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INTERNATIONAL STANDARD

colour inside

Fibre optic interconnecting devices and passive components performance standard –
Part 086-2: Non-connectorized single-mode bidirectional 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM devices for category C – Controlled environment

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CONTENTS

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 086-2: Non-connectorized single-mode bidirectional 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM devices for category C – Controlled environment

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International Standard IEC 61753-086-2 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/2892/FDIS	86B/2922/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 2.

A list of all parts of IEC 61753 series, under the general title *Fibre optic interconnecting devices and passive components performance standards*, 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

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 086-2: Non-connectorized single-mode bidirectional 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM devices for category C – Controlled environment

1 Scope

This part of IEC 61753 contains the minimum initial performance, test and measurement requirements and severities which a fibre optic pigtailed 1 490 / 1 550 nm downstream and 1 310 nm upstream wide wavelength division multiplexing (WWDM) passive optical network (PON) device must satisfy in order to be categorized as meeting the requirements of category C (controlled environments), as defined in Annex A of IEC 61753-1.

Annex B of this standard provides information concerning the function of the 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM.

2 Normative references

The following referenced 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 2-50: Product specifications – Sectional specification for class B single-mode fibres*

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

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

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 61300-3-2, *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 61300-3-6, *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: 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 61300-3-29, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-29: Examinations and measurements – Measurement techniques for characterizing the amplitude of the spectral transfer function of DWDM components*

IEC 61753-1, *Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance standard*

3 Test

Unless otherwise specified, all test methods are in accordance with the relevant part of IEC 61300 series.

Each test defines the number of samples to be evaluated. The samples used for each test are intended to be previously unstressed new samples but may also be selected from previously used samples if desired. The samples shall be terminated onto single-mode fibres as per IEC 60793-2-50, Type B 1.1, in either coated fibres (primary and secondary) or reinforced cable format. All measurements shall be carried out at normal room conditions, unless otherwise stated.

All tests shall be carried out over the optical wavelength bands of 1 260 nm to 1 360 nm, 1 480 nm to 1 500 nm, and 1 550 nm to 1 560 nm, unless otherwise specified.

NOTE 1 310 nm, 1 490 nm and 1 550 nm are the peak or centre wavelengths, stated for the bands 1 260 nm to 1 360 nm, 1 480 nm to 1 500 nm and 1 550 nm to 1 560 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 Reference components

The testing for these components does not require the use of reference components.

5.2 Dimensions

Dimensions shall comply with either an appropriate IEC interface standard or with those given in appropriate manufacturers drawings, where the IEC interface standard does not exist or cannot be used.

5.3 Sample size

Sample sizes for the tests are defined in Annex A of this standard.

5.4 Test details and requirements

Table 1 – Test details and requirements

No.	Test	Requirement	Details	
1	Attenuation IEC 61300-3-7	≤ 0,8 dB Attenuation shall be met over the operating wavelength ranges	Launch patchcord length: Source type: Launch conditions: Other requirements:	≥ 2 m Unpolarised The wavelength of the source shall be longer than cut-off wavelength of the fibre Test results shall be obtained under measurement uncertainty of ± 0,1 dB
2	Total channel isolation IEC 61300-3-7; IEC 61300-3-29	≥ 18 dB between wavelength ranges 1 480 nm to 1 500 nm and 1 550 nm to 1 560 nm; ≥ 30 dB between wavelength ranges 1 260 nm to 1 360 nm and 1 550 nm to 1 560 nm	Launch patchcord length: Source type: Launch conditions: Other requirements:	≥ 2 m Unpolarised The wavelength of the source shall be longer than cut-off wavelength of the fibre Test results shall be obtained under measurement uncertainty of ± 1 dB
3	Directivity IEC 61300-3-20	≥ 50 dB Grade U Directivity shall be met over the specified wavelength ranges	Source: Other requirements:	Laser diode (LD) Test results shall be obtained under measurement uncertainty of ± 1 dB All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement The directivity shall be measured between any pair of input or output ports

