# IEC 61753-086-6

Edition 1.0 2010-12

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

## Fibre optic interconnecting devices and passive components – Performance standard –
## Part 086-6: Non-connectorized single-mode bidirectional 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM devices for category O – Uncontrolled environment

## Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –
## Partie 086-6: Dispositifs WWDM unimodaux non connectorisés bidirectionnels 1 490 / 1 550 nm en voie descendante et 1 310 nm en voie montante pour la catégorie O – Environnement non contrôlé

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

## Part 086-6: Non-connectorized single-mode bidirectional 1 490 / 1 550 nm downstream and 1 310 nm upstream WWDM devices for category O – Uncontrolled environment

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

| FDIS | Report on voting |
|---|---|
| 86B/3094/FDIS | 86B/3132/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.

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

## Part 086-6: Non-connectorized single-mode bidirectional 1 490 / 1 550 nm downstream and 1 310 nm upstream 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 1 490 / 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 O (uncontrolled environment), as defined in Annex A of IEC 61753-1:2007.

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 fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

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*

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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: Examinations 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 61753-1:2007, *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 IEC 61300 series. 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 or B 1.3 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 operating wavelength ranges 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 nominal or centre wavelengths, stated for the ranges 1 260 nm to 1 360 nm, 1 480 nm to 1 500 nm and 1 550 nm to 1 560 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.

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### 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

For test details and requirements, please see Table 1.

**Table 1 – Test details and requirements**

| No. | Test | Requirement | Details | |
|---|---|---|---|---|
| 1 | **Insertion loss (Attenuation)**<br><br>IEC 61300-3-7 | ≤ 0,8 dB<br>Insertion loss shall be met over the operating wavelength ranges. | Launch patchcord length:<br>Source type:<br>Launch conditions:<br><br>Other requirements: | ≥ 2 m<br><br>Unpolarised<br>The wavelength of the source shall be longer than cut-off wavelength of the fibre.<br>Test results shall be obtained under measurement uncertainty of ± 0,1 dB. |
| 2 | **Wavelength isolation**<br><br>IEC 61300-3-7 | ≥ 18 dB between wavelength ranges 1 480 nm to 1 500 nm and 1 550 nm to 1 560 nm;<br>≥ 30 dB between wavelength ranges 1 260 nm to 1 360 nm and 1 550 nm to 1 560 nm; | Launch patchcord length:<br>Source type:<br>Launch conditions:<br><br>Other requirements: | ≥ 2 m<br><br>Unpolarised<br>The wavelength of the source shall be longer than the cut-off wavelength of the fibre.<br>Test results shall be obtained under measurement uncertainty of ±1 dB. |
| 3 | **Directivity**<br><br>IEC 61300-3-20 | ≥ 50 dB Grade U<br><br>Directivity shall be met over the operating wavelength ranges. | Source:<br>Other requirements: | Laser diode (LD)<br>Test results shall be obtained under measurement uncertainty of ± 1 dB.<br>All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement.<br>The directivity shall be measured between any pair of input or output ports. |
| 4 | **Return loss**<br><br>IEC 61300-3-6 | ≥ 50 dB Grade U<br><br>Return loss shall be met over the specified wavelength ranges. | Source:<br>Other requirements: | LD<br>Test results shall be obtained under measurement uncertainty of ±1 dB.<br>All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement. |
| 5 | **Polarisation dependent loss (PDL)**<br><br>IEC 61300-3-2 | ≤ 0,2 dB<br><br>Polarisation dependent loss shall be met over the specified wavelength ranges. | Launch patchcord length:<br>Source type:<br>Other requirements: | ≥ 2 m<br><br>LD<br>Test results shall be obtained under measurement uncertainty of ± 0,05 dB. |

