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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic communication subsystems D PREVIEW Part 1: Generic specification (standards.iteh.ai)

Sous-systèmes de télécommunications fibroniques – Partie 1: Spécification générique c22d354a9ea5/iec-61281-1-2017





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IEC Central Office	Tel.: +41 22 919 02 11
3, rue de Varembé	Fax: +41 22 919 03 00
CH-1211 Geneva 20	info@iec.ch
Switzerland	www.iec.ch

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Fibre optic comm**inication SubsystemsRD PREVIEW** Part 1: Generic specification (standards.iteh.ai)

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FIBRE OPTIC COMMUNICATION SUBSYSTEMS -

Part 1: Generic specification

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International Standard IEC 61281-1 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 1999. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition: addition of new definitions.

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

CDV	Report on voting
86C/1408/CDV	86C/1468/RVC

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 in the IEC 61281-1 series, published under the general title *Fibre optic communication subsystems*, 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,
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FIBRE OPTIC COMMUNICATION SUBSYSTEMS -

Part 1: Generic specification

1 Scope

This part of IEC 61281 is a generic specification for fibre optic communication subsystems (FOCSs).

The parameters defined herein form a specifiable minimum set of specifications that are common to all fibre optic subsystems. Additional parameters can be used depending on the particular application and technology. Those additional parameters will be specified in the relevant documents, as appropriate.

Each specified parameter is measured using one of the test procedures. The use of these parameters for system design is given in design guides.

2 Normative references

There are no normative references in this document **PREVIEW**

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3 Terms and definitions

<u>IEC 61281-1:2017</u>

For the purpose of this document, the following terms and definitions apply.

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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

NOTE Within a definition, terms defined elsewhere in Clause 3 are in italics.

3.1

active optical device

optical device, other than an optical dynamic device, exhibiting one or more of the following functions:

- generation or detection of optical power;
- conversion of an electronic signal to a corresponding optical one or vice versa;
- optical amplification or optical regeneration (2R or 3R) of an optical signal;
- direct conversion of the optical frequency of an optical signal

Note 1 to entry: Active optical devices may comprise passive optical elements.

[SOURCE: IEC TS 62538:2008, 2.1.2, modified – The term "optical active device" has been replaced by "active optical device".]

amplified spontaneous emission

ASE

optical power associated to spontaneously emitted photon amplified by an active medium in an optical amplifier

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC TR 61931:1998, 2.7.87 - The note has been added.]

3.3

analogue input signal bandwidth

bandwidth at the electrical input to the transmitter

3.4

attenuation

reduction of optical power induced by transmission through a medium, given as L (dB) where $L = 10 \log_{10}(P_{in}/P_{out})$, and P_{in} and P_{out} are the power into and out of the transmission medium

Note 1 to entry: P_{in} and P_{out} are typically expressed in mW.

3.5

bandwidth

difference (expressed in Hz) between the highest and lowest modulation frequencies at which the modulus of the power spectrum or of the complex transfer function is one-half of the peak value of the modulus

3.6

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basic fibre optic system BFOS

IEC 61281-1:2017

serial combination of pa//transmitterminalg/devices/at/fibre3optic-fihk, and a receive terminal device c22d354a9ea5/iec-61281-1-2017

Note 1 to entry: This note applies to the French language only.

3.7 bit-error ratio

number of errored bits divided by the total number of bits, over some stipulated period of time

Note 1 to entry: This note applies to the French language only.

3.8 branching device BD

passive device whose purpose is to transfer optical power between two or more ports in a predetermined manner

Note 1 to entry: The ports may be connected to waveguides, sources, detectors etc.

Note 2 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-731:1991, 731-05-10, modified – The other terms "optical fibre coupler" and "optical coupler" have been deleted, and the acronym "BD" has been added. Note 2 has also been added.]

