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61290-7-1

Second edition
Deuxième édition
2007-04

Optical amplifiers –
Test methods –

Part 7-1:
Out-of-band insertion losses –
Filtered optical power meter method

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Amplificateurs optiques –
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Partie 7-1:
Pertes d'insertion hors-bande –
Méthode par puissance-mètre optique filtré



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**OPTICAL AMPLIFIERS –
TEST METHODS –****Part 7-1: Out-of-band insertion losses –
Filtered optical power meter method**

FOREWORD

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International Standard IEC 61290-7-1 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 1998 and constitutes a technical revision. The main significant changes are the following:

- a) the title has been changed to be consistent with other documents in the IEC 61290 series;
- b) the applicability has been extended to all commercially available optical amplifiers - not just optical fiber amplifiers;
- c) Clause 9, EMC, has been added.

This standard shall be used in conjunction with IEC 61291-1. It was established on the basis of the second (2006) edition of that standard.

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

CDV	Report on voting
86C/726/CDV	86C/741/RVC

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 of the IEC 61290 series, 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 publication will remain unchanged until the maintenance result 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- withdrawn;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
- amended.

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INTRODUCTION

This International Standard is devoted to the subject of optical amplifiers. The technology of optical amplifiers is still rapidly evolving, hence amendments and new additions to this standard can be expected.

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OPTICAL AMPLIFIERS – TEST METHODS –

Part 7-1: Out-of-band insertion losses – Filtered optical power meter method

1 Scope and object

This part of IEC 61290 applies to optical amplifiers (OAs) using active fibres presently commercially available containing rare-earth dopants.

The object of this standard is to establish uniform requirements for accurate and reliable measurements, by means of the filtered optical power meter test method, of the following OA parameters, as defined in IEC 61291-1:

- a) out-of-band insertion loss;
- b) out-of-band reverse insertion loss.

NOTE 1 The out-of-band insertion loss of an OA is highly dependent on the amplifier configuration and the out-of-band wavelength.

NOTE 2 All numerical values followed by (†) are suggested values.

2 Normative references

[IEC 61290-7-1:2007](#)

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

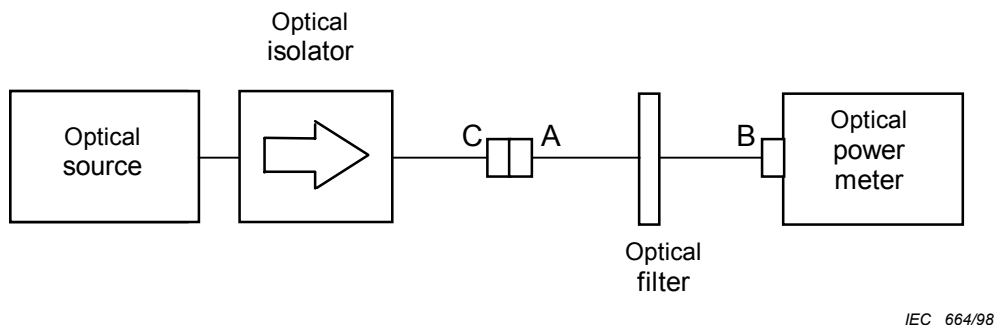
3 Abbreviated terms

Each abbreviation introduced in this standard is explained in the text at least the first time it appears. However, for an easier understanding of the whole text, the following is a list of all abbreviations used in this standard:

OA	Optical amplifier
EMC	Electromagnetic compatibility
ESD	Electrostatic discharge

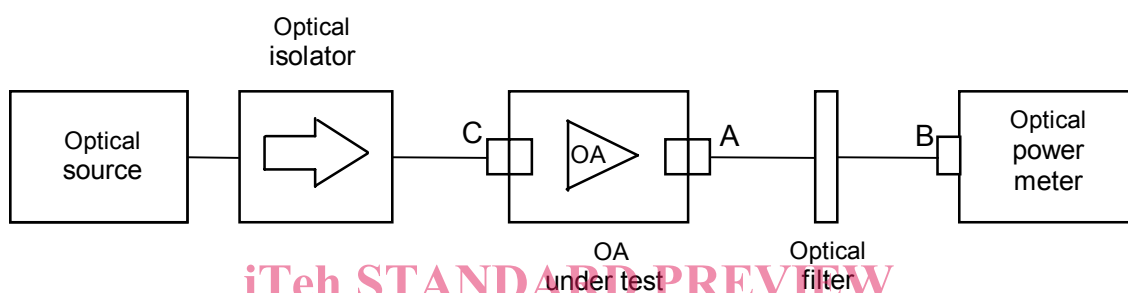
4 Apparatus

A scheme of the measurement set-up is given in Figure 1.



