Standards

Insertion Loss Measurement Procedures

FOTP-171

Being rewritten to define encircled flux as a launch condition requirement on certain measurements
Method A: Single cable reference
Method B: Two cable method, with a recommendation to measure multimode cabling in two directions by swapping the ends
Method C: Replacement method (golden cable) for hybrid cable styles

IEC 61300-3-4

Insertion Method A: Splice between loss. DUT is spliced between a length of fiber for the measurement
Insertion Method B: Single reference cable method. DUT connected at end of reference cable for measurement
Insertion Method C: Two reference cable method. Two reference cables referenced together and DUT connected between them for measurement

Equipment Requirements

FOTP-171 Source Requirements:

Nothing specifically stated. Recommended mandrel sizes:

Table 1 – Mandrel Mode Filter Sizes

Fiber Core Diameter (microns)	Mode Filter Diameter (mm)
50	25
62.5	20
100	25

Encircled Flux to be added in the future.

FOTP-171 OPM requirements:

Resolution: 0.05dB for loss >5dB, 0.01dB for loss <5dB.

IEC 61300-3-4

Source Requirements

Table 1 – Preferred source conditions

No.	Type	Central wavelength nm	Spectral width nm	Source type
S1	Multimode	660 ± 30	≥30	Monochromator or LED
S2	Multimode	780 ± 30	≥30	Monochromator or LED
S3	Multimode	850 ± 30	≥30	Monochromator or LED
S4	Multimode	1300 ± 30	≥30	Monochromator or LED
S5	Single Mode	1310 ± 30	To be reported	Laser diode monochromator or LED
S6	Single Mode	1550 ± 30	To be reported	Laser diode monochromator or LED
S7	Single Mode	1625 ± 30	To be reported	Laser diode monochromator or LED

Stability shall be +/-0.01dB for SM assemblies over the duration of the measurement. For MM assemblies +/-0.02dB.
Source output power needs to be 20dB above the minimum power level.

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Source launch conditions: Encircled flux launch per IEC 61300-1 for

Optical Power Meter Requirements

Number	Type	Maximum nonlinearity dB	Relative uncertainty dB
D1	Multimode	± 0.05 (-60dBm < input power < -5dBm)	≤0.05
D2	Single Mode	± 0.01 (attenuation < 10dB) ± 0.05 (10dB < attenuation < 60dB)	≤0.02

NOTE 1: In order to ensure that all light exiting the fibre is detected by the power meter, the sensitive area of the detector and the relative position between it and the fibre should be compatible with the numerical aperture of the fibre.

NOTE 2: Common sources of relative uncertainty are polarization dependence and interference with reflections from the power meter and fibre connector surfaces. The sensitivity of the power meter to such reflections can be characterized by the parameter spectra ripple, determined as the periodic change in responsivity vs. the wavelength of a coherent light source.

Return Loss

IEC 61300-3-6: Method 2, Return Loss measurement with OTDR.

Connector Loss/Geometry specifications

FOTP-171

Table A1 – Recommended Multimode Reference Connector Criteria		
Parameter	**Section**	**Reference Criteria**
Ferrule outside diameter	A.2.1.1	2.4990 ± 0.0005mm
Connector endface geometry: Radius of curvature Apex offset Fiber height	A.2.1.2	 10 to 25mm 50 microns maximum ± 50nm
Polished ferrule length	A.2.1.3	Per applicable FOCIS document requirement
Reference connector loss	A.2.1.4	≤ 0.25dB at 850 and 1300nm
Beam exit angle	A.2.1.6.5	≤ 0.5 degree
Fiber core position	A.2.1.6.4	Eccentricity ≤ 3 microns

A.2.2.1 Single Mode

The values in table A2 are recommended for the following Class IV single mode fiber types installed in non-angled physical contact connectors: 9.3/125, 1310/1550nm, 0.13 NA

Table A2 – Recommended Single Mode Reference Connector Criteria		
Parameter	**Section**	**Reference Criteria**
Ferrule outside diameter	A.2.1.1	2.4990 ± 0.0005mm
Connector endface geometry: Radius of curvature Apex offset Fiber height	A.2.1.2	 10 to 25mm 50 microns maximum ± 50nm
Polished ferrule length	A.2.1.3	Per applicable FOCIS document requirement
Reference connector loss	A.2.1.4	≤ 0.15dB at 1310 and 1550nm
Beam exit angle	A.2.1.6.5	≤ 0.25 degree
Fiber core position	A.2.1.6.4	Eccentricity ≤ 0.25 microns

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Connector Loss Grades

Insertion Loss get grades of A, B, C, etc.

Table 2 – Single Mode attenuation grades at 1310nm and 1550nm (dB)			
Attenuation grade	**Attenuation (≥ 97%)[a]**	**Mean**	**Notes**
A			Reserved for future application
B	≤ 0.25	≤ 0.12	
C	≤ 0.50	≤ 0.25	
D	≤ 1.0	≤ 0.50	

[a] The probability of a random mated connector set of meeting or exceeding the specific level of attenuation will be ≥ 97%. This performance is reached considering a statistical distribution of connector's parameters (MFD, eccentricity and tilt angle) and using a nominal value for wavelength.

Return Loss get grades of 1, 2, 3, etc.

Table 3 – Single Mode Return Loss grades at 1310nm and 1550nm (dB)		
Return Loss grade	**Return Loss (mated)**	**Notes**
1	≥ 60	≥ 55dB in unmated condition (APC only)
2	≥ 45	
3	≥ 35	
4	≥ 26	

Reference Grade Connectors

IEC 61755-2-4, 61755-2-5

Table 1 – Single Mode attenuation grades at 1310nm		
Reference grade [a]	**Attenuation [a] dB**	**Contribution to measurement uncertainty [b] dB**
R1	≤ 0.1	± 0.1
R2	≤ 0.2	± 0.2

[a] Under the assumption of worst case alignment with identical connector plug. Expected attenuation measured when connecting two plugs of the same grade may be higher due to significant measurement uncertainty.
[b] As described in Clause 8.

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