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Edition 1.0 2009-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components performance standard –
Part 031-3: Non-connectorized single-mode 1×N and 2×N non-wavelength-selective branching devices (NWBD) for Category U – Uncontrolled environment

Norme de performance des dispositifs d'interconnexion et composants passifs à fibres optiques –
Partie 031-3: Dispositifs de couplage indépendants de la longueur d'onde 1×N et 2×N en unimodal non connectorisés pour la catégorie U – Environnement non contrôlé

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International Standard IEC 61753-031-3 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This bilingual version (2014-03) corresponds to the monolingual English version, published in 2009-02.

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

FDIS	Report on voting
86B/2789/FDIS	86B/2821/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.

The French version of this standard has not been voted upon.

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

A list of all the parts in the IEC 61753 series, under the general title *Fibre optic interconnecting devices and passive components performance standard*, can be found on the IEC website.

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,
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- amended.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 031-3: Non-connectorized single-mode 1×N and 2×N non-wavelength-selective branching devices (NWBD) for Category U – Uncontrolled environment

1 Scope

This part of IEC 61753 contains the minimum initial tests and measurement requirements and severities which a non-wavelength selective branching device (NWBD) should satisfy in order to be categorized as meeting the requirements of Category U (uncontrolled environment) as defined in Annex A of IEC 61753-1.

This standard takes into account two technologies present on the market: the Fused Biconical Taper (FBT) and the Planar Lightwave Circuit (PLC). Requirements cover balanced, bidirectional, non-connectorized, single-mode 1 × N and 2 × N non-wavelength-selective branching devices for use in an IEC Category U environment (N is the number of output ports), especially for Passive Optical Network (PON) application. The specifications of unbalanced branching devices are limited to 1 × 2 and 2 × 2 devices because they are the most commonly used.

2 Normative references

The following normative 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 60793-2-50: *Optical fibres – Part 2: Product specifications – Sectional specification for class B single-mode fibres*

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion/Twist*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-12, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-12: Tests – Impact*

IEC 61300-2-14, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-14: Tests – Optical power handling and damage threshold characterization*

IEC 61300-2-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for connectors*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-2-46 *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-46: Tests – Damp heat, cyclic*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examinations and measurements – Polarization dependence of attenuation in a single-mode fibre optic device*

IEC 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

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 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss*

IEC 61300-3-20, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-20: Examinations and measurements – Directivity of fibre optic branching devices*

IEC 61753-2-1: *Fibre optic interconnecting devices and passive components performance standard – Part 2-1: Fibre optic connectors terminated on single-mode fibre for category U – Uncontrolled environment*

3 Test

All test methods are selected from the IEC 61300 series of standards.

The samples for tests shall be terminated onto single-mode fibres according to type B1.1 of IEC 60793-2-50 in either coated fibres (primary and secondary) or reinforced cable format.

All tests shall be carried out to validate performance over the full wavelength range of the optical fibre, 1 260 nm to 1 650 nm. However, from an application and laser wavelength point of view, more limited bands can be considered in the test, such as:

a) Spectral bands I:

1 260 nm to 1 360 nm

1 480 nm to 1 500 nm

b) Spectral bands II:

1 615 nm to 1 635 nm (1 625 nm OTDR band)

1 640 nm to 1 660 nm (1 650 nm OTDR band).

4 Test report

Fully documented test reports and supporting evidence shall be prepared and be available for inspection as evidence that the tests have been carried out and complied with.

5 Performance requirements

5.1 Dimensions

Dimensions shall comply with either an appropriate IEC interface standard or a relevant specification.

5.2 Sample size

Sample sizes for the tests are defined in Annex B.

5.3 Test details and requirements

Attenuation and return loss performances are given only for non-connectorized branching devices. For connectorized components the connector performances shall be in compliance with IEC 61753-2-1.

During the environmental tests where monitoring of the branching device is needed, all ports of the device shall be controlled.

