IEC 62149-12

Edition 1.0 2023-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic active components and devices – Performance standards – Part 12: Distributed feedback laser diode device for analogue radio over fibre systems

Composants et dispositifs actifs fibroniques – Normes de performances – Partie 12: Dispositif à diode laser à rétroaction répartie pour systèmes radio analogiques sur fibre



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – PERFORMANCE STANDARDS –

Part 12: Distributed feedback laser diode device for analogue radio over fibre systems

FOREWORD

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

Draft	Report on voting
86C/1808/CDV	86C/1840/RVC

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 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 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- withdrawn,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.

INTRODUCTION

Distributed feedback laser diode (DFB-LD) devices for analogue radio over fibre (A-RoF) systems are used to convert electrical radio signals into optical signals. This document covers the performance specification for DFB-LD devices in A-RoF systems. The optical and electrical performance criteria are generally well specified for a number of internationally agreed upon application areas, such as ITU-T Recommendation G.9803 and IEC 62149-10. This document provides optical and electrical performance specifications for RoF transceivers. These transceivers are necessary for operation of A-RoF systems, because the RoF transmitter requires a light source such as a DFB-LD device. DFB-LD devices for RoF transceivers are supplied by different manufacturers. However, they do not guarantee the operation of DFB-LD devices in A-RoF systems. Manufacturers using this document are responsible for meeting the required performance and/or reliability and quality assurance under a recognized scheme.

FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – PERFORMANCE STANDARDS –

Part 12: Distributed feedback laser diode device for analogue radio over fibre systems

1 Scope

This part of IEC 62149 defines performance specifications for distributed feedback laser diode (DFB-LD) devices used in analogue radio over fibre (RoF) systems. It defines product performance requirements together with a series of tests and measurements with clearly defined conditions, severities, and pass/fail criteria. The tests are intended to be run on a "once-off" basis to prove a product's ability to satisfy the performance requirements.

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 60749-6, *Semiconductor devices – Mechanical and climatic test methods – Part 6: Storage at high temperature*

IEC 60749-7, *Semiconductor devices – Mechanical and climatic test methods – Part 7: Internal moisture content measurement and the analysis of other residual gases*

IEC 60749-10, *Semiconductor devices – Mechanical and climatic test methods – Part 10: Mechanical shock – Device and subassembly*

IEC 60749-11, *Semiconductor devices – Mechanical and climatic test methods – Part 11: Rapid change of temperature – Two-fluid-bath method*

IEC 60749-12, *Semiconductor devices – Mechanical and climatic test methods – Part 12: Vibration, variable frequency*

IEC 60749-25, *Semiconductor devices – Mechanical and climatic test methods – Part 25: Temperature cycling*

IEC 60749-26, *Semiconductor devices – Mechanical and climatic test methods – Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)*

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

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

IEC 61300-2-48, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-48: Tests – Temperature-humidity cycling*

IEC 62149-1, *Fibre optic active components and devices – Performance standards – Part 1: General and guidance*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62149-1 and the following 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

3.1.1
relative intensity noise
RIN
<DFB-LD for RoF> instability in the power level of a laser output power, which is the noise normalized to the average power level

3.1.2
third order inter-modulation distortion
IMD3
<DFB-LD for RoF> amplitude modulation of signals containing two or more different frequencies, caused by nonlinearities or time variance in a system

Note 1 to entry: Each individual signal frequency, including original signals at frequencies f_1 and f_2 and the second-order intermodulation products at $f_1 + f_2$, $|f_2 - f_1|$, $2f_1$ and $2f_2$, will add to and subtract from other frequency components to give rise to more signal components.

Note 2 to entry: The two intermodulation products at frequencies $|2f_1 - f_2|$ and $|2f_2 - f_1|$ in particular can be troublesome and can cause interference, as their frequencies are close to the frequencies of the original signals.

3.2 Symbols

E_r	tracking error
I_d	dark current
I_f	forward current
I_{fd}	forward current for photodiode
I_m	monitor current
I_{op}	operating current
I_{th}	threshold current
I_{rl}	reverse current for photodiode
P_f	optical output power
P_{th}	optical output power at threshold current
S_r	side mode suppression ratio
T_c	operating case temperature

T_{stg} storage temperature

V_{op} operating voltage

V_{rd} reverse voltage for photodiode

V_{rl} reverse voltage for laser diode

η slope efficiency

$\Delta\eta$ delta slope efficiency

λ_c light-emission central wavelength

λ_{ct} wavelength temperature coefficient

3.3 Abbreviated terms

APC automatic power control

A-RoF analogue radio over fibre

CW continuous wave

CWDM coarse wavelength division multiplexing

DFB-LD distributed feedback laser diode

DS data sheet

LSL lower specification limit

OMI optical modulation index

RH relative humidity

RoF radio over fibre

USL upper specification limit

4 Product parameters

4.1 Absolute limiting ratings

Absolute limiting (maximum and/or minimum) ratings imply that no catastrophic damage will occur if the product is subject to these ratings for short periods of time, provided each limiting parameter is in isolation and all other parameters have values within the normal performance parameters. It should not be assumed that the limiting value of more than one parameter can be applied at any one time. The absolute limiting ratings are listed in Table A.1.

4.2 Operating environment

The operating environment of DFB-LD devices for A-RoF systems is specified in Table 1.

Table 1 – Operating case environment

Parameter	Symbol	Value		Unit
		Minimum	Maximum	
Operating case temperature	T_c	–20	+60	°C

4.3 Functional specifications

The functional specifications and operating conditions for DFB-LD devices for A-RoF systems are provided in Clause A.3.