

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Composants et dispositifs actifs à fibres optiques – Normes de
fonctionnement –
Partie 5: Emetteurs-récepteurs ATM-PON avec programme de gestion LD
et ICs CDR



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IEC 62149-5

Edition 2.0 2009-08

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INTERNATIONAL
ELECTROTECHNICAL
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ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

U

ICS 33.180.20

ISBN 978-2-88910-634-9

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Term, definitions and abbreviations.....	8
3.1 Terms and definitions.....	8
3.2 Abbreviations.....	9
4 Classification.....	9
5 Product definition.....	9
5.1 Description of transceiver module.....	9
5.2 Description of applied form.....	10
5.3 Block diagram.....	10
5.4 Absolute limiting rating.....	10
5.5 Functional specification.....	11
6 Testing.....	20
6.1 Characterization testing.....	20
6.1.1 Characterization: transmitter section.....	21
6.1.2 Characterization: receiver section.....	22
6.2 Performance testing.....	22
7 Environmental specifications.....	23
7.1 General safety.....	23
7.2 Laser safety.....	23
7.3 Electromagnetic emission.....	23
Annex A (informative) Measurement on tolerance to the reflected optical power (Table 3, Item 13).....	24
Annex B (informative) Logic level of alarm and shutdown signal.....	26
Bibliography.....	27
Figure 1 – Functional block diagram (example).....	10
Figure 2 – Relationship of phase between clock and data signals.....	18
Figure 3 – Recommended electrical circuit diagram for LVTTTL-type interface (example).....	19
Figure 4 – Schematic drawing for defining launched optical power without input to transmitter.....	19
Figure 5 – Schematic drawing for defining launched optical power without input to transmitter.....	20
Figure A.1 – Model for incidence into ONU receiver.....	24
Figure A.2 – An example system to measure tolerance to the reflected optical power.....	24
Figure A.3 – A recommended system to measure tolerance to the reflected optical power.....	25
Table 1 – Absolute maximum ratings.....	11
Table 2 – Operating environment.....	12
Table 3 – Electrical and optical characteristics.....	13
Table 4 – Electrical interface characteristics (PECL type).....	16

Table 5 – Electrical interface characteristics (LVTTL type).....	17
Table 6 – Electrical interface characteristics of alarm output voltage (PECL type).....	17
Table 7 – Electrical interface characteristics of alarm output voltage (LVTTL type)	17
Table 8 – Electrical interface characteristics of shutdown input voltage (both PECL and LVTTL types)	18
Table 9 – Transmitter section characterization tests	21
Table 10 – Receiver section characterization tests	22
Table 11 – Performance testing plan.....	23

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**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 second edition cancels and replaces the first edition published in 2003, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- Normative references have been updated
- Incorrect "Letter symbols" have been corrected
- Some "Notes" in tables have been revised in order to harmonize with IEC 62150-2 (2004).

The text of this standard is based on the following documents:

FDIS	Report on voting
86C/891/FDIS	86C/916/RVD

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

This publication 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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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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 802.3. This standard aims to assure inter-changeability in performance between fibre optic transceivers for ATM-PON systems supplied by different manufacturers, but does not guarantee operation between fibre optic transceivers.

Manufacturers using the standards 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 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 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 60825-1:2007, *Safety of laser products – Part 1: Equipment classification and requirements*

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IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

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/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*

IEC62150-2:2004, *Fibre optic active components and devices – Test and measurement procedures - Part 2: ATM-PON transceivers*

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

3 Term, definitions and abbreviations

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

Further terminology concerning related physical concepts, types of devices, general terms, and terms related to ratings and characteristics can be found in IEC 61931.

It is also recommended to refer to ITU-T Recommendation G.983.1 <https://www.itu.int/rec/T-REC-G983-1-200903-I>

3.1 Terms and definitions

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 The OAN may 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. It 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 Abbreviations

ATM-PON	Asynchronous transfer mode passive optical network
ATT	Attenuator
BER	Bit error ratio
CDR	Clock and data recovery
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
SLM	Single-longitudinal modes

4 Classification

Fibre optic transceiver modules are classified into 5 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.

