

INTERNATIONAL STANDARD

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Fibre optic interconnecting devices and passive components – Performance standard –

Part 058-2: Single mode fibre pigtailed style optical power limiter for category C – Controlled environment

[IEC 61753-058-2:2013](#)

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

Partie 058-2: Limiteur de puissance optique de type fibre amorce, à fibre unimodale pour catégorie C – Environnement contrôlé



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES AND
PASSIVE COMPONENTS – PERFORMANCE STANDARD –**
**Part 058-2: Single mode fibre pigtailed style optical
power limiter for category C – Controlled environment**

FOREWORD

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International Standard IEC 61753-058-2 has been prepared by subcommittee SC86B: Fibre optic interconnecting devices and passive components, of IEC technical committee TC86: Fibre optics.

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

| | |
|---------------|------------------|
| FDIS | Report on voting |
| 86B/3552/FDIS | 86B/3594/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 in the IEC 61753 series, published under the general title *Fibre optic interconnecting devices and passive components – Performance standard*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

- 1) The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning power limiters, registered as follows:

| Country | Patent number |
|----------------|----------------|
| Israel | 147554 |
| European Union | EP 1467239 A2 |
| USA | USP110/398'859 |
| Japan | 4587695 |
| Canada | 24649043 |

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- 2) The optical power limiter is a passive device that regulates the optical power in fibres, producing a controlled, constant output power P_{limit} , as a result of varying input power higher than P_{limit} , and has no influence at powers below P_{limit} . Under normal operation, when the input power is low, the optical power limiter has no effect on the system. However, when the input power is high, the optical output power is limited to a predetermined level (P_{limit}). The optical limiter is wavelength independent over its entire specified spectral range. IEC 60869-1 contains the generic information of the optical power limiter. The optical power limiter is used at the input of power-sensitive equipment and at the output of high power devices, such as amplifiers, or wherever power regulation is required. The optical power limiter can serve as an eye safety device. The optical power limiter has a maximal allowed optical power $P_{\text{in max}}$. Above this power the optical limiter can melt down and open a through path for light. Numerical values for $P_{\text{in max}}$ are given in Annex D.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 058-2: Single mode fibre pigtailed style optical power limiter for category C – Controlled environment

1 Scope

This part of IEC 61753 contains the minimum initial test and measurement requirements and severities which an optical power limiter needs to satisfy in order to be categorized as meeting the requirements of single mode fibre pigtailed style optical power limiter used in controlled environments. Optical performance specified in this standard relates to in-line type configuration power limiters only.

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 60869-1, *Fibre optic interconnecting devices and passive components – Fibre optic passive power control devices – Part 1: Generic specification*

[IEC 61753-058-2:2013](#)

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 connectors*

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 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

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 61300-3-32, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-32: Examinations and measurements – Polarization mode dispersion measurement for passive optical components*

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3 Tests

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All test methods are in accordance with the IEC 61300 series.

All tests shall be carried out to validate performance over the required operating wavelength and power range.

4 Test reports

Fully documented test reports and supporting evidence shall be prepared and shall be available for inspection as evidence that the tests have been carried out and complied with relevant requirements.

5 Performance requirements

5.1 Sample size, sequencing and grouping

Sample sizes for the tests are defined in Annex A.

Test groups shall be performed as shown in Annex A.

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 Test details and requirements

Table 1 specifies the optical, environmental and mechanical performance requirements and related test methods for optical power limiters.

Compliance to this standard requires demonstration of the ability to meet the relevant performance requirement in Table 1.

Table 1 – Performance requirements for optical power limiters (1 of 6)

