

SLOVENSKI STANDARD

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Laser modules used for telecommunication - Reliability assessment (IEC 61751:1998)

Laser modules used for telecommunication - Reliability assessment

Lasermodule für Telekommunikationsanwendungen - Zuverlässigkeitsbewertung

Modules laser utilisés pour les télécommunications - Evaluation de la fiabilité

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EUROPEAN STANDARD

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**Laser modules used for telecommunication
Reliability assessment
(IEC 61751:1998)**

Modules laser utilisés pour les
télécommunications
Evaluation de la fiabilité
(CEI 61751:1998)

Lasermodule für
Telekommunikationsanwendungen
Zuverlässigkeitsbewertung
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This European Standard was approved by CENELEC on 1998-04-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 86/115/FDIS, future edition 1 of IEC 61751, prepared by SC 47C, Optoelectronic, display and imaging devices, of IEC TC 47, Semiconductor devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61751 on 1998-04-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 1999-01-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2001-01-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A and ZA are normative and annex B is informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61751:1998 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)**Normative references to international publications
with their corresponding European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-1	1990	Environmental testing Part 2: Tests Tests A: Cold	EN 60068-2-1	1993
IEC 60068-2-14	1984	Part 2: Tests Test N: Change of temperature	HD 323.2.14 S2 ¹⁾	1987
IEC 60747-1	1983	Semiconductor devices Discrete devices and integrated circuits Part 1: General	-	-
+ A3	1996		-	-
IEC 60747-12-2	1995	Part 12: Optoelectronic devices Section 2: Blank detail specification for laser diode modules with pigtail for fibre optic systems and sub-systems	-	-
IEC 60749	1996	Semiconductor devices Mechanical and climatic test methods	-	-
ISO 9000	series	Quality management and quality assurance standards	EN ISO 9000	series
MIL-STD-883	1985	Test Methods and Procedures for Microelectronics	-	-

1) HD 323.2.14 S2 includes A1:1986 to IEC 60068-2-14.

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For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LASER MODULES USED FOR TELECOMMUNICATION – Reliability assessment

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61751 has been prepared by subcommittee 47C: Optoelectronic, display and imaging devices, of IEC technical committee 47: Semiconductor devices.

The field of this standard will henceforth be placed under the responsibility of IEC technical committee 86: Fibre optics.

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

FDIS	Report on voting
86/115/FDIS	86/116/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.

Annex A forms an integral part of this standard.

Annex B is for information only.

INTRODUCTION

The laser modules covered by this International Standard are purchased by a system supplier (SS) to be inserted in equipments which in turn are supplied/sold to a system operator (SO), for example a national PTT or a network operator (see definitions in clause 3).

For the system operator to act as an informed buyer, a knowledge of the potential risks posed by the use of critical components is required.

Optoelectronic component technology is continuing to develop. Consequently, during product development phases, many failure mechanisms in laser modules have been identified. These failure mechanisms, if undetected, could result in very short laser lifetime in system use.

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LASER MODULES USED FOR TELECOMMUNICATION – Reliability assessment

1 Scope

This International Standard deals with reliability assessment of laser modules used for telecommunication.

The aim of this standard is:

- to establish a standard method of assessing the reliability of laser modules in order to minimize risks and to promote product development and reliability;
- to establish means by which the distribution of failures with time can be determined. This should enable the determination of equipment failure rates for specified end of life criteria.

In addition, guidance is given on:

- the testing that a system supplier should ensure is in a place prior to procurement of a laser module from a laser module manufacturer;
- a range of activities expected of a system supplier to verify a laser module manufacturer's reliability claims.

Further details concerning the rationale are given in annexes A and B.

