SLOVENSKI STANDARD

SIST EN 61280-2-9:2004

september 2004

Preskusni postopki komunikacijskega podsistema optičnih vlaken – 2-9. del: Digitalni sistemi - Merjenje optičnega razmerja med signalom in hrupom pri gostih mnogokratnih sistemih z valovno dolžino (IEC 61280-2-9:2002)*

Fibre optic communication subsystem test procedures - Part 2-9: Digital systems - Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems (IEC 61280-2-9:2002)

ICS 33.180.20

Referenčna številka
SIST EN 61280-2-9:2004(en)

EUROPEAN STANDARD **EN 61280-2-9**

NORME EUROPÉENNE

EUROPÄISCHE NORM December 2002

ICS 33.180.20

English version

Fibre optic communication subsystem test procedures Part 2-9: Digital systems – Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems

(IEC 61280-2-9:2002)

Procédures d'essai des sous-systèmes de télécommunications à fibres optiques
Partie 2-9: Systèmes numériques –
Mesure du rapport signal sur bruit optique pour les systèmes multiplexés à répartition en longueur d'onde dense
(CEI 61280-2-9:2002)

Prüfverfahren für Lichtwellenleiter-Kommunikationsuntersysteme
Teil 2-9: Digitale Systeme –
Messung des optischen Signal-Rausch-Verhältnisses für dichte Wellenlängen-Multiplex-Systeme
(IEC 61280-2-9:2002)

This European Standard was approved by CENELEC on 2002-11-01. 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.

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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

Ref. No. EN 61280-2-9:2002 E

Foreword

The text of document 86C/457/FDIS, future edition 1 of IEC 61280-2-9, prepared by SC 86C, Fibre optic systems and active devices, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61280-2-9 on 2002-11-01.

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)	2003-08-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2005-11-01

Annexes designated "informative" are given for information only.
In this standard, annex A is informative.

Endorsement notice

The text of the International Standard IEC 61280-2-9:2002 was approved by CENELEC as a European Standard without any modification.

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61280-2-9

Première édition
First edition
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Procédures d'essai des sous-systèmes de télécommunications à fibres optiques –

**Partie 2-9:
Systèmes numériques – Mesure du rapport signal sur bruit optique pour les systèmes multiplexés à répartition en longueur d'onde dense**

Fibre optic communication subsystem test procedures –

**Part 2-9:
Digital systems – Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems**

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 2-9: Digital systems – Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems

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.
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3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 61280-2-9 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics

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

FDIS	Report on voting
86C/457/FDIS	86C/479/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

IEC 61280-2 consists of the following parts, under the general title *Fibre optic communication subsystem test procedures*[1]):

Part 2-1: Test procedures for digital systems – Receiver sensitivity and overload measurement

Part 2-2: Test procedures for digital systems – Optical eye pattern, waveform, and extinction ratio

Part 2-4: Test procedures for digital systems – Bit-rate tolerance measurement

Part 2-5: Test procedures for digital systems – Jitter transfer function measurement

Part 2-9: Digital systems – Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems

1) The general title of the IEC 61280 series has changed. Parts 2-1, 2-2, 2-4 and 2-5 were published under the general title *Fibre optic communication subsystem basic test procedures*

INTRODUCTION

At the optical interfaces within wavelength-division multiplexed (WDM) networks, it is desirable to measure parameters that provide information about the integrity of the physical plant. Such parameters are necessary to *monito*r network performance as an integral part of network management. They are also necessary to assure proper system operation for *installation and maintenance* of the network.

Ideally, such parameters would directly correspond to the bit error ratio (BER) of each channel of a multichannel carrier at the particular optical interface. Related parameters such as Q-factor or those calculated from optical eye patterns would provide similar information, that is, they would correlate to the channel BER. However, it is difficult to obtain access to these parameters at a multichannel interface point. It is necessary to demultiplex the potentially large number of channels and make BER, Q-factor, or eye-diagram measurements on a per-channel basis.

In contrast, useful information about the optical properties of the multichannel carrier is readily obtained by measuring the optical spectrum. Wavelength-resolved signal and noise levels provide information on signal level, signal wavelength, and amplified spontaneous emission (ASE) for each channel. Spectral information, however, does not show signal degradation due to waveshape impairments resulting from polarization-mode dispersion (PMD), and chromatic dispersion. Also, intersymbol interface and time jitter are not revealed from an optical signal to noise ratio (OSNR) measurement. In spite of these limitations, OSNR is listed as an interface parameter in ITU-T Recommendation G.692; “Optical interfaces for multichannel systems with optical amplifiers.”[1][2] OSNR is also listed in ITU-T Recommendation G.959.1, “Optical transport network physical layer interfaces.”

