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**Fibre optic active components and devices – Performance standards –
Part 5: ATM-PON transceivers with LD driver and CDR ICs**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES –
PERFORMANCE STANDARDS –****Part 5: ATM-PON transceivers with LD driver and CDR ICs**

FOREWORD

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International Standard IEC 62149-5 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

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

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

- a) description of types in Clause 4 has been removed;
- b) titles of reference documents have been updated.

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

FDIS	Report on voting
86C/1667/FDIS	86C/1678/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.

A list of all parts of IEC 62149 series, published under the general title *Fibre optic active components and devices – Performance standards*, 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Fibre optic transceivers are used to convert electrical signals into optical signals and vice versa. The optical performance criteria are generally well specified for a number of internationally agreed applications areas such as ITU-T Recommendation G.983.1 and IEEE Std 802.3. This document aims to assure inter-changeability in performance between fibre optic transceivers for ATM-PON (ATM-based broadband passive optical network) systems supplied by different manufacturers but does not guarantee operation between fibre optic transceivers.

Manufacturers using this document are responsible for meeting the required performance and/or reliability and quality assurance under a recognized scheme.

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FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – PERFORMANCE STANDARDS –

Part 5: ATM-PON transceivers with LD driver and CDR ICs

1 Scope

This part of IEC 62149 specifies performance on the transceiver modules for asynchronous-transfer-mode passive optical network (ATM-PON) systems recommended by the International Telecommunication Union (ITU) in ITU-T Recommendation G.983.1.

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 60068-2-6:~~2007~~, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:~~2008~~, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60332-3-24, *Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C*

IEC 60825-1:~~2007~~, *Safety of laser products – Part 1: Equipment classification and requirements*

<http://standards.iteh.ai/> IEC 60950-1:~~2005~~, *Information technology equipment – Safety – Part 1: General requirements* 020

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61280-1-1:~~1998~~, *Fibre optic communication subsystem basic test procedures – Part 1-1: Test procedures for general communication subsystems – Transmitter output optical power measurement for single-mode optical fibre cable*

IEC 61280-1-3:~~1998~~, *Fibre optic communication subsystem ~~basic~~ test procedures – Part 1-3: ~~Test procedures for~~ General communication subsystems – Central wavelength and spectral width measurement*

IEC 61280-2-2:~~2008~~, *Fibre optic communication subsystem test procedures – Part 2-2: Digital systems – Optical eye pattern, waveform and extinction ratio measurement*

IEC 61300-2-4:~~1995~~, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre ~~or~~ cable retention*

IEC 61300-2-17:~~2003~~, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18:~~2005~~, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19:~~2005~~, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22:~~2007~~, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-3-6:~~2003~~, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61753-1:~~2007~~, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and guidance ~~for performance standards~~*

~~IEC 61931, *Fibre optic Terminology*~~

IEC 62148-1, *Fibre optic active components and devices – Package and interface standards – Part 1: General and guidance*

IEC 62150-2:~~2004~~, *Fibre optic active components and devices – Test and measurement procedures – Part 2: ATM-PON transceivers*

ITU-T Recommendation G.957:2006, *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*

ITU-T Recommendation G.983.1:2005, *Broadband optical access systems based on Passive Optical Networks (PON)*

3 Term, definitions and abbreviated terms

3.1 Terms and definitions

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

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

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

NOTE Further terminology concerning related physical concepts, types of devices, general terms, and terms related to ratings and characteristics can be found in IEC 61931. See also ITU-T Recommendation G.983.1.

3.1.1

optical access network

OAN

set of access links sharing the same network-side interfaces and supported by optical access transmission systems

Note 1 to entry: The OAN ~~may~~ can include a number of ODNs connected to the same OLT.

3.1.2

optical distribution network

ODN

apparatus or component that provides the optical transmission means from the OLT to the users and vice versa

Note 1 to entry: The ODN utilizes passive optical components.

3.1.3**optical line termination**

OLT

apparatus that provides the network-side interface of the OAN and is connected to one or more ODNs

3.1.4**optical network unit**

ONU

apparatus that provides (directly or remotely) the user-side interface of the OAN, and is connected to the ODN

3.2 Abbreviated terms

ATM-PON asynchronous transfer mode passive optical network

ATT attenuator

BER bit error ratio

CDR clock and data recovery

CMOS complementary metal-oxide semiconductor

DUT device under test

~~ERD Error ratio detector~~

~~EX Extinction ratio~~

~~FTT Cab/C/B/H Fibre to the cabinet/curb/building/home~~

IC integrated circuit

LD laser diode

MLM multi-longitudinal mode

~~PPG Pulse pattern generator~~

RMS root mean square IEC 62149-5:2020

SLM single-longitudinal modes <https://standards.iteh.ai/standards/iec-62149-5-2020>

4 Classification

Fibre optic transceiver modules are classified into ~~5~~ several types of forms according to the combination of mating types of electrical and optical interfaces (for details, see IEC 62148-1). ~~Those combinations include the following:~~

~~Type 1: Fibre optic connector interface with direct solderable type electrical terminals.~~

~~Type 2: Fibre optic connector interface with plug-in type electrical terminals.~~

~~Type 3: Fibre optic pigtail interface with direct solderable type electrical terminals.~~

~~Type 4: Fibre optic pigtail interface with plug-in type electrical terminals.~~

~~Type 5: Modules are not classified into type 1 to type 4. (A typical example is a module that has both electrical connectors and non-connector type terminals as an electrical interface such as a coaxial connector for signal and lead terminals for the power supply.)~~

5 Product definition**5.1 Description of transceiver module**

Information on the following devices constituting the optical transceiver module shall be stated. This statement shall include details of technologies. For example, technologies used for ICs such as CMOS, bipolar, etc., shall be described.

