INTERNATIONAL STANDARD

IEC 61753-2-3

First edition
2001-07

Fibre optic interconnecting devices and passive components performance standard –

Part 2-3:
Non-connectorised single-mode 1×N and 2×N non-wavelength-selective branching devices for Category U – Uncontrolled environment

Norme de qualité de fonctionnement des dispositifs d'interconnexion et composants passifs à fibres optiques –

Partie 2-3:
Dispositifs de couplage non-connectorisés monomodes 1×N et 2×N ne dépendant pas de la longueur d'onde pour catégorie U –
Environnement non contrôlé

Reference number
IEC 61753-2-3:2001(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 2-3: Non-connectorised single-mode 1×N and 2×N non-wavelength-selective branching devices for Category U – Uncontrolled environment

FOREWORD

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International Standard IEC 61753-2-3 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

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

FDIS	Report on voting
86B/1509/FDIS	86B/1548/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annex B forms an integral part of this standard.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 2-3: Non-connectorised single-mode 1×N and 2×N non-wavelength-selective branching devices for Category U – Uncontrolled environment

1 Scope

This part of IEC 61753 contains the minimum initialisation test and measurement requirements and severities which a branching device shall satisfy in order to be categorised as meeting the IEC standard. The requirements cover balanced non-connectorised 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). 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 contain provisions which, through reference in this text, constitute provisions of this part of IEC 61753. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61753 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60793-1-1:1995, *Optical fibres – Part 1: Generic specification – Section 1: General*

IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

IEC 61300-2-1:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-4:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-5:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion/twist*

IEC 61300-2-12:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-12: Tests – Impact*

IEC 61300-2-14:1997, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-14: Tests – Maximum input power*

IEC 61300-2-17:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-26:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-26: Tests – Salt mist*

IEC 61300-2-27:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-27: Tests – Dust – Laminar flow*

IEC 61300-2-28:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-28: Tests – Industrial atmosphere (sulphur dioxide)*

IEC 61300-2-45:1999, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-45: Tests – Durability test by water immersion*

IEC 61300-3-2:1999, *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 61300-3-3:1997, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Monitoring change in attenuation and in return loss (multiple paths)*

IEC 61300-3-5:2001, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-5: Examinations and measurements – Wavelength dependence of attenuation*

IEC 61300-3-6:1997, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61300-3-20:2001*, 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 61753-2-1:2000, *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 in accordance with the IEC 61300 series of standards.

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

Each test defines the number of samples to be evaluated.

All tests shall be carried out to validate performance over the optical pass-bands of 1 260 nm to 1 360 nm and 1 480 nm to 1 580 nm. This is the minimum requirement for devices corresponding to Class 1 as described in 5.2. Extensions to these windows are covered by classes 2 and 3. Class 2 specifies additional attenuation limits for 1 450 nm to 1 480 nm and 1 580 nm to 1 600 nm. Class 3 devices shall meet Class 2 requirements and additionally have defined attenuation limits for 1 600 nm to 1 650 nm.

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 Sample size, sequencing and grouping

Sample sizes for the tests are defined in annex B of this document.

Test groups and test sequences shall be performed individually or in sequential order as shown in annex B.

When testing in sequential order, the test sequence shown in annex B shall be followed

5.2 Test details and requirements

Attenuation and return loss performances are given only for non-connectorised branching devices. For connectorised 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.

