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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

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FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

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

FOREWORD

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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- withdrawn,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.

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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*

3 Terms, definitions and abbreviated terms

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:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Wavelength

NOTE The following wavelength terms provide quantitative definitions for the description of the central wavelength of a spectrum. In this document, "central wavelength" is a general category label for these terms.

3.1.1
centre wavelength
λ_0
mean of the closest spaced half-power wavelengths in an optical spectrum, one above and one below the peak wavelength

Note 1 to entry: Centre wavelength is also called “half-power mid-point”.

3.1.2
half-power wavelength
λ_{3dB}
wavelength corresponding to a half-peak power value of the optical spectrum

3.1.3
peak wavelength
λ_p
wavelength corresponding to the maximum power value of the optical spectrum

3.1.4
centroidal wavelength
λ_c
mean or average wavelength of an optical spectrum

3.2 Spectral width

3.2.1
RMS spectral width
$\Delta\lambda_{rms}$
square root of the second moment of the power distribution about the centroidal wavelength

3.2.2
***n*-dB-down spectral width**

$\Delta\lambda_{n\text{-}dB}$
positive difference of the closest spaced wavelengths, one above and one below the peak wavelength λ_p, at which the spectral power density determined in a specified resolution bandwidth is n dB down from its peak value

3.2.3
full-width at half-maximum
$\Delta\lambda_{fwhm}$
positive difference of the closest spaced wavelengths, one above and one below the peak wavelength λ_p, at which the spectral power density determined in a specified resolution bandwidth is 3 dB down from its peak value

3.3 Additional spectral characteristics

3.3.1
side-mode suppression ratio
SMSR
ratio of the largest peak of the optical spectrum to the second largest peak under non-modulated (continuous wave) operating condition, which is determined in a specified wavelength resolution bandwidth (RBW), for a nominally single-longitudinal mode (SLM) spectrum

Note 1 to entry: See 8.8.

3.3.2
signal-to-source spontaneous emission ratio
SSER
ratio between the signal power and maximum source spontaneous emission (SSE) power under the non-modulated (CW) condition which is determined in a specified bandwidth

3.4 Abbreviated terms

CW	continuous wave
DFB	distributed feedback
ESD	electrostatic discharge
InGaAsP	indium gallium arsenide phosphide
LD	laser diode
LED	light-emitting diode
MLM	multi-longitudinal mode
MTM	multi-transverse mode
OSA	optical spectrum analyzer
OWM	optical wavelength meter
RBW	resolution bandwidth
RMS	root-mean-square
SLM	single-longitudinal mode
SMSR	side-mode suppression ratio
SSE	source spontaneous emission
SSER	signal-to-source spontaneous emission ratio
TLA	tuneable laser assembly
VCSEL	vertical cavity surface emitting lasers
WDM	wavelength-division multiplexing

4 Apparatus

4.1 Calibrated optical spectrum analyzer (OSA)

This special-purpose test equipment uses a dispersive spectrophotometric method to resolve and record the optical spectral distribution. The required wavelength resolution bandwidth and range depend on the type and variety of signals to be measured. Generally, LED sources have wide spectra with little structure, so a range of at least 200 nm and resolution bandwidth of 1 nm or narrower are recommended. Laser sources have much narrower spectra and can be used in wavelength-division multiplexing (WDM) applications, where more accurate determination of the wavelength is required. A resolution bandwidth of 0,1 nm or narrower is recommended, and the actual requirement is determined by the application. In any case, the sensitivity and wavelength range of the spectrum analyzer shall be sufficient to measure all of the spectrum within at least −20 dB from the peak power. For measurement of SMSR, a larger dynamic range is typically required.

OSA equipment shall be calibrated for vacuum wavelengths in order to be consistent with the calibration processes and results of IEC 62129-1. The equipment used shall have a valid calibration certificate, in accordance with the applicable quality system for the period over which the testing is done.

4.2 Calibrated optical wavelength meter (OWM)

For central wavelength measurements of SLM lasers, such as distributed feedback (DFB) lasers or tuneable laser assemblies (TLAs) for dense WDM applications, sufficient