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MxN fibre branching devices functional specifications**

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Foreword

This draft Interim European Telecommunication Standard (I-ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

An ETSI standard may be given I-ETS status either because it is regarded as a provisional solution ahead of a more advanced standard, or because it is immature and requires a "trial period". The life of an I-ETS is limited to three years after which it can be converted into an ETS, have its life extended for a further two years, be replaced by a new version, or be withdrawn.

The draft I-ETS refers to fibre pigtailed components. The optical fibre pigtails or other external fibre interfaces are those described in EN 188000 [6] and EN 188101 [4].

Proposed announcement date	
Date of latest announcement of this I-ETS (doa):	3 months after ETSI publication

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1 Scope

This Interim European Telecommunication Standard (I-ETS) applies to balanced fibre branching devices to be used in single mode optical transmission networks. Unbalanced fibre branching devices should satisfy similar mechanical and environmental requirements. The scope is to establish minimum uniform requirements for the following aspects:

- optical, environmental and mechanical properties;
- test conditions;
- acceptance criteria.

Some users may have additional specific requirements such as a need to verify performance at lower temperatures. These users should specify branching devices conforming to the basic ETSI performance standard plus additional tests or more severe test conditions.

Acceptance criteria will be interpreted with respect to the consideration that some of the parameters specified in this I-ETS may be affected by measurement uncertainty arising either from measurement or calibration errors. Test methods are in accordance with EN 181000 [1] unless otherwise specified.

A fibre branching device is defined in subclause 3.1 of this I-ETS.

2 Normative references

This I-ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this I-ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] EN 181000 (1994): "Generic specification: Fibre optic branching devices".
- [2] IEC 1300-3-2 (1995): "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Examinations and measurements - Part 3-2: Polarization dependence of a single-mode fibre optic device".
- [3] IEC 1300-2-5 (1995): "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Tests - Part 2-5: Torsion/twist".
- [4] EN 188101 (1995): "Family Specification: Single-mode dispersion unshifted (B1.1) optical fibre".
- [5] ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".
- [6] EN 188000 (1992): "Generic specification: Optical fibres".

3 Definition

For the purposes of this I-ETS, the following definition applies:

fibre branching device: A passive optical component which splits the incoming signal (M) to a number of outputs (N).

4 Tests

All tests are to be carried out to validate performance over the optical pass bands 1 260 nm to 1 360 nm and 1 480 nm to 1 580 nm. Upon request, performance in additional pass bands may be required as described in subclause 4.1.

The test wavelength requirement for attenuation measurements is that at least three test wavelengths shall be used within each operating range.

A minimum length of fibre or cable of 1,5 m per port shall be included in all climatic and environmental tests.

4.1 Attenuation

Attenuation requirements for 1 x N and 2 x N devices are detailed in the next section. Three classes of requirements have been identified. Note that, for example, a device complying with the Class III requirement shall comply with table 1, table 2 and table 3 simultaneously:

<u>Class</u>	<u>Description</u>	<u>Attenuation requirement</u>	<u>Abbreviation</u>
I	Standard and obligatory requirement for telecommunications operation in 1 260 nm - 1 360 nm and 1 480 nm - 1 580 nm bands.	table 1	Standard (S)
II	Extended wavelength operation over a 150 nm pass band in the 1 550 nm optical window.	table 1 and 2	Extended (E)
III	Extended further in a third window.	table 1 and 2 and 3	Maintenance (M)

4.1.1 Details

Method: EN 181000 [1], subclause 4.5.5.
 Condition: The minimum and maximum attenuation values apply to any combination of input and output port.

4.1.2 Requirements

Other numbers of output ports can be specified.

Table 1: Wavelengths 1 260 nm - 1 360 nm and 1 480 nm - 1 580 nm

N	M = 1		M = 2	
	Attenuation: minimum [dB]	Attenuation: maximum [dB]	Attenuation: minimum [dB]	Attenuation: maximum [dB]
2	2,60	4,20	2,50	4,50
3	4,10	5,90	4,00	6,10
4	5,40	7,80	5,30	8,10
6	6,80	9,50	6,70	9,80
8	8,10	11,40	8,00	11,70
12	9,50	13,00	9,40	13,30
16	10,80	14,90	10,70	15,20
24	12,00	16,60	11,95	17,40
32	13,10	18,60	13,10	18,90

