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# INTERNATIONAL STANDARD

**Optical amplifiers - Test methods -**
**Part 3-2: Noise figure parameters - Electrical spectrum analyzer method**

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# Optical amplifiers - Test methods - Part 3-2: Noise figure parameters - Electrical spectrum analyzer method

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IEC 61290-3-2 has been prepared by subcommittee 86C: Fibre optic systems, sensing and active devices, of IEC technical committee 86: Fibre optics. It is an International Standard.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

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

a) shortening and clarification of the scope in Clause 1;
b) update of the normative references in Clause 2;
c) deletion of duplicate instructions in 7.2 to measure the time-average input power;
d) deletion of unused symbols in 3.3 and addition of new symbol.

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

| Draft | Report on voting |
|---|---|
| 86C/2027/FDIS | 86C/2032/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 http://www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at http://www.iec.ch/publications.

A list of all parts of the IEC 61290 series [1], published under the general title *Optical amplifiers - Test methods*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under http://webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

# INTRODUCTION

This part of IEC 61290 covers the noise figure measurements of optical amplifiers using the electrical spectrum analyser method.

Each symbol and abbreviated term introduced in this document is generally explained in the text the first time it appears. However, for an easier understanding of the whole text, a list of all symbols and abbreviated terms used in this document is given in Clause 3.

# 1 Scope

This part of IEC 61290 applies to all commercially available optical amplifiers (OAs), including OAs using optically pumped fibres (i.e. optical fibre amplifiers (OFAs) based on either rare-earth doped fibres or on the Raman effect), semiconductor optical amplifiers (SOAs), and planar waveguide optical amplifiers (PWOAs).

This document defines requirements for accurate and reliable measurements of the noise figure parameters of OAs by means of the electrical spectrum analyser (ESA) method. The noise figure parameters of OAs are defined in IEC 61291-1 [2].

# 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 61291-1, *Optical amplifiers - Part 1: Generic specification*

# 3 Terms, definitions, abbreviated terms, and symbols

## 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 terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

## 3.2 Abbreviated terms

| | |
|---|---|
| CW | continuous wave |
| DFB | distributed feedback |
| ESA | electrical spectrum analyser |
| FWHM | full width at half maximum |
| MPI | multiple path interference |
| OA | optical amplifier |
| OFA | optical fibre amplifier |
| PWOA | planar waveguide optical amplifier |
| RIN | relative intensity noise (of the source, expressed in $Hz^{-1}$) |
| RMS | root mean square |
| SOA | semiconductor optical amplifier |
| VOA | variable optical attenuator |

## 3.3 Symbols

| | |
|---|---|
| $B_e$ | calibrated, noise equivalent ESA electrical bandwidth (not necessarily the resolution bandwidth) |
| c | speed of light in vacuum |
| $e$ | electron charge |
| $f$ | baseband frequency |