No.	Tests	Requirements	Details
1	Attenuation Three classes of requirements have been identified for attenuation requirements: 1) Class 1 for standard and obligatory requirements for telecom operation in 1 260 nm – 1 360 nm and 1 480 nm – 1 580 nm bands (attenuation requirements in Eq. 1 for balanced devices and in Eq. 1′ for unbalanced devices) 2) Class 2 for extended wavelength operation over a pass-band of 150 nm around the 1 550 nm optical window (attenuation requirements in Eq. 1 and Eq. 2 simultaneously) 3) Class 3 for further extended band-pass between 1 600 nm and 1 650 nm for maintenance operation (attenuation requirements in Eq. 1, Eq. 2 and Eq. 3 simultaneously)	The attenuation requirements of 1×N and 2×N balanced branching devices are given for each Class in Eq. 1, 2 and 3, while the attenuation requirements of 1×2 and 2×2 unbalanced branching devices are expressed in Eq 1′, only for Class 1. Eq. 1 (pass-band 1 260 nm to 1 360 nm and 1 480 nm to 1 580 nm) 1×N 2×N A max. (dB) $0,6 + 3,6 \times \log_2 N$ $0,9 + 3,6 \times \log_2 N$ A min. (dB) $2,7 \times \log_2 N$ $2,7 \times \log_2 N - 0,1$ (See also table A.1 of annex A) Eq. 1′ A max. (dB) = $25,5 - 12,5 \log_{10} (P\ \%)$ where P % is the nominal percentage of the power associated with one port (See also table A.2 of annex A) Eq. 2 (pass-band 1 450 nm to 1 480 nm and 1 580 nm to 1 600 nm) 1×N 2×N A max. (dB) $0,6 + 3,7 \times \log_2 N$ $0,9 + 3,7 \times \log_2 N$ A min. (dB) $2,5 \times \log_2 N + 0,1$ $2,5 \times \log_2 N$ (See also table A.3 of annex A) Eq. 3 (pass-band 1 600 nm to 1 650 nm) 1×N 2×N A max. (dB) $0,6 + 3,9 \times \log_2 N$ $0,9 + 3,9 \times \log_2 N$ A min. (dB) $2,4 \times \log_2 N - 0,1$ $2,4 \times \log_2 N - 0,2$ (See also table A.4 of annex A)	IEC 61300-3-5 Fibre lengths of the branching device pigtail: ≥2 m Launch fibre lengths: ≥2 m Source: the stability at the operating wavelength shall be better than ±0,05 dB over the measuring period Unpolarised source Launch conditions: the wavelength of the source shall be longer than the cut-off wavelength of the fibre Wavelength bands: 1 260 nm – 1 360 nm and 1 480 nm – 1 580 nm (Class 1), 1 260 nm – 1 360 nm and 1 450 nm – 1 600 nm (Class 2) and 1 260 nm – 1 360 nm and 1 450 nm – 1 650 nm (Class 3) Detector system: linearity within ±0,05 dB spectral response matched to source dynamic range within the attenuation values to be measured wavelength resolution: ≤10 nm wavelength accuracy: ±1 nm The minimum and maximum attenuation values apply to any combination of input/output ports
2	Directivity	≥35 dB Class T ≥45 dB Class U ≥55 dB Class V over the operating wavelength range	IEC 61300-3-20 Details: same as in test No. 1 All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement Other conditions: the directivity shall be measured between any pair of input or output ports

3a	Return loss (branching device method)	≥35 dB Class T ≥45 dB Class U	IEC 61300-3-6, Method 1 Branching device: nominal splitting ratio: 50/50 directivity: >60 dB Source: central wavelength: 1 310 nm ± 20 nm, 1 550 nm ± 20 nm, 1 625 nm ± 20 nm spectral width: ≤20 nm stability at the operating wavelength in a period of at least 1 h: within ±0,05 dB Detector: sensitivity:<–80 dBm linearity: within ±0,05 dB All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement
3b	Return loss (OTDR method)	≥55 dB Class V	IEC 61300-3-6, Method 2 OTDR source specifications: central wavelength: 1 310 nm ± 20 nm, 1 550 nm ± 20 nm, 1 625 nm ± 20 nm spectral width: ≤20 nm pulse duration: <500 ns Fibre lengths L1 + L2, L3 ≥ 500 m All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement
4	Polarisation dependent loss	For balanced branching devices ≤0,3 dB $N \leq 4$ ≤0,5 dB $4 < N \leq 8$ ≤0,6 dB $N > 8$ For unbalanced 1×2 and 2×2 branching devices (only for Class 1) and for both output ports: $\leq 0{,}7 - 0{,}25 \times \log_{10}(P\,\%)$ where P % is the nominal percentage of the power associated with one port	IEC 61300-3-2, Option 1, Method A Source: LD 1 310 nm ± 10 nm, 1 550 nm ± 10 nm, 1 625 nm ± 10 nm Other details: same as in test No 1 The allowable loss combination applies to all combinations of input and output ports
5	Maximum input power	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-14 Maximum power to apply: 20 dBm Power increments: 5 dBm Duration of the optical power exposure at the different levels: 30 min Other details: same as in tests Nos. 1 and 3 Attenuation and return loss shall be measured before the test, during the test at a maximum interval of 10 min and after the test by means of the monitoring set-ups defined in test No. 6a or 6b

6a	Monitoring of attenuation and return loss (branching device method)	See requirements of attenuation and return loss (Classes T and U) of the environmental tests stated below	IEC 61300-3-3 Method 1 or Method 2 Source characteristics: same as tests Nos. 1 and 3 (branching device method) Branching devices directivity: >60 dB 1×N switch: repeatability <0,02 dB over the monitoring period Method to verify reference return loss and how to insert it in the reference line: to be decided
6b	Monitoring of attenuation and return loss (OTDR method)	See requirements of attenuation and return loss (Class V) of the environmental tests stated below	IEC 61300-3-3 Method 3 or Method 4 OTDR source specifications: same as tests No. 3 (return loss for Class V) 1×N switch: repeatability: <0,02 dB over the monitoring period Fibres: length as in test No. 3 (OTDR method) or longer than the distance required between the marker locations to make attenuation measurements
7	Cold	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-17 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. 6a or 6b 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
8	Dry heat – high temperature endurance	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-18 Temperature: +70 °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. 6a or 6b 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

