

| | | |
|------------|---|--|
| STN | Skúšobné postupy pre optické vláknové komunikačné podsystémy. Časť 4-2: Inštalovaná zostava káblov. Meranie jednovidového tlmenia a jednovidových optických strát odrazom. | STN EN 61280-4-2 35 9270 |
|------------|---|--|

Fibre-optic communication subsystem test procedures - Part 4-2: Installed cable plant - Single-mode attenuation and optical return loss measurement

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 03/15

Obsahuje: EN 61280-4-2:2014, IEC 61280-4-2:2014

Oznámením tejto normy sa od 01.08.2017 ruší
STN EN 61280-4-2 (35 9270) z decembra 2000

120439

Úrad pre normalizáciu, metrológiu a skúšobníctvo SR, odbor SÚTN, 2015
Podľa zákona č. 264/1999 Z. z. v znení neskorších predpisov sa môžu slovenské technické normy rozmnožovať a rozširovať iba so súhlasom Úradu pre normalizáciu, metrológiu a skúšobníctvo SR.

English Version

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

Procédures d'essai des sous-systèmes de
télécommunication à fibres optiques - Partie 4-2:
Installations câblées - Mesure de l'affaiblissement de
réflexion optique et de l'affaiblissement des fibres
unimodales
(CEI 61280-4-2:2014)

Prüfverfahren für Lichtwellenleiter-
Kommunikationsuntersysteme - Teil 4-2: Installierte
Kabelanlagen - Einmoden-Dämpfungs- und optische
Rückflussdämpfungsmessung
(IEC 61280-4-2:2014)

This European Standard was approved by CENELEC on 2014-08-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 86C/1238/FDIS, future edition 2 of IEC 61280-4-2, prepared by SC 86C, "Fibre optic systems and active devices", of IEC TC 86, "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61280-4-2:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-05-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-08-01

This document supersedes EN 61280-4-2:1999.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61280-4-2:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

| | | |
|----------------|------|--|
| IEC 60793-1-40 | NOTE | Harmonized as EN 60793-1-40. |
| IEC 60793-2 | NOTE | Harmonized as EN 60793-2. |
| IEC 61280-1-3 | NOTE | Harmonized as EN 61280-1-3. |
| IEC 61753-1 | NOTE | Harmonized as EN 61753-1. |
| IEC 61755-2-1 | NOTE | Harmonized as EN 61755-2-1. |
| IEC 61755-2-2 | NOTE | Harmonized as EN 61755-2-2. |
| IEC 61755-2-4 | NOTE | Harmonized as EN 61755-2-4 ¹⁾ . |
| IEC 61755-2-5 | NOTE | Harmonized as EN 61755-2-5 ¹⁾ . |

¹⁾ To be published.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

| <u>Publication</u> | <u>Year</u> | <u>Title</u> | <u>EN/HD</u> | <u>Year</u> |
|--------------------|-------------|--|---------------|-------------|
| IEC 60793-2-50 | - | Optical fibres -- Part 2-50: Product specifications - Sectional specification for class B single-mode fibres | EN 60793-2-50 | - |
| IEC 60825-2 | - | Safety of laser products -- Part 2: Safety of optical fibre communication systems (OFCS) | EN 60825-2 | - |
| IEC 60874-14-2 | - | Connectors for optical fibres and cables - Part 14-2: Detail specification for fibre optic connector type SC-PC tuned terminated to single-mode fibre type B1 | - | - |
| IEC 61300-3-6 | - | Fibre optic interconnecting devices and passive components - Basic test and measurement procedures -- Part 3-6: Examinations and measurements - Return loss | EN 61300-3-6 | - |
| 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 | EN 61300-3-35 | - |
| IEC 61315 | - | Calibration of fibre-optic power meters | EN 61315 | - |
| IEC 61746-1 | 2009 | Calibration of Optical Time-Domain Reflectometers (OTDR) -- Part 1: OTDR for single-mode fibres | EN 61746-1 | 2011 |
| IEC/TR 62627-01 | - | Fibre optic interconnecting devices and passive components - Part 01: Fibre optic connector cleaning methods | - | - |



INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Procédures d'essai des sous-systèmes de télécommunication à
fibres optiques –
Partie 4-2: Installations câblées – Mesure de l'affaiblissement de réflexion
optique et de l'affaiblissement des fibres unimodales**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2014 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
 3, rue de Varembe
 CH-1211 Geneva 20
 Switzerland

Tel.: +41 22 919 02 11
 Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Procédures d'essai des sous-systèmes de télécommunication à
fibres optiques –
Partie 4-2: Installations câblées – Mesure de l'affaiblissement de réflexion
optique et de l'affaiblissement des fibres unimodales**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XC**
CODE PRIX

ICS 33.180.01

ISBN 978-2-8322-1665-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

| | |
|---|----|
| FOREWORD..... | 7 |
| INTRODUCTION..... | 9 |
| 1 Scope..... | 10 |
| 2 Normative references | 10 |
| 3 Terms, definitions, graphical symbols and abbreviations..... | 11 |
| 3.1 Terms and definitions..... | 11 |
| 3.2 Graphical symbols | 13 |
| 3.3 Abbreviations | 14 |
| 4 Measurement methods | 15 |
| 4.1 General..... | 15 |
| 4.2 Cabling configurations and applicable test methods | 16 |
| 4.2.1 Cabling configurations and applicable test methods for attenuation measurements..... | 16 |
| 4.2.2 Cabling configurations and applicable test methods for optical return loss measurements..... | 18 |
| 4.3 Overview of uncertainties | 18 |
| 4.3.1 General | 18 |
| 4.3.2 Test cords | 18 |
| 4.3.3 Reflections from other interfaces | 18 |
| 4.3.4 Optical source | 18 |
| 4.3.5 Output power reference | 19 |
| 4.3.6 Received power reference | 19 |
| 4.3.7 Mode field diameter variation..... | 19 |
| 4.3.8 Bi-directional measurements..... | 19 |
| 5 Apparatus..... | 19 |
| 5.1 General..... | 19 |
| 5.2 Light source | 19 |
| 5.2.1 Stability | 19 |
| 5.2.2 Spectral characteristics | 20 |
| 5.2.3 Launch cord..... | 20 |
| 5.3 Receive or tail cord..... | 20 |
| 5.4 Substitution cord..... | 21 |
| 5.5 Power meter – LSPM methods only..... | 21 |
| 5.6 OTDR apparatus..... | 21 |
| 5.7 Return loss test set..... | 22 |
| 5.8 Connector end-face cleaning and inspection equipment..... | 22 |
| 5.9 Adapters | 22 |
| 6 Procedures..... | 22 |
| 6.1 General..... | 22 |
| 6.2 Common procedures..... | 23 |
| 6.2.1 Care of the test cords | 23 |
| 6.2.2 Make reference measurements (LSPM and OCWR methods only) | 23 |
| 6.2.3 Inspect and clean the ends of the fibres in the cabling | 23 |
| 6.2.4 Make the measurements..... | 23 |
| 6.2.5 Make the calculations | 23 |
| 6.3 Calibration | 23 |

