

**Optical amplifiers - Test methods - Part 4-1: Gain  
transient parameters - Two-wavelength method**

This document is a preview generated by EVS

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 61290-4-1:2011 sisaldab Euroopa standardi EN 61290-4-1:2011 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 30.09.2011 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 23.09.2011.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 61290-4-1:2011 consists of the English text of the European standard EN 61290-4-1:2011.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 30.09.2011 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text 23.09.2011.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

ICS 33.180.30

### Standardite reprodutseerimis- ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:  
Aru 10 Tallinn 10317 Eesti; [www.evs.ee](http://www.evs.ee); Telefon: 605 5050; E-post: [info@evs.ee](mailto:info@evs.ee)

### Right to reproduce and distribute belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without permission in writing from Estonian Centre for Standardisation.

If you have any questions about standards copyright, please contact Estonian Centre for Standardisation:  
Aru str 10 Tallinn 10317 Estonia; [www.evs.ee](http://www.evs.ee); Phone: 605 5050; E-mail: [info@evs.ee](mailto:info@evs.ee)

**Optical amplifiers -  
Test methods -  
Part 4-1: Gain transient parameters -  
Two-wavelength method  
(IEC 61290-4-1:2011)**

Amplificateurs optiques -  
Méthodes d'essai -  
Partie 4-1: Paramètres de gain  
transitoire - Méthode à deux longueurs  
d'onde (CEI 61290-4-1:2011)

Lichtwellenleiter-Verstärker -  
Prüfverfahren -  
Teil 4-1: Transiente Verstärkerparameter -  
Zwei-Wellenlängen Verfahren  
(IEC 61290-4-1:2011)

This European Standard was approved by CENELEC on 2011-09-14. 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 Central Secretariat 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 Central Secretariat 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 86C/956/CDV, future edition 1 of IEC 61290-4-1, 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 61290-4-1:2011.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-06-14
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-09-14

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 61290-4-1:2011 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 61290-1-1	NOTE Harmonized as EN 61290-1-1.
IEC 61290-1-2	NOTE Harmonized as EN 61290-1-2.
IEC 61290-1-3	NOTE Harmonized as EN 61290-1-3.
IEC 61290-3-1	NOTE Harmonized as EN 61290-3-1.
IEC 61290-3-2	NOTE Harmonized as EN 61290-3-2.
IEC 61290-4-2	NOTE Harmonized as EN 61290-4-2.

**Annex ZA**  
(normative)

**Normative references to international publications  
with their corresponding European publications**

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.

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61291-1	-	Optical amplifiers - Part 1: Generic specification	EN 61291-1	-

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope and object.....	6
2 Normative references.....	6
3 Terms, definitions and abbreviations .....	6
3.1 General .....	6
3.2 Terms and definitions .....	9
3.3 Abbreviated terms .....	10
4 Apparatus.....	11
5 Test specimen .....	11
6 Procedure.....	11
7 Calculations.....	12
8 Test results .....	12
Annex A (informative) Background on transient phenomenon in optical amplifiers .....	13
Annex B (informative) Slew rate effect on transient gain response .....	16
Bibliography .....	19
Figure 1 – Definitions of rise and fall times (a) in the case of a channel addition event, and (b) in the case of a channel removal event .....	7
Figure 2 – OFA transient gain response for (a) a channel removal event, and (b) a channel addition event .....	8
Figure 3 – Generic transient control measurement setup .....	11
Figure A.1 – EDFA pump control for a chain of 5 EDFAs and 4 fibre spans .....	14
Figure A.2 – EDFA spectral hole depth for different gain compression .....	15
Figure A.3 – EDFA spectral hole depth for different wavelengths .....	15
Figure B.1 – Transient gain response at various slew rates.....	17
Figure B.2 – 16 dB add/drop (rise time = 10 µsec) .....	18
Figure B.3 – 16 dB add/drop (rise time = 1 000 µsec) .....	18
Table 1 – Examples of add and drop scenarios for transient control measurement .....	12
Table 2 – Typical results of transient control measurement.....	12
Table B.1 – Transient gain response for various rise time and fall time (16 dB add/drop) .....	17

## INTRODUCTION

This part of IEC 61290-4 is devoted to the subject of Optical Amplifiers (OAs). The technology of optical amplifiers is quite new and still emerging; hence amendments and new editions to this standard can be expected.

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, a list of all abbreviations used in this standard is given in 3.3.

Background information on the transient phenomenon in erbium-doped fibre amplifiers and the consequences on fibre optic systems is provided in Annex A and on slew rate effects in Annex B.

## OPTICAL AMPLIFIERS – TEST METHODS –

### Part 4-1: Gain transient parameters – Two-wavelength method

#### 1 Scope and object

This part of IEC 61290-4 applies to erbium-doped fibre amplifiers (EDFAs) and optically amplified elementary sub-systems. It applies to OAs using active fibres (optical fibre amplifiers, OFAs), containing rare-earth dopants. These amplifiers are commercially available and widely deployed in service provider networks.

The object of this part of IEC 61290-4 is to provide the general background for EDFA transients and related parameters, and to describe a standard test method for accurate and reliable measurement of the following transient parameters:

- Channel addition/removal transient gain overshoot and transient net gain overshoot
- Channel addition/removal transient gain undershoot and transient net gain undershoot
- Channel addition/removal gain offset
- Channel addition/removal transient gain response time constant (settling time)

#### 2 Normative references

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*

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

#### 3 Terms, definitions and abbreviations

##### 3.1 General

When the input power to an OFA operating in saturation changes sharply, the gain of the amplifier will typically exhibit a transient response before settling back into the required gain. This response is dictated both by the optical characteristics of the active fibre within the OFA as well as the performance of the automatic gain control (AGC) mechanism.

Since a change in input power typically occurs when part of the DWDM channels within the specified transmission band are dropped or added, definitions are provided that describe a dynamic event leading to transient response. Rise and fall time definitions are shown in Figure 1.