- For a transmitter:
 - laser diode (in this description, a single- or a multi-longitudinal mode type shall be specified);
 - monitoring photodiode;
 - driver IC;
 - thermal sensor (where appropriate).
- For a receiver:
 - photodiode;
 - pre-amp IC;
 - data/clock recovery IC.
- For a wavelength division multiplexer device:
 - technology used for this device.
- For a package:
 - refer to the ~~IEC document number standardized as a package interface standard~~ IEC 62148 series.

5.2 Description of applied form

According to ITU-T Recommendation G.983.1, the applied form of nominal bit rate, the class (class B or class C), the applied unit (ONU or OLT), and the number of fibres (one for duplex working or two for simplex working) shall be stated.

5.3 Block diagram

A block diagram or equivalent circuit information on the optical transceiver module shall be given (see Figure 1).

The following terminals may be distinguished:

- supply terminals, i.e., terminals intended to be connected to the power supplies;
- input and output terminals, i.e., terminals into or out of which signals are passed.

The term "signal" includes both pulse and more complex waveforms and includes strobe or control pulses.

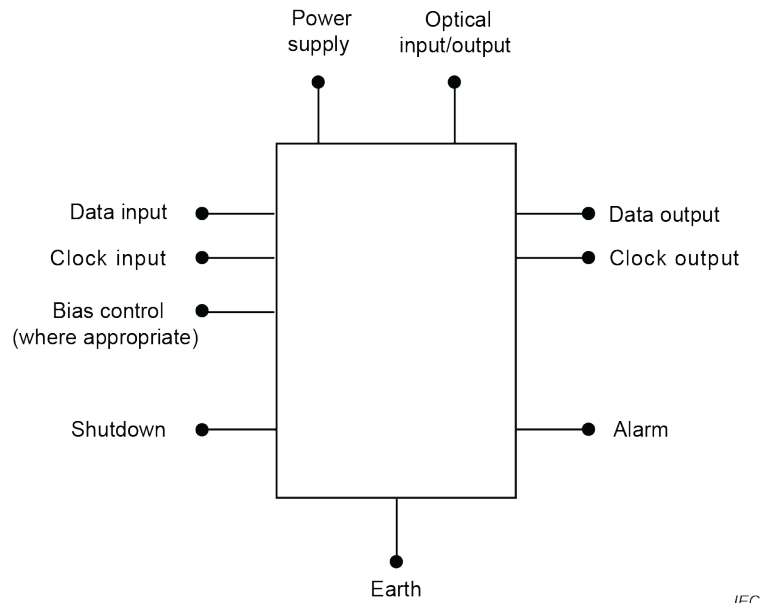


Figure 1 – Functional block diagram (example)

5.4 Absolute limiting rating

Absolute limiting (maximum) ratings imply that no catastrophic damage will occur if the product is subjected to these ratings ~~for short periods~~, provided each limiting parameter is in isolation and all other parameters have values within the normal performance parameters. It should not be assumed that limiting values of more than one parameter could be applied at any one time.

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Table 1 – Absolute maximum ratings

Items	Condition	Letter symbol	Requirements		Units
			Minimum	Maximum	
Storage temperature ^a		T_{stg}	-40	85	°C
Storage relative humidity		H_{stg}	5	95	%
Bend radius of pigtail for type 3, 4, and 5 transceivers (at specified distance from the case) ^b		r	30		mm
Shock ^c	Pulse eye duration: 18 ms 3 times/axis			300	m/s ²
Vibration ^d	10 Hz to 55 Hz, 3 axes, 1,5 mm, 2 h			100	m/s ²
Tensile force on devices with pigtail Buffer-coated fibre ^e Reinforced fibre ^e		F		5 100	N
Electrical limiting values					
– Power supply voltage		V_{SUPmax} U_{SUPmax}	-0,5	4,0	V
– Input voltage		V_{INmax} U_{INmax}	-0,5	$V_{sup} U_{sup}$	V
– Output voltage		V_{OUTmax} U_{OUTmax}	0	$V_{sup} U_{sup} + 0,5$	V
– Output current PECL interface LVTTTL interface		I_{OUTmax}	0 -20	50 20	mA
Optical limiting values					
– Permissible input power		P_{in}		-5	dBm
^a Ambient temperature and humidity for outdoor ONU is under further study in ITU-T Recommendation G.983.1, thus these specifications may be varied in the future. ^b IEC 62148-1 shall be referred to for detail. ^c IEC 60068-2-27 shall be referred to for detail. ^d IEC 60068-2-6 shall be referred to for detail. ^e For the requirements see The requirements of IEC 61753-1 shall be applied.					

5.5 Functional specification

Electro-optical characteristics for the items in Table 3 shall be satisfied at the operating environmental conditions specified in Table 2.

NOTE Optical characteristics specified in ITU-T Recommendation G.983.1 should be satisfied.

Each electrical and optical characteristics of 5.5 shall be measured under conditions specified in each reference.

Each electrical and optical characteristic of 5.5 shall be stated under specified worst-case conditions, with respect to the recommended range of operating conditions as stated. The measuring method of each electrical and optical characteristics specified in Table 3 shall be measured based on the method stated in the reference of each row.