| | | |
|---------|--|----|
| 6.4 | Safety | 24 |
| 7 | Calculations..... | 24 |
| 8 | Documentation | 24 |
| 8.1 | Information for each test | 24 |
| 8.2 | Information to be made available | 24 |
| Annex A | (normative) One-cord reference method..... | 25 |
| A.1 | Applicability of test method | 25 |
| A.2 | Apparatus | 25 |
| A.3 | Procedure | 25 |
| A.4 | Calculation..... | 26 |
| A.5 | Components of reported attenuation | 26 |
| Annex B | (normative) Three-cord reference method | 27 |
| B.1 | Applicability of test method | 27 |
| B.2 | Apparatus | 27 |
| B.3 | Procedure | 27 |
| B.4 | Calculations | 28 |
| B.5 | Components of reported attenuation | 28 |
| Annex C | (normative) Two-cord reference method | 29 |
| C.1 | Applicability of test method | 29 |
| C.2 | Apparatus | 29 |
| C.3 | Procedure | 29 |
| C.4 | Calculations | 31 |
| C.5 | Components of reported attenuation | 31 |
| Annex D | (normative) Optical time domain reflectometer..... | 32 |
| D.1 | Applicability of test method | 32 |
| D.2 | Apparatus | 32 |
| D.2.1 | General | 32 |
| D.2.2 | OTDR | 32 |
| D.2.3 | Test cords | 32 |
| D.3 | Procedure (test method) | 33 |
| D.4 | Calculation of attenuation | 34 |
| D.4.1 | General | 34 |
| D.4.2 | Connection location | 34 |
| D.4.3 | Definition of the power levels F_1 and F_2 | 35 |
| D.4.4 | Alternative calculation..... | 36 |
| D.5 | Calculation of optical return loss | 37 |
| D.6 | Calculation of reflectance for discrete components | 39 |
| D.7 | OTDR uncertainties | 40 |
| Annex E | (normative) Continuous wave optical return loss measurement – Method A | 41 |
| E.1 | Applicability of test method | 41 |
| E.2 | Apparatus | 41 |
| E.2.1 | General | 41 |
| E.2.2 | Light source..... | 41 |
| E.2.3 | Branching device or coupler | 41 |
| E.2.4 | Power meters | 42 |
| E.2.5 | Connector interface | 42 |
| E.2.6 | Low reflection termination..... | 42 |
| E.3 | Procedure | 42 |

| | | |
|-----------------------|--|----|
| E.3.1 | Test set characterization..... | 42 |
| E.3.2 | Measurement procedure..... | 44 |
| E.3.3 | Calculations..... | 44 |
| E.3.4 | Measurement uncertainty..... | 45 |
| Annex F (normative) | Continuous wave optical return loss measurement – Method B..... | 46 |
| F.1 | Applicability of test method..... | 46 |
| F.2 | Apparatus..... | 46 |
| F.2.1 | General requirements..... | 46 |
| F.2.2 | Known reflectance termination..... | 46 |
| F.3 | Procedure..... | 46 |
| F.3.1 | Set-up characterization..... | 46 |
| F.3.2 | Measurement procedure..... | 47 |
| F.3.3 | Calculation..... | 48 |
| F.3.4 | Measurement uncertainty..... | 48 |
| Annex G (informative) | Measurement uncertainty examples..... | 49 |
| G.1 | Reduction of uncertainty by using reference grade terminations and related issues..... | 49 |
| G.1.1 | Motivations for using reference grade terminations on test cords..... | 49 |
| G.1.2 | Adjusting acceptance limits to allow for different expected losses when using reference grade and standard grade connectors..... | 49 |
| G.2 | Estimation of the measurement uncertainties..... | 51 |
| G.2.1 | Measurement uncertainty..... | 51 |
| G.2.2 | Uncertainty due to the instrument..... | 51 |
| G.2.3 | Uncertainty due to the source..... | 51 |
| G.2.4 | Uncertainty due to the device under test..... | 52 |
| G.2.5 | Example of uncertainty accumulation using a single power meter..... | 53 |
| G.2.6 | Example of uncertainty accumulation using two power meters..... | 54 |
| Annex H (informative) | OTDR configuration information..... | 55 |
| H.1 | Introductory remarks..... | 55 |
| H.2 | Fundamental parameters that define the operational capability of an OTDR..... | 56 |
| H.2.1 | Dynamic range..... | 56 |
| H.2.2 | Pulse width..... | 56 |
| H.2.3 | Averaging time..... | 56 |
| H.2.4 | Dead zone..... | 56 |
| H.3 | Other parameters..... | 56 |
| H.3.1 | Index of refraction..... | 56 |
| H.3.2 | Measurement range..... | 57 |
| H.3.3 | Distance sampling..... | 57 |
| H.4 | Other measurement configurations..... | 57 |
| H.4.1 | General..... | 57 |
| H.4.2 | Macro bend attenuation measurement..... | 57 |
| H.4.3 | Splice attenuation measurement..... | 58 |
| H.4.4 | Measurement with high reflection connectors or short length cabling..... | 58 |
| H.4.5 | Ghost..... | 60 |
| H.5 | More on the measurement method..... | 61 |
| H.6 | Bidirectional measurement..... | 62 |
| H.7 | OTDR bi-directional trace analysis..... | 63 |
| H.8 | Non recommended practices..... | 64 |
| H.8.1 | Measurement without tail cord..... | 64 |

