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Foreword

This final 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 Voting 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it can be converted into an ETS, have its life extended for a further two years, be replaced by a new version, or be withdrawn.

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 fibre-pigtailed optical fixed attenuators to be used in single-mode optical fibre transmission networks and which are designed to be spliced into the optical path. This includes splices which are fabricated to produce an attenuation and which are fitted with an appropriate protector. It does not cover variable attenuators or attenuators that are based on connectors. This I-ETS is intended to establish uniform requirements for the following aspects:

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

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.

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 180000 (1996): "Generic specification: Fibre optic attenuators".

[2] IEC 1300-3-2: "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] draft IEC 1300-2-14: "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Tests - Part 2-14: Optical power handling".

[4] IEC 68-2-30: "Damp Heat (12 + 12 hour cycle)".

[5] IEC 1300-2-5 (1995): "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Tests - Part 2-5: Torsion/twist".

[6] ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

[7] IEC 1300-3-6: "Return Loss".

3 Definition

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

pigtailed fixed attenuator: A passive optical component which produces a controlled signal attenuation when inserted in an optical path. The attenuation shall not be adjustable and the attenuator shall be a one-piece assembly which does not have demateable components.

4 Details, measurements and performance requirements

Most of the tests required to qualify the performance of connectors for applications covered by this I-ETS are contained in EN 180000 [1]. Several tests which are required by ETSI member countries are not included in EN 180000 [1] and in these instances the test details from the IEC 1300-3 series have been called up by this I-ETS.

In this I-ETS the limit of allowed variation, expressed as a percentage, shall be interpreted as a percentage change in the attenuation measured in decibels (dB). For example, a variation of ±5 % for a 10 dB attenuator would be ±0,5 dB.

A length of 1,5 m on each side of the attenuator shall be exposed to the test conditions of all optical, mechanical and environmental tests unless otherwise specified in the test details.

4.1 Visual inspection

In accordance with EN 180000 [1], subclause 4.4.1.

Details:

preconditioning procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);

Requirements:

Workmanship shall be in accordance with subclause 2.4.2 of EN 180000 [1]. The device must be marked with the attenuation value and the operating wavelength. A serial number, or some other form of marking, shall be visible which uniquely identifies the manufacturer and the date of manufacture.

4.2 Attenuation

In accordance with EN 180000 [1], subclause 4.4.5. Attenuation is to be specified at either 1 310 nm or 1 550 nm.

4.2.1 Attenuation at 1 310 nm

Details:

wavelength:	1 310 nm (peak emission);
spectral width of source:	< 10 nm;
launch mode conditions:	cladding modes fully stripped;
lengths:	L1 ≥ 1,5 m, L2 ≥ 1,5 m, L3 ≥ 1,5 m, L4 ≥ 1,5 m, L5 ≥ 1,5 m;
maximum mean attenuation of temporary joint:	0,20 dB;
maximum standard deviation of temporary joint attenuation:	0,10 dB;
preconditioning procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
deviations:	one measurement per direction.

Requirements:

allowable attenuation values:	nominal value 5 dB = 4,5 dB to 5,5 dB;
	nominal value 10 dB = 9 dB to 11 dB;
	nominal value 15 dB = 13,5 dB to 16,5 dB;
	nominal value 20 dB = 18 dB to 22 dB.

4.2.2 Attenuation at 1 550 nm

Details:

wavelength:	1 550 nm (peak emission);
spectral width of source:	< 10 nm;
launch mode conditions:	cladding modes fully stripped;
lengths:	L1 ≥ 1,5 m, L2 ≥ 1,5 m, L3 ≥ 1,5 m, L4 ≥ 1,5 m, L5 ≥ 1,5 m;
maximum mean attenuation of temporary joint:	0,20 dB;
maximum standard deviation of temporary joint attenuation:	0,10 dB;
preconditioning procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
deviations:	one measurement per direction.

Requirements:

allowable attenuation values:	nominal value 5 dB = 4,5 dB to 5,5 dB;
	nominal value 10 dB = 9 dB to 11 dB;
	nominal value 15 dB = 13,5 dB to 16,5 dB;
	nominal value 20 dB = 18 dB to 22 dB.

4.3 Return loss

In accordance with EN 180000 [1], subclause 4.4.6.

An acceptable alternative is to measure the return loss using an Optical Time Domain Reflectometer in accordance with IEC 1300-3-6 [7], method 2.