Table 2: Wavelengths 1 450 nm - 1 480 nm and 1 580 nm - 1 600 nm

N	M = 1		M = 2	
	Attenuation: minimum [dB]	Attenuation: maximum [dB]	Attenuation: minimum [dB]	Attenuation: maximum [dB]
2	2,60	4,20	2,50	4,50
3	4,00	6,00	3,90	6,20
4	5,10	8,00	5,00	8,30
6	6,40	10,10	6,30	10,40
8	7,60	11,60	7,50	11,90
12	8,90	13,90	8,80	14,20
16	10,10	15,40	10,10	15,70
24	11,30	16,70	11,20	18,00
32	12,40	19,20	12,30	19,50

Table 3: Wavelength 1 600 nm - 1 650 nm

N	M = 1		M = 2	
	Attenuation: minimum [dB]	Attenuation: maximum [dB]	Attenuation: minimum [dB]	Attenuation: maximum [dB]
2	2,30	4,50	2,20	4,80
3	3,70	6,30	3,60	6,60
4	4,70	8,40	4,60	8,70
6	6,10	10,40	6,00	10,70
8	7,10	12,30	7,00	12,60
12	8,50	14,20	8,40	14,50
16	9,50	16,20	9,40	16,50
24	10,90	17,25	10,80	18,45
32	11,90	20,10	11,80	20,50

4.2 Directivity

Method: EN 181000 [1], subclause 4.5.5.

Condition: Directivity is measured between any pair of adjacent input and output ports.

Requirements: Allowable directivity of 55 dB (minimum).

4.3 Return loss

Method: EN 181000 [1], subclause 4.5.6.

Condition: All ports not under test shall be optically terminated to avoid unwanted reflections contributing to the measurement.

Requirements: Allowable return loss of 55 dB (minimum).

The value of the return loss shall be maintained throughout all the tests.

4.4 Polarization sensitivity

Method: IEC 1300-3-2 [2], method A (all polarization states).

Condition: The allowable sensitivity applies to every combination of input and output port.

Requirements: Maximum allowable loss variation of 0,20 dB for $N \leq 4$ and 0,50 dB for $N > 4$.

4.5 Vibration

Method: EN 181000 [1], subclause 4.6.1.

Details:

- frequency range: 10 - 55 Hz;
- displacement: 0,75 mm;
- number of axes: three orthogonal;
- endurance duration per axis: 0,50 hours;
- number of cycles (10-55-10): 15.

Requirements: On completion of the test, the attenuation limits of subclause 4.1.2 shall be met and the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 2 ms in at least one of the output ports.

4.6 Fibre nutation

This test is intended for use with devices terminated with reinforced cable.

Method: EN 181000 [1], subclause 4.6.35.

Details:

- number of cycles: 10;
- tensile force: 10 N.

Requirements: On completion of the test, the attenuation limits of subclause 4.1.2 shall be met and the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

4.7 Dry heat

Method: EN 181000 [1], subclause 4.6.18.

Details:

- temperature: $+70^{\circ}\text{C}$;
- duration of exposure: 96 hours;
- preconditioning procedure: standard atmospheric conditions for 2 hours (see subclause 4.1 of EN 181000 [1]);
- recovery procedure: allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements: During the test, the attenuation limits of subclause 4.1.2 shall be met. During and on completion of the test, the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 1 hour during the first 16 hours and thereafter at a maximum interval of 24 hours until completion of the test.

4.8 Damp heat (steady state)

Method: EN 181000 [1] subclause 4.6.19.

Details:

- temperature: 40°C;
- relative humidity: 93 % ± 2 %;
- exposure duration: 96 hours;
- preconditioning procedure: standard atmospheric conditions for 2 hours (see subclause 4.1 of EN 181000 [1]);
- recovery procedure: allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements: During the test, the attenuation limits of subclause 4.1.2 shall be met. During and on completion of the test, the attenuation shall be within the following limits of the initial value:

- ± 0,30 dB where $N \leq 4$;
- ± 0,50 dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 1 hour.

4.9 Change of temperature

Method: EN 181000 [1], subclause 4.6.22.

Details:

- high temperature: +70°C;
- low temperature: -25°C;
- duration at extreme temperatures: 1 hour;
- number of cycles: 12;
- rate of temperature change: 1°C/minute;
- preconditioning procedure: standard atmospheric conditions for 2 hours;
- recovery procedure: allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements: During the test, the attenuation limits of subclause 4.1.2 shall be met. During and on completion of the test, the attenuation shall be within the following limits of the initial value:

- ± 0,30 dB where $N \leq 4$;
- ± 0,50 dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 10 minutes.

