SLOVENSKI STANDARD
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Polprevodniške optoelektronske naprave za uporabo v sistemih z optičnimi vlakni - 2. del: Merilne metode

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

Optoelektronische Halbleiterbauelemente für Anwendungen in Lichtwellenleitersystemen - Teil 2: Messverfahren

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

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ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general
31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment
33.180.01	Sistemi z optičnimi vlakni na splošno	Fibre optic systems in general

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86C/1895/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 62007-2 ED3**	
DATE OF CIRCULATION: **2023-12-08**	CLOSING DATE FOR VOTING: **2024-03-01**
SUPERSEDES DOCUMENTS: **86C/1881/CD, 86C/1892/CC**	

IEC SC 86C : FIBRE OPTIC SYSTEMS AND ACTIVE DEVICES	
SECRETARIAT: United States of America	SECRETARY: Mr Fred Heismann
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

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

PROPOSED STABILITY DATE: 2027

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SEMICONDUCTOR OPTOELECTRONIC DEVICES FOR FIBRE OPTIC SYSTEM APPLICATIONS –

Part 2: Measuring methods

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IEC 62007-2 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 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) Correction of an error in Formula (1) for relative intensity noise;
b) Correction of errors in the title of Figure 11 and the text of 4.9 (replaced “LD” with “LED”);
c) Clarification of how to calculate the 1 dB compression in 4.9;

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d) Correction of an error in Figure 21 (added missing label “SA”);

e) Clarification of the measurement setup (Figure 28) in 5.10.

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

Draft	Report on voting
86C/XX/FDIS	86C/XX/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,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Semiconductor optical signal transmitters and receivers play important roles in optical information networks. This standard covers the measurement procedures for their optical and electrical properties that are intended for digital communication systems. These properties are essential to specify their performance.

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SEMICONDUCTOR OPTOELECTRONIC DEVICES FOR FIBRE OPTIC SYSTEM APPLICATIONS –

Part 2: Measuring methods

1 Scope

This part of IEC 62007 specifies measuring methods for characterizing semiconductor optoelectronic devices that are used in the field of fibre optic digital communication systems and subsystems.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms, definitions and abbreviations apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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3.1.1
PIN photodiode
photodiode with a large intrinsic region sandwiched between p- and n-doped semiconducting regions used for the detection of optical radiation

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[SOURCE: IEV 731-06-29]

3.1.2
avalanche photodiode
photodiode operating with a bias voltage such that the primary photocurrent undergoes amplification by cumulative multiplication of charge carriers

[SOURCE: IEV 731-06-30]

3.1.3
pigtail
short optical fibre or optical fibre cable that is attached to a device being measured

3.2 Abbreviated terms

AC alternating current
APD avalanche photodiode
BER bit-error ratio
DC direct current
LED light emitting diode
LD laser diode

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PD photodetector

RF radio frequency

RIN relative intensity noise

RMS root mean square

TIA transimpedance amplifier

4 Measuring methods for photoemitters

4.1 Outline of the measuring methods

Light emitting diodes (LEDs) and laser diodes (LDs) have important opto-electronic properties, which need to be specified when they are used in optical communication systems. The measurement methods for characterizing these opto-electronic properties are described in subclauses 4.2 to 4.11, where each subclause covers the following topics.

a) Purpose;

b) One of the following items

- Measurement equipment;
- Equipment setup;
- Circuit diagram;
- Circuit design and current waveform for measurement.

c) Equipment / circuit description and requirements;

d) Precautions to be observed;

e) Measurement procedures;

f) Specified conditions.

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If a device is equipped with an optical fibre pigtail, all optical fibres and cables defined in the IEC 60793 and IEC 60794 series are applicable. If a pigtail is to be terminated with an optical connector, all optical connectors defined in the IEC 61754 and IEC 61755 series are applicable.

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4.2 Radiant power and forward current of LEDs and LDs with or without optical fibre pigtails

a) Purpose

To measure the radiant power Φ_e and the forward current I_F of LEDs and LDs, with or without optical fibre pigtails, under specified conditions.

b) Measurement equipment

Figure 1 shows the equipment setup for measuring the radiant power and forward current of LEDs and LDs.