4.3.1 Return loss at 1 310 nm

Details (for EN 180000, subclause 4.4.6):

minimum launch power of source:	-10 dBm;
spectral width of source:	< 10 nm;
launch fibre length:	≥ 1,5 m;
launch mode conditions:	fibre cladding mode fully stripped;
wavelength:	1 310 nm (peak emission);
source stability:	variation < ±0,1 dB;
branching device type:	2 × 2 "Transmissive Star";
branching device directivity:	> 60 dB;
branching device excess loss:	< 0,20 dB;
detector area:	> 1 mm^2;
detector linearity:	better than 1 %;
preconditioning procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
attenuation of temporary joint:	< 0,20 dB (fusion splice).

All fibre ends to be anti-reflection terminated.

Requirements:

return loss grade S:	≥ 25 dB;
return loss grade T:	≥ 35 dB;
return loss grade U:	≥ 50 dB;
return loss grade V:	≥ 55 dB.

4.3.2 Return loss at 1 550 nm

Details:

minimum launch power of source:	-10 dBm;
spectral width of source:	< 10 nm;
launch fibre length:	≥ 1,5 m;
launch mode conditions:	cladding modes fully stripped;
wavelength:	1 550 nm (peak emission);
source stability:	variation < ±0,1 dB;
branching device type:	2 × 2 "Transmissive Star";
branching device directivity:	> 60 dB;
branching device excess loss:	< 0,20 dB;
detector area:	> 1 mm^2;
detector linearity:	better than 1 %;
preconditioning procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
attenuation of temporary joint:	< 0,20 dB (fusion splice).

All fibre ends to be anti-reflection terminated.

Requirements:

return loss grade S:	≥ 25 dB;
return loss grade T:	≥ 35 dB;
return loss grade U:	≥ 50 dB;
return loss grade V:	≥ 55 dB.

4.4 Spectral dependence of attenuation

In accordance with EN 180000 [1], subclause 4.4.7.

Requirements:

Spectral dependence of attenuation: variation ≤ 5 % in the wavelength regions of 1 260 nm to 1 360 nm or 1 480 nm to 1 580 nm.

4.5 Polarization dependence of attenuation

In accordance with IEC 1300-3-2 [2], method A (all polarization states).

Requirements:

attenuation variation:	≤ 0,2 dB.

4.6 Optical power handling

In accordance with IEC 1300-2-14 [3].

Details:

CW test:

optical power:	10 mW;
test duration:	10 minutes.

pulsed light test:

peak power:	10 mW;
pulse duration:	0,2 ms to 0,8 ms;
light pulses:	10^4;
repetition rate:	10 to 1 000 pulses/s.

Requirements:

attenuation after test:	within ±10 % of initial value.

4.7 Modal noise

Test method and performance requirements are under study. Until harmonized methods and requirements are established, testing should be carried out in accordance with specific user test methods and requirements.

4.8 Vibration

In accordance with EN 180000 [1], subclause 4.5.1.

Details:

frequency range:	10 Hz to 55 Hz;
displacement:	0,75 mm;
number of axes:	three orthogonal;
endurance duration per axis:	0,5 hours;
number of cycles (10-55-10):	15.

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.9 Pulling

In accordance with EN 180000 [1], subclause 4.5.4.

Details:

magnitude and rate of application of the tensile load:	100 ± 5 N at a speed of 5 N/s for reinforced cable; 5 ± 0,5 N at a speed of 0,5 N/s for primary coated fibres;
point of application of the tensile load:	0,3 m from the end of the device;
duration of the test(maintaining the load):	120 s at 100 N for reinforced cable; 60 s at 5 N for primary coated fibre.

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.10 Torsion

In accordance with IEC 1300-2-5 [5].

Details:

magnitude of the tensile load:	15 N (for reinforced cable); 2 N (for primary coated fibre);
point of application of the tensile load:	0,2 m from the end of the attenuator;
duration of the test:	25 cycles (not to exceed the cable specification).

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.11 Drop test

In accordance to EN 180000 [1], subclause 4.5.14.

Details:

number of drops:	5;
drop height:	1,5 m.

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.12 Cold

In accordance with EN 180000 [1], subclause 4.5.17.

Details:

temperature:	-25°C;
duration of exposure:	16 hours;
optically functioning or not:	optically functioning;
preconditioning procedure:	standard atmospheric conditions for 2 hours (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements:

change in attenuation value during test:	< ±5 % of the initial value;
attenuation change after test:	< ±5 % of the initial value.

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

4.13 Dry heat

In accordance with EN 180000 [1], subclause 4.5.18.

Details:

temperature:	+70°C;
duration of exposure:	96 hours;
optically functioning or not:	optically functioning;
preconditioning procedure:	standard atmospheric conditions for 2 hours (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements:

change in attenuation value during test:	< ±5 % of the initial value;
attenuation change after test:	< ±5 % of the initial value.

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

4.14 Damp heat (steady state)

In accordance with EN 180000 [1], subclause 4.5.19.