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**Table 1** (*continued*)

| No. | Test | Requirement | Details | |
|---|---|---|---|---|
| 6 | **Optical ower handling and damage threshold characterization**<br><br>IEC 61300-2-14, method 2 | ≥ 300 mW (sum of power at the three wavelength ranges at the same time)<br><br>During and on completion of the test the insertion loss limits of Test No. 1 shall be met.<br><br>After the test the isolation limits of Test No. 2 shall be met.<br><br>During and on completion of the test the return loss limits of Test No. 4 shall be met. | Source type<br>Max. power to be applied at wavelength range 1 550 nm to 1 560 nm:<br>Max. power to be applied at wavelength ranges 1 480 nm to 1 500 nm and 1 260 nm to 1 360 nm:<br>Power increments:<br>Test duration:<br>Other requirements: | LD<br>300 mW (+ ~25 dBm)<br><br>10 mW (+ 10 dBm)<br><br>3 dB<br><br>0,5 h at each power level.<br>Test results shall be obtained under insertion loss measurement uncertainty of ±0,1 dB.<br>Test results shall be obtained under return loss measurement uncertainty of ±1 dB. |
| 7 | **Damp heat (steady state)**<br><br>**IEC 61300-2-19** | During and on completion of the test the insertion loss limits of Test No. 1 shall be met.<br><br>After the test the isolation limits of Test No. 2 shall be met.<br><br>During and on completion of the test the return loss limits of Test No. 4 shall be met. | Temperature:<br>Humidity:<br>Duration of the exposure:<br>Maximum sampling interval during the test:<br>Measurements required: | + 75 °C ± 2 °C<br>90 % RH ± 5 % RH<br>168 h<br><br>1 h<br><br>Insertion loss shall be measured before, during and after the test.<br>Return loss shall be measured before, during and after the test. |
| 8 | **Vibration**<br><br>IEC 61300-2-1 | After the test the insertion loss limits of Test No. 1 shall be met.<br><br>After the Test the isolation limits of test No. 2 shall be met.<br><br>After the test the return loss limits of Test No. 4 shall be met. | Frequency range:<br>Constant vibration amplitude:<br>Number of cycles (10 Hz - 55 Hz - 10 Hz):<br>Frequency change:<br>Number of axes:<br>Duration per axis:<br>Measurements required: | 10 Hz - 55 Hz<br>1,52 mm<br><br>15<br><br>1 octave/min<br>3 orthogonal<br>2 h<br><br>Insertion loss shall be measured before and after the test.<br>Return loss shall be measured before and after the test. |

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**Table 1** (*continued*)

| No. | Test | Requirement | Details | |
|---|---|---|---|---|
| 9 | **Shock**<br><br>IEC 61300-2-9 | After the test the insertion loss limits of Test No. 1 shall be met.<br><br>After the test the isolation limits of Test No. 2 shall be met.<br><br>After the test the return loss limits of Test No. 4 shall be met. | Acceleration force:<br>Number of shocks:<br>Number of axes:<br><br>Duration shock:<br>Pulse:<br>Number of shocks:<br>Measurements required: | 500 $g_n$<br><br>12<br><br>3 main axes, perpendicular on each other<br>1 ms<br>Half sine<br>2 per axis and direction (two in each direction)<br>Insertion loss shall be measured before and after the test.<br>Return loss shall be measured before and after the test. |
| 10 | **Change of temperature**<br><br>IEC 61300-2-22 | During and on completion of the test the insertion loss limits of Test No. 1 shall be met.<br><br>After the test the isolation limits of Test No. 2 shall be met.<br><br>During and on completion of the test the return loss limits of Test No. 4 shall be met. | High temperature:<br>Low temperature:<br>Number of cycles:<br>Rate of temperature change:<br>Duration at extreme temperatures:<br>Maximum sampling interval during the test:<br>Measurements required: | + 75 °C ± 2 °C<br><br>- 40 °C ± 2 °C<br><br>10<br><br>1 °C/min<br><br>1 h<br><br>0,5 h<br><br>Insertion loss shall be measured before, during and after the test.<br>Return loss shall be measured before, during and after the test. |
| 11 | **Temperature humidity cycling**<br><br>IEC 61300-2-48 | During and on completion of the test the insertion loss limits of Test No. 1 shall be met.<br><br>After the test the isolation limits of Test No. 2 shall be met.<br><br>During and on completion of the test the return loss limits of Test No. 4 shall be met. | High temperature:<br>Low temperature:<br>Humidity at high temperature:<br>Number of cycles:<br>Rate of temperature change:<br>Duration at extreme temperatures:<br>Maximum sampling interval during the test:<br>Measurements required: | + 85 °C ± 2 °C<br><br>- 40 °C ± 2 °C<br><br>85 % RH ± 5 % RH<br><br>42<br><br>1 °C/min<br><br>1 h<br><br>0,5 h<br><br>Insertion loss shall be measured before, during and after the test.<br>Return loss shall be measured before, during and after the test. |

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