

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Fibre optic interconnecting devices and passive components – Performance standard –**

**Part 382-2: Non-connectorized single-mode bidirectional G-PON-NGA WWDM devices for category C – Controlled environment**

[IEC 61753-382-2:2015](https://standards.iteh.ai/catalog/standards/sist/27a05ef8-c83e-49e8-81d8-114420023333/iec-61753-382-2:2015)

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**Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –**

**Partie 382-2: Dispositifs WWDM G-PON-NGA bidirectionnels unimodaux non connectés pour la catégorie C – Environnement contrôlé**



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

**Part 382-2: Non-connectorized single-mode  
bidirectional G-PON-NGA WDM devices for category C –  
Controlled environment**

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

FDIS	Report on voting
86B/3942FDIS	86B/3962/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.

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

## Part 382-2: Non-connectorized single-mode bidirectional G-PON-NGA 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 wide wavelength division multiplexing (WWDM) device for combining and splitting gigabit-capable passive optical networks (G-PON) up/down signals and next generation access (NGA) bands satisfies in order to be categorized as meeting the requirements of category C (controlled environments), as defined in Annex A of IEC 61753-1:2007.

Annex B of this standard provides information concerning the principle and function of the WWDM.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

### 2 Normative references

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

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

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 – High optical power*

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 strain relief*

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: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examination 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: Examination and measurements – Directivity of fibre optic branching devices*

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

ITU-T Recommendation G.984.2 – *Gigabit-capable Passive Optical Networks (G-PON): Physical Media Dependent (PMD) layer specification*

ITU-T Recommendation G.984.5 – *Gigabit-capable Passive Optical Networks (G-PON): Enhancement band*

### 3 Terms, definitions and abbreviations

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62074-1, as well as the following apply.

##### 3.1.1

##### **next generation access**

##### **NGA**

possible new optical access system that coexists with G-PON on the same ODN

Note 1 to entry: NGA is defined in ITU-T Recommendation G.984.5.

Note 2 to entry: This note applies to the French language only.



**3.1.2****gigabit-capable passive optical network wavelength range  
G-PON wavelength range**

range of wavelengths from 1 480 nm to 1 500 nm for downstream signal (single fibre system) and from 1 260 nm to 1 360 nm for upstream signal which are specified in ITU-T Recommendation G.984.2

Note 1 to entry: Within ITU-T Recommendation G.984.5 the upstream wavelength range for G-PON is reduced to enable coexistence of G-PON and additional services including NGA and video from 1 290 nm to 1 330 nm.

Note 2 to entry: This note applies to the French language only.

**3.1.3****next generation access downstream wavelength range  
NGAd wavelength range**

range of wavelengths from 1 400 nm to 1 450 nm and from 1 530 nm to 1 625 nm which are specified in ITU-T Recommendation G.984.5

**3.1.4****video wavelength range**

range of wavelengths between 1 550 nm and 1 560 nm which can be used for video distribution services

Note 1 to entry: The video distribution services wavelength range falls within the NGA wavelength range.

**3.1.5****optical time-domain reflectometer wavelength range  
OTDR wavelength range**

range of wavelengths from 1 625 nm to 1 675 nm which are reserved for monitoring purposes in ITU-T Recommendation G.984.5

Note 1 to entry: This note applies to the French language only.

**3.1.6****WDM1**

WDM filter that may be located in the central office to combine/isolate the wavelengths of G-PON and NGA signals and combine the video signals

Note 1 to entry: WDM1 is defined in ITU-T Recommendation G.984.5.

**3.2 Abbreviations**

The following abbreviations are given in order of appearance:

WWDM	wide wavelength division multiplexing
G-PON	gigabit-capable passive optical network
NGA	next generation access
ODN	optical distribution network
OTDR	optical time-domain reflectometer
OLT	optical line termination

Additional abbreviations from informative Annex B are given in order of appearance:

WDM1r	wavelength division multiplexer 1 (type) r
OLT1r	optical line termination 1 (type) r
NGAu	next generation access upstream
NGAd	next generation access downstream
NGAd wV	next generation access downstream with video (overlay)

NGA wV wO next generation access downstream with video (overlay) with OTDR

#### 4 Test

Unless otherwise specified, all test methods are in accordance with the 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 have pigtails of single-mode fibres as per IEC 60793-2-50 category B1.1, B1.3 or B6 in either coated fibres (primary and secondary) or reinforced cable format. All measurements shall be carried out at standard atmosphere conditions defined in IEC 61300-1, unless otherwise stated.

