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STN	**Skúšobné postupy pre optické vláknové komunikačné podsystémy. Časť 2-12: Digitálne systémy. Meranie očkových diagramov a faktora Q s použitím techniky spúšťania softvérom na posudzovanie kvality prenášaného signálu.**	**STN EN 61280-2-12** 35 9270

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

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English Version

Fibre optic communication subsystem test procedures - Part 2-12: Digital systems - Measuring eye diagrams and Q-factor using a software triggering technique for transmission signal quality assessment (IEC 61280-2-12:2014)

Procédures d'essai des sous-systèmes de télécommunication à fibres optiques - Partie 2-12: Systèmes numériques - Mesure des diagrammes de l'oeil et du facteur de qualité à l'aide d'une technique par déclenchement logiciel pour l'évaluation de la qualité de la transmission de signaux (CEI 61280-2-12:2014)

Prüfverfahren für Lichtwellenleiter-Kommunikationssysteme - Teil 2-12: Digitale Systeme - Messungen von Augendiagrammen und des Q-Faktors mit einem Software-Triggerverfahren für die Qualitätsbewertung von Übertragungssignalen (IEC 61280-2-12:2014)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 61280-2-12:2014 E

Foreword

The text of document 86C/1150/CDV, future edition 1 of IEC 61280-2-12, 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 approved by CENELEC as EN 61280-2-12:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-03-10
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-06-10

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 61280-2-2	-	Fibre optic communication subsystem test procedures - Part 2-2: Digital systems - Optical eye pattern, waveform and extinction ratio measurement	EN 61280-2-2	-
ITU-T Recommendation G.959.1	2012	Optical transport network physical layer interfaces	-	-

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FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 2-12: Digital systems – Measuring eye diagrams and Q-factor using a software triggering technique for transmission signal quality assessment

FOREWORD

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The holders of these patent rights have assured the IEC that they are willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of these holders of these patent rights are registered with IEC.

For US patent 6,744,496, information may be obtained from:

Alcatel-Lucent
Intellectual Property Business Group
16 Brookside Dr.
Sutton, MA 01590 USA

For Japanese patent 3987001 and US patent 7190752, information may be obtained from:

Nippon Telegraph and Telephone Corporation
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International Standard IEC 61280-2-12 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:

CDV	Report on voting
86C/1150/CDV	86C/1220/RVC

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 2.

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 publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

INTRODUCTION

Signal quality monitoring is important for operation and maintenance of optical transport networks (OTN). From the network operator's point of view, monitoring techniques are required to establish connections, protection, restoration, and/or service level agreements. In order to establish these functions, the monitoring techniques used should satisfy some general requirements:

- in-service (non-intrusive) measurement
- signal deterioration detection (both SNR degradation and waveform distortion)
- fault isolation (localize impaired sections or nodes)
- transparency and scalability (irrespective of the signal bit rate and signal formats)
- simplicity (small size and low cost).

There are several approaches, both analogue and digital techniques, which make it possible to detect various impairments:

- bit error rate (BER) estimation [1,2][1]
- error block detection
- optical power measurement
- optical SNR evaluation with spectrum measurement [3,4]
- pilot tone detection [5,6]
- Q-factor monitoring [7]
- pseudo BER estimation using two decision circuits [8,9]
- histogram evaluation with synchronous eye diagram measurement [10].

A fundamental performance monitoring parameter of any digital transmission system is its end-to-end BER. However, the BER can be correctly evaluated only with out of service BER measurements, