncertainties of attenuation measurements in fibre plants

1 Scope

This part of IEC 61282, which is a Technical Report, establishes the detailed analysis and calculation of the uncertainties related to the measurement of the attenuation of both multimode and single mode optical fibre cabling using optical light sources and power meters.

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 61280-4-1:2009, *Fibre-optic communication subsystem test procedures – Part 4-1: Installed cable plant – Multimode attenuation measurement*

IEC 61280-4-2:2014, *Fibre-optic communication subsystem test procedures – Part 4-2: Installed cable plant – Single-mode attenuation and optical return loss measurement*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement* (GUM:1995)

TECHNICAL REPORT



**Fibre optic communication system design guidelines –
Part 14: Determination of the uncertainties of attenuation measurements in fibre
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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	10
4 Overview of uncertainty	10
4.1 What is uncertainty?	10
4.2 Origin of uncertainties.....	11
4.3 What may not be considered as uncertainty?	11
5 Fibre cabling attenuation measurement	11
5.1 Test methods	11
5.2 Sources of uncertainty to be considered	11
5.2.1 Analysis.....	11
5.2.2 Uncertainties due to the environment.....	14
5.2.3 Uncertainties due to operator skills.....	14
5.2.4 Uncertainties due to test methods.....	14
5.2.5 Uncertainties due to measuring instruments	14
5.2.6 Uncertainties due to the setup	16
5.2.7 Uncertainties due to cabling.....	16
6 Uncertainties estimation	17
6.1 Measurement model.....	17
6.2 Accumulation of uncertainties	19
7 General representation of the equation using sensitivity coefficients.....	19
8 Calculation	23
8.1 Combined standard uncertainty.....	23
8.2 Expanded uncertainty	23
8.3 Determination of the coverage factor k	23
8.3.1 General approach	23
8.3.2 Discussion.....	23
8.3.3 Typical values of degree of freedom	24
Annex A (informative) Mathematical basis.....	25
A.1 General.....	25
A.2 Type A evaluation of uncertainty	25
A.3 Type B evaluation of uncertainty	25
A.4 Determining the combined standard uncertainty.....	26
A.5 Reporting	27
Annex B (informative) Test methods	28
B.1 Test methods as per IEC 61280-4-1 and 61280-4-2	28
B.1.1 General	28
B.1.2 Measurement configuration.....	28
B.1.3 One-cord reference configuration	28
B.1.4 Two-cord reference configuration	29
B.1.5 Three-cord reference configuration	29

B.2	Test methods defined in ISO/IEC 14763-3:2014.....	29
B.2.1	General	29
B.2.2	Channels	30
B.2.3	Links.....	31
Annex C (informative)	Uncertainties evaluation	32
C.1	Type A uncertainties	32
C.1.1	General	32
C.1.2	Evaluation of optical source instability and associated uncertainties	32
C.2	Type B uncertainties	32
C.2.1	General	32
C.2.2	Evaluation of the power meter noise	32
C.2.3	Elements to be considered for power meter stability analysis.....	33
C.2.4	Evaluation of the centre wavelength dependence	33
C.2.5	Spectral width dependence.....	35
C.2.6	Evaluation of the uncertainties due to MM launch conditions	35
C.2.7	Evaluation of the PDL	36
C.2.8	Uncertainty of absolute power measurement	37
Annex D (informative)	Typical values of uncertainties	38
Annex E (informative)	Linear to dB scale conversion of uncertainties.....	40
E.1	Definition of decibel	40
E.2	Conversion of relative uncertainties	40
Bibliography	41
Figure 1	– Fishbone analysis	13
Figure 2	– Measurement model.....	17
Figure B.1	– Measurement configuration.....	28
Figure B.2	– One-cord reference measurement.....	28
Figure B.3	– Two-cord reference measurement.....	29
Figure B.4	– Three-cord reference measurement	29
Figure B.5	– Measurement on channel.....	30
Figure B.6	– Channel reference measurement	30
Figure B.7	– Link measurement configuration	31
Figure B.8	– Link reference measurement.....	31
Figure C.1	– Typical spectral response of a fibre	34
Figure C.2	– Uncertainties due to the launch conditions for a given loss	36
Table 1	– Source of uncertainty (raw list).....	12
Table 2	– Uncertainties due to measuring instruments	15
Table 3	– Uncertainties due to the setup.....	16
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