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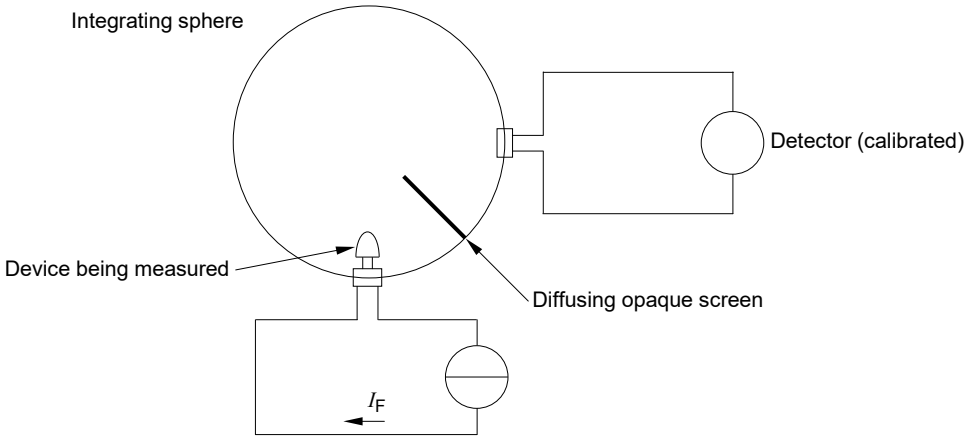

Figure 1 – Equipment setup for measuring radiant power and forward current of LEDs or LDs

c) Equipment description and requirements

The radiation emitted by the device is subjected to multiple reflections from the walls of the integrating sphere; this leads to a uniform irradiance of the surface proportional to the emitted flux. A detector located in the walls of the sphere measures this irradiance. An opaque screen shields the detector from the direct radiation of the device being measured.

d) Precautions to be observed

The device being measured, the screen, and the apertures shall be small compared to the sphere surface.

The inner surface of the sphere and screen shall have a diffusing coating with a high uniform reflection coefficient (0,8 minimum).

The sphere and detector assembly shall be calibrated.

Variations in peak-emission wavelength and in radiation flux due to power dissipation shall be taken into account.

When the radiation emitted by the device being measured is pulsed, the detector shall time-average the measured radiation.

e) Measurement procedures

The emitting device is positioned at the entrance of the integrating sphere, so that no direct radiation will reach the detector.

For measurements of radiant power, the specified forward current I_F is applied to the device, and the radiant power is measured by the photodetector.

For measurements of forward current, the current applied to the device is increased until the specified radiant power Φ_e is achieved. The value of this current is recorded.

f) Specified conditions

– Ambient or case temperature.
– Radiant power (when measuring forward current).
– Forward current (when measuring radiant power).

4.3 Small signal cut-off frequency f_c of LEDs and LDs with or without optical fibre pigtails

a) Purpose

To measure the small-signal cut-off frequency f_c of LEDs and LDs with or without optical fibre pigtails, under specified conditions.

b) Circuit diagram

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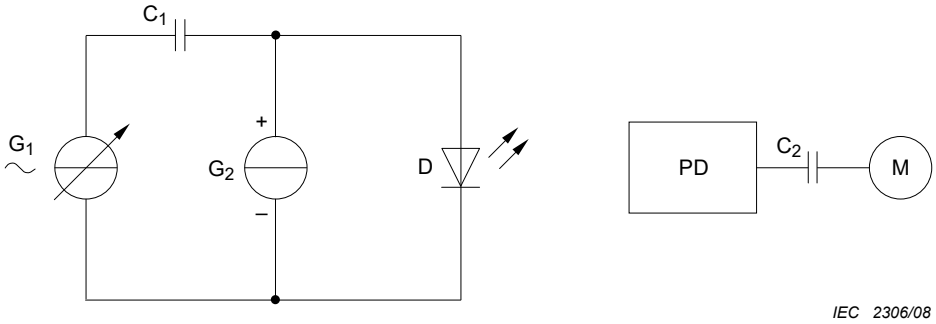
Figure 2 shows a circuit diagram for measuring the small-signal cut-off frequency of LEDs and LDs.



Key

D	device being measured
G_1	AC generator with adjustable frequency
G_2	DC generator
PD	photodetector
M	measuring instrument for AC radiant power
C_1, C_2	coupling capacitors

Figure 2 – Circuit diagram for measuring the small-signal cut-off frequency of LEDs or LDs

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c) Equipment description and requirements

No requirements for this item.

d) Precautions to be observed

The radiant power reflected back into the laser diode shall be minimized to avoid modulation distortions, which could affect the accuracy of the measurement. The photodetector must have a frequency response greater than f_c.

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e) Measurement procedure

For LEDs, the specified direct forward current or the direct forward current required to obtain the specified radiant power is applied to the device being measured.

For laser diodes, the forward current is adjusted to a value which is equal to the continuous forward current above threshold or which generates a specified radiant power.

The forward current is modulated using generator G_1 at a low frequency f_l (less than f_c /100) and the AC radiant power is measured by instrument M (see Figure 2).

Keeping the modulation level constant, the modulation frequency is increased until the output radiant power measured by M is reduced to 50 % of the value obtained at f_l.

This frequency is the small-signal cut-off frequency f_c.

f) Specified conditions

For light-emitting diodes (LED):

– ambient or case temperature;

– DC forward current or radiant power.

For the laser diodes (LD):

– ambient, case, or submount temperature;

– radiant power or difference between applied DC forward current and threshold current of LD.