9	Damp heat (steady state)	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-19 Temperature: (+40 ± 2) °C Relative humidity: (93 ± 2) % 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. 6a or 6b 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
10	Change of temperature	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-22 High temperature: +70 °C Low temperature: –25 °C Duration at extreme temperature: 1 h Temperature rate of change: 1 °C/min Number of cycles: 12 Specimens shall be optically functioning: attenuation and return loss shall be measured before the test, during the test at a maximum interval of 10 min and after the test by means of the monitoring set-ups defined in test No. 6a or 6b 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
11	Damp heat (cyclic)	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	Future IEC 61300-2-46* High temperature: +55 °C Low temperature: +25 °C Relative humidity: (93 ± 3) % except for the first and the last 15 min of each cycle that shall be between 90 % and 100 % Number of cycles: 10 Specimens shall be optically functioning: attenuation and return loss shall be measured before the test, during the test at a maximum interval of 10 min and after the test by means of the monitoring set-ups defined in test No. 6a or 6b 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

* *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-46: Tests – Damp heat (cyclic).* Under consideration.

12	Vibration (sinusoidal)	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-1 Frequency range: 10 Hz – 55 Hz Duration per axis: 0,5 h Number of axes: 3 orthogonal Number of sweeps (10 Hz – 55 Hz – 10 Hz): 15 Vibration amplitude: 0,75 mm Specimens shall be optically functioning: attenuation shall be measured before the test, during the test at a maximum interval of 10 min and after the test, while return loss shall be measured before and after the test by means of the monitoring set-ups defined in tests No. 6a or 6b Method of mounting: the device shall be mounted rigidly to the mounting fixture together with the assembling cassette or organiser
13	Fibre/cable retention	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-4 Magnitude and rate of application of the tensile load: 100 N ± 5 N at a speed of 5 N/s for reinforced cable 5 N ± 0,5 N at a speed of 0,5 N/s for coated fibres (primary and secondary) Point of application of tensile load: 0,3 m from the end of the device Duration of the test (maintaining the load): 120 s at 100 N and 60 s at 5 N Sampling rate: losses shall be measured at least once after the load has reached its maximum level and been maintained for a minimum period of 30 s Specimens shall be optically functioning: attenuation shall be measured before, during and after the test while return loss shall be measured before and after the test by means of the monitoring set-ups defined in test No. 6a or 6b
14	Torsion	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-5 Magnification and rate of application of the tensile load 15 N at a speed of 1 N/s for reinforced cable terminated device 2 N at a speed of 0,1 N/s for coated fibre terminated device Point of application of the load: 0,2 m from the end of the device Duration of the test: 25 cycles ± 180° Sampling rate: Losses shall be measured at least once every five cycles Specimens shall be optically functioning: attenuation shall be measured before, during and after the test while return loss shall be measured before and after the test by means of the monitoring set-ups defined in test No. 6a or 6b

15	Impact	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-12 Method A Number of drops: 5 Drop height: 1,5 m Sampling rate: losses shall be measured after each drop Specimens shall be optically functioning: attenuation shall be measured before, during and after the test while return loss shall be measured before and after the test by means of the monitoring set-ups defined in test No. 6a or 6b
16	Durability by water immersion (optional)	During the test the attenuation limits of test No. 1 shall be met. Moreover, during and on completion of the test, the attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class	IEC 61300-2-45 pH water: 5,5 ± 0,5 Head of water: 150 mm Temperature: +43 °C Duration: 168 h 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. 6a or 6b 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
17	Salt mist (optional)	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class Visual inspection	IEC 61300-2-26 Atmosphere: salt solution 5 % NaCl, pH 6,5 – 7,2 Temperature: +35 °C Duration of the test: 96 h Specimen shall be optically non-functioning: attenuation and return loss shall be measured before and after the test by means of the monitoring set-ups defined in test No. 6a or 6b 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

