IEC 61291-2

Edition 5.0 2023-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical amplifiers –
Part 2: Single channel applications – Performance specification template

Amplificateurs optiques –
Partie 2: Applications à un seul canal – Modèle de spécifications de performances



IEC 61291-2:2023-02(en-fr)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, …). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 61291-2

Edition 5.0 2023-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical amplifiers –
Part 2: Single channel applications – Performance specification template

Amplificateurs optiques –
Partie 2: Applications à un seul canal – Modèle de spécifications de performances

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.180.30

ISBN 978-2-8322-6454-6

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms, definitions and abbreviated terms 7
3.1 Terms and definitions 7
3.2 Abbreviated terms 8
4 Performance specification templates for power amplifiers 8
5 Performance specification templates for pre-amplifiers 11
6 Performance specification templates for line amplifiers 15
7 Electromagnetic compatibility (EMC) requirements 19
8 Laser safety requirements 19
Bibliography 20

Table 1 – Minimum relevant parameters for power amplifiers based on OFA components or modules using active fibre specified for single channel applications 9
Table 2 – Minimum relevant parameters for power amplifiers based on SOA components specified for single channel applications 10
Table 3 – Minimum relevant parameters for pre-amplifiers based on OFA components or modules using active fibre specified for single channel applications 12
Table 4 – Minimum relevant parameters for pre-amplifiers based on SOA components specified for single channel applications 14
Table 5 – Minimum relevant parameters for line amplifiers based on OFA components or modules using active fibre specified for single channel applications 16
Table 6 – Minimum relevant parameters for line amplifiers based on SOA components specified for single channel applications 18

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

OPTICAL AMPLIFIERS –

Part 2: Single channel applications – Performance specification template

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61291-2 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 fifth edition cancels and replaces the fourth edition published in 2016. This edition constitutes a technical revision.

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

a) the test methods for gain ripple in Table 2, Table 4 and Table 6 refer now to the IEC 61290-1 series;
b) the SOA definition (3.1.3) refers now to IEC 61931.

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

Draft	Report on voting
86C/1849/FDIS	86C/1858/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. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

INTRODUCTION

This document is devoted to the subject of optical amplifiers. The technology of optical amplifiers is still rapidly evolving, hence amendments and new additions to this document can be expected. Each 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 abbreviated terms used in this document is given in Clause 3.

OPTICAL AMPLIFIERS –

Part 2: Single channel applications – Performance specification template

1 Scope

This part of IEC 61291 provides a performance specification template applicable to optical amplifiers (OAs) used in single channel applications. Multichannel applications are covered in IEC 61291-4.

The objective of this template is to provide a framework for the preparation of performance standards and/or product specifications defining the performance of OA devices used in single channel applications. In addition to the requirements specified in this template, a performance standard or product specification could include other parameters, such as ratings, operating conditions, tests, and pass/fail criteria.

For a particular application, product specification writers could add specification parameters and/or groups of specification parameters to this template, without removing the parameters specified in this document.

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

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments*

IEC 61290-1 (all parts), *Optical amplifiers – Test methods – Part 1: Power and gain parameters*

IEC 61290-3 (all parts), *Optical amplifiers – Test methods – Part 3: Noise figure parameters*

IEC 61290-4-3, *Optical amplifiers – Test methods – Part 4-3: Power transient parameters – Single channel optical amplifiers in output power control*

IEC 61290-5 (all parts), *Optical amplifiers – Test methods – Part 5: Reflectance parameters*

IEC 61290-6-1, *Optical fibre amplifiers – Basic specification – Part 6-1: Test methods for pump leakage parameters – Optical demultiplexer*

IEC 61290-11 (all parts), *Optical amplifiers – Test methods – Part 11: Polarization mode dispersion parameter*

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*

IEC TS 62538:2008, *Categorization of optical devices*

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, IEC TS 62538 and the following apply.

NOTE Possible supplementary definitions specific to OAs for single channel applications can be given in product specifications.

3.1.1
optical amplifier
OA
optical waveguide device containing a suitably pumped, active medium that is able to amplify an optical signal

[SOURCE: IEC TR 61931:1998, 2.7.75]

3.1.2
optical fibre amplifier
OFA
optical amplifier made of active optical fibre that is doped with rare-earth ions or that presents non-linear optical effects in order to obtain optical amplification

3.1.3
semiconductor optical amplifier
SOA
optical amplifier in which the active optical waveguide is formed by a semiconductor laser diode structure and will be electrically pumped

Note 1 to entry: The structure of these amplifiers is similar to that of Fabry-Perot laser diodes but with anti-reflection design elements at the end-face surfaces. The signal is amplified through the stimulated emission phenomenon in the gain medium.

[SOURCE: IEC TR 61931:1998, 2.7.77, modified – The note to entry has been added.]

3.1.4
optical element
unpackaged or partially packaged optical basic unit, typically non repairable and non-re-workable (at least by users)

Note 1 to entry: Examples of optical elements include laser chips or laser diodes, photodiodes, lenses, prisms, optical collimators, grating chips and filter chips.

[SOURCE: IEC TS 62538:2008, 2.2.1]

3.1.5
optical component
packaged unit comprising at least one optical element, typically non repairable and non-re-workable (at least by users), suitably pigtailed or connectorized

Note 1 to entry: Examples of optical components include packaged lasers, photodiodes, optical splitters, couplers, attenuators, isolators, MEMS, and modulators.

[SOURCE: IEC TS 62538:2008, 2.2.2]

3.1.6
optical module
packaged integration of optical components and/or elements, accomplishing defined functionality, typically repairable and re-workable

Note 1 to entry: An optical module may comprise electronic components.

Note 2 to entry: An optical module is to be used as it is; users are not normally enabled to re-arrange inner components or add other components inside.

[SOURCE: IEC TS 62538:2008, 2.2.5]

3.1.7
OFA component
fibre-pigtailed optical component that consists of fibre based gain medium such as an erbium-doped fibre, one or more optical isolator(s), optical couplers for the wavelength-selector or the power monitor, a package, and fibres

Note 1 to entry: An OFA component may include an optical filter, such as a gain equalizing filter or ASE rejection filter, and possibly other components.

3.1.8
OFA module
fibre-pigtailed optical module that consists of an OFA component, pump laser component(s) with driving circuit, monitor photodiode component(s) with driving circuit, and a control circuit

3.1.9
SOA element
optical element of SOA that consists of a semiconductor chip

3.1.10
SOA component
fibre-pigtailed optical component that consists of an SOA element, lenses, optical isolator(s) (if necessary), a thermoelectric cooler (TEC), a thermistor, a package, and fibres

3.2 Abbreviated terms

EMC electromagnetic compatibility
OA optical amplifier
OFA optical fibre amplifier
SOA semiconductor optical amplifier
TEC thermoelectric cooler

4 Performance specification templates for power amplifiers

The following templates contain a minimum set of performance parameters to be included in the specifications for OFA components or modules (see Table 1) and SOA components (see Table 2) used as power amplifiers in single channel applications. The tables include specification criteria (in terms of the maximum values, minimum values or both) and references to the corresponding standards describing the test methods. Note that the list of the minimum parameters for SOAs (see Table 2) covers SOA components only, because most SOA products are currently commercialized in the form of a package, such as a butterfly-type package, which contains only the SOA.