

INTERNATIONAL STANDARD

ISO/IEC 14763-3

First edition
2006-06

**Information technology –
Implementation and operation of
customer premises cabling –**

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

Copyright © 2006 ISO/IEC, Geneva — All rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



PRICE CODE

U

For price, see current catalogue

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references.....	9
3 Definitions and abbreviations	10
3.1 Definitions	10
3.2 Abbreviations.....	12
3.3 Symbols	12
4 Conformance.....	12
5 General requirements	13
5.1 Test system.....	13
5.2 Normalisation and calibration.....	13
5.3 Environmental conditions	13
5.3.1 Protection of transmission and terminal equipment.....	13
5.3.2 Contamination	14
5.3.3 Use of test equipment.....	14
5.3.4 Relevance of measurement.....	14
5.3.5 Treatment of marginal test results.....	14
5.4 Documentation	14
6 Test equipment.....	15
6.1 LSPM.....	15
6.1.1 General	15
6.1.2 Light sources	15
6.1.3 Power meters	15
6.1.4 Test system stability	15
6.2 OTDR.....	16
6.2.1 General	16
6.2.2 OTDR characterization using a launch cord only.....	16
6.2.3 OTDR characterization using a launch cord and a tail cord	16
6.3 Cabling interface adapters	18
6.3.1 Connecting hardware at test interfaces.....	18
6.3.2 Reference connector requirements.....	18
6.3.3 MMF test cords	18
6.3.4 SMF test cords	21
6.4 MMF launched modal distribution (LMD)	22
6.5 SMF launched modal distribution (LMD).....	22
7 Inspection equipment.....	23
7.1 Connecting hardware end-face	23
7.1.1 General	23
7.1.2 Optical, direct vision microscope.....	23
7.1.3 CCD microscope.....	23
8 Cabling under test.....	23
8.1 Channels and permanent links.....	23
8.1.1 General	23

8.1.2	Reference planes.....	24
8.1.3	Wavelength of measurement.....	25
8.1.4	Direction of measurement.....	25
9	Testing of installed cabling.....	25
9.1	Attenuation/insertion loss.....	25
9.1.1	LSPM.....	25
9.1.2	OTDR.....	29
9.2	Propagation delay.....	32
9.2.1	Test method.....	32
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.....	32
10.1	Attenuation/insertion loss (optical fibre cable).....	32
10.1.1	Test method.....	32
10.1.2	Measurement uncertainty.....	33
10.1.3	Treatment of results.....	33
10.2	Attenuation/insertion loss (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	Insertion loss (connecting hardware).....	35
10.3.1	Test method.....	35
10.3.2	Treatment of results.....	36
10.4	Return loss (connecting hardware).....	36
10.4.1	Test method (in accordance with IEC 61300-3-6, method 2).....	36
10.4.2	Treatment of results.....	37
10.4.3	Measurement uncertainty.....	38
10.5	Optical fibre length.....	38
10.5.1	Test method.....	38
10.5.2	Measurement uncertainty.....	40
10.5.3	Treatment of results.....	40
10.6	Attenuation/insertion loss (cords).....	40
10.6.1	Test method.....	40
10.6.2	Treatment of results.....	41
10.7	Return loss (cords).....	41
11	Inspection of cabling and cabling components.....	41
11.1	Optical fibre continuity.....	41
11.2	Cabling polarity.....	42
11.3	Optical fibre cable length.....	42
11.4	Inspection of optical fibre end-faces.....	42
11.5	Optical fibre core size.....	42
Annex A (normative)	Launched modal distribution (LMD).....	43
A.1	Distribution of optical power within a MMF.....	43
A.2	Modal transfer function.....	43

