

Optical amplifiers - Test methods - Part 1: Power and gain parameters

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English Version

**Optical amplifiers - Test methods - Part 1: Power and gain  
parameters  
(IEC 61290-1:2022)**

Amplificateurs optiques - Méthodes d'essai - Partie 1:  
Paramètres de puissance et de gain  
(IEC 61290-1:2022)

Prüfverfahren für Lichtwellenleiter-Verstärker - Teil 1:  
Optische Leistungs- und Verstärkungsparameter  
(IEC 61290-1:2022)

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## European foreword

The text of document 86C/1746/CDV, future edition 2 of IEC 61290-1, prepared by SC 86C "Fibre optic systems and active devices" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61290-1:2022.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-04-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-07-12

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IEC 60793-1-1	NOTE Harmonized as EN 60793-1-1
IEC 60793-1-40	NOTE Harmonized as EN IEC 60793-1-40
IEC 60825-1	NOTE Harmonized as EN 60825-1
IEC 60825-2	NOTE Harmonized as EN 60825-2
IEC 61290-10 (series)	NOTE Harmonized as EN 61290-10 (series)

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Optical amplifiers – Test methods –  
Part 1: Power and gain parameters**

**Amplificateurs optiques – Méthodes d'essai –  
Partie 1: Paramètres de puissance et de gain**



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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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**Optical amplifiers – Test methods –  
Part 1: Power and gain parameters**

**Amplificateurs optiques – Méthodes d’essai –  
Partie 1: Paramètres de puissance et de gain**

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**OPTICAL AMPLIFIERS – TEST METHODS –****Part 1: Power and gain parameters**

## FOREWORD

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IEC 61290-1 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics. It is an International Standard.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) specification of gain ripple as a new parameter;
- b) specification of test method and test report for gain ripple measurements;
- c) use of the term “measurement uncertainty” instead of “measurement accuracy”.

The text of this International Standard is based on the following documents:

Draft	Report on voting
86C/1746/FDIS	86C/1783/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

A list of all parts in the IEC 61290 series, published under the general title *Optical amplifiers – Test methods*, can be found on the IEC website.

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## OPTICAL AMPLIFIERS – TEST METHODS –

### Part 1: Power and gain parameters

#### 1 Scope

This part of IEC 61290 applies to all commercially available optical amplifiers (OAs) and optically amplified subsystems. It applies to OAs using optically pumped fibres (optical fibre amplifiers (OFAs) based on either rare-earth doped fibres or on the Raman effect), semiconductors (semiconductor optical amplifiers (SOAs)), and waveguides (planar optical waveguide amplifiers (POWAs)). It is specifically directed to single-channel amplifiers. Test methods for multichannel amplifiers are defined in the IEC 61290-10 series.

This document establishes uniform requirements for accurate and reliable measurements of the following OA parameters, as defined in IEC 61291-1:2018, Clause 3:

- a) nominal output signal power;
- b) gain;
- c) reverse gain;
- d) maximum gain;
- e) maximum gain wavelength;
- f) maximum gain variation with temperature;
- g) gain wavelength band;
- h) gain wavelength variation;
- i) gain stability;
- j) polarization-dependent gain;
- k) gain ripple (SOA only);
- l) large-signal output stability;
- m) saturation output power;
- n) maximum output signal power;
- o) maximum total output power.

NOTE 1 The applicability of the test methods described in this document to distributed Raman amplifiers is still under study.

NOTE 2 All numerical values followed by ( $\pm$ ) are suggested values for which the measurement is assured. Other values are acceptable if verified.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61290-1-1, *Optical amplifiers – Test methods – Part 1-1: Power and gain parameters – Optical spectrum analyzer method*

IEC 61290-1-2, *Optical amplifiers – Test methods – Part 1-2: Power and gain parameters – Electrical spectrum analyzer method*

IEC 61290-1-3, *Optical amplifiers – Test methods – Part 1-3: Power and gain parameters – Optical power meter method*

IEC 61291-1:2018, *Optical amplifiers – Part 1: Generic specification*

### 3 Terms, definitions and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61291-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.2 Abbreviated terms

ASE	amplified spontaneous emission
FWHM	full width at half maximum
OA	optical amplifier
OFA	optical fibre amplifier
OSA	optical spectrum analyzer
POWA	planar optical waveguide amplifier
SOA	semiconductor optical amplifier

### 4 Optical power and gain test method

One of the three test methods described in IEC 61290-1-1, IEC 61290-1-2, and IEC 61290-1-3 for quantifying the optical power and gain of an OA shall be followed in this document.

The test method described in IEC 61290-1-1 determines the optical power and gain by means of an optical spectrum analyzer.

The test method described in IEC 61290-1-2 determines the optical power and gain by means of an optical detector and an electrical spectrum analyzer.

The test method described in IEC 61290-1-3 determines the optical power and gain by means of an optical power meter and an optical bandpass filter.

### 5 Optical power and gain parameters

The parameters listed below are required for gain and power:

- a) Nominal output signal power: The nominal output signal power is given by the minimum output signal optical power for an input signal optical power specified in the relevant detail specification and under nominal operating conditions given in the relevant detail specification. To find this minimum value, input and output signal power levels shall be continuously monitored for a given duration of time and in the presence of changes in the state of polarization and other instabilities, as specified in the relevant detail specification. The measurement procedures and calculations are described in each test method.
- b) Gain: The measurement procedures and calculations are described in each test method.