

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –

Part 087-6: Non-connectorised single-mode bidirectional 1 310 nm upstream and 1 490 nm downstream WDM devices for category O – Uncontrolled environment

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

Partie 087-6: Dispositifs WDM unimodaux non-connectorisés bidirectionnels 1 310 nm en voie montante et 1 490 nm en voie descendante, pour la catégorie O – Environnement non contrôlé



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## CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references .....	5
3 Test.....	6
4 Test report.....	6
5 Performance requirements .....	6
5.1 Reference components.....	6
5.2 Dimensions .....	7
5.3 Sample size, sequencing and grouping .....	7
5.4 Test Details and Requirements.....	7
Annex A (normative) Sample size, sequencing and grouping .....	12
Annex B (informative) General information for 1 310 nm upstream and 1 490 nm downstream PON WWDM device .....	13
Bibliography.....	14
Figure B.1 – Example for 1490 nm downstream and 1310 nm upstream WWDM at central office and customer side.....	13
Table 1 – Test details and requirements .....	7
Table A.1 – Sample size and sequencing of tests .....	12

  
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**FIBRE OPTIC INTERCONNECTING DEVICES  
AND PASSIVE COMPONENTS –  
PERFORMANCE STANDARD –**

**Part 087-6: Non-connectorised single-mode  
bidirectional 1 310 nm upstream and  
1 490 nm downstream WWDM devices for category O –  
Uncontrolled environment**

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

CDV	Report on voting
86B/3256/CDV	86B/3328/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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# FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

## Part 087-6: Non-connectorised single-mode bidirectional 1 310 nm upstream and 1 490 nm downstream WWDM devices for category O – Uncontrolled environment

### 1 Scope

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

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

**ITeH STANDARD PREVIEW**

### 2 Normative references **(standards.iteh.ai)**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 61300-2-1, *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*

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 61300-2-19, *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 61300-2-48, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-48: Tests – Temperature-humidity cycling*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss 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: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components*

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

IEC 62074-1, *Fibre optic interconnecting devices and passive components – Fibre optic WDM devices – Part 1: Generic specification*

### 3 Test

Unless otherwise specified, all test methods are in accordance with IEC 61300 series standards. Each test defines the number of samples to be evaluated. The samples shall have pigtails of single-mode fibres as per IEC 60793-2-50 type B 1.1, B 1.3 or B 6 in either coated fibres (primary and secondary) or reinforced cable format. All measurements shall be carried out at standard atmosphere condition defined in IEC 61300-1, unless otherwise stated.

All tests shall be carried out over the operating wavelength ranges of 1 260 nm to 1 360 nm, 1 480 nm to 1 500 nm, unless otherwise specified.

NOTE 1 310 nm and 1 490 nm are the nominal or centre wavelengths, stated for the ranges 1 260 nm to 1 360 nm and 1 480 nm to 1 500 nm as defined in ITU-T Recommendations G.983.3 and G.984.2 and IEEE standard 802.3ah-2004.

### 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, sequencing and grouping

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

Test groups and test sequences shall be performed in sequential order as shown in Annex A.

The test sequence shown in Annex A shall be followed.

## 5.4 Test details and requirements

Table 1 gives test details and requirements.

**Table 1 – Test details and requirements**

No.	Test	Requirement	Details	
1	<b>Insertion loss (Attenuation)</b> IEC 61300-3-7	$\leq 0,8$ dB Insertion loss shall be met over the operating wavelength ranges.	Launch patchcord length: Source type: Launch conditions: Measurement uncertainty:	$\geq 2$ 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 $\pm 0,1$ dB.
2	<b>Wavelength Isolation</b> IEC 61300-3-7	$\geq 20$ dB between wavelength ranges 1 260 nm to 1 360 nm and 1 480 nm to 1 500 nm;	Launch patchcord length: Source type: Launch conditions: Measurement uncertainty:	$\geq 2$ 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 $\pm 1$ dB.
3	<b>Directivity</b> IEC 61300-3-20	$\geq 50$ dB Directivity shall be met over the operating wavelength ranges.	Source type: Measurement uncertainty: Other requirements:	Laser diode (LD) Test results shall be obtained under measurement uncertainty of $\pm 1$ 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	<b>Return Loss</b> IEC 61300-3-6	≥ 50 dB Grade U	Source type: Measurement wavelength: Measurement uncertainty:  Other requirements:	Laser diode (LD) 1 310 nm ± 20 nm, 1 490 nm ± 10 nm. 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	<b>Polarisation Dependent Loss (PDL)</b> IEC 61300-3-2	≤ 0,2 dB Polarisation dependent loss shall be met over the operating wavelength ranges.	Launch patchcord length: Source type: Measurement uncertainty:	≥ 2 m Laser diode (LD) Test results shall be obtained under measurement uncertainty of ± 0,05 dB.
6	<b>Optical Power Handling And Damage Threshold Characterization</b> IEC 61300-2-14 method 2	≥ 300 mW (sum of power at the two wavelength ranges at the same time) During and on completion of the test the insertion loss 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 ranges 1 480 nm to 1 500 nm and 1 260 nm to 1 360 nm: Power increments: Test duration: Measurement uncertainty:	Laser diode (LD) 300 mW (~ + 25 dBm) 3 dB 0,5 h at each power level. Test results shall be obtained under insertion loss measurement uncertainty of ± 0,1 dB. Test results shall be obtained under return loss measurement uncertainty of ± 1 dB.
7	<b>Damp Heat (Steady State)</b> IEC 61300-2-19	During and on completion of the test the insertion loss 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:	+ 75 °C ± 2 °C 90 % RH ± 5 % RH 168 h 1 h Insertion loss 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	<b>Vibration</b> IEC 61300-2-1	After the test the insertion loss 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: Measurements required:	10 Hz – 55 Hz 1,52 mm 15 1 octave/min 3 orthogonal Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
9	<b>Shock</b> IEC 61300-2-9	After the test the insertion loss 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:	5 000 m/s <sup>2</sup> 3 main axes, perpendicular on each other 1 ms Half sine 2 per axis and direction (two in each direction) Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
10	<b>Change Of Temperature</b> IEC 61300-2-22	During and on completion of the test the insertion loss 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:	+ 75 °C ± 2 °C - 40 °C ± 2 °C 10 1 °C/min 1 h 0,5 h Insertion loss 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	<b>Temperature humidity cycling</b> IEC 61300-2-48	During and on completion of the test the insertion loss 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: Humidity at high temperature: Number of cycles: Rate of temperature change: Duration at extreme temperatures: Maximum sampling interval during the test: Measurements required:	+ 85 °C ± 2 °C - 40 °C ± 2 °C 85 % RH ± 5 % RH 42 1 °C/min 1 h 0,5 h Insertion loss shall be measured before, during and after the test. Return loss shall be measured before, during and after the test.
12	<b>Flexing Of The Strain Relief Of Fibre Optic Devices</b> IEC 61300-2-44	After the test the insertion loss 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: Number of cycles: Measurements required:	5,0 N ± 0,5 N for reinforced cable, 2,0 N ± 0,2 N for primary and secondary coated fibres 0,2 m from end of device 10 Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
13	<b>Torsion/Twist</b> IEC 61300-2-5	After the test the insertion loss 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: Number of cycles: Measurements required:	5,0 N ± 0,5 N for reinforced cable, 2,0 N ± 0,2 N for primary and secondary coated fibres 30 Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.