Details:

temperature:	40°C;
relative humidity:	93 ± 2 %;
exposure duration:	96 hours;
optically functioning or not:	optically functioning;
preconditioning procedure	standard atmospheric conditions for 2 hours (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements:

change in attenuation value during test:	< ±5 % of the initial value;
attenuation change after test:	< ±5 % of the initial value.

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

4.15 Damp heat (cyclic)

This test shall be carried out on attenuators which are to be used in weather protected environments corresponding to ETS 300 019 [2], classes 3.3, 3.4 or 3.5.

The test should therefore be carried out in accordance with IEC 68-2-30 [4]. Test cycle variant 1 is preferred but this cycle requires special test chambers and variant 2 is acceptable for qualification.

Details:

test cycle	variant 1 or 2;
high temperature:	+ 55°C;
low temperature:	+ 25°C;
duration of each cycle:	24 hours;
number of cycles:	6;
pre-conditioning procedure:	2 hours at normal ambient conditions;
recovery procedure:	16 hours at normal ambient conditions.

Requirements:

change in attenuation value during test:	< ±5 % of the initial value;
attenuation change after test:	< ±5 % of the initial value.

4.16 Change of temperature

In accordance with EN 180000 [1], subclause 4.5.22.

Details:

high temperature:	+70°C;
low temperature:	-25°C;
duration:	1 hour;
number of cycles:	12;
rate of temperature change:	1°C per minute;
optically functioning or not:	optically functioning;
preconditioning procedure:	standard atmospheric conditions for 2 hours (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	allow specimen to return to 20°C in period not exceeding 2 hours.

Requirements:

change in attenuation value during test:	< ±5 % of the initial value;
attenuation change after test:	< ±5 % of the initial value.

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

4.17 Corrosive atmosphere (salt mist)

In accordance with EN 180000 [1], subclause 4.5.26.

This test shall be carried out on attenuators which are to be used in weather protected environments corresponding to ETS 300 019 [6], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [6], class 4.1.

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 (see subclause 4.1 of EN 180000 [1]);
recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]).

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.18 Industrial atmosphere

In accordance with EN 180000 [1], subclause 4.5.28.

This test shall be carried out on attenuators which are to be used in weather protected environments corresponding to ETS 300 019 [6], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [6], class 4.1.

Details:

atmosphere:	sulphur dioxide (SO_2) 25 ppm;
temperature and relative humidity:	+25°C, 75 % RH;
duration of test:	96 hours;
preconditioning procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]);
Recovery procedure:	standard atmospheric conditions for 1 hour (see subclause 4.1 of EN 180000 [1]).

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.19 Dust

In accordance with EN 180000 [1], subclause 4.5.27.

This test shall be carried out on attenuators which are to be used in weather protected environments corresponding to ETS 300 019 [6], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [6], class 4.1.

Details:

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

Requirements:

attenuation change after test:	< ±5 % of the initial value.

4.20 Condensation

In accordance with EN 180000 [1], subclause 4.5.21.

This test shall be carried out on attenuators which are to be used in non-weather protected environments corresponding to ETS 300 019 [6], class 4.1.

Details:

preconditioning procedure:	2 hours at normal ambient conditions;
recovery procedure:	2 hours at normal ambient conditions.

Requirements:

change in attenuation value during test:	< ±5 % of the initial value;
attenuation change after test:	< ±5 % of the initial value.

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

5 Acceptance criteria

5.1 Attenuation and return loss

A minimum sample size of 20 shall be measured at the required operation wavelength in accordance with subclauses 4.2 and 4.3.

5.2 Other optical, environmental and mechanical requirements

A minimum sample size of 4 shall be subjected to each test. Any parallel or serial grouping of tests can be used, provided that each test or serial group of tests is preceded by visual inspection and followed by the change of temperature test. Mechanical or environmental acceptance obtained from these tests may apply to other devices of the same design which have different attenuation values. Products which can be approved on the basis of commonality of design shall be agreed between the user and the supplier. The user may require a number of additional tests.

5.3 Pass/fail criteria

To satisfy the qualification approval requirements of this I-ETS performance specification there shall be no failures of any in the sample groups for any test parameter. If a failure does occur this shall be investigated and the cause of failure identified and corrected. The test which is affected shall then be repeated using the minimum sample size stated in this I-ETS.

A fully documented test report and supporting data shall be prepared and shall be available for inspection. Failures and the corrective action taken to eliminate failures shall be documented and evidence shall be presented to show that the corrective action will have no detrimental effect on the performance in any of the other tests. Design changes, as opposed to improvements in quality control, will usually be deemed to necessitate a repeat of the full qualification programme.

History

Document history			
August 1996	Public Enquiry	PE 112:	1996-08-19 to 1996-12-13
December 1997	Vote	V 9807:	1997-12-16 to 1998-02-13