

ISO/IEC 14763-3:2024-05 (E)

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

Contents	Page
FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms, definitions, abbreviated terms and symbols.....	11
3.1 Terms and definitions.....	11
3.2 Abbreviated terms.....	15
3.3 Symbols.....	16
4 Conformance	16
5 Test equipment.....	17
5.1 General requirements	17
5.2 Documentation.....	17
5.3 Apparatus	17
5.4 Light source and power meter	17
5.4.1 Light source.....	17
5.4.2 Power meter	19
5.5 OTDR	19
5.5.1 General	19
5.5.2 OTDR requirements.....	20
5.6 Test cord connectors	21
5.6.1 Connecting hardware at test interfaces	21
5.6.2 Connecting hardware attenuation requirements	21
5.6.3 Mechanical requirements for reference connectors	22
5.6.4 Reference adaptors at test interfaces	24
5.7 Test cord characteristics	24
5.7.1 General	24
5.7.2 LSPM launch test cord.....	24
5.7.3 LSPM tail test cord	25
5.7.4 LSPM substitution test cord	25
5.7.5 OTDR launch test cord	25
5.7.6 OTDR tail test cord.....	26
5.8 Visual inspection equipment.....	26
6 Testing	27
6.1 General.....	27
6.2 Reference planes.....	27
6.3 Wavelength of measurement.....	30
6.4 Direction of measurement	30
6.5 Protection of transmission and terminal equipment	30
6.6 Use of test equipment	30
6.7 Relevance of measurement.....	30
6.8 Visual inspection for cleanliness and cleaning of cabling interfaces	30

6.9	Testing of installed cabling.....	31
6.9.1	General	31
6.9.2	Attenuation of single fibre connector cabling – LSPM	31
6.9.3	Attenuation of multi-fibre connector cabling – LSPM	43
6.9.4	Attenuation of link and channel by means of OTDR testing	53
6.9.5	Propagation delay.....	57
6.9.6	Length	57
6.9.7	Optical fibre continuity	59
6.9.8	Cabling polarity	59
6.9.9	Optical fibre core size	59
7	Performance assessment of installed cabling components using OTDR.....	59
7.1	General.....	59
7.2	OTDR basis	59
7.3	Fundamental parameters that define the operational capability of an OTDR.....	60
7.3.1	Dynamic range	60
7.3.2	Dynamic margin.....	61
7.3.3	Pulse width.....	61
7.3.4	Averaging time	61
7.3.5	Dead zone	61
7.3.6	Group index.....	61
7.3.7	Measurement range.....	62
7.3.8	Distance sampling	62
7.3.9	Event threshold	62
7.4	Bi-directional measurement.....	62
7.5	Attenuation of optical fibre cable	63
7.5.1	Test method	63
7.5.2	Treatment of results.....	64
7.6	Attenuation of local and remote test interfaces.....	64
7.6.1	Test method	64
7.6.2	Test system measurement uncertainties	65
7.6.3	Treatment of results.....	65
7.7	Attenuation of connecting hardware	66
7.7.1	Test method	66
7.7.2	Test system measurement uncertainties	67
7.7.3	Treatment of results.....	67
7.8	Return loss of connecting hardware	68
7.8.1	General	68
7.8.2	Test method	68
7.8.3	Test system measurement uncertainties	69
7.8.4	Treatment of results.....	69
7.9	Optical fibre length.....	70
7.9.1	Test method	70
7.9.2	Measurement uncertainties.....	72
7.9.3	Treatment of results.....	72
8	Test result documentation	73
Annex A (normative)	Test cord attenuation verification	74
A.1	General requirements	74
A.2	Attenuation (test and substitution test cord reference connections).....	74

