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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical amplifiers – Test methods – Part 4-4: Gain transient parameters – Single channel optical amplifiers with gain control

Amplificateurs optiques – Méthodes d'essai – Partie 4-4: Paramètres de gain transitoire – Amplificateurs optiques monocanaux avec commande de gain

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CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms, definitions, and abbreviated terms 6
3.1 Terms and definitions 6
3.2 Abbreviated terms 7
4 Apparatus 7
4.1 General 7
4.2 Test set-up 10
4.3 Characteristics of test equipment 10
5 Test sample 11
6 Procedure 11
6.1 Test preparation 11
6.2 Test 11
7 Calculations 12
8 Test result 12
8.1 Test setting conditions 12
8.2 Test data 12
Bibliography 13

Figure 1 – Definition of rise and fall times 8
Figure 2 – OA transient gain response for power decrease event, and power increase event 9
Figure 3 – Gain transient measurement test set-up 10

Table 1 – Template for transient control measurement test conditions 12

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL AMPLIFIERS – TEST METHODS –

Part 4-4: Gain transient parameters – Single channel optical amplifiers with gain control

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

FDIS	Report on voting
86C/1507/FDIS	86C/1525/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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A list of all parts in the 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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INTRODUCTION

This document is based on standard OITDA AM 01 published by the optoelectronic industry and technology development association (OITDA).

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OPTICAL AMPLIFIERS – TEST METHODS –

Part 4-4: Gain transient parameters – Single channel optical amplifiers with gain control

1 Scope

This part of IEC 61290-4 applies to optical amplifiers (OAs) and optically amplified elementary sub-systems. More specifically, it applies to OAs using active fibres (optical fibre amplifiers, OFAs) containing rare-earth dopants, such as erbium doped fibre amplifiers (EDFAs), presently commercially available, as indicated in IEC 61291-1.

This document provides the general background for optical amplifier gain transients and their measurements and indicates those IEC standard test methods for accurate and reliable measurements of the following transient parameters:

a) optical input power increase/decrease transient gain overshoot and transient net gain overshoot;

b) optical input power increase/decrease transient gain undershoot and transient net gain undershoot;

c) optical input power increase/decrease gain offset;

d) optical input power increase/decrease transient gain response constant (settling time).

These parameters have been included to provide a complete description of the transient behaviour of gain controlled OA. The parameters defined here are applicable if the amplifier is an OFA or an alternative type of OA.

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 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication* (available at www.electropedia.org)

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

IEC TR 61931, *Fibre optic – Terminology*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-731, IEC 61291-1 and IEC TR 61931 apply.

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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3.2 Abbreviated terms

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

DFB	distributed feedback
DUT	device under test
NEM	network equipment manufacturer
OA	optical amplifier
O/E	optical-to-electronic
OFA	optical fibre amplifier
SOP	state of polarization
VOA	variable optical attenuator

NOTE DFB applies to lasers.

4 Apparatus

4.1 General

When the input power to an OA operating in saturation changes sharply, the gain of the amplifier will typically exhibit a transient response before settling to the required gain. This response is dictated both by the optical characteristics of the active fibre within the OA as well as the performance of the gain control mechanism. Definitions are provided that describe a dynamic event leading to transient response. Rise and fall time definitions are shown in Figure 1.