3.9 carrier-to-noise ratio

CNR

ratio of carrier power to noise power in a channel of defined bandwidth, prior to any non-linear processing

Note 1 to entry: Carrier-to-noise ratio is expressed in dB.

Note 2 to entry: This note applies to the French language only.

3.10

centre wavelength

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

Note 1 to entry: Other spectral wavelengths are centroidal wavelengths, half-power wavelengths, and peak wavelengths.

3.11

centroidal wavelength

mean or average wavelength of an optical spectrum

Note 1 to entry: Other spectral wavelengths are centre wavelengths, half-power wavelengths, and peak wavelengths.

3.12

chirping iTeh STANDARD PREVIEW change of the wavelength or optical frequency of an intensity-modulated *transmitter* as a function of the instantaneous intensity of the modulating signal

Note 1 to entry: When chirped signals are transmitted through an optical fibre, the signal waveform is distorted by chromatic dispersion. This process may cause a degradation in the guality of performance, designated as a objective dispersion. This process may cause a degradation in the guality of performance, designated as a chirping penalty. c22d354a9ea5/iec-61281-1-2017

3.13

chromatic dispersion dispersion

rate of change in group delay to wavelength between the end points of the fibre optic cable plant

Note 1 to entry: Chromatic dispersion is usually expressed in ps/nm.

3.14

encircled flux

fraction of cumulative power to total output power as a function of radial distance from the centre of the multimode optical fibre's core

3.15

environmental condition

characteristic of the environment that may affect performance of a device or system

Note 1 to entry: Examples of ambient conditions are pressure, temperature, humidity, radiation, and vibration.

[SOURCE: IEC 60050-151:2001, 151-16-03, modified – The other term "ambient condition" has been deleted.]

3.16

extinction ratio

ratio of the average power level of logical "1" to the average power level of logical "0", in a digital transmission system

Note 1 to entry: Extinction ratio is expressed in dB.

fibre optic cable plant

FOCP

serial combination of *fibre optic cable sections*, *connectors*, and *splices* providing the optical path between two *terminal devices*, between two *optical devices*, or between a *terminal device* and an *optical device*

Note 1 to entry: This note applies to the French language only.

3.18

fibre optic cable section

single optical fibre cable which can be unjointed

3.19

fibre optic communication system

assembly of *fibre optic subsystems* for transmitting information

3.20

fibre optic link

FOL

serial combination of a fibre optic cable plant and optical devices, providing the optical path between a transmit terminal device and a receive terminal device

Note 1 to entry: This is equivalent to a basic fibre optic subsystem minus the transmitter and receiver.

Note 2 to entry: This note applies to the French anguage only. PREVIEW

3.21

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fibre optic subsystem

assembly of interconnected basic fibre optic subsystems

Note to entry: The assembly is specified at defined interfaces within the fibre optic system.

3.22

fibre optic terminal device

device that converts one or more electrical signals into one or more optical signals, or vice-versa, and that is connected to at least one optical fibre

Note 1 to entry: A fibre optic terminal device always has one or more integral connectors or pigtails.

Note 2 to entry: Examples include a receive terminal device, a transmit terminal device, a transmitter, and a receiver.

3.23

full-width at half-maximum

FWHM

positive difference of the closest spaced *half-power wavelengths*, one above and one below the *peak wavelength* of an optical spectrum

Note 1 to entry: Other spectral widths are *N*-dB-down widths and root-mean-square widths.

Note 2 to entry: The FWHM equals the N-dB-down width where N = 3.

Note 3 to entry: This note applies to the French language only.

3.24

half-power wavelength

wavelength corresponding to a half peak power value of the optical spectrum

Note 1 to entry: Other spectral wavelengths are *central wavelengths*, *centroidal wavelengths*, and *peak wavelengths*.

harmonic distortion

distortion in a system or transducer characterized by the presence at the output of spectral components which are harmonically related to the spectral components of the input signal

Note 1 to entry: See IEEE Dictionary Online.

