

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 fibroniques – Normes de performances –
Partie 5: Émetteurs-récepteurs ATM-PON avec programme de gestion
LD et CI CDR**

ITU STANDARD PREVIEW
(standards.iteh.ai)

IEC 62149-5:2020
<https://standards.iteh.ai/catalog/standards/sist/iec/62149-5-2020>
6a008d623e66/iec-62149-5-2020





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 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 Central Office
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 It also gives information on projects, replaced and withdrawn publications.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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22,000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67,000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Composants et dispositifs actifs fibroniques – Normes de performances –
Partie 5: Émetteurs-récepteurs ATM-PON avec programme de gestion
LD et CI CDR**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.180.20

ISBN 978-2-8322-8608-1

**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	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Term, definitions and abbreviated terms	8
3.1 Terms and definitions	8
3.2 Abbreviated terms	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	18
6.1 General	18
6.2 Characterization testing	18
6.2.1 Characterization: transmitter section	19
6.2.2 Characterization: receiver section	20
6.3 Performance testing	20
7 Environmental specifications	21
7.1 General safety	21
7.2 Laser safety	21
7.3 Electromagnetic emission	21
Annex A (informative) Measurement on tolerance to the reflected optical power (Table 3, item 13)	22
Annex B (informative) Logic level of alarm and shutdown signal	24
Bibliography	25
Figure 1 – Functional block diagram (example)	10
Figure 2 – Relationship of phase between clock and data signals	17
Figure 3 – Recommended electrical circuit diagram for LVTTTL-type interface (examples)	17
Figure 4 – Schematic drawing for defining launched optical power without input to transmitter	18
Figure 5 – Experimental setup for measuring tolerance to the transmitter incident light power	18
Figure A.1 – Model for incidence into ONU receiver	22
Figure A.2 – Example system to measure tolerance to the reflected optical power	23
Figure A.3 – Recommended system to measure tolerance to the reflected optical power	23
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).....	15
Table 5 – Electrical interface characteristics (LVTTTL type).....	15
Table 6 – Electrical interface characteristics of alarm output voltage (PECL type).....	16
Table 7 – Electrical interface characteristics of alarm output voltage (LVTTTL type).....	16
Table 8 – Electrical interface characteristics of shutdown input voltage (both PECL and LVTTTL types).....	16
Table 9 – Transmitter section characterization tests.....	19
Table 10 – Receiver section characterization tests.....	20
Table 11 – Performance testing plan.....	21

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

[IEC 62149-5:2020](https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020)

<https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 62149-5:2020](https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020)

<https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020>

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 62149-5:2020](https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020)

<https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020>

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

IEC 60068-2-27, *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, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60950-1, *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, *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, *Fibre optic communication subsystem test procedures – Part 1-3: General communication subsystems – Central wavelength and spectral width measurement*

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

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

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

IEC 61300-2-18, *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, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

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

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

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

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

IEC 62150-2, *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)*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3 Term, definitions and abbreviated terms

3.1 Terms and definitions

<https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020>

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 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
IC	integrated circuit
LD	laser diode
MLM	multi-longitudinal mode
RMS	root mean square
SLM	single-longitudinal modes

STANDARD PREVIEW
(standards.iteh.ai)
IEC 62149-5:2020
<https://standards.iteh.ai/catalog/standards/sist/fc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020>

4 Classification

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

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 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.

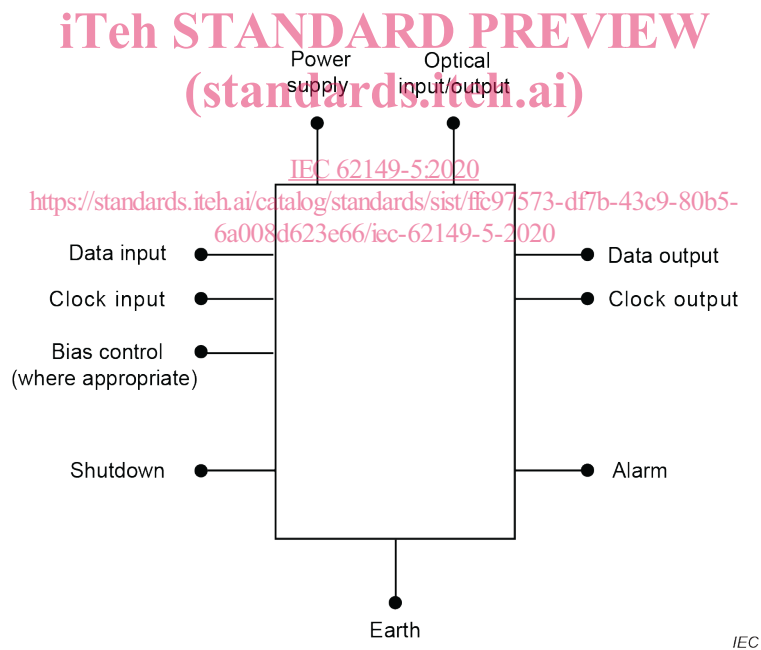


Figure 1 – Functional block diagram (example)

5.4 Absolute limiting rating

Absolute limiting (maximum) ratings imply that no catastrophic damage will occur if the product is subjected to these ratings, 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 relative humidity		H_{stg}	5	95	%
Bend radius of pigtail for transceivers (at specified distance from the case) ^b		r	30		mm
Shock ^c	Pulse 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		U_{SUPmax}	–0,5	4,0	V
– Input voltage		U_{INmax}	–0,5	U_{sup}	V
– Output voltage		U_{OUTmax}	0	$U_{sup} + 0,5$	V
– Output current PECL interface LVTTTL interface		I_{OUTmax}	0 –20	50 20	mA
Optical limiting values					
– Permissible input power		P_{in}		–5	dBm
<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 62148-1 shall be referred to for detail.</p> <p>^c IEC 60068-2-27 shall be referred to for detail.</p> <p>^d IEC 60068-2-6 shall be referred to for detail.</p> <p>^e The requirements of IEC 61753-1 shall be applied.</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. Optical characteristics specified in ITU-T Recommendation G.983.1 should be satisfied.

Each electrical and optical characteristic 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.

Table 2 – Operating environment

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

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 62149-5:2020](https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020)

<https://standards.iteh.ai/catalog/standards/sist/ffc97573-df7b-43c9-80b5-6a008d623e66/iec-62149-5-2020>

Table 3 – Electrical and optical characteristics

Item number	Items	Letter symbol	Requirements			Units	Reference
			Minimum	Typical	Maximum		
1	Nominal bit rate			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						
5	Extinction ratio	r_{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	r_{SMSR}	30			dB	IEC 61280-1-3
9	Maximum reflectance measured at transmitter wavelength	R_{TX}	-6			dB	IEC 61300-3-6
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
13	Tolerance to the reflected optical power ^c				10	dB	ITU-T G.957:2006, Appendix III
14	Clock input voltage (high)		See Table 4 and Table 5				
15	Clock input voltage (low)		See Table 4 and Table 5				
16	Clock input voltage (swing centre)		See Table 4 and Table 5				
17	Data input voltage (high)		See Table 4 and Table 5				
18	Data input voltage (low)		See Table 4 and Table 5				
19	Data input voltage (swing centre)		See Table 4 and Table 5				
20	Clock output voltage (high)		See Table 4 and Table 5				
21	Clock output voltage (low)		See Table 4 and Table 5				