| | | |
|-----------------------|---|----|
| H.8.2 | Cursor measurement | 64 |
| Annex I (informative) | Test cord attenuation verification | 65 |
| I.1 | Introductory remarks | 65 |
| I.2 | Apparatus | 65 |
| I.3 | Procedure | 65 |
| I.3.1 | General | 65 |
| I.3.2 | Test cord verification for the one-cord and two-cord reference test methods when using non-pinned/unpinned and non-plug/socket style connectors | 66 |
| I.3.3 | Test cord verification for the one-cord and two-cord reference test methods using pinned/unpinned or plug/socket style connectors | 67 |
| I.3.4 | Test cord verification for the three-cord reference test method using non-pinned/unpinned and non-plug/socket style connectors | 68 |
| I.3.5 | Test cord verification for the three-cord reference test method using pinned/unpinned or plug/socket style connectors | 70 |
| Annex J (informative) | Spectral attenuation measurement | 72 |
| J.1 | Applicability of test method | 72 |
| J.2 | Apparatus | 72 |
| J.2.1 | Broadband light source | 72 |
| J.2.2 | Optical spectrum analyser | 72 |
| J.3 | Procedure | 72 |
| J.3.1 | Reference scan | 72 |
| J.3.2 | Measurement scan | 73 |
| J.4 | Calculations | 73 |
| Bibliography | | 74 |
| Figure 1 | – Connector symbols | 13 |
| Figure 2 | – Symbol for cabling under test | 14 |
| Figure 3 | – Configuration A – Start and end of measured losses in reference test method | 16 |
| Figure 4 | – Configuration B – Start and end of measured losses in reference test method | 17 |
| Figure 5 | – Configuration C – Start and end of measured losses in reference test method | 17 |
| Figure 6 | – Typical OTDR schematic | 21 |
| Figure 7 | – Return loss test set illustration | 22 |
| Figure A.1 | – One-cord reference measurement | 26 |
| Figure A.2 | – One-cord test measurement | 26 |
| Figure B.1 | – Three-cord reference measurement | 27 |
| Figure B.2 | – Three-cord test measurement | 28 |
| Figure C.1 | – Two-cord reference measurement | 30 |
| Figure C.2 | – Two-cord test measurement | 30 |
| Figure C.3 | – Two-cord test measurement for plug-socket style connectors | 30 |
| Figure D.1 | – Test measurement for method D | 34 |
| Figure D.2 | – Location of the cabling under test ports | 35 |
| Figure D.3 | – Graphic construction of F_1 and F_2 | 36 |
| Figure D.4 | – Graphic construction of F_1 , F_{11} , F_{21} and F_2 | 37 |