18	Industrial atmosphere (sulphur dioxide) (optional)	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class Visual inspection	IEC 61300-2-28 Atmosphere: sulphur dioxide SO_2 2 ppm Temperature: 25 °C Relative humidity: 75 % Duration of test: 96 h Specimens shall be optically non-functioning: attenuation and return loss shall be measured before and after the test by means of the monitoring set-ups defined in test No. 6a or 6b 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
19	Dust	The attenuation limits of test No. 1 shall be met. The attenuation of balanced branching devices shall be within ±0,3 dB for $N \leq 4$ 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 Return loss shall satisfy the requirements for the specified class Visual inspection	IEC 61300-2-27 Dust particle size: d < 150 µm Dust concentration: 10,6 g/m^3 ± 7,1 g/m^3 Temperature: 35 °C Relative humidity: 60 % Duration of test: 10 min Specimens shall be optically non-functioning: attenuation and return loss shall be measured before and after the test by means of the monitoring set-ups defined in test No. 6a or 6b 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

Annex A
(informative)

Examples of attenuation requirements of 1×N and 2×N branching devices

Table A.1 – Attenuation requirements of balanced branching devices having the most common port configurations for Class 1 application

	1×N		2×N	
	***A* min.** dB	***A* max.** dB	***A* min.** dB	***A* max.** dB
N = 2	2,7	4,2	2,6	4,5
N = 3	4,3	6,3	4,2	6,6
N = 4	5,4	7,8	5,3	8,1
N = 6	7,0	9,9	6,9	10,2
N = 8	8,1	11,4	8,0	11,7
N = 12	9,7	13,5	9,6	13,8
N = 16	10,8	15,0	10,7	15,3
N = 24	12,4	17,1	12,3	17,4
N = 32	13,5	18,6	13,4	18,9

Table A.2 – Attenuation requirements of 1×2 and 2×2 unbalanced branching devices having the most common port configurations for Class 1 application.

Coupling ratio (P_1 %/P_2 %)	**A_1 max./A_2max.** dB
40/60	5,5/3,3
30/70	7,0/2,4
20/80	9,2/1,7
10/90	13,0/1,1
5/95	16,8/0,8
1/99	25,5/0,6

Table A.3 – Attenuation requirements of balanced branching devices having the most common port configurations for Class 2 application

	1×N		2×N	
	***A* min.** dB	***A* max.** dB	***A* min.** dB	***A* max.** dB
N = 2	2,6	4,3	2,5	4,6
N = 3	4,1	6,5	4,0	6,8
N = 4	5,1	8,0	5,0	8,3
N = 6	6,6	10,2	6,5	10,5
N = 8	7,6	11,7	7,5	12,0
N = 12	9,1	13,9	9,0	14,2
N = 16	10,1	15,4	10,0	15,7
N = 24	11,6	17,6	11,5	17,9
N = 32	12,6	19,1	12,5	19,4

Table A.4 – Attenuation requirements of balanced branching devices having the most common port configurations for Class 3 application

	1×N		2×N	
	***A* min.** dB	***A* max.** dB	***A* min.** dB	***A* max.** dB
N = 2	2,3	4,5	2,2	4,8
N = 3	3,7	6,8	3,6	7,1
N = 4	4,7	8,4	4,6	8,7
N = 6	6,1	10,7	6,0	11,0
N = 8	7,1	12,3	7,0	12,6
N = 12	8,5	14,6	8,4	14,9
N = 16	9,5	16,2	9,4	16,5
N = 24	10,9	18,5	10,8	18,8
N = 32	11,9	20,1	11,8	20,4

Annex B
(normative)

Sample size, sequencing and grouping

Test groups and sequences shall be performed individually or in sequential order. The samples are sourced as defined.

When testing in sequential order all the samples undergo tests 1 to 5. After completion of the Group 1 tests, the 12 specimens are divided into three subgroups of four samples; each subgroup is subjected to the tests of one of the three different remaining groups, in the order presented in table B.1.

Table B.1 – Sample size and sequencing and grouping of tests

Sequence number	Test	Sample size	Test from which samples are sourced	Group
1	Attenuation	12	New	1
2	Directivity	12	1	
3	Return loss	12	2	
4	Polarisation dependent loss	12	3	
5	Maximum input power	12	4	
6	Cold	4	5	2
7	High temperature endurance	4	6	
8	Damp heat (steady state)	4	7	
9	Damp heat (cyclic)	4	8	
10	Change of temperature	4	9	
11	Vibration	4	5	3
12	Fibre/cable retention	4	11	
13	Torsion	4	12	
14	Impact	4	13	
15	Change of temperature	4	14	
16	Durability by water immersion (optional)	4	5	4
17	Corrosive atmosphere (optional)	4	16	
18	Industrial atmosphere (optional)	4	17	
19	Dust	4	18	
20	Change of temperature	4	19	

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ISBN 2-8318-5792-9

ICS 33.180.20

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND