

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical amplifiers – **STANDARD PREVIEW**
Part 4: Multichannel applications – Performance specification template
(standards.iteh.ai)

Amplificateurs optiques –
Partie 4: Applications multicanaux – Modèle de spécification de fonctionnement

IEC 61291-4:2011
<https://standards.iteh.ai/catalog/standards/sist/5d6c7514-ac9c-4541-bad9-7417083d0faf/iec-61291-4-2011>





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CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references.....	6
3 Terms, definitions and abbreviations.....	6
3.1 Terms and definitions.....	6
3.2 Overview of multichannel definitions.....	6
3.3 Abbreviations.....	7
4 Product specification worksheet for booster (power) amplifiers (BA).....	8
5 Product specification worksheet for pre-amplifiers (PA).....	9
6 Product specification worksheet for line amplifiers (LA).....	9
7 Electromagnetic compatibility requirements.....	10
Bibliography.....	11
Figure 1 – An optical amplifier in a multichannel application.....	7
Table 1 – Minimum list of relevant parameters of BA amplifiers to be specified for multichannel applications.....	8
Table 2 – Minimum list of relevant parameters of pre-amplifiers to be specified for multichannel applications.....	9
Table 3 – Minimum list of relevant parameters of line amplifiers to be specified for multichannel applications.....	10

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OPTICAL AMPLIFIERS –

**Part 4: Multichannel applications –
Performance specification template**

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International Standard IEC 61291-4 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2008 and constitutes a technical revision. The main significant changes are the following:

The transient parameter test methods, IEC 61290-4 series, have been added to Tables 1, 2, and 3.

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

CDV	Report on voting
86C/993/CDV	86C/1024/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.

This standard is to be used in conjunction with IEC 61291-1.

A list of all parts in the IEC 61291 series, published under the general title *Optical amplifiers*, 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
- 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 editions to this standard can be expected. Each abbreviation introduced in this International Standard is generally explained in the text the first time it appears. However, for an easier understanding of the whole text, a list of abbreviations used in this International Standard is given in 3.3.

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OPTICAL AMPLIFIERS –

Part 4: Multichannel applications – Performance specification template

1 Scope

This part of IEC 61291 applies to optical amplifier (OA) devices and sub-systems to be used in multichannel applications. For single channel applications, use IEC 61291-2.

The object of this performance specification template is to provide a frame for the preparation of detail specifications on the performances of OA devices and sub-systems to be used in multichannel applications.

Detail product specification writers may add specification parameters and/or groups of specification parameters for particular applications. However, detail specification writers may not remove specification parameters specified in this standard.

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 61291-4:2011](https://standards.iteh.ai/catalog/standards/sist/5d8e7514-ac9e-4541-bad9-7d1708310368/iec-61291-4-2011)

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NOTE A list of informative references is given in the bibliography.

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 61290 (all parts), *Optical amplifiers – Test methods*

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

IEC 61291-5-2, *Optical amplifiers – Part 5-2: Qualification specifications – Reliability qualification for optical fibre amplifiers*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.2 Overview of multichannel definitions