4.10 Cold

Method: EN 181000 [1], subclause 4.6.17.

Details:

- temperature: -25°C;
- duration of exposure: 16 hours;
- preconditioning procedure: standard atmospheric conditions for 2 hours;
- recovery procedure: allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements: During the test, the attenuation limits of subclause 4.1.2 shall be met. During and on completion of the test, the attenuation shall be within the following limits of the initial value:

- ± 0,30 dB where $N \leq 4$;
- ± 0,50 dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 1 hour.

4.11 Condensation

This test shall be carried out on devices which are to be used in weather protected environments corresponding to ETS 300 019 [5], classes 3.3, 3.4 or 3.5, or in non-weather protected environments corresponding to ETS 300 019 [5], class 4.1.

Method: EN 181000 [1], subclause 4.6.21.

Details:

- preconditioning procedure: standard atmospheric conditions for 2 hours;
- recovery procedure: allow specimen to return to 20°C in a period not exceeding 2 hours.

Requirements: During the test, the attenuation limits of subclause 4.1.2 shall be met. During and on completion of the test, the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 10 minutes.

4.12 Torsion

This test is not applicable to devices terminated with primary coated fibre.

Method: IEC 1300-2-5 [3].

Details:

- magnitude and rate of application of the tensile load:
 - 15 N at a speed of 1 N/s (for reinforced cable terminated devices);
 - 2 N at a speed of 0,1 N/s (for secondary coated fibre terminated devices);
- point of application of the tensile load: 0,2 m from the end of the device;
- duration of the test: 25 cycles (not to exceed the cable specification);
- rotation: $\pm 180^\circ$.

Requirements: On completion of the test, the attenuation limits of subclause 4.1.2 shall be met and the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

4.13 Water immersion

This test shall be carried out on devices which are to be used in weather protected environments corresponding to ETS 300 019 [5], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [5], class 4.1.

Method: EN 181000 [1], subclause 4.6.24.

Details:

- head of water: 150 mm;
- temperature: +43°C;
- duration: 168 hours.

Requirements: During the test, the attenuation limits of subclause 4.1.2 shall be met. During and on completion of the test, the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

During the test, the attenuation value shall be measured at a maximum interval of 1 hour.

4.14 Corrosive atmosphere (salt mist)

This test shall be carried out on devices which are to be used in weather protected environments corresponding to ETS 300 019 [5], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [5], class 4.1.

Method: EN 181000 [1], subclause 4.6.26.

Details:

- atmosphere: 5 % sodium chloride (NaCl) salt solution, pH 6,5 - 7,2;
- temperature: +35°C;
- duration of test: 96 hours;
- preconditioning procedure: standard atmospheric conditions for 1 hour;
- recovery procedure: standard atmospheric conditions for 1 hour.

Requirements: On completion of the test, the attenuation limits of subclause 4.1.2 shall be met and the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

4.15 Industrial atmosphere

This test shall be carried out on devices which are to be used in weather protected environments corresponding to ETS 300 019 [5], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [5], class 4.1.

Method: EN 181000 [1], subclause 4.6.28.

Details:

- atmosphere: sulphur dioxide (SO₂) 25 ppm;
- temperature and relative humidity: +25°C, 75 %;
- duration of test: 96 hours;
- preconditioning procedure: standard atmospheric conditions for 1 hour;
- recovery procedure: standard atmospheric conditions for 1 hour.

Requirements: On completion of the test, the attenuation limits of subclause 4.1.2 shall be met and the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

4.16 Dust

This test shall be carried out on devices which are to be used in weather protected environments corresponding to ETS 300 019 [5], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [5], class 4.1.

Method: EN 181000 [1], subclause 4.6.27.

Details:

- dust particle size: diameter < 150 μ m;
- temperature and relative humidity: +35°C, 60 %;
- duration of test: 10 minutes.

Requirements: On completion of the test, the attenuation limits of subclause 4.1.2 shall be met and the attenuation shall be within the following limits of the initial value:

- $\pm 0,30$ dB where $N \leq 4$;
- $\pm 0,50$ dB where $N > 4$.

History

Document history	
August 1996	Public Enquiry PE 112: 1996-08-19 to 1996-12-13