A.3 MPD (modal power distribution)	44
A.3.1 General	44
A.3.2 Requirements	45
A.4 CPR (coupled power ratio)	45
A.4.1 General	45
A.4.2 Test system	46
A.4.3 Test method	46
Annex B (normative) Visual inspection criteria for connectors	49
B.1 Connector end-face definitions	49
B.1.1 General	49
B.1.2 End-face zone definitions	49
B.1.3 Modified inspection criteria	49
B.2 Inspection of terminated optical fibre	50
B.2.1 General	50
B.2.2 Scratch and pit defects	50
B.2.3 Chip defects	50
B.2.4 Cracks	50
Annex C (informative) Optical time domain reflectometry	51
C.1 Operational capability	51
C.1.1 Effective characterization	51
C.1.2 Dynamic range	51
C.1.3 Pulse width	51
C.1.4 Integration or sample count	51
C.2 Limitations of OTDR capability	52
C.2.1 Minimum lengths of operation	52
C.2.2 Ghosting	53
C.2.3 Effective group index of refraction (IOR)	54
C.2.4 Scattering coefficient	54
Annex D (normative) Inspection and testing of test and field calibration cords	55
D.1 General requirements	55
D.2 Insertion loss (test and field calibration cord reference connections)	55
Annex E (informative) 3-jumper method for link and channel attenuation	57
Annex F (informative) Quality planning	58
F.1 Inspection and test schedules	58
F.2 Stage 1 inspection and testing	58
F.3 Stage 2 testing	59
F.3.1 Basic test group	59
F.3.2 Extended test group	59
BIBLIOGRAPHY	60

Figure 1 – Document relationships	8
Figure 2 – The test system and the cabling under test	13
Figure 4 – OTDR characterization using a launch cord and a tail cord	17
Figure 5 – Test cord labelling and identification	19
Figure 6 – OTDR launch cord schematic	20
Figure 7 – Channels and permanent links in accordance with ISO/IEC 11801 and equivalent standards	24
Figure 8 – Channel and permanent link test configuration	24
Figure 9 – LSPM 3-jumper attenuation measurement of installed cabling	27
Figure 10 – LSPM 1-jumper attenuation measurement of installed link	28
Figure 11 – OTDR measurement of installed cabling (permanent link)	30
Figure 12 – OTDR measurement of installed cabling (channel)	30
Figure 13 – OTDR measurement of optical fibre attenuation	34
Figure 14 – OTDR measurement of interface insertion loss	35
Figure 15 – OTDR measurement of joint insertion loss	36
Figure 16 – OTDR measurement of return loss	37
Figure 17 – Determination of length using an OTDR	39
Figure 18 – OTDR characterization of a SMF permanent link containing a break	39
Figure 19 – OTDR characterization of an permanent link containing a macrobend	40
Figure 20 – Measurement of cord interface attenuation/insertion loss	41
Figure A.1 – Example of a characteristic MTF	44
Figure A.2 – Example of a characteristic MPD	44
Figure A.3 – MPD (modal power distribution) specification	45
Figure A.4 – CPR measurement method	47
Figure B.1 – Connector end-face region definitions	49
Figure B.2 – Polishing defects and cracks	50
Figure C.1 – OTDR characterization using different length launch cords	52
Figure C.2 – OTDR characterization showing ghost effects	53
Figure C.3 – OTDR characterization showing complex ghost effects	54
Figure D.1 – Measurement of field calibration cord interface attenuation/insertion loss	55
Figure E.1 – Example of cabling and test cord configuration with 3-jumper test method	57

Table 1 – MMF light source characteristics	15
Table 2 – SMF light source characteristics	15
Table 3 – Non-SC reference connector requirements.....	18
Table 4 – Connecting hardware insertion loss.....	29
Table B.1 – Connector end-face regions.....	49
Table B.2 – Requirements for visual end-face inspection	50
Table C.1 – Default effective group IOR values	54
Table C.2 – Default scattering coefficient values.....	54

Withdrawn

**INFORMATION TECHNOLOGY –
IMPLEMENTATION AND OPERATION OF
CUSTOMER PREMISES CABLING –
Part 3: Testing of optical fibre cabling**

FOREWORD

- 1) ISO (International Organization for Standardization) and IEC (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. Their preparation is entrusted to technical committees; any ISO and IEC National Committee interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with ISO and IEC also participate in this preparation.
- 2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.
- 3) All users should ensure that they have the latest edition of this publication.
- 4) 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 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.
- 5) 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.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

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

This International Standard replaces ISO/IEC TR 14763-3, first edition, published in 2000, and constitutes a technical revision.

This standard incorporates innovations and recent developments including guidance in the proper use of uni-directional and bi-directional OTDR testing, the three-jumper method as default test method, fibre end-face inspection and criteria for scratches, return loss values for SC and non-SC connectors and the normative use of reference connectors. However, the most substantial change is the application of the 2 parameters which are used to determine the two repeatable multimode launch conditions “modal power distribution” and “coupled power ratio”.

This International Standard has been approved by vote of the member bodies, and the voting results can be obtained from the address given on the title page.

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

INTRODUCTION

This document is one of three prepared in support of International Standard ISO/IEC 11801.

Figure 1 below shows the inter-relationship between ISO/IEC 11801, these associated Technical Reports/Standards and other related standards.

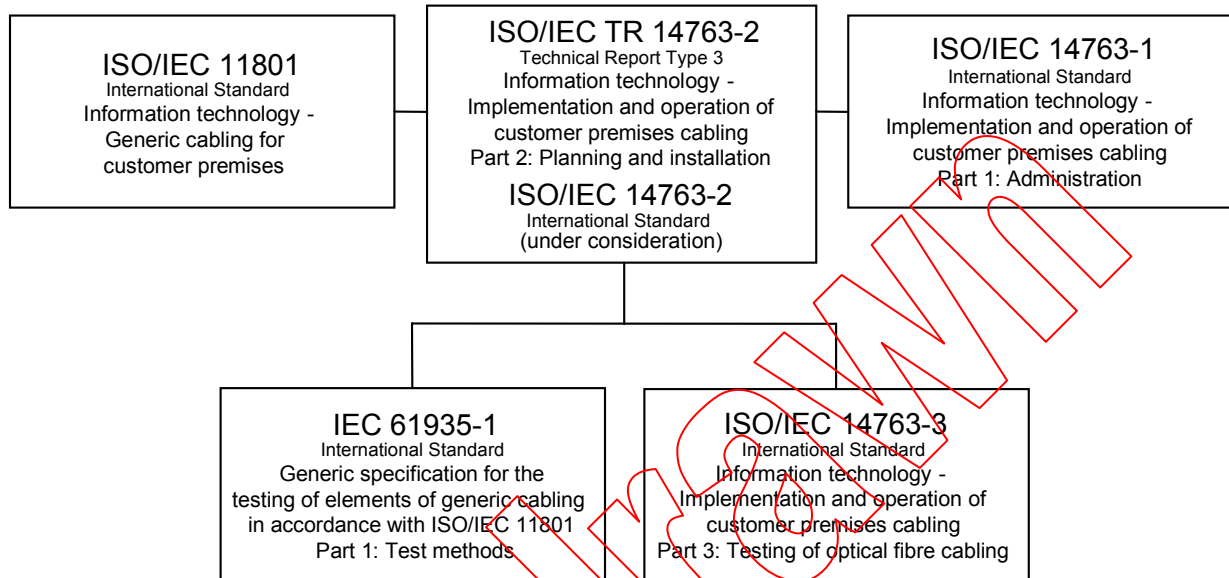


Figure 1 – Document relationships

Part 3 of ISO/IEC 14763 details inspection and test procedures for optical fibre cabling

- designed in accordance with ISO/IEC 11801 and equivalent standards and
- installed according to the requirements and recommendations of ISO/IEC 14763-2 (under consideration).

Users of this International Standard should be familiar with both ISO/IEC 11801 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 (under consideration).

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 optical fibre cabling designed in accordance with ISO/IEC 11801 or equivalent standards. The test methods refer to existing standards-based procedures where they exist.

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.

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

ISO/IEC TR 14763-2, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*¹

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

IEC 60793-1-20, *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry*

IEC 60793-1-45, *Optical fibres – Part 1-45: Measurement methods and test procedures – Mode field diameter*

IEC 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

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 60874-14-1, *Connectors for optical fibres and cables – Part 14-1: Detail specification for fibre optic connector type SC/PC standard terminated to multimode fibre type A1a, A1b*

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

IEC 60874-19, *Connectors for optical fibres and cables – Part 19: Sectional specification for fibre optic connector – Type SC-D(uplex)*

¹ ISO/IEC 14763-2 is planned to become an International Standard.

IEC 60874-19-1, *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 60874-19-2, *Connectors for optical fibres and cables – Part 19-2: Fibre optic adaptor (duplex) type SC for single-mode fibre connectors – Detail specification*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

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/PAS 61300-3-43, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-43: Examination and measurements – Mode Transfer Function Measurement for fibre optic sources*

Withdrawal