



NSAI
Standards

Irish Standard
I.S. EN 61290-10-5:2014

Optical amplifiers - Test methods - Part 10-5: Multichannel parameters - Distributed Raman amplifier gain and noise figure

I.S. EN 61290-10-5:2014

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 61290-10-5:2014

Published:

2014-07-25

*This document was published
under the authority of the NSAI
and comes into effect on:*

2014-08-27

ICS number:

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

EUROPEAN STANDARD

EN 61290-10-5

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2014

ICS 33.180.30

English Version

**Optical amplifiers - Test methods - Part 10-5: Multichannel
parameters - Distributed Raman amplifier gain and noise figure
(IEC 61290-10-5:2014)**

Amplificateurs optiques - Méthodes d'essai - Partie 10-5:
Paramètres à canaux multiples - Gain et facteur de bruit
des amplificateurs Raman répartis
(CEI 61290-10-5:2014)

Prüfverfahren für Lichtwellenleiter-Verstärker - Teil 10-5:
Mehrkanalparameter - Verstärkung und Rauschzahl von
verteilten Raman-Verstärkern
(IEC 61290-10-5:2014)

This European Standard was approved by CENELEC on 2014-06-27. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 86C/1142/CDV, future edition 1 of IEC 61290-10-5, 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 61290-10-5:2014.

The following dates are fixed:

- latest date by which the document has to be (dop) 2015-03-27
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2017-06-27
standards conflicting with the
document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61290-10-5:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61290-3	NOTE	Harmonized as EN 61290-3.
IEC 61290-10-4	NOTE	Harmonized as EN 61290-10-4.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60825-1	-	Safety of laser products -- Part 1: Equipment classification and requirements	EN 60825-1	-
IEC 61291-1	-	Optical amplifiers -- Part 1: Generic specification	EN 61291-1	-
IEC 61291-4	-	Optical amplifiers -- Part 4: Multichannel applications - Performance specification template	EN 61291-4	-
IEC/TR 61292-4	-	Optical amplifiers -- Part 4: Maximum permissible optical power for the damage-free and safe use of optical amplifiers, including Raman amplifiers	-	-

This page is intentionally left blank



IEC 61290-10-5

Edition 1.0 2014-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Optical amplifiers – Test methods –

Part 10-5: Multichannel parameters – Distributed Raman amplifier gain and noise figure

Amplificateurs optiques – Méthodes d'essai –

Partie 10-5: Paramètres à canaux multiples – Gain et facteur de bruit des amplificateurs Raman répartis



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 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 Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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: csc@iec.ch.

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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

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 aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

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



IEC 61290-10-5

Edition 1.0 2014-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Optical amplifiers – Test methods –

Part 10-5: Multichannel parameters – Distributed Raman amplifier gain and noise figure

Amplificateurs optiques – Méthodes d'essai –

Partie 10-5: Paramètres à canaux multiples – Gain et facteur de bruit des amplificateurs Raman répartis

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

S

ICS 33.180.30

ISBN 978-2-8322-1581-4

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.

CONTENTS

FOREWORD.....	3
1 Scope and object.....	5
2 Normative references	5
3 Terms, definitions and abbreviations	6
3.1 Terms and definitions.....	6
3.2 Abbreviated terms.....	7
4 DRA gain and noise figure parameters – Overview	7
5 Apparatus.....	9
5.1 General.....	9
5.2 Multi-channel signal source.....	10
5.3 Polarization controller	11
5.4 Optical spectrum analyser.....	11
5.5 Optical power meter.....	12
5.6 Tuneable narrowband source	12
5.7 Broadband optical source	12
5.8 Optical connectors and jumpers	12
6 Test sample.....	12
7 Procedure.....	12
7.1 Overview.....	12
7.1.1 Channel on-off gain	12
7.1.2 Pump module channel insertion loss and channel net gain	13
7.1.3 Channel equivalent noise figure (NF).....	13
7.2 Calibration	13
7.2.1 Calibration of optical bandwidth	13
7.2.2 Calibration of OSA power correction factor	15
7.3 Measurement.....	15
7.4 Calculation.....	17
7.4.1 Channel on-off gain	17
7.4.2 Channel net gain	17
7.4.3 Channel equivalent <i>NF</i>	17
8 Test results	17
Annex A (informative) Field measurements versus laboratory measurements	19
Annex B (informative) Pump depletion and channel-to-channel Raman scattering.....	20
Bibliography.....	21
Figure 1 – Distributed Raman amplification in co-propagating (left) and count-propagating (right) configurations	9
Figure 2 – Measurement set-up without a pump module.....	10
Figure 3 – Measurement set-up for counter-propagating configuration	10
Figure 4 – Measurement set-up for co-propagating configuration	10
Figure 5 – Possible implementation of a multi-channel signal source	11

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**OPTICAL AMPLIFIERS –
TEST METHODS –****Part 10-5: Multichannel parameters –
Distributed Raman amplifier gain and noise figure**

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.

International Standard IEC 61290-10-5 has been prepared by 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

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

CDV	Report on voting
86C/1142/CDV	86C/1233/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 in 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 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

OPTICAL AMPLIFIERS – TEST METHODS –

Part 10-5: Multichannel parameters – Distributed Raman amplifier gain and noise figure

1 Scope and object

This part of IEC 61290 applies to distributed Raman amplifiers (DRAs). DRAs are based on the process whereby Raman pump power is introduced into the transmission fibre, leading to signal amplification within the transmission fibre through stimulated Raman scattering. A detailed overview of the technology and applications of DRAs can be found in IEC TR 61292-6.

A fundamental difference between these amplifiers and discrete amplifiers, such as EDFAs, is that the latter can be described using a black box approach with well-defined input and output ports. On the other hand, a DRA is basically a pump module, with the actual amplification process taking place along the transmission fibre. This difference means that standard methods described in other parts of IEC 61290 for measuring amplifier parameters, such as gain and noise figure, cannot be applied without modification.

The object of this standard is to establish uniform requirements for accurate and reliable measurements, using an optical spectrum analyser (OSA), of the following DRA parameters:

- a) channel on-off gain;
- b) pump unit insertion loss;
- c) channel net gain;
- d) channel signal-spontaneous noise figure.

The measurement method is largely based on the interpolated source subtraction (ISS) method using an optical spectrum analyser, as described and elaborated in IEC 61290-10-4, with relevant modifications relating to a DRA.

All numerical values followed by (\pm) are suggested values for which the measurement is assured. Other values may be acceptable but should be verified.

NOTE General aspects of noise figure test methods are reported in IEC 61290-3.

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

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

IEC 61291-4, *Optical amplifiers – Part 4: Multichannel applications – Performance specification template*

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-