

This is a preview of "IEC 61280-4-1 Ed. 2....". Click here to purchase the full version from the ANSI store.



Edition 2.0 2009-06

INTERNATIONAL STANDARD

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XB**

ICS 33.180.01

ISBN 978-2-88910-478-9

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms, definitions, graphical symbols and acronyms	8
3.1 Terms and definitions	8
3.2 Graphical symbols.....	9
3.3 Acronyms	11
4 Measurement methods	11
4.1 General.....	11
4.2 Cabling configurations and applicable test methods	12
4.3 Overview of uncertainties	12
4.3.1 General	12
4.3.2 Test cords	13
4.3.3 Launch conditions at the connection to the cabling under test	13
4.3.4 Optical source	13
4.3.5 Output power reference	13
4.3.6 Received power reference	14
5 Apparatus.....	14
5.1 General.....	14
5.2 Light source	14
5.2.1 Stability	14
5.2.2 Spectral characteristics	14
5.2.3 Launch cord	14
5.3 Receive or tail cord	15
5.4 Substitution/dummy cord	15
5.5 Power meter – LSPM methods only.....	15
5.6 OTDR apparatus	15
5.7 Connector end-face cleaning and inspection equipment	16
5.8 Adapters	16
6 Procedures.....	16
6.1 General.....	16
6.2 Common procedures	17
6.2.1 Care of the test cords	17
6.2.2 Make reference measurements (LSPM methods only)	17
6.2.3 Inspect and clean the ends of the fibres in the cabling.....	17
6.2.4 Make the measurements.....	17
6.2.5 Make the calculations	17
6.3 Calibration.....	17
6.4 Safety	17
7 Calculations	17
8 Documentation	18
8.1 Information for each test.....	18
8.2 Information to be available	18
Annex A (normative) One-cord reference method.....	19
Annex B (normative) Three-cord reference method	21

Annex C (normative) Two-cord reference method	23
Annex D (normative) Optical time domain reflectometer	26
Annex E (normative) Requirements for the source characteristics for multimode measurement.....	32
Annex F (informative) Measurement uncertainty examples.....	35
Annex G (informative) OTDR configuration information	44
Annex H (informative) Test cord insertion loss verification	53
Bibliography.....	61
Figure 1a – Socket and plug assembly.....	10
Figure 1b – Connector set (plug, adapter, plug)	10
Figure 1c – Light source	10
Figure 1d – Power meter.....	10
Figure 1 – Connector symbols	10
Figure 2 – Symbol for cabling under test.....	10
Figure 3 – OTDR schematic.....	16
Figure A.1 – Reference measurement.....	20
Figure A.2 – Test measurement	20
Figure B.1 – Reference measurement.....	22
Figure B.2 – Test measurement	22
Figure C.1 – Reference measurement.....	24
Figure C.2 – Test measurement.....	24
Figure C.3 – Test measurement for plug-socket style connectors.....	24
Figure D.1 – Test measurement for Method D.....	27
Figure D.2 – Location of the cabling under test ports	28
Figure D.3 – Graphic construction of F_1 and F_2	29
Figure D.4 – Graphic construction of F_1 , F_{11} , F_{12} and F_2	30
Figure E.1 – Encircled flux template example.....	33
Figure F.1 – Initial power measurement	37
Figure F.2 – Verification of reference grade connection	38
Figure F.3 – Two offset splices	38
Figure F.4 – Five offset splices	38
Figure F.5 – EF centred	40
Figure F.6 – EF underfilling.....	40
Figure F.7 – EF overfilling.....	41
Figure F.8 – L1 loss with mandrel	41
Figure F.9 – L1 loss with mandrel and mode conditioner.....	42
Figure F.10 – L2 loss (adjusted) with mandrel.....	42
Figure F.11 – L2 loss (adjusted) with mandrel and mode conditioning.....	42
Figure F.12 – L3 loss (adjusted) with mandrel.....	43
Figure F.13 – L3 loss (adjusted) with mandrel and mode conditioning.....	43
Figure G.1 – Splice and macro bend attenuation measurement.....	47
Figure G.2 – Attenuation measurement with high reflection connectors.....	48