3.26

input power range

range of optical power levels such that, for any input signal power of the OFA which lies within this range, the corresponding output signal power lies in the specified output power range, where the OFA performance is ensured

[SOURCE: IEC 61291-1:2012, 3.2.1.36, modified – In the definition, the two occurrences of the term "OA" have been replaced by "OFA".]

3.27

intermodulation distortion

IMD

distortion characterized by the appearance of spectral components with frequencies equal to the sums and differences of integral multiples of two or more component frequencies of the input signal

Note 1 to entry: See IEEE Dictionary Online.

Note 2 to entry: This note applies to the French anguage only. PREVIEW

3.28

intersymbol interference

ISI

overlap of adjacent pulses as caused by the limited bandwidth characteristics of the optical devices in a fibre optic link c22d354a9ea5/iec-61281-1-2017

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Note 1 to entry: This note applies to the French language only.

3.29

jitter

random or data-induced short-term non-cumulative variations of the phases or of the significant instants of a digital signal from their ideal positions in time relative to a reference (clock) signal

Note 1 to entry: In practice, "short-term" embraces all spectral components of 10 Hz and above.

Note 2 to entry: Jitter is expressed in terms of absolute time or as a fraction of a unit interval.

3.30

jitter tolerance

maximum *jitter* amplitude that a digital receiver can accept for a given penalty or alternatively without the addition of a given number of errors to the digital signal

Note 1 to entry: The maximum jitter amplitude tolerated is generally dependent on the frequency of the jitter.

3.31

jitter transfer function

ratio of the output *jitter* to the applied input *jitter* as a function of modulation frequency

3.32

light source

device or instrument that emits light that is coupled into a fibre under test

line code

sequence of symbols that the binary data is converted into for purposes of transmission

Note 1 to entry: Examples include Manchester, return-to-zero, block codes, digital scrambling.

Note 2 to entry: Line codes are used to recover timing, and in some cases they may be used to detect line errors, and to convey additional information.

3.34

loss budget

sum of the fibre optic link loss and the power penalty

Note 1 to entry: The loss budget equals the power budget minus the working margin.

Note 2 to entry: The initial/final loss budget is the loss budget at the beginning/end of the life of the link.

Note 3 to entry: The final loss budget equals the sum of the initial loss budget and the reserve margin.

Note 4 to entry: Loss budget is expressed in dB.

3.35

maximum reflectance tolerable at input

<optical fibre amplifier> maximum fraction of power exiting the input port of the OFA, reflected into the OFA itself, for which the device still meets its specifications

Note 1 to entry: The measurement is performed with a given input signal optical power-

Note 2 to entry: Maximum reflectance tolerable at input is expressed in dB.

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3.36

maximum reflectance tolerable at output

<optical fibre amplifier> maximum fraction of power exiting the output port of the OFA,
reflected into the OFA itself, for which the device still meets its specifications

Note 1 to entry: The measurement is performed with a given input signal optical power.

Note 2 to entry: Maximum reflectance tolerable at output is expressed in dB.

3.37

maximum total output power

<an optical fibre amplifier> highest optical power level at the output port of the OFA operating within the absolute maximum ratings

3.38

modal bandwidth

multimode fibre bandwidth due to differential mode attenuation and delay

Note 1 to entry: It does not include chromatic dispersion.

Note 2 to entry: It is measured using a source of narrow spectral width.

3.39

modal noise

noise generated in a *fibre optic communication system* by the combination of differential modal attenuation and of fluctuations in the distribution of optical energy among the bound modes or in the relative phases of the bound modes

3.40

mode partition noise

MPN

noise due to the rapid fluctuation of the power distribution among the longitudinal modes of a laser

Note 1 to entry: Due to the *chromatic dispersion* of the *fibre optic cable plant*, mode partition noise can produce signal fluctuations at the receiver.

- 12 -

Note 2 to entry: This note applies to the French language only.

