

This is a preview - click here to buy the full publication



ISO/IEC 14763-3

Edition 2.0 2014-06

# INTERNATIONAL STANDARD



---

**Information technology – Implementation and operation of customer premises cabling –  
Part 3: Testing of optical fibre cabling**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE

**G**

ICS 35.200

ISBN 978-2-8322-1631-6

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

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references .....	9
3 Terms, definitions and abbreviations .....	10
3.1 Terms and definitions.....	10
3.2 Abbreviations.....	13
3.3 Symbols.....	13
4 Conformance.....	14
5 General requirements .....	14
5.1 Test system .....	14
5.2 Reference measurement and calibration .....	15
5.3 Environmental conditions .....	15
5.3.1 Protection of transmission and terminal equipment .....	15
5.3.2 Inspecting and cleaning connectors .....	15
5.3.3 Use of test equipment.....	15
5.3.4 Relevance of measurement .....	16
5.3.5 Treatment of marginal test results.....	16
5.4 Documentation.....	16
6 Test equipment.....	16
6.1 Light source and power meter .....	16
6.1.1 General .....	16
6.1.2 Light sources .....	16
6.1.3 Power meters .....	17
6.1.4 Test system stability (ffs).....	17
6.2 OTDR .....	17
6.2.1 General .....	17
6.2.2 OTDR characterization using a launch test cord and a tail test cord.....	18
6.3 Test cords and adapters .....	18
6.3.1 Connecting hardware at test interfaces .....	18
6.3.2 Reference connector requirements .....	19
6.3.3 Test cords .....	20
6.4 MMF launched modal distribution.....	22
6.5 SMF launch condition.....	22
7 Inspection equipment.....	22
8 Cabling under test – Channels and permanent links .....	23
8.1 General.....	23
8.2 Reference planes.....	23
8.3 Wavelength of measurement.....	24
8.4 Direction of measurement .....	24
9 Testing of installed cabling .....	25
9.1 Attenuation .....	25
9.1.1 LSPM .....	25
9.1.2 OTDR.....	29

9.2	Propagation delay .....	31
9.2.1	Test method .....	31
9.2.2	Treatment of results .....	32
9.3	Length .....	32
9.3.1	Test method .....	32
9.3.2	Measurement uncertainty .....	32
9.3.3	Treatment of results .....	32
10	Testing of cabling components within installed cabling .....	33
10.1	Attenuation of optical fibre cable .....	33
10.1.1	Test method .....	33
10.1.2	Measurement uncertainty .....	33
10.1.3	Treatment of results .....	33
10.2	Attenuation of local and remote test interfaces .....	34
10.2.1	Test method .....	34
10.2.2	Test system measurement uncertainty .....	34
10.2.3	Treatment of results .....	35
10.3	Attenuation of connecting hardware .....	36
10.3.1	Test method .....	36
10.3.2	Treatment of results .....	36
10.4	Return loss of connecting hardware .....	37
10.4.1	Test method (in accordance with IEC 61300-3-6, method 2) .....	37
10.4.2	Treatment of results .....	38
10.4.3	Measurement uncertainty .....	39
10.5	Optical fibre length .....	39
10.5.1	Test method .....	39
10.5.2	Measurement uncertainty .....	41
10.5.3	Treatment of results .....	41
10.6	Attenuation of cords .....	41
10.6.1	Test method .....	41
10.6.2	Treatment of results .....	42
11	Inspection of cabling and cabling components .....	42
11.1	Optical fibre continuity .....	42
11.2	Cabling polarity .....	42
11.3	Optical fibre cable length .....	42
11.4	Inspection of optical fibre end faces .....	43
11.5	Optical fibre core size .....	43
Annex A (normative) Launch modal conditions for testing multimode optical fibre cabling .....		44
Annex B (normative) Visual inspection criteria for connectors .....		45
Annex C (informative) Optical time domain reflectometry .....		46
C.1	Operational capability .....	46
C.1.1	Effective characterization .....	46
C.1.2	Dynamic range .....	46
C.1.3	Pulse width .....	46
C.1.4	Integration or sample count .....	46
C.2	Limitations of OTDR capability .....	47
C.2.1	Minimum lengths of operation – Attenuation dead zone .....	47
C.2.2	Ghosting .....	48