All tests shall be carried out over the wavelength range of 1 260 nm to 1 675 nm, unless otherwise specified.

NOTE 1 310 nm, and 1 490 nm are the centre wavelengths, stated for the ranges 1 260 nm to 1 360 nm, and 1 480 nm to 1 500 nm respectively, 1 550 nm are the nominal or centre wavelengths, stated for the ranges 1 550 nm to 1 560 nm, as defined in ITU-T Recommendations G.983.3, G.984.2 and IEEE standard 8023ah. 1 655 nm is the nominal centre wavelength for the OTDR wavelength range as defined in ITU-T Recommendation G.984.5.

#### 5 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.

#### 6 Performance requirements

##### 6.1 Reference components

[IEC 61753-382-2:2015](https://standards.iteh.ai/catalog/standards/sist/27a05ef8-c83e-49e8-81d8-645f921afbd/iec-61753-382-2-2015)

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

##### 6.2 Dimensions

Dimensions shall comply with those given in appropriate manufacturers drawings.

##### 6.3 Sample size

Sample sizes for the tests are defined in Annex A.

## 6.4 Test details and requirements

**Table 1 – Test details and requirements (1 of 5)**

No.	Test	Requirement		Details
1	Insertion loss (attenuation) IEC 61300-3-7	$\leq 0,8$ dB  Insertion loss shall be met between common port and OLT port for the wavelength ranges 1 290 nm to 1 440 nm and 1 480 nm to 1 500 nm and between common port and NGA port for the wavelength ranges 1 260 nm to 1 280 nm and 1 524 nm to 1 625 m	Launch patchcord length:  Source:  Launch conditions:   Measurement uncertainty:	$\geq 2$ m  Unpolarized  The wavelength of the source shall be longer than the cut-off wavelength of the fibre.  Test results shall be obtained under measurement uncertainty of $\pm 0,1$ dB
2	Wavelength isolation IEC 61300-3-7	$\geq 30$ dB  Wavelength isolation shall be met between common port and OLT port for the wavelength ranges 1 260 nm to 1 280 nm and 1 524 nm to 1 625 nm and between common port and NGA port for the wavelength ranges 1 290 nm to 1 440 nm and 1 480 nm to 1 500 nm	Launch patchcord length:  Source:  Launch conditions:   Measurement uncertainty:	$\geq 2$ m  Unpolarized  The wavelength of the source shall be longer than the cut-off wavelength of the fibre.  Test results shall be obtained under measurement uncertainty of $\pm 1$ dB
3	Directivity IEC 61300-3-20	$\geq 50$ dB Grade U between OLT port and NGA port.  Directivity shall be met over the specified 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
4	Return loss IEC 61300-3-7	$\geq 50$ dB Grade U  Return loss shall be met over the specified wavelength ranges.	Source type:  Measurement uncertainty:   Other requirements:	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
5	Polarisation dependent loss (PDL) IEC 61300-3-2	$\leq 0,2$ dB  PDL shall be met over the specified wavelength ranges	Launch patchcord length:  Source type:  Measurement uncertainty:	$\geq 2$ m  LD  Test results shall be obtained under measurement uncertainty of $\pm 0,05$ dB

**Table 1 (2 of 5)**

No.	Test	Requirement	Details	
6	High optical power IEC 61300-2-14	<p>≥ 300 mW (max power at the single wavelength on the wavelength ranges, at the same time).</p> <p>During and on completion of the test the insertion loss limits of test No. 1 shall be met.</p> <p>After the test the wavelength isolation limits of test No. 2 shall be met.</p> <p>During and on completion of the test, the return loss limits of test No. 4 shall be met</p>	<p>Source type:</p> <p>Max. power to be applied at wavelength 1 550 nm and wavelength range 1 620 nm to 1 630 nm (1 650 nm to 1 660 nm):</p> <p>Max. power to be applied at wavelength 1490 nm and 1310 nm:</p> <p>Temperature:</p> <p>Measurement uncertainty:</p>	<p>LD</p> <p>300 mW (+ ~25 dBm)</p> <p>10 mW (+10 dBm)</p> <p>60 °C ± 2 °C</p> <p>Test results shall be obtained under insertion loss measurement uncertainty of ± 0,1 dB.</p> <p>Test results shall be obtained under return loss measurement uncertainty of ± 1 dB</p>
7	Cold IEC 61300-2-17	<p>After the test the insertion loss limits of test No. 1 shall be met.</p> <p>In addition the insertion loss during the test shall be within ±0,3 dB from the initial value.</p> <p>After the test the wavelength isolation limits of test No. 2 shall be met.</p> <p>During and on completion of the test the return loss limits of test No. 4 shall be met.</p>	<p>Temperature:</p> <p>Duration of the exposure:</p> <p>Maximum sampling interval during the test:</p> <p>Measurements required:</p>	<p>-10 °C ± 2 °C</p> <p>96 h</p> <p>1 h</p> <p>Insertion loss shall be measured before, during and after the test.</p> <p>Return loss shall be measured before, during and after the test</p>
8	Dry heat – High temperature endurance IEC 61300-2-18	<p>After the test the insertion loss limits of test No. 1 shall be met.</p> <p>In addition, the insertion loss during the test shall be within ±0,3 dB from the initial value.</p> <p>After the test the wavelength isolation limits of test No. 2 shall be met.</p> <p>During and on completion of the test, the return loss limits of test No. 4 shall be met</p>	<p>Temperature:</p> <p>Duration of the exposure</p> <p>Maximum sampling interval during the test.</p> <p>Measurements required</p>	<p>+ 60 °C ± 2 °C</p> <p>96 h</p> <p>1 h</p> <p>Insertion loss shall be measured before, during and after the test.</p> <p>Return loss shall be measured before, during and after the test</p>

Table 1 (3 of 5)

No.	Test	Requirement	Details	
9	Change of temperature IEC 61300-2-22	<p>After the test the insertion loss limits of test No. 1 shall be met.</p> <p>In addition, the insertion loss during the test shall be within <math>\pm 0,3</math> dB from the initial value.</p> <p>After the test the wavelength isolation limits of test No. 2 shall be met.</p> <p>During and on completion of the test the return loss limits of test No. 4 shall be met.</p>	<p>High temperature:</p> <p>Low temperature:</p> <p>Number of cycles:</p> <p>Rate of temperature change:</p> <p>Duration at extreme temperatures:</p> <p>Maximum sampling interval during the test:</p> <p>Measurements required:</p>	<p><math>+60\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}</math></p> <p><math>-10\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}</math></p> <p>5</p> <p>1 <math>^{\circ}\text{C}/\text{min}</math></p> <p>1 h</p> <p>0,5 h</p> <p>Insertion loss shall be measured before, during and after the test.</p> <p>Return loss shall be measured before, during and after the test</p>
10	<b>Damp heat (steady state)</b> IEC 61300-2-19	<p>After the test the insertion loss limits of test No. 1 shall be met.</p> <p>In addition the insertion loss shall be within <math>\pm 0,3</math> dB from the initial value.</p> <p>After the test the wavelength isolation limits of test No. 2 shall be met.</p> <p>During and on completion of the test the return loss limits of test No. 4 shall be met.</p>	<p>Temperature:</p> <p>Humidity:</p> <p>Duration of the exposure:</p> <p>Maximum sampling interval during the test:</p> <p>Measurements required:</p>	<p><math>+40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}</math></p> <p>93 % RH + 2 % RH, -3 % RH</p> <p>96 h</p> <p>1 h</p> <p>Insertion loss shall be measured before, during and after the test.</p> <p>Return loss shall be measured before, during and after the test</p>
11	Vibration IEC 61300-2-1	<p>After the test the insertion loss limits of test No. 1 shall be met.</p> <p>After the test the wavelength isolation limits of test No. 2 shall be met.</p> <p>After the test the return loss limits of test No. 4 shall be met</p>	<p>Frequency range:</p> <p>Constant vibration amplitude:</p> <p>Number of cycles (10 Hz to 55 Hz to 10 Hz):</p> <p>Frequency change:</p> <p>Number of axes:</p> <p>Measurements required:</p>	<p>10 Hz to 55 Hz</p> <p>0,75 mm</p> <p>15</p> <p>1 octave/min</p> <p>3 orthogonal</p> <p>Insertion loss shall be measured before and after the test.</p> <p>Return loss shall be measured before and after the test</p>