Figure G.3 – Attenuation measurement of a short length cabling.....	49
Figure G.4 – OTDR trace with ghost	50
Figure G.5 – Cursors positioning.....	51
Figure H.1 – Obtaining reference power level P_0	54
Figure H.2 – Obtaining power level P_1	55
Figure H.3 – Obtaining reference power level P_0	56
Figure H.4 – Obtaining power level P_1	56
Figure H.5 – Obtaining reference power level P_0	57
Figure H.6 – Obtaining power level	57
Figure H.7 – Obtaining reference power level P_0	58
Figure H.8 – Obtaining power level P_1	58
Figure H.9 – Obtaining power level P_5	58
Figure H.10 – Obtaining reference power level P_0	59
Figure H.11 – Obtaining power level P_1	59
Table 1 – Cabling configurations.....	12
Table 2 – Test methods and configurations.....	12
Table 3 – Spectral requirements	14
Table E.1 – Threshold tolerance	33
Table E.2 – EF requirements for 50 μm core fibre cabling at 850 nm	34
Table E.3 – EF requirements for 50 μm core fibre cabling at 1 300 nm	34
Table E.4 – EF requirements for 62,5 μm core fibre cabling at 850 nm	34
Table E.5 – EF requirements for 62,5 μm core fibre cabling at 1 300 nm.....	34
Table F.1 – Expected loss for examples (note 1).....	35
Table G.1 – Default effective group index of refraction values.....	46

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 4-1: Installed cable plant – Multimode attenuation 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 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 61280-4-1 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition, published in 2003, and constitutes a technical revision.

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

- An additional measurement method based on optical time domain reflectometry (OTDR) is documented, with guidance on best practice in using the OTDR and interpreting OTDR traces.
- The requirement for the sources used to measure multimode fibres is changed from one based on coupled power ratio (CPR) and mandrel requirement to one based on measurements of the near field at the output of the launching test cord.

This is a preview of "IEC 61280-4-1 Ed. 2...". [Click here to purchase the full version from the ANSI store.](#)

- Highlighting the importance of, and giving guidance on, good measurement practices including cleaning and inspection of connector end faces.

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

FDIS	Report on voting
86C/879/FDIS	86C/892/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 the parts in the IEC 61280 series, under the general title *Fibre-optic communication subsystem test procedure*, can be found on the IEC website.

For the Part 4, the new subtitle will be *Installed cable plant*. Subtitles of existing standards in this series will be updated at the time of the next edition.

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 publication may be issued at a later date.

FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 4-1: Installed cable plant – Multimode attenuation measurement

1 Scope

This part of IEC 61280-4 is applicable to the measurement of attenuation of installed fibre-optic cabling using multimode fibre, typically in lengths of up to 2 000 m. This cabling can include multimode fibres, connectors, adapters and splices.

Cabling design standards such as ISO/IEC 11801, ISO/IEC 24702 and ISO/IEC 24764 contain specifications for this type of cabling. ISO/IEC 14763-3, which supports these design standards, makes reference to the test methods of this standard.

In this standard, the fibre types that are addressed include category A1a (50/125 μm) and A1b (62,5/125 μm) multimode fibres, as specified in IEC 60793-2-10. The attenuation measurements of the other multimode categories can be made, using the approaches of this standard, but the source conditions for the other categories have not been defined.

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 document (including any amendments) applies.

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

IEC 61280-1-3, *Fibre optic communication subsystem basic test procedures – Part 1-3: Test procedures for general communication subsystems – Central wavelength and spectral width measurement*

IEC 61280-1-4, *Fibre optic communication subsystem test procedures – Part 1-4: General communication subsystems – Light source encircled flux measurement method¹*

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 61745, *End-face image analysis procedure for the calibration of optical fibre geometry test sets*

IEC 61746, *Calibration of optical time-domain reflectometers (OTDRs)*

¹ A new edition is in preparation.