3.41

modulation factor/index

ratio of the peak optical signal of a *transmitter* modulated by an input analogue signal to the average optical signal without any input signal

Note 1 to entry: Modulation factor/index is expressed as a percentage.

3.42

multipoint link

two or more fibre optic links that interconnect three or more terminal devices

3.43

N-dB-down width

positive difference of the closest spaced wavelengths, one above and one below the *peak* wavelength, at which the spectral power density is *N* dB down from its peak value

Note 1 to entry: Other spectral widths are full-widths at half-maximum and root-mean-square widths.

3.44

noise figure

NF

decrease of the signal-to-noise ratio (SNR), at the output of the optical detector with unitary quantum efficiency and zero excess noise, due to the propagation of a shot noise-limited signal through the OFA (Standards.iten.al)

Note 1 to entry: The operating conditions at which the noise figure is specified should be stated.

Note 2 to entry: This property can be described at a discrete wavelength or as a function of wavelength.

Note 3 to entry: The noise degradation due to the OFA is attributable to different contributions, for example: signal-spontaneous beat noise, spontaneous-spontaneous beat noise, internal reflections noise, signal shot noise, spontaneous shot noise. Each of these contributions depends on various conditions which should be specified for a correct evaluation of the noise figure.

Note 4 to entry: By convention this noise figure is a positive number.

Note 5 to entry: In the case of OFAs for analogue applications the noise figure also represents the ratio between input and the output carrier-to-noise ratios.

Note 6 to entry: The noise figure is expressed in dB.

Note 7 to entry: This note applies to the French language only.

[SOURCE: IEC 61291-1:2012, 3.2.1.38, modified – The information about the unit has been moved from the definition to the new Note 6. In this entry, the term "OA" has been replaced by "OFA". Note 7 has been added.]

3.45

non-wavelength-selective branching device NWSBD

bidirectional passive component possessing three or more ports which operates nonselectively over a specified range of wavelengths, divides or combines optical power coming into one or more input port(s) among its one or more output port(s) in a predetermined fashion, without any amplification, switching, or other active modulation

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC 60875-1:2015, 3.2.1, modified – The other terms "optical coupler" and "optical splitter" have been deleted, and the abbreviated term "NWSBD" and the note have been added.]

3.46

operating wavelength range

specified interval of wavelengths around a nominal wavelength within which an optical component is designed to operate with the specified performance

[SOURCE: IEC TR 61931:1998, 2.6.88, modified - The words "the operating wavelength" have been replaced by "a nominal wavelength" in the definition.]

3.47

optical amplifier

active optical device that receives an optical input and retransmits it as an optical output of increased power

Note 1 to entry: An example is an optical fibre amplifier (OFA).

3.48

optical attenuator

passive device, which produces a controlled signal attenuation in an optical fibre transmission line

Note 1 to entry: An attenuator is intended to be wavelength independent.

[SOURCE: IEC 60869-1:2012, 3.2.1, modified - The information in the note was originally in the definition.]

3.49

IEC 61281-1:2017

optical connection https://standards.iteh.ai/catalog/standards/sist/68f3ff35-cfac-4119-8f9a-

splice type, connector type and/or fibre type used as input and output ports of an optical device

3.50

optical device

generic optical unit, either an optical element, optical component, optical assembly, optical sub-assembly or optical module

Note 1 to entry: Optical devices can reduce the optical power or change the wavelength of the optical input.

Note 2 to entry: There are active optical devices and passive optical devices.

[SOURCE: IEC TS 62538:2008, 2.2.6, modified - The note has been replaced by two new notes.]

3.51

optical fibre connector

component normally attached to an optical cable or piece of apparatus for the purpose of providing frequent optical interconnection/disconnection of optical fibres or cables

Note 1 to entry: This usually consists of two plugs mated together in an adaptor.

[SOURCE: IEC 60874-1:2011, 3.14, modified - The information in the note was originally in the definition.]