C.2.3	Effective group index of refraction .....	49
C.2.4	Backscattering coefficient .....	49
Annex D (normative)	Inspection and testing of test and substitution test cords .....	50
D.1	General requirements .....	50
D.2	Attenuation (test and substitution test cord reference connections) .....	50
Annex E (informative)	Enhanced three-test-cord and one-test-cord reference methods for link and channel attenuation .....	52
E.1	Reference methods for link attenuation .....	52
E.2	One-test-cord reference method for link attenuation .....	52
E.3	Test method for channel attenuation .....	52
Annex F (informative)	Quality planning .....	53
F.1	Inspection and test schedules .....	53
F.2	Stage 1 inspection and testing .....	53
F.3	Stage 2 testing .....	53
F.3.1	Basic test group .....	53
F.3.2	Extended test group .....	54
Annex G (informative)	Examples of calculations of channel and permanent link limits .....	55
G.1	Channel measurement .....	55
G.2	Permanent link measurement .....	55
Annex H (informative)	Cleaning and inspection of fibre optic connections .....	57
Bibliography	.....	58
Figure 1	– Relationship of related International Standards .....	8
Figure 2	– Test system and the cabling under test .....	15
Figure 3	– OTDR characterization using a launch test cord and a tail test cord .....	18
Figure 4	– An example of test cord labelling and identification .....	20
Figure 5	– OTDR launch test cord and/or tail test cord schematic .....	21
Figure 6	– Channels and permanent links in accordance with ISO/IEC 11801 and equivalent standards .....	23
Figure 7	– Channel and permanent link test configuration .....	24
Figure 8	– LSPM enhanced three-test-cord attenuation measurement of installed channels .....	26
Figure 9	– LSPM one test cord attenuation measurement of installed permanent links .....	27
Figure 10	– OTDR measurement of installed cabling (channel): 2 point attenuation measurement method .....	30
Figure 11	– OTDR measurement of installed cabling (permanent link) .....	31
Figure 12	– OTDR measurement of optical fibre attenuation .....	34
Figure 13	– OTDR measurement of connection attenuation .....	35
Figure 14	– OTDR measurement of joint attenuation .....	37
Figure 15	– OTDR measurement of return loss .....	38
Figure 16	– Determination of length using an OTDR .....	39
Figure 17	– OTDR characterization of a SMF permanent link containing a break .....	40
Figure 18	– OTDR characterization of a permanent link containing a macrobend .....	41
Figure 19	– Measurement of cord interface attenuation .....	42
Figure C.1	– OTDR characterization using different length launch test cords .....	47
Figure C.2	– OTDR characterization showing ghost effects .....	48

Figure C.3 – OTDR characterization showing complex ghost effects .....	49
Figure D.1 – Measurement of substitution test cord interface attenuation.....	50
Table 1 – MMF light source characteristics .....	17
Table 2 – SMF light source characteristics.....	17
Table 3 – Non-LC reference connector requirements .....	19
Table 4 – Connecting hardware attenuation .....	28
Table C.1 – Default effective group IOR values.....	49
Table C.2 – Default backscattering coefficient values .....	49

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### INFORMATION TECHNOLOGY – IMPLEMENTATION AND OPERATION OF CUSTOMER PREMISES CABLING –

#### Part 3: Testing of optical fibre cabling

#### FOREWORD

- 1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.
- 2) The formal decisions or agreements of IEC and ISO 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 and ISO member bodies.
- 3) IEC, ISO and ISO/IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO 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 and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO, IEC or ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.
- 5) ISO and IEC do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. ISO or IEC are 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 ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC National Committees or ISO member bodies 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 of, use of, or reliance upon, this ISO/IEC Publication or any other IEC, ISO or ISO/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 ISO/IEC Publication may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 14763-3 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This second edition cancels and replaces the first edition published in 2006 and its Amendment 1:2009.

This edition constitutes a technical revision.

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

- general requirements (Clause 5) have been revised and the concept of normalization has been replaced by reference measurements;
- OTDR characterization (6.2) and requirements for cabling interface adapters (6.3) and test cords have been revised and requirements for single-mode fibre test cords (6.3.4) have been removed;
- enhanced three-test-cord reference method has been introduced (9.1.1.2);
- requirements for the attenuation measurement of cords (10.6) have been revised;
- Annex A "Launched modal distribution (LMD)" has been simplified and the new title now reads "Launched modal conditions for testing multimode optical fibre cabling";
- visual inspection criteria for connectors have been reworked (Annex B);
- information on optical time domain reflectometry (Annex C) has been revised;
- examples of calculations of channel and permanent link limits (Annex G) have been revised;
- and information regarding cleaning and inspection of fibre optic connections have been added (Annex H).

A list of all parts in the ISO/IEC 14763 series, published under the general title *Information technology – Implementation and operation of customer premises cabling*, can be found on the IEC website.

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

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.

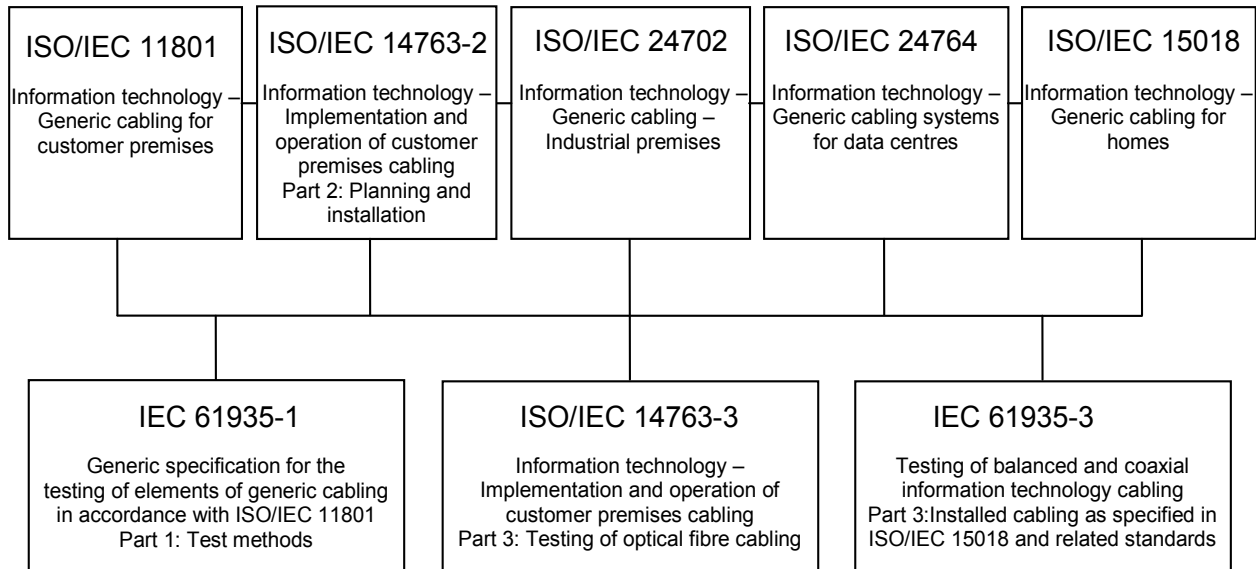
The contents of the corrigendum of March 2015 have been included in this copy.

**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 International Standard is one of four prepared in support of International Standard ISO/IEC 11801 and other cabling standards.

Figure 1 below shows the inter-relationship between ISO/IEC 11801 and other International Standards and for cabling systems with related standards.



**Figure 1 – Relationship of related International Standards**

ISO/IEC 14763-3 details the inspection and test procedures for optical fibre cabling,

- a) designed in accordance with premises cabling standards including ISO/IEC 11801, ISO/IEC 24764, ISO/IEC 24702 and ISO/IEC 15018, and
- b) installed according to the requirements and recommendations of ISO/IEC 14763-2.

Users of this International Standard should be familiar with relevant premises cabling standards and ISO/IEC 14763-2.

The quality plan for each installation will define the acceptance tests and sampling levels selected for that installation. Requirements and recommendations for the development of a quality plan are described in ISO/IEC 14763-2.

NOTE JTC 1/SC 25, in cooperation with IEC/TC 86, is currently developing an overall quantitative model to calculate total measurement uncertainty as stated in the reference planes of ISO/IEC 11801. When such a model has been verified, it is expected to be incorporated into this standard in form of an Amendment, thereby removing pertinent clauses currently marked “ffs” (for further study).



# INFORMATION TECHNOLOGY – IMPLEMENTATION AND OPERATION OF CUSTOMER PREMISES CABLING –

## Part 3: Testing of optical fibre cabling

### 1 Scope

This part of ISO/IEC 14763 specifies systems and methods for the inspection and testing of installed optical fibre cabling designed in accordance with premises cabling standards including ISO/IEC 11801, ISO/IEC 24764, ISO/IEC 24702 and ISO/IEC 15018. The test methods refer to existing standards-based procedures where they exist.

### 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.

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

ISO/IEC 14763-2, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*

IEC 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication*

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

IEC 60874-14-3, *Connectors for optical fibres and cables – Part 14-3: Detail specification for fibre optic adapter (simplex) type SC for single-mode fibre*

IEC 60874-19-1, *Fibre optic interconnecting devices and passive components – Connectors for optical fibres and cables – Part 19-1: Fibre optic patch cord connector type SC-PC (floating duplex) standard terminated on multimode fibre type A1a, A1b – Detail specification*

IEC 61280-1-3, *Fibre optic communication subsystem test procedures – Part 1-3: 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 method*

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

IEC 61280-4-2, *Fibre optic communication subsystem basic test procedures – Part 4-2: Fibre optic cable plant – Single-mode fibre optic cable plant attenuation*

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

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 61300-3-35:2009, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Fibre optic connector endface visual and automated inspection*

IEC 61300-3-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-42: Examinations and measurements – Attenuation of single mode alignment sleeves and or adaptors with resilient alignment sleeves*

IEC 61755-3-1, *Fibre optic connector optical interfaces – Part 3-1: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical full zirconia PC ferrule, single mode fibre*

IEC 61755-3-2, *Fibre optic connector optical interfaces – Part 3-2: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical full zirconia ferrules for 8 degrees angled-PC single mode fibres*

IEC 62614, *Fibre optics – Launch condition requirements for measuring multimode attenuation*

IEC 62664-1-1, *Fibre optic interconnecting devices and passive components – Fibre optic connector product specifications – Part 1-1: LC-PC duplex multimode connectors terminated on IEC 60793-2-10 category A1a fibre*