IEC 664/98

Figure 1a – Optical filter calibration



IEC 665/98

Figure 1b – Out-of-band insertion loss measurement

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Figure 1 – Typical arrangement of the optical filter test apparatus for out-of-band insertion loss measurements

The test equipment listed below, with the required characteristics, is needed:

- optical source*: the optical source shall generate a light at the out-of-band wavelength specified in the relevant detail specification. Unless otherwise specified, the optical source shall emit a continuous wave with the full width at half maximum of the spectrum narrower than 1 nm (\pm);
- optical isolator*: the polarization-dependent loss variation of the isolator, at the out-of-band wavelength, shall be better than 0,2 dB (\pm). Optical isolation shall be better than 40 dB (\pm). The reflectance from this device shall be smaller than -40 dB (\pm) at each port;
- optical filter*: it shall be pass band at the out-of-band wavelength, and have a high loss over the OA (optical amplifier) pump and signal wavelength ranges, in such a way as to render the total power in these wavelength ranges more than 20 dB (\pm) lower than the out-of-band power after passing through the OA;
- optical power meter*: it shall have a measurement accuracy better than $\pm 0,2$ dB, irrespective of the state of polarization, at the out-of-band wavelength of the OA;
- optical fibre jumpers*: the mode field diameter of the optical fibre jumpers used should be as close as possible to that of fibres used at input and output ports of the OA. Their reflectance shall be smaller than -40 dB (\pm) at each port, and the length of each jumper shall be less than 2 m.

5 Test sample

The OA shall operate as specified in the relevant detail specification.

NOTE The operating conditions of the OA under test could be, for instance, the nominal operating conditions or the unpowered conditions.

6 Procedure

This method permits determination of the OA out-of-band insertion losses according to the procedures described below:

a) *out-of-band insertion loss:*

- 1) set the optical source at the out-of-band wavelength, as specified in the relevant detail specification;
- 2) calibrate the optical filter measuring the optical power at the out-of-band wavelength P_0 with the optical power meter, without the OA, as shown in Figure 1a;
- 3) insert the OA under test, as shown in Figure 1b, and measure the optical power P_1 at the out-of-band wavelength, with the optical power meter.

b) *out-of-band reverse insertion loss:*

As in a), but with the OA inserted with the input port used as output port and vice-versa.

7 Calculation

Calculation shall be carried out as indicated below.

a) *Out-of-band insertion loss*

Calculate the OA out-of-band insertion loss, L_{OB} , from the power levels P_0 and P_1 (in dBm), as:

$$L_{OB} = P_0 - P_1 \text{ (dBm)}$$

b) *Out-of-band reverse insertion loss*

As in a), taking into account that L_{OB} represents, in this case, the out-of-band reverse insertion loss of the OA.

8 Test results

Report the following information for each test.

a) *Out-of-band insertion loss*

The following details shall be presented:

- 1) arrangement of the test set-up;
- 2) spectral linewidth (full width at half maximum) of the optical source;
- 3) out-of-band wavelengths of the measurement;
- 4) indication of the optical pump power (if applicable);
- 5) ambient temperature (if required);
- 6) out-of-band insertion loss.

b) *Out-of-band reverse insertion loss*

In addition to details 1) to 5), previously listed for the out-of-band insertion loss, the following shall be presented:

- 6) out-of-band reverse insertion loss.

9 Electromagnetic compatibility (EMC) requirements

The devices and assemblies addressed by the present standard shall comply with suitable requirements for electromagnetic compatibility (in terms of both emission and immunity), depending on particular usage/environment in which they are intended to be installed or integrated. Guidance on the drafting of such EMC requirements is provided in IEC Guide 107. Guidance for electrostatic discharge (ESD) is still under study.

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