5.2 Description of applied form

According to ITU-T Recommendation G.983.1, applied form of nominal bit rate, class (class B or class C), 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

Block diagram or equivalent circuit information on the optical transceiver module shall be given.

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.

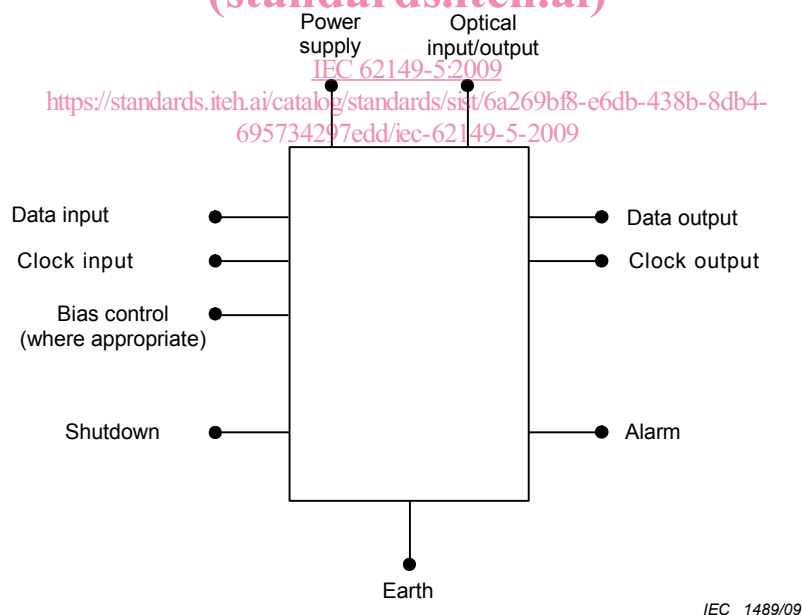


Figure 1 – Functional block diagram (example)

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.

Table 1 – Absolute maximum ratings

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

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 this clause shall be measured under conditions specified in each reference.

Each electrical and optical characteristic of this clause 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.

Table 2 – Operating environment

Items	Letter symbol	Requirements			Units
		Minimum	Typical	Maximum	
Power supply voltage	V_{SUP}	3,135	3,3	3,465	V
Operating case temperature ^a	T_{case}	–5		75	°C
Ambient humidity ^a	RH	5		95	%
^a Operating case 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.					

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Table 3 – Electrical and optical characteristics

Item number	Items	Letter symbol	Requirements			Units	Reference
			Minimum	Typical	Maximum		
1	Nominal bit rate	B		155,52		Mb/s	
2	Mean launched power ^a – Class B – Class C	P_{mean}	-4 -2		+2 +4	dBm	IEC 61280-1-1
3	Transmitter wavelength	λ	1 260		1 360	nm	IEC 61280-1-3
4	Mask of transmitter eye diagram ^b	–					
5	Extinction ratio	Ex	10			dB	IEC 61280-2-2
6	For MLM laser, maximum RMS width	$\Delta\lambda$			5,8	nm	IEC 61280-1-3
7	For SLM laser, maximum -20 dB width	$\Delta\lambda$			1,0	nm	IEC 61280-1-3
8	For SLM laser, minimum side mode suppression ratio	SMSR	30			dB	IEC 61280-1-3
9	Maximum reflectance, measured at transmitter wavelength	R_{TX}	-6			dB	IEC 61300-3-6, 4.1
10	Receiver overload: – Class B – Class C	S_O	-8 -11			dBm	IEC 62150-2
11	Receiver sensitivity: – Class B – Class C	S			-30 -33	dBm	IEC 62150-2
12	Maximum reflectance, measured at receiver wavelength	R_{RX}	-20			dB	IEC 61300-3-6, 4.1
13	Tolerance to the reflected optical power ^c				10	dB	ITU-T G.957 Appendix III
14	Clock input voltage (high)			See Tables 4 and 5			
15	Clock input voltage (low)			See Tables 4 and 5			
16	Clock input voltage (swing centre)			See Tables 4 and 5			
17	Data input voltage (high)			See Tables 4 and 5			
18	Data input voltage (low)			See Tables 4 and 5			
19	Data input voltage (swing centre)			See Tables 4 and 5			