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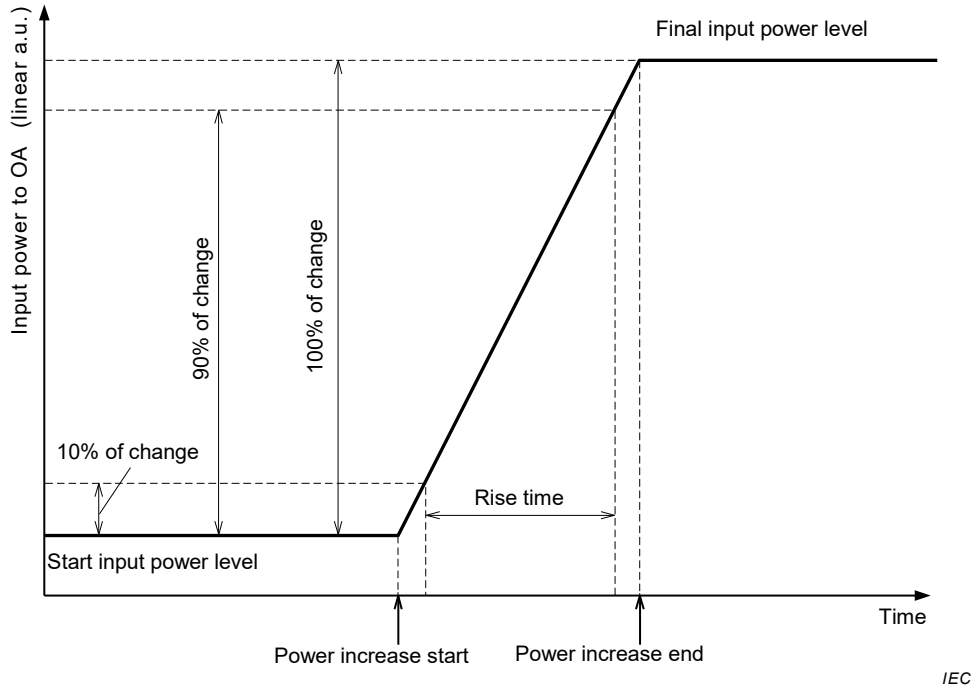
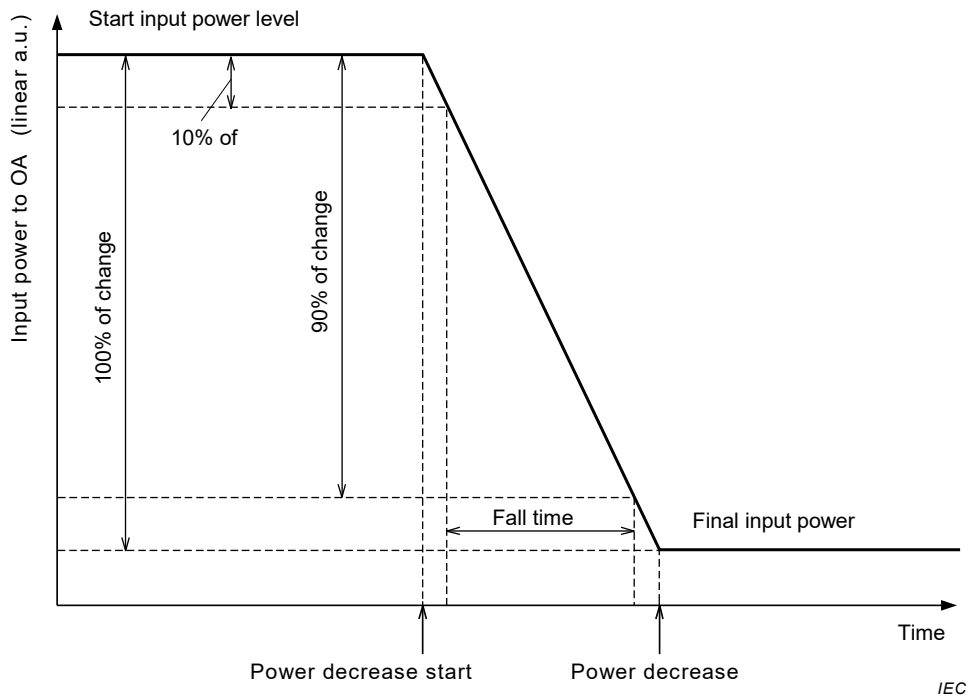


a) Power increase event



b) Power decrease event

Figure 1 – Definition of rise and fall times

The terms generally used to characterize the transient gain behaviour of a gain controlled OA for the case of optical input power decrease are defined in Figure 2 a). The figure specifically represents the dependence of the gain of optical signal when optical input power is decreased. Likewise, the transient gain behaviour for the case when optical input power is increased is shown Figure 2 b).

The main transient parameters are the following:

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