Table 1 *(continued)*

No.	Test	Requirement	Details	
4	Return loss IEC 61300-3-6	≥ 50 dB Grade U Return loss shall be met over the specified wavelength ranges	Source: Other requirements:	LD Test results shall be obtained under measurement uncertainty of ± 1 dB All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement
5	Polarisation dependent loss (PDL) IEC 61300-3-2	≤ 0,2 dB Polarisation dependent loss shall be met over the specified wavelength ranges	Launch patchcord length: Source type: Other requirements:	≥ 2 m LD Test results shall be obtained under measurement uncertainty of ± 0,05 dB
6	Optical power handling and damage threshold characterization IEC 61300-2-14	≥ 300 mW (sum of power at the three wavelength ranges at the same time) During and on completion of the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met During and on completion of the test the return loss limits of test No. 4 shall be met	Source type Max. power to be applied at wavelength range 1 550 nm to 1 560 nm: Max. power to be applied at wavelength ranges 1 480 nm to 1 500 nm and 1 260 nm to 1 360 nm: Power increments: Test duration: Other requirements:	LD 300 mW (+ ~25 dBm) 10 mW (+ 10 dBm) 3 dB 0,5 h at each power level Test results shall be obtained under attenuation measurement uncertainty of ± 0,1 dB Test results shall be obtained under return loss measurement uncertainty of ± 1 dB
7	Cold IEC 61300-2-17	During and on completion of the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met During and on completion of the test the return loss limits of test No. 4 shall be met	Temperature: Duration of the exposure: Maximum sampling interval during the test: Measurements required:	- 10 °C ± 2 °C 96 h 1 h Attenuation shall be measured before, during and after the test Return loss shall be measured before, during and after the test

Table 1 *(continued)*

No.	Test	Requirement	Details	
8	Dry heat – High temperature endurance IEC 61300-2-18	During and on completion of the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met During and on completion of the test the return loss limits of test No. 4 shall be met	Temperature: Duration of the exposure: Maximum sampling interval during the test: Measurements required:	+ 60 °C ± 2 °C 96 h 1 h Attenuation shall be measured before, during and after the test Return loss shall be measured before, during and after the test
9	Change of temperature IEC 61300-2-22	During and on completion of the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met During and on completion of the test the return loss limits of test No. 4 shall be met	High temperature: Low temperature: Number of cycles: Rate of temperature change: Duration at extreme temperatures: Maximum sampling interval during the test: Measurements required:	+ 60 °C ± 2 °C - 10 °C ± 2 °C 5 1 °C/min 1 h 0,5 h Attenuation shall be measured before, during and after the test Return loss shall be measured before, during and after the test
10	Damp heat (steady state) IEC 61300-2-19	During and on completion of the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met During and on completion of the test the return loss limits of test No. 4 shall be met	Temperature: Humidity: Duration of the exposure: Maximum sampling interval during the test: Measurements required:	+ 40 °C ± 2 °C 93 % RH ± 2 % RH 96 h 1 h Attenuation shall be measured before, during and after the test Return loss shall be measured before, during and after the test

Table 1 *(continued)*

No.	Test	Requirement	Details	
11	Vibration IEC 61300-2-1	After the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met After the test the return loss limits of test No. 4 shall be met	Frequency range: Constant vibration amplitude: Number of cycles: (10 Hz - 55 Hz -10 Hz): Frequency change: Number of axes: Duration per axis: Measurements required:	10 Hz – 55 Hz 0,75 mm 15 1 octave/min 3 orthogonal 0,5 h Attenuation shall be measured before and after the test Return loss shall be measured before and after the test
12	Shock IEC 61300-2-9	After the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met After the test the return loss limits of test No. 4 shall be met	Acceleration force: Number of axes: Duration shock: Pulse: Number of shocks: Measurements required:	500 G 3 main axes, perpendicular on each other 1 ms Half sine 2 per axis (one in each direction) Attenuation shall be measured before, after each axis and after the test Return loss shall be measured before and after the test

Table 1 *(continued)*

No.	Test	Requirement	Details	
13	Fibre/Cable retention IEC 61300-2-4	After the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met After the test the return loss limits of test No. 4 shall be met	Magnitude of the load: Load application point: Load rate: Duration of the load: Measurements required:	10 N ± 1 N for reinforced cable 5,0 N ± 0,5 N for secondary coated fibre 2,0 N ± 0,2 N at 0,5 N/s for primary coated fibre 0,3 m from the end of device 5 N/s for reinforced cable 0,5 N/s for coated fibre 120 s at 10 N 60 s at 5 N and 2 N Attenuation shall be measured before and after the test Return loss shall be measured before and after the test
14	Flexing of the strain Relief of fibre optic devices IEC 61300-2-44	After the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met After the test the return loss limits of test No. 4 shall be met	Magnitude of the load: Rate of load application: Load application point: Number of cycles: Measurements required:	2,0 N ± 0,2 N for reinforced cable 0,5 N/s for reinforced cable 0,2 m from end of device 30 cycles Attenuation shall be measured before and after the test Return loss shall be measured before and after the test
15	Static side load IEC 61300-2-42	After the test the attenuation limits of test No. 1 shall be met After the test the isolation limits of test No. 2 shall be met After the test the return loss limits of test No. 4 shall be met	Magnitude of the load: Load application point: Load rate: Duration of the load: Measurements required:	1,0 N ± 0,1 N for reinforced cable 0,2 N ± 0,1 N for secondary coated fibres 0,3 m from the end of device 0,5 N/s 1 h at 1N 5 min at 0,2 N Attenuation shall be measured before and after the test Return loss shall be measured before and after the test

Annex A
(normative)

Sample size

Table A.1 indicates sample sizes for the tests.

Table A.1 – Sample size

Sequence number	Test	Sample size
1	Attenuation	12
2	Total channel isolation	12
3	Directivity	12
4	Return loss	12
5	Polarization dependent loss	12
6	Optical power handling and damage threshold characterization	12
7	Cold	6
8	Dry Heat - High temperature endurance	6
9	Damp heat (steady state)	6
10	Change of temperature	6
11	Vibration	6
12	Shock	6
13	Fibre / Cable retention	6
14	Flexing of the strain relief of fibre optic devices	6
15	Static side load	6

Annex B
(informative)

General information for 1 490 / 1 550 nm downstream and 1 310 nm upstream PON WWDM devices

The 1 490 / 1 550 nm downstream and 1 310 nm upstream PON WWDM devices are used inside the PON for facilitating the transport of downstream traffic and the separate analogue radio frequency (RF) overlaid video (CATV) signal from the central office (CO) optical line terminal (OLT) with the upstream one from the optical network unit (ONU) installed at the premises. They also can be used to combine and separate the downstream and upstream traffic at the customer ONU.

They multiplex and demultiplex the voice, data and CATV:

– 1 310nm channel for Data/Voice upstream;
– 1 490nm channel for Data/Voice downstream;
– 1 550nm channel for CATV.

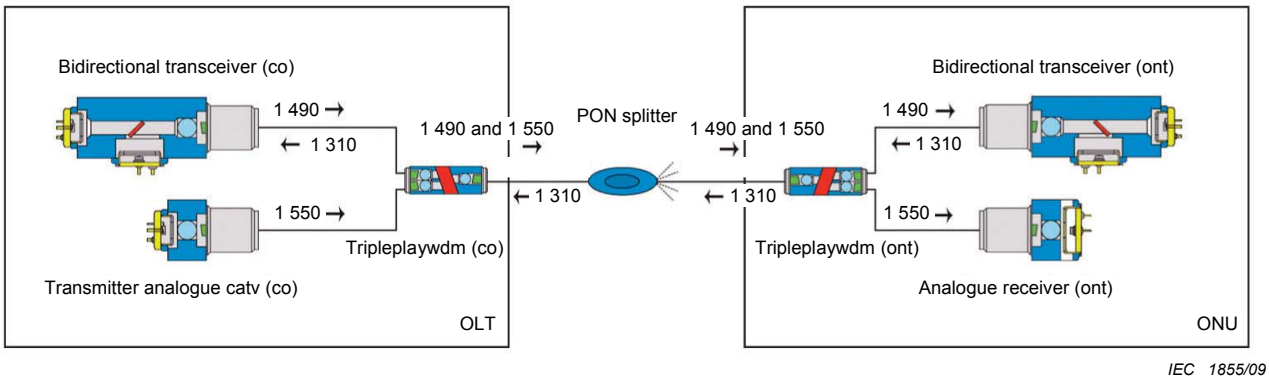

Figure B.1 – Example of 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM at central office and customer side – Separate video detection inside the ONU

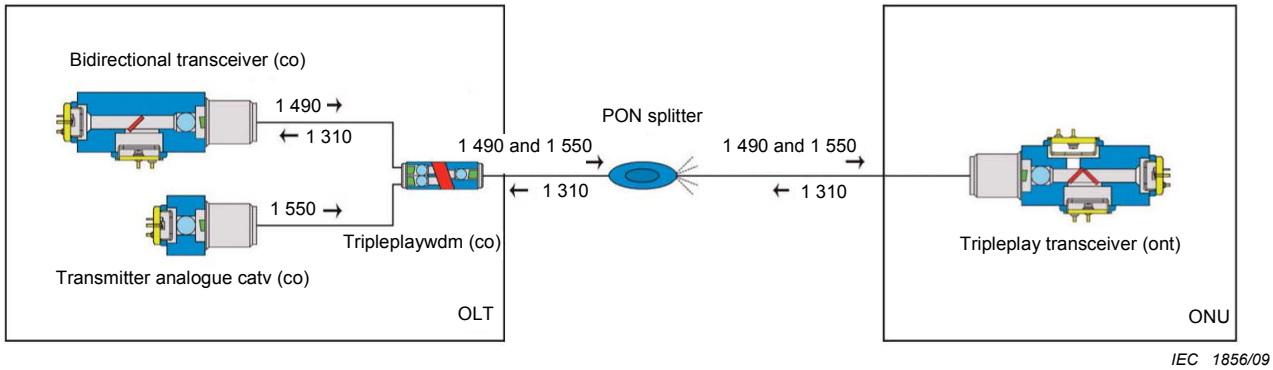

Figure B.2 – Example of 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM at central office side – Integrated video detection inside the ONU

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