| No. | Tests | Requirements | Details | |
|-----|------------------------------|---|---|---|
| 1 | Insertion loss | Operating wavelength range: 1 520 nm-1 625 nm Insertion loss: ≤ 2 dB for $P_{\text{limit}} > 9$ dBm ≤ 5 dB for 0 dBm $\leq P_{\text{limit}}$ ≤ 9 dBm ≤ 7 dB for $P_{\text{limit}} \leq 0$ dBm Insertion loss is measured with input power ≤ -5 dBm. This power level is always below P_{limit} at the linear behaviour of the limiter | Method: Launch patchcord length: Launch conditions: Source power stability: Wavelength range: Total uncertainty: | IEC 61300-3-7, method B.2.1. Test sample configuration in accordance with IEC 61300-3-4, substitution method. ≥ 2 m. Only the fundamental mode shall propagate at the optical power limiter interface and at the detector. The wavelength of the source shall be longer than cut-off wavelength of the fibre $\leq \pm 0,05$ dB over the measuring period or at least 1 h 1 520 nm to 1 625 nm $\leq \pm 0,05$ dB |
| 2 | Return loss | Up to $P_{\text{limit}}: \geq 40$ dB return loss is measured with input power ≤ -5 dBm. This power level is always below P_{limit} at the linear behaviour of the limiter. Above $P_{\text{limit}}: \geq 30$ dB return loss is measured with input power of + 3 dB above P_{limit} | Method: Optical source wavelength: Total uncertainty: | IEC 61300-3-6, Method 1 OCWR 1 520 nm and 1 625 nm Test every sample with the two wavelengths $\leq \pm 2$ dB over the dynamic range to be measured |
| 3 | Polarization dependent loss | $\leq 0,2$ dB Over the specified operating wavelength range. Measurements carried out only in low power ≤ -5 dBm | Method: Optical source wavelength: Total uncertainty: | IEC 61300-3-2, all polarization method 1 550 nm ± 10 nm $\leq \pm 0,05$ dB over the dynamic range to be measured |
| 4 | Polarization mode dispersion | $\leq 0,2$ ps Over the specified operating wavelength range. Measurements carried out only in low power ≤ -5 dBm | Method: Optical source wavelength: Total uncertainty: | IEC 61300-3-32, MPS method 1 550 nm ± 10 nm $\leq \pm 0,05$ dB over the dynamic range to be measured |

Table 1 (2 of 6)

| No. | Tests | Requirements | Details | |
|-----|--------------------|--|---|--|
| 5 | High optical power | <p>Before and after the test, the insertion loss shall meet the requirements of test 1.</p> <p>Before and after the test, the return loss shall meet the requirements of test 2</p> | <p>Method:</p> <p>Test temperature:</p> <p>Power loads for testing:</p> <p>Optical source wavelength:</p> <p>Test duration:</p> <p>Launch patchcord length and launch conditions:</p> | <p>Future IEC 61300-2-14: Full characterization at a specific wavelength</p> <p>25 °C ± 2 °C</p> <p>For $P_{\text{limit}} \leq 10$ dBm: $P_{\text{limit}} + 5$ dB for continuous wave (CW) operation, tested for 96 h $P_{\text{limit}} + 8$ dB for short bursts, up to 1 s/min for 1 h</p> <p>For $P_{\text{limit}} > 10$ dBm: $P_{\text{limit}} + 3$ dB for CW operation, tested for 96 h $P_{\text{limit}} + 5$ dB for short bursts, up to 1 s/min for 1 h</p> <p>1 550 nm</p> <p>Duration of long-term test: 96 h at max. power. For short bursts, up to 1 s/ min</p> <p>Same as test No. 1</p> |
| 6 | Limit power | <p>P_{limit} as specified ± 0,5 dB.</p> <p>P_{limit} example is shown in Annex B.</p> <p>The limiter will meet the limit power requirements as specified in Annex D, when operated at the 3 specified temperatures.</p> <p>This test uses a slowly varying optical power source starting at -5 dBm and up to +8 dB above P_{limit}, giving results of insertion loss and P_{limit} for the whole range of input powers</p> | <p>Method:</p> <p>Source:</p> <p>Optical source wavelength:</p> <p>Optical source power increment:</p> <p>Test temperature:</p> <p>Detector system:</p> <p>Launch patchcord length and Launch conditions:</p> | <p>See Annex F</p> <p>Slowly varying optical power source from -5 dBm and up to +8 dB above P_{limit}</p> <p>1 550 nm</p> <p>100 mW power increments, at a rate of 1 increment of 100 mW/s</p> <p>10 °C ± 2 °C 25 °C ± 2 °C 60 °C ± 2 °C</p> <p>Linearity within ± 0,05 dB. Spectral response matched to source. Dynamic range between -5 dBm to +8 dB above P_{limit}</p> <p>Same as test No. 1</p> |

