

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Semiconductor optoelectronic devices for fibre optic system applications –
Part 2: Measuring methods**

**Dispositifs optoélectroniques à semiconducteurs pour application dans les
systèmes fibroniques –
Partie 2: Méthodes de mesure**

IEC 62007-2:2025

<https://standards.iteh.ai/catalog/standards/iec/8fde877e-557a-4324-9e1e-a7816dc784c1/iec-62007-2-2025>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2025 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 Varembe
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 It also gives information on projects, replaced and withdrawn publications.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, graphical symbols and the glossary. 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 22 500 terminological entries in English and French, with equivalent terms in 25 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, symboles graphiques et le glossaire. 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 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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
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 Measuring methods for photoemitters.....	7
4.1 Outline of the measuring methods	7
4.2 Radiant power and forward current of LEDs and LDs with or without optical fibre pigtails	8
4.3 Small signal cut-off frequency of LEDs and LDs with or without optical fibre pigtails.....	9
4.4 Threshold current of LDs with or without optical fibre pigtails	10
4.5 Relative intensity noise of LEDs and LDs with or without optical fibre pigtails	11
4.6 S_{11} parameter of LEDs, LDs, and LD modules with or without optical fibre pigtails.....	12
4.7 Tracking error for LD modules with optical fibre pigtails, with or without cooler	14
4.8 Spectral linewidth of LDs with or without optical fibre pigtails	17
4.9 Modulation current at 1 dB efficacy compression of LEDs.....	19
4.10 Differential efficiency of an LD module or an LD with or without optical fibre pigtail.....	21
4.11 Differential (forward) resistance of an LD with or without optical fibre pigtail	23
5 Measuring methods for receivers	24
5.1 Outline of the measuring methods	24
5.2 Noise of a PIN photodiode.....	25
5.3 Excess noise factor of an APD with or without optical fibre pigtails.....	27
5.4 Small-signal cut-off frequency of a photodiode with or without optical fibre pigtails.....	29
5.5 Multiplication factor of an APD with or without an optical fibre pigtail	30
5.6 Responsivity of a PIN-TIA module	31
5.7 Frequency response flatness of a PIN-TIA module	33
5.8 Output noise power (spectral) density of a PIN-TIA module	34
5.9 Low frequency output noise power (spectral) density and corner frequency of a PIN-TIA module.....	36
5.10 Minimum detectable power of PIN-TIA module	38
Bibliography	40

Figure 1 – Equipment setup for measuring radiant power and forward current of LEDs or LDs	8
Figure 2 – Circuit diagram for measuring f_c of LEDs or LDs	9
Figure 3 – Circuit diagram for measuring threshold current of LDs	10
Figure 4 – Graph to determine threshold current of LDs	11
Figure 5 – Circuit diagram for measuring RIN of LEDs or LDs	11
Figure 6 – Circuit diagram for measuring the S_{11} parameter of LEDs, LDs, or LD modules	13

Figure 7 – Circuit diagrams for LDs with cathode or anode connected to package	15
Figure 8 – Output radiant power versus time	16
Figure 9 – Output radiant power versus case temperature	17
Figure 10 – Equipment setup for measuring the spectral linewidth of LDs.....	18
Figure 11 – Circuit diagram for measuring 1 dB efficacy compression of LEDs	20
Figure 12 – Plot of $20 \times \log(I_2)$ versus $20 \times \log(I_1)$	21
Figure 13 – Circuit diagram for measuring differential efficiency of LDs	22
Figure 14 – Current waveform for differential efficiency measurement.....	22
Figure 15 – Circuit diagram for measuring differential resistance of LDs.....	23
Figure 16 – Current waveform for differential resistance	24
Figure 17 – Circuit diagram for measuring noise of a PIN photoreceiver	25
Figure 18 – Circuit diagram for measuring noise with synchronous detection.....	26
Figure 19 – Circuit diagram for measuring excess noise of an APD	27
Figure 20 – Circuit diagram for measuring f_c of a photodiode	29
Figure 21 – Circuit diagram for measuring multiplication factor of an APD	30
Figure 22 – Graph showing measurement of I_{R1} and I_{R2}	31
Figure 23 – Circuit diagram for measuring responsivity of a PIN-TIA module	32
Figure 24 – Circuit diagram for measuring frequency response flatness of a PIN-TIA module	33
Figure 25 – Circuit diagram for measuring output noise power (spectral) density of a PIN-TIA module under matched output conditions.....	35
Figure 26 – Circuit diagram for measuring output noise power (spectral) density of a non-irradiated PIN-TIA module in the low frequency region	36
Figure 27 – Graph of V_m versus frequency	38
Figure 28 – Circuit diagram for measuring minimum detectable power of a PIN-TIA module	39

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Semiconductor optoelectronic devices
for fibre optic system applications -
Part 2: Measuring methods**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62007-2 has been prepared by subcommittee 86C: Fibre optic systems, sensing and active devices, of IEC technical committee 86: Fibre optics. It is an International Standard.

This third edition cancels and replaces the second edition published in 2009. This edition constitutes a technical revision.

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

- a) Modification of the definition of “optical fibre pigtail” in 3.1.3;
- b) Correction of an error in Formula (1) for relative intensity noise;
- c) Correction of an error in Formula (5);
- d) Correction of errors in the title of Figure 11 and the text of 4.9 (replaced "LD" with "LED");
- e) Clarification of how to calculate the 1 dB compression in 4.9;
- f) Corrections of the circuit diagrams in Figure 2, Figure 5, Figure 11, Figure 17, Figure 18, Figure 19, Figure 20, and Figure 21;
- g) Clarification of the measurement setup in 5.10 (Figure 28).

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

Draft	Report on voting
86C/1975/FDIS	86C/1985/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 of the IEC 62007 series can be found, under the general title *Semiconductor optoelectronic devices for fibre optic system applications*, 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, or
- revised.

INTRODUCTION

Semiconductor optical signal transmitters and receivers play important roles in optical communication networks. This document covers the measurement procedures for evaluating their optical and electrical properties that are important for applications in digital communication systems. These properties are essential for specifying the performance of these devices.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62007-2:2025](https://standards.iteh.ai/catalog/standards/iec/8fde877e-557a-4324-9e1e-a7816dc784c1/iec-62007-2-2025)

<https://standards.iteh.ai/catalog/standards/iec/8fde877e-557a-4324-9e1e-a7816dc784c1/iec-62007-2-2025>