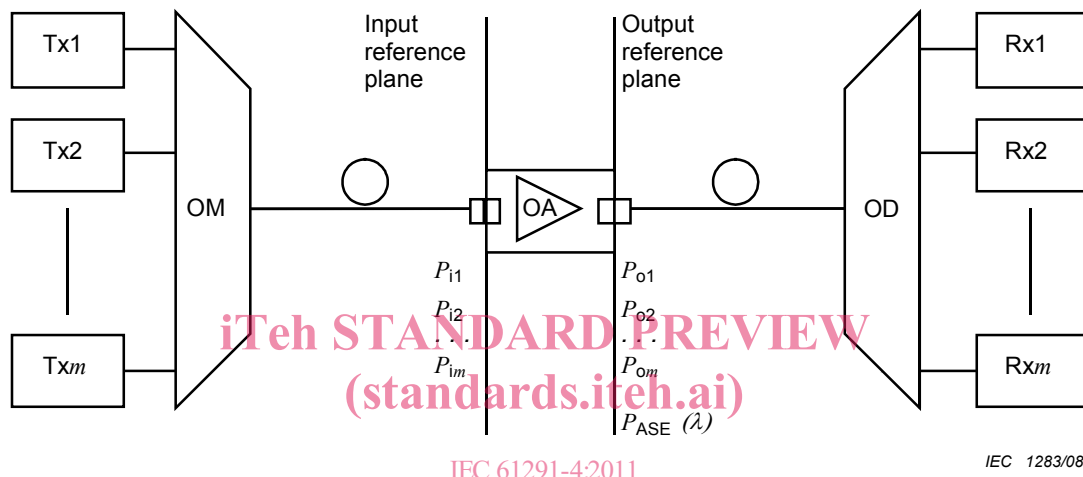
Parameters specified for optical devices are those characterizing the transmission, operation, reliability and environmental properties of the OA device, which is seen as a black box from a general point of view as defined in the generic specification IEC 61291-1.

Each test method (OA test methods, IEC 61290 series) is generally given for the measurement of a group of homogeneous parameters. The grouping of the homogeneous parameters is

given in the generic specification, IEC 61291-1, together with the corresponding test method specification number.

Safety characteristics of optical amplifiers described in the present standard are provided in IEC 60825-1.

A typical configuration of an OA in a multichannel application is illustrated in Figure 1. At the transmitting side, m signals, coming from m optical transmitters, Tx1, Tx2, . . . Tx m , each with a unique wavelength, $\lambda_1, \lambda_2, \dots, \lambda_m$, respectively, are combined by an optical multiplexer (OM). At the receiving side, the m signals at $\lambda_1, \lambda_2, \dots, \lambda_m$, are separated with an optical demultiplexer (OD) and routed to separate optical receivers, Rx1, Rx2, . . . Rx m , respectively. To characterize the OA in this multichannel application an input reference plane and an output reference plane are defined at the OA input and output ports, respectively, as shown in Figure 1.



<https://standards.iteh.ai/catalog/standards/sist/5d8e7514-ac9e-4541-bad9-777777777777>
Figure 1 – An optical amplifier in a multichannel application

At the input reference plane, m input signals at the m wavelengths are considered, each with a unique power level, $P_{i1}, P_{i2}, \dots, P_{im}$, respectively. At the output reference plane, m output signals at the m wavelengths, resulting from the optical amplification of the corresponding m input signals, are considered, each with power level $P_{o1}, P_{o2}, \dots, P_{om}$, respectively. Moreover, the amplified spontaneous emission, ASE, with a noise power spectral density, $P_{ASE}(\lambda)$, is also to be considered at the OA output port.

Most definitions of relevant parameters given in the generic specification IEC 61291-1 can be suitably extended to multichannel applications. When this extension is straightforward, the word “channel” will be added to the pertinent parameter. In particular, the noise figure and the signal-spontaneous noise figure as defined in IEC 61291-1 may be extended to multichannel applications, channel by channel, by considering the value of $P_{ASE}(\lambda)$ at each channel wavelength and the channel signal bandwidth. For each channel wavelength there will be a unique value of noise figure that will be a function of the input power level of all signals. In this case the parameters, channel noise figure and channel signal-spontaneous noise figure, are introduced.

3.3 Abbreviations

ASE	Amplified spontaneous emission
BA	Booster (power) amplifier
LA	Line amplifier
na	Not applicable
OA	Optical amplifier
OFA	Optical fibre amplifier

PA Pre-amplifier
 PMD Polarization mode dispersion

4 Product specification worksheet for booster (power) amplifiers (BA)

The worksheet in Table 1 contains a minimum list of specification parameters to be included in product specifications of OA devices to be used as booster (power) amplifiers in multichannel applications, together with their specification criteria (that is in terms of maximum value, minimum value or both) and the indication of the corresponding standard test method.