| | |
|--|----|
| Figure D.5 – Graphic representation of OTDR ORL measurement..... | 38 |
| Figure D.6 – Graphic representation of reflectance measurement | 39 |
| Figure E.1 – Return loss test set illustration..... | 41 |
| Figure E.2 – Measurement of the system internal attenuation P_{ref2} | 43 |
| Figure E.3 – Measurement of the system internal attenuation P_{ref1} | 43 |
| Figure E.4 – Measurement of the system reflected power P_{rs} | 43 |
| Figure E.5 – Measurement of the input power P_{in} | 44 |
| Figure E.6 – Measurement of the reflected power | 44 |
| Figure F.1 – Return loss test set illustration | 46 |
| Figure F.2 – Measurement of P_{rs} with reflections suppressed | 47 |
| Figure F.3 – Measurement of P_{ref} with reference reflector | 47 |
| Figure F.4 – Measurement of the system reflected power P_{rs} | 47 |
| Figure F.5 – Measurement of the reflected power | 48 |
| Figure H.1 – Splice and macro bend attenuation measurement..... | 58 |
| Figure H.2 – Attenuation measurement with high reflection connectors | 59 |
| Figure H.3 – Attenuation measurement of a short length cabling..... | 60 |
| Figure H.4 – OTDR trace with ghost..... | 61 |
| Figure H.5 – Cursor positioning..... | 62 |
| Figure H.6 – Bidirectional OTDR trace display | 63 |
| Figure H.7 – Bi-directional OTDR trace loss analysis | 63 |
| Figure I.1 – Obtaining reference power level P_0 | 66 |
| Figure I.2 – Obtaining power level P_1 | 67 |
| Figure I.3 – Obtaining reference power level P_0 | 67 |
| Figure I.4 – Obtaining power level P_1 | 67 |
| Figure I.5 – Obtaining reference power level P_0 | 68 |
| Figure I.6 – Obtaining power level..... | 68 |
| Figure I.7 – Obtaining reference power level P_0 | 69 |
| Figure I.8 – Obtaining power level P_1 | 69 |
| Figure I.9 – Obtaining power level P_6 | 70 |
| Figure I.10 – Obtaining reference power level P_0 | 70 |
| Figure I.11 – Obtaining power level P_1 | 71 |
| Figure J.1 – Result of spectral attenuation measurement | 73 |
| Table 1 – Cabling configurations..... | 16 |
| Table 2 – Test methods and configurations..... | 17 |
| Table D.1 – Typical launch and tail cord lengths | 33 |
| Table G.1 – Expected loss for examples (see NOTE 1)..... | 49 |
| Table G.2 – Example of uncertainty accumulation using a single power meter | 53 |
| Table G.3 – Example of uncertainty accumulation using two power meters | 54 |
| Table H.1 – Example of effective group index of refraction values..... | 57 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –**Part 4-2: Installed cable plant –
Single-mode attenuation and optical return loss measurement**

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.

International Standard IEC 61280-4-2 has been prepared by subcommittee SC86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition, published in 1999, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- revision of optical time-domain reflectometer (OTDR) measurements;
- addition of optical return loss (ORL) measurements;
- addition of informative annexes on measurement uncertainties, OTDR configuration, test cord attenuation verification and spectral attenuation measurement.

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

| FDIS | Report on voting |
|---------------|------------------|
| 86C/1238/FDIS | 86C/1261/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 in the IEC 61280 series, published under the general title *Fibre-optic communication subsystem test procedures*, 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

INTRODUCTION

This second edition of IEC 61280-4-2 for testing single-mode cable plant follows on from the second edition of IEC 61280-4-1, dealing with multimode cable plants.

Cabling design standards such as ISO/IEC 11801 for commercial premises, ISO/IEC 24702 for industrial premises, ISO/IEC 24764 for data centres and ISO/IEC 15018 for residential cabling contain specifications for this type of cabling. These standards support cabling lengths of up to 2 km for commercial premises and data centres and up to 10 km for industrial premises. ISO/IEC 14763-3, which supports these design standards, makes reference to the test methods of this standard.

Various recommendations from ITU-T have requirements for longer distance applications including short haul (40 km), long haul (80 km) and ultra long haul (160 km). The testing of cable plant for these is covered in ITU-T Recommendation G.650.3, which makes reference to the test methods of this standard.

FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 4-2: Installed cable plant – Single-mode attenuation and optical return loss measurement

1 Scope

This part of IEC 61280 is applicable to the measurement of attenuation and optical return loss of installed optical fibre cable plant using single-mode fibre. This cable plant can include single-mode optical fibres, connectors, adapters, splices and other passive devices. The cabling may be installed in a variety of environments including residential, commercial, industrial and data centre premises, as well as outside plant environments.

This standard may be applied to all single-mode fibre types including those designated by IEC 60793-2-50 as Class B fibres.

The principles of this standard may be applied to cable plants containing branching devices (splitters) and at specific wavelength ranges in situations where passive wavelength selective components are deployed, such as WDMs, CWDM and DWDM devices.

This standard is not intended to apply to cable plant that includes active devices such as fibre amplifiers or dynamic channel equalizers.

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 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 60874-14-2, *Connectors for optical fibres and cables – Part 14-2: Detail specification for fibre optic connector type SC-PC tuned terminated to single-mode fibre type B1*

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Fibre optic cylindrical connector endface visual inspection*

IEC 61315, *Calibration of fibre-optic power meters*

IEC 61746-1:2009, *Calibration of optical time-domain reflectometers (OTDR) – Part 1: OTDR for single-mode fibres*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN