IEC 61280-1-3

Edition 3.0 2021-07

INTERNATIONAL STANDARD

colour inside

Fibre optic communication subsystem test procedures – Part 1-3: General communication subsystems – Measurement of central wavelength, spectral width and additional spectral characteristics

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.01

ISBN 978-2-8322-9954-8

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms, definitions and abbreviated terms 6
3.1 Wavelength 6
3.2 Spectral width 7
3.3 Additional spectral characteristics 7
3.4 Abbreviated terms 8
4 Apparatus 8
4.1 Calibrated optical spectrum analyzer (OSA) 8
4.2 Calibrated optical wavelength meter (OWM) 8
4.3 Power supplies 9
4.4 Input signal source or modulator 9
4.5 Test cord 9
5 Test sample 9
6 Procedure (method A) 9
6.1 General 9
6.2 Setup 10
6.3 Adjustment of spectrum analyzer controls 10
6.4 Setting of optical wavelength meter 11
7 Procedure (method B) 11
7.1 Setup 11
7.2 Adjustment of spectrum analyzer controls 11
7.3 Setting of optical wavelength meter 11
7.4 Continuous LED and SLM spectra 12
7.5 Discrete MLM spectra 12
7.6 SLM spectra 12
8 Calculation 13
8.1 General 13
8.2 Centre wavelength 13
8.2.1 Continuous LED spectra 13
8.2.2 Discrete MLM spectra 13
8.3 Centroidal wavelength 13
8.4 Peak wavelength 14
8.4.1 Continuous LED and SLM spectra 14
8.4.2 Discrete MLM spectra 14
8.5 RMS spectral width ($\Delta\lambda_{rms}$) 14
8.6 n-dB-down spectral width ($\Delta\lambda_{n\text{-}dB}$) 14
8.7 Full-width at half-maximum spectral width ($\Delta\lambda_{fwhm}$) 14
8.7.1 Continuous LED spectra 14
8.7.2 Discrete MLM spectra 15
8.8 Side-mode suppression ratio (SMSR) 15
8.9 Signal-to-source spontaneous emission ratio (SSER) 15
9 Test results 15
9.1 Required information 15

9.2 Information to be available on request 16
10 Examples of results 16
Bibliography 21

Figure 1 – Example of a LED optical spectrum 16
Figure 2 – Typical spectrum analyzer output for MLM laser 18
Figure 3 – $\Delta\lambda_{fwhm}$ spectral width measurement for MLM laser 18
Figure 4 – $\Delta\lambda_{fwhm}$ spectral width calculation for MLM laser 19
Figure 5 – Peak emission wavelength and $\Delta\lambda_{30\text{-dB}}$ measurement for SLM laser 19
Figure 6 – Resolution bandwidth (RBW) dependence of SMSR for SLM laser 20
Figure 7 – Signal-to-source spontaneous emission ratio measurement for SLM laser 20

Table 1 – Measurement points for LED spectrum from Figure 1 17
Table 2 – RMS spectral characterization 17

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 1-3: General communication subsystems – Measurement of central wavelength, spectral width and additional spectral characteristics

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.

IEC 61280-1-3 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics. It is an International Standard.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

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

a) addition of measurement of signal-to-source spontaneous emission ratio in 8.9;
b) change of document title to reflect the additional measurement;
c) additional information on the resolution bandwidth used in the measurement of the side-mode suppression ratio in 8.8;
d) use of a calibrated optical wavelength meter for accurate wavelength measurements of single-longitudinal mode lasers.

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

Draft	Report on voting
86C/1701/CDV	86C/1717/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/standardsdev/publications.

A list of all parts in the IEC 61280 series, published under the general title *Fibre optic communication subsystem test procedures*, 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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 1-3: General communication subsystems – Measurement of central wavelength, spectral width and additional spectral characteristics

1 Scope

This part of IEC 61280 provides definitions and measurement procedures for several wavelength and spectral width properties of an optical spectrum associated with a fibre optic communication subsystem, an optical transmitter, or other light sources used in the operation or test of communication subsystems. This document also provides definitions and measurement procedures for side-mode suppression ratio and signal-to-source spontaneous emission ratio.

The measurement is done for the purpose of system construction and/or maintenance. In the case of communication subsystem signals, the optical transmitter is typically under modulation.

NOTE Different properties can be appropriate to different spectral types, such as continuous spectra characteristics of light-emitting diodes (LEDs), as well as multilongitudinal-mode (MLM), multitransverse-mode (MTM) and single-longitudinal mode (SLM) spectra, which are characteristic of laser diodes (LDs).

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

IEC 62129-1, *Calibration of wavelength/optical frequency measurement instruments – Part 1: Optical spectrum analyzers*

IEC 62129-2, *Calibration of wavelength/optical frequency measurement instruments – Part 2: Michelson interferometer single wavelength meters*