[2] Figures in brackets refer to the bibliography.

FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 2-9: Digital systems – Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems

1 Scope

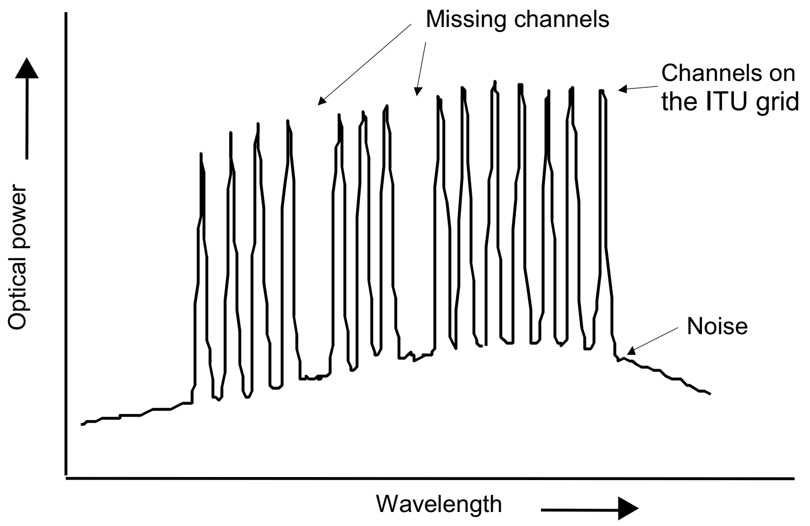
This part of IEC 61280 provides a parameter definition and a test method for obtaining optical signal-to-noise ratio (OSNR) using apparatus that measures the optical spectrum at a multichannel interface. Because noise measurement is made on an optical spectrum analyzer, the measured noise does not include source relative intensity noise (RIN) or receiver noise.

Three implementations for an optical spectrum analyser (OSA) are discussed: a diffraction-grating-based OSA, a Michelson interferometer-based OSA, and a Fabry-Perot-based OSA. Performance characteristics of the OSA that affect OSNR measurement accuracy are provided.

A typical optical spectrum at a multichannel interface is shown in figure 1. Important characteristics are as follows.

- The channels are placed nominally on the grid defined by ITU Recommendation G.694.1.
- Individual channels may be non-existent because it is a network designed with optical add/drop demultiplexers or because particular channels are out of service.
- Both channel power and noise power are a function of wavelength.

For calculating OSNR, the most appropriate noise power value is that at the channel wavelength. However, with a direct spectral measurement, the noise power at the channel wavelength is included in signal power and is difficult to extract. An estimate of the channel noise power can be made by interpolating the noise power value between channels.



IEC 2407/02

Figure 1 – A typical optical spectrum at an optical interface in a multichannel transmission system

2 Normative references

None.

3 Definitions

3.1
optical signal-to-noise ratio (OSNR)
ratio in decibels, from the optical spectrum, defined by the equation

$$\text{OSNR} = 10\text{Log}\frac{P_i}{N_i} + 10\text{Log}\frac{B_\text{m}}{B_\text{r}} \quad \text{dB} \tag{1}$$

where:

P_i is the optical signal power in watts at the i-th channel.

B_r is the reference optical bandwidth.

N_i is the interpolated value of noise power in watts measured in noise equivalent bandwidth, B_m,

$$N_\text{i} = \frac{N(\lambda_i - \Delta\lambda) + N(\lambda_i + \Delta\lambda)}{2} \tag{2}$$

at the i-th channel;

λ_i is the wavelength of the *I*-th channel;

$\Delta\lambda$ is the interpolation offset equal to or less than one-half the ITU grid spacing.

(The units for B_m and B_r may be in frequency or wavelength but must be consistent.) Typically, the reference optical bandwidth is 0,1 nm. See figure 2.

NOTE The noise equivalent bandwidth of a filter is such that it would pass the same total noise power as a rectangular passband that has the same area as the actual filter, and the height of which is the same as the height of the actual filter at its center wavelength.