Annex B (informative) Quality planning	76
B.1 General.....	76
B.2 Specification of cabling components	77
B.3 Treatment of non-compliant results	77
Annex C (informative) Examples of calculations of channel and permanent link limits	78
C.1 Channel measurement	78
C.2 Permanent link measurement.....	79
Annex D (informative) Optional inspection of polished end face of test connectors.....	80
Annex E (normative) Cleaning of connectors.....	82
E.1 General.....	82
E.2 Cleaning procedure for LC multimode cabling interface.....	82
E.3 Cleaning procedure for the LC single-mode cabling interfaces	83
E.4 Cleaning procedure for the LC/APC single-mode cabling interfaces	84
E.5 Cleaning procedure for single-mode (SM) MPO APC cabling interface	85
Annex F (normative) MPO to MPO link or permanent link – enhanced-three-test-cord method LSPM	86
F.1 General.....	86
F.2 Requirements for the test system.....	86
F.3 Test method.....	86
F.4 Measurement uncertainties	88
F.5 Treatment of results	88
Bibliography.....	89
Figure 1 – Relationship of related International Standards	9
Figure 2 – OTDR characterization using a launch test cord and a tail test cord	21
Figure 3 – An example of test cord labelling and identification	24
Figure 4 – OTDR launch test cord and tail test cord schematic	25
Figure 5 – Normal illumination (left) and illumination with floodlight (right)	27
Figure 6 – Representative reference planes for channels, links, permanent links, E2E links, MPTL.....	28
Figure 7 – Test reference planes	29
Figure 8 – Fibre end face cleaning cycle	31
Figure 9 – Connection of LS to LTC to PM for reference setting	33
Figure 10 – Connection of LTC to TTC to verify attenuation of reference connectors	33
Figure 11 – Connections to link or permanent link for attenuation measurement	34
Figure 12 – Connection of LS to LTC to PM for reference setting	36
Figure 13 – Connection of LTC to TTC to verify attenuation of reference connectors	36
Figure 14 – Connections to E2E link for attenuation measurement.....	37
Figure 15 – Connection of LS to LTC to near end EQP cord to PM for reference setting	39
Figure 16 – Connections to channel test for attenuation measurement.....	39
Figure 17 – Connection of LS to LTC to PM for reference setting	41
Figure 18 – Connection of LTC to TTC to verify attenuation of reference connectors	41
Figure 19 – Connections to MPTL for attenuation measurement	42
Figure 20 – Connection of LS to LTC to PM for reference setting	44
Figure 21 – Connection of LTC to TTC for test-cord verification	44

Figure 22 – Connections to link or permanent link attenuation	45
Figure 23 – Connection of LS to LTC to PM for reference setting.....	47
Figure 24 – Connection of LTC to PCTC to TTC to verify the attenuation of reference connectors.....	47
Figure 25 – Connections to E2E link for attenuation measurement.....	48
Figure 26 – Connection of LS to LTC to PM for reference setting.....	50
Figure 27 – Connection of LTC to TTC for test-cord verification	50
Figure 28 – Connection of LTC to PCTC to TTC for enhanced-three-test-cord verification	50
Figure 29 – MPO to single fibre link attenuation testing where no pin conversion is required on launch test cord.....	51
Figure 30 – MPO to single fibre link attenuation testing where pin conversion is required on LTC.....	51
Figure 31 – OTDR measurement of installed cabling (permanent link) – linear regression measurement method	54
Figure 32 – OTDR measurement of installed cabling (channel): two-point attenuation measurement method	56
Figure 33 – OTDR measurement of optical fibre attenuation	64
Figure 34 – OTDR measurement of connection attenuation.....	66
Figure 35 – OTDR measurement of joint attenuation.....	67
Figure 36 – OTDR measurement of return loss	69
Figure 37 – Determination of length using an OTDR	71
Figure 38 – OTDR characterization of a SMF permanent link containing a break	71
Figure 39 – OTDR characterization of a permanent link containing a macrobend	72
Figure A.1 – Measurement of launch test cord, tail test cord and substitution test cord interface attenuation	74
Figure E.1 – Example of multimode LC channel interface.....	82
Figure E.2 – Example of multimode LC link interface	82
Figure E.3 – Example of MPO channel interface	83
Figure E.4 – Example of MPO link interface	83
Figure E.5 – Example of MPO ferrule with normal illumination (left) and side illumination (right).....	83
Figure E.6 – Example of single-mode LC channel interface.....	84
Figure E.7 – Example of single-mode LC link interface	84
Figure E.8 – Example of single-mode LC/APC channel interface.....	84
Figure E.9 – Example of single-mode LC/APC link interface	84
Figure E.10 – Example of SM MPO APC channel interface	85
Figure E.11 – Example of SM MPO/APC link interface	85
Figure F.1 – Connection of LS to LTC to PM for reference setting.....	87
Figure F.2 – Connection of LTC to STC to TTC for enhanced-three-test-cord verification.....	87
Figure F.3 – Connections to link or permanent link for attenuation measurement where no pin conversion is required on test cords	87
Table 1 – MMF spectral requirements	19
Table 2 – SMF spectral requirements.....	19

Table 3 – Connector identification and attenuation test limits	22
Table 4 – Single fibre MM reference connector requirements	22
Table 5 – Single fibre single-mode reference connector requirements.....	23
Table 6 – Multi-fibre MM reference connector requirements	23
Table 7 – Multi-fibre single-mode reference connector requirements.....	23
Table 8 – Default group index values	62
Table 9 – Default backscattering coefficient values	70
Table D.1 – Cladding zone requirements of reference connectors	80
Table D.2 – Core zone requirements of reference connectors	81