Table 1 – Minimum list of relevant parameters of BA amplifiers to be specified for multichannel applications

	Parameters		Unit	Minimum value	Maximum value	Test method
Transmission characteristics	Channel allocation		nm or THz			Under consideration
	Channel input power range		dBm			IEC 61290-10 series
	Total input power range		dBm			IEC 61290-10 series
	Channel output power range		dBm			IEC 61290-10 series
	Maximum total output power		dBm	na		IEC 61290-10 series
	Channel addition/removal gain transient response		dB	na		IEC 61290-4 series
	Multichannel gain variation (gain flatness)		dB	na		IEC 61290-10 series
	Channel signal-spontaneous noise figure (channel noise figure)		dB	na		IEC 61290-3 series
	Input reflectance		dB	na		IEC 61290-5 series
	Output reflectance		dB	na		IEC 61290-5 series
	Pump leakage to input (for OFA only)		dBm	na		IEC 61290-6 series
Environmental parameters	Operating temperature range		°C			IEC 61291-5-2
	Maximum operating relative humidity		%	na		IEC 61291-5-2
	Maximum operating vibration severity	Range of frequencies	Hz			IEC 61291-5-2
		Amplitude Peak-to-peak	mm p-p	na		
		Duration	s	na		
	Storage temperature range		°C			IEC 61291-5-2
	Maximum storage relative humidity		%	na		IEC 61291-5-2
Maximum shock severity, free drop	Drop height	mm	na		IEC 61291-5-2	
Safety parameters	Safety laser classification			na	na	IEC 60825-1

5 Product specification worksheet for pre-amplifiers (PA)

The worksheet in Table 2 contains a minimum list of specification parameters to be included in product specifications of OA devices to be used as pre-amplifiers in multichannel applications, together with their specification criteria (that is in terms of maximum value, minimum value or both) and the indication of the corresponding standard test method.

Table 2 – Minimum list of relevant parameters of pre-amplifiers to be specified for multichannel applications

	Parameters		Unit	Minimum value	Maximum value	Test method
Transmission characteristics	Channel allocation		nm or THz			Under consideration
	Channel input power range		dBm			IEC 61290-10 series
	Total input power range		dBm			IEC 61290-10 series
	Channel output power range		dBm			IEC 61290-10 series
	Maximum total output power		dBm	na		IEC 61290-10 series
	Channel addition/removal transient gain response		dB	na		IEC 61290-4 series
	Channel signal-spontaneous noise figure		dB	na		IEC 61290-3 series
	Channel gain		dB		na	IEC 61290-10 series
	Multichannel gain variation (gain flatness)		dB	na		IEC 61290-10 series
	Input reflectance		dB	na		IEC 61290-5 series
	Output reflectance		dB	na		IEC 61290-5 series
	Pump leakage to output (for OFA only)		dBm	na		IEC 61290-6 series
Environmental parameters	Operating temperature range		°C			IEC 61291-5-2
	Maximum operating relative humidity		%	na		IEC 61291-5-2
	Maximum operating vibration severity	Range of frequencies	Hz			IEC 61291-5-2
		Amplitude peak-to-peak	mm	na		
		Duration	s	na		
	Storage temperature range		°C			IEC 61291-5-2
	Maximum storage relative humidity		%	na		IEC 61291-5-2
Maximum shock severity, free drop	Drop height	mm	na		IEC 61291-5-2	
Safety parameters	Laser safety classification			na	na	IEC 60825-1

6 Product specification worksheet for line amplifiers (LA)

The worksheet in Table 3 contains a minimum list of specification parameters to be included in product specifications of OA devices to be used as line amplifiers in multichannel applications, together with their specification criteria (that is in terms of maximum value, minimum value or both) and the indication of the corresponding standard test method.