Table 1 – Test details and requirements

No.	Tests	Requirements					Details
1	Attenuation (A)	Configuration	1xN		2xN		Launch patchcord length: ≥ 2 m.
	IEC 61300-3-7	Technology	FBT	PLC	FBT	PLC	Light source: unpolarized.
		Balanced NWBD					Launch conditions: The wavelength of the source shall be longer than the cut-off wavelength of the fibre.
		Spectral band I	A [dB] ≤ 0,1 + 3,6 $\log_2 N$	A [dB] ≤ 1,2 + 3,3 $\log_2 N$	A [dB] ≤ 0,4 + 3,6 $\log_2 N$	A [dB] ≤ 1,5 + 3,3 $\log_2 N$	
		Spectral bands I and II	A [dB] ≤ 4 $\log_2 N$	A [dB] ≤ 1,5 + 3,4 $\log_2 N$	A [dB] ≤ 0,3 + 4 $\log_2 N$	A [dB] ≤ 1,5 + 3,5 $\log_2 N$	Uncertainty: ± 0,05 dB or lower.
		Unbalanced NWBD					The measurement should be performed with any combination of input/output and output/input ports. The results should meet the requirements.
		Spectral band I Spectral bands I and II	A [dB] ≤ 22 – 10,8$\log_{10}$P where P is the nominal percentage of power associated with one port				
							See Tables A.1 and A.2 for examples
2	Uniformity (U)	Configuration	1xN		2xN		Same as above.
	IEC 61300-3-7	Technology	FBT	PLC	FBT	PLC	See Table A.3 for example
		Balanced NWBD					
		Spectral band I	U [dB] ≤ 0,1 + 0,55 $\log_2 N$	U [dB] ≤ 0,3 $\log_2 N$	U [dB] ≤ 0,4 + 0,55 $\log_2 N$	U [dB] ≤ 0,1 + 0,65 $\log_2 N$	
		Spectral bands I and II	U [dB] ≤ 0,3 +0,9 $\log_2 N$	U [dB] ≤ 0,65 + 0,2 $\log_2 N$	U [dB] ≤ 0,6 + 0,9 $\log_2 N$	U [dB] ≤ 0,7 + 0,6$\log_2 N$	
		Unbalanced NWBD					
		Spectral band I Spectral bands I and II	A [dB] ≤ 22 – 10,8$\log_{10}$P where P is the nominal percentage of power associated with one port				

Table 1 *(continued)*

No.	Tests	Requirements	Details
3	Directivity IEC 61300-3-20	≥55 dB	Same as in test No. 1. Source type : LD. Uncertainty: ± 1 dB or lower. All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement. The measurement should be made between any pair of input/output ports
4	Return loss IEC 61300-3-6	≥50 dB Grade U	Same as in test No. 1. Source type : LD. Uncertainty of ± 1 dB or lower. All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement
5	Polarization dependent loss IEC 61300-3-2	For balanced branching devices: ≤0,2 dB for N < 4 and ≤0,3 dB for N = 4 and ≤0,4 dB for N > 4 For unbalanced 1×2 and 2×2 branching devices and for both output ports: $\leq 0{,}7 - 0{,}25 \log_{10} P$ where P is the nominal percentage of the power associated with one port	Launch patchcord length: ≥ 2m. Source type : LD. Uncertainty: ± 0,05 dB or lower. The test should be performed for all combinations of input and output ports

Table 1 *(continued)*

No.	Tests	Requirements	Details
6	Active monitoring of changes in attenuation and return loss IEC 61300-3-3	1) For climatic tests: During and on completion of the test the attenuation of balanced branching devices shall be within ±0,3 dB for N ≤ 4 and within ±0,5 dB for N > 4 of the original value under ambient conditions. For unbalanced branching devices, the attenuation limits shall be within ±0,3 dB for P % > 2 % and ±0,5 dB for P % ≤ 2 % during the test. After the test, the return loss limits of test No. 4 shall be met. 2) For mechanical tests: On completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for N ≤ 4 and within ±0,5 dB for N > 4 of the original value. For unbalanced branching devices, the attenuation limits shall be within ±0,3 dB for P % > 2 % and ±0,5 dB for P % ≤ 2 % during the test. After the test, the return loss limits of test No. 4 shall be met	Uncertainty: ± 0,05 dB or lower for attenuation. Uncertainty: ± 1 dB or lower for return loss. Other details: same as in Test Nos. 1 and 4
7	Optical power handling and damage threshold characterization IEC 61300-2-14	P_{max}= 500 mW (+27 dBm) per port only one at a time. During the test, the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation shall be within ± 0,3 dB of original value under ambient conditions. After the test, the return loss limits of test No. 4 shall be met	Same as test no.1. Test wavelengths: 1 310 nm ± 20 nm, 1 550 nm ± 20 nm, 1 625 nm ± 20 nm. Power increments: 3 dB. Duration of the optical power exposure at each level: 30 min. Attenuation test: Uncertainty = ± 0,05 dB or lower. Return loss test: Uncertainty = ± 1 dB or lower
8	Cold IEC 61300-2-17	See requirement 1) of test No. 6	Temperature: –25 °C. Duration of exposure: 96 h. Length of the cable on each side of the device: >1,5 m. Specimens shall be optically functioning: attenuation and return loss shall be measured before the test, during the test at a maximum interval of 1 h and after the test by means of the monitoring set-ups defined in test No. 6. Preconditioning procedure: before test, specimens shall be maintained at room temperature for 2 h. Recovery procedure: after test, specimens shall be maintained at room temperature for 2 h