Table 1 (3 of 6)

| No. | Tests | Requirements | Details | |
|-----|--------------------------|---|--|---|
| 7 | Response time | <p>500 $\mu\text{s} \pm 10 \mu\text{s}$</p> <p>Response time example see Annex C.</p> <p>The limiter will meet the requirements as specified when operated at the 3 specified temperatures</p> | <p>Method:</p> <p>Optical source:</p> <p>Optical source wavelength:</p> <p>Test temperature:</p> <p>Launch patchcord length and Launch conditions:</p> | <p>See Annex F</p> <p>Laser source having adjustable power up to 8 dB above P_{limit}</p> <p>Square wave input power, having rise time of 10 μs</p> <p>1 550 nm</p> <p>10 °C \pm 2 °C</p> <p>25 °C \pm 2 °C</p> <p>60 °C \pm 2 °C</p> <p>Same as test No.1</p> |
| 8 | Damp heat (steady state) | <p>Before and after the test the insertion loss shall meet the requirements of test 1.</p> <p>Before and after the test the return loss shall meet the requirements of test 2.</p> <p>The insertion loss change during the test shall be within $\pm 0,5$ dB of the initial value .</p> <p>Above measurements carried out in power ≤ -5 dBm</p> <p>Before and after the test the P_{limit} shall meet the requirements of test 6</p> | <p>Method:</p> <p>Pre conditioning procedure:</p> <p>Temperature:</p> <p>Relative humidity:</p> <p>Duration of exposure:</p> <p>Specimen optically functioning:</p> <p>Optical source wavelength:</p> <p>Recovery procedure:</p> | <p>IEC 61300-2-19</p> <p>During the test, the change in insertion loss shall be measured by test method IEC 61300-3-3.</p> <p>Standard atmospheric conditions as defined in IEC 61300-1 for 2 h.</p> <p>+40 \pm 2 °C</p> <p>93 \pm $\frac{2}{3}$ %</p> <p>96 h</p> <p>Yes</p> <p>1 550 nm</p> <p>Allow specimens to return to standard atmospheric conditions as defined in IEC 61300-1 in 2 h</p> |

Table 1 (4 of 6)

| No. | Tests | Requirements | Details | |
|-----|---------------------------------------|--|--|---|
| 9 | Change of temperature | <p>Before and after the test the insertion loss shall meet the requirements of test 1.</p> <p>Before and after the test the return loss shall meet the requirements of test 2.</p> <p>The insertion loss change during the test shall be within $\pm 0,5$ dB of the initial value. The above measurements are carried out at a power of ≤ -5 dBm.</p> <p>Before and after the test, the P_{limit} shall meet the requirements of test 6</p> | <p>Method:</p> <p>Pre conditioning procedure:</p> <p>High temperature:</p> <p>Low temperature:</p> <p>Duration at extreme temperature:</p> <p>Temperature rate of change:</p> <p>Number of cycles:</p> <p>Specimen optically functioning:</p> <p>Maximum sampling interval during the test:</p> <p>Optical source wavelength:</p> <p>Recovery procedure:</p> | <p>IEC 61300-2-22</p> <p>During the test the change in insertion loss shall be measured by test method IEC 61300-3-3.</p> <p>Standard atmospheric conditions as defined in IEC 61300-1 for 2 h.</p> <p>$+60 \pm 2$ °C</p> <p>-10 ± 2 °C</p> <p>1 h</p> <p>1 °C/min</p> <p>5</p> <p>Yes</p> <p>15 min</p> <p>1 550 nm</p> <p>Allow specimens to return to standard atmospheric conditions as defined in IEC 61300-1 in 2 h</p> |
| 10 | Dry heat – High temperature endurance | <p>Before and after the test the insertion loss shall meet the requirements of test 1.</p> <p>Before and after the test the return loss shall meet the requirements of test 2</p> <p>The insertion loss change during the test shall be within $\pm 0,5$ dB of the initial value. The above measurements carried out at a power of ≤ -5 dBm.</p> <p>Before and after the test the P_{limit} shall meet the requirements of test 6</p> | <p>Method:</p> <p>Pre conditioning procedure:</p> <p>High temperature:</p> <p>Duration at extreme temperature:</p> <p>Maximum sampling interval during the test:</p> <p>Specimen optically functioning:</p> <p>Optical source wavelength:</p> <p>Recovery procedure:</p> | <p>IEC 61300-2-18.</p> <p>During the test the change in insertion loss shall be measured by test method IEC 61300-3-3.</p> <p>Standard atmospheric conditions as defined in IEC 61300-1 for 2 h.</p> <p>$+60 \pm 2$ °C</p> <p>96 h</p> <p>1 h</p> <p>Yes</p> <p>1 550 nm</p> <p>Allow specimens to return to standard atmospheric conditions as defined in IEC 61300-1 within 2 h</p> |