2 Normative references

[SIST EN 61751:1999](https://standards.iteh.ai/catalog/standards/sist/9e47a274-a326-41af-9f05-86e397025007/sist-en-61751-1999)

<https://standards.iteh.ai/catalog/standards/sist/9e47a274-a326-41af-9f05-86e397025007/sist-en-61751-1999>

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests. Tests A: Cold*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests. Test N: Change of temperature*

IEC 60747-1:1996, *Semiconductor devices – Discrete devices and integrated circuits – Part 1: General*
Amendment 3 (1996)

IEC 60747-12-2:1995, *Semiconductor devices – Part 12: Optoelectronic devices – Section 2: Blank detail specification for laser diode modules with pigtail for fibre optic systems and sub-systems*

IEC 60749:1996, *Semiconductor devices – Mechanical and climatic test methods*

ISO 9000: *Quality management and quality assurance standards*

MIL-STD-883:1985, *Test methods and Procedures for Microelectronics*

3 Terms and definitions

For the purpose of this International Standard the following definitions apply:

laser module

a packaged assembly containing a laser diode and photodiode

NOTE – The module may also include a cooler and temperature sensor to enable laser temperature to be controlled and monitored. The optical output is normally via an optical fibre pigtail.

submount

a substrate upon which a laser diode or photodiode may be mounted for assembly into the laser module

NOTE – Components on submounts are also subject to qualification testing.

laser module manufacturer (LMM)

a manufacturer of laser modules who provides devices meeting the requirements of the relevant detail specification (DS) and the customer's reliability requirements

system supplier (SS)

a manufacturer of telecommunications/data transmission equipment containing optoelectronic semiconductor lasers, i.e. laser module customer

system operator (SO)

a network operator of telecommunications/data transmission equipment containing optoelectronic semiconductor lasers in the transmission path

NOTE – The system may also be part of other more extensive systems, for example telecommunications, rail, road vehicles, aerospace or weapons.

capability qualifying components (CQC)

components selected to represent critical stages of the process and limiting or boundary characteristics of mechanical and electro-optic design

Such components should aid the identification of end product failure mechanisms to enable the determination of activation energies.

4 Laser reliability and quality assurance procedure

4.1 Demonstration of product quality

This standard (where required by the detail specification (DS)) gives the minimum mandatory requirements and is part of a total laser reliability and quality assurance procedure adopted by the laser module manufacture.

It gives guidance on the activities of the system supplier, and the system operator as well as feedback of field performance, the laser module manufacturer and the system supplier.

The laser module manufacturer shall be able to demonstrate, by means of qualification approval of devices, technology approval or capability approval of the manufacturing process:

- a) a documented and audited manufacturing process including the qualification of purchased components in accordance with ISO 9000;
- b) a performance qualification programme, including for example, accelerated life testing, burn-in and screening of components and modules;
- c) a qualification maintenance programme to ensure continuity of reliability performance;
- d) a procedure to feedback reliability issues to development and production.

In addition, there are many elements which make up a comprehensive reliability assurance programme (see annex B).

4.2 Testing responsibilities

The testing detailed in tables 1a and 1b is to be performed by the laser module manufacturer and component suppliers (where applicable). Additional testing may be specified in the DS.

4.2.1 Recommendation (applicable to laser customer/system supplier)

The system supplier is recommended to have a programme to analyse and verify the results including failure analysis. This programme includes an independent life test of fully packaged laser modules, see table 1b test 2 and/or test 3 and/or test 5 (sample size >10 per test).

4.2.2 Recommendation applicable to system operator

The system operator is recommended to have a programme to monitor and report field failure rates in sufficient detail to enable system supplier and laser module manufacturer to initiate any necessary corrective actions at an early stage in the lifetime of a product.

Suppliers may have different approaches (i.e. to reliability concepts) during the development of product maturity and resource limitations may dictate testing strategies.

Alternative tests and activities to those specified are permitted provided the LMM/SS/SO can show intent to remove end-product failures and the associated failure mechanisms. However, this will require significant data to substantiate compliance.

4.3 Quality improvement programmes (QIPs)

Quality improvement programmes (QIPs) shall be initiated with component suppliers and customers (SOs, SSs and LMMs) to address non-compliances (including quality and reliability problems identified during subsequent service life of the laser). The correction of non-compliances and subsequent QIPs are a required strategy to minimize reliability risks. The operation of QIPs should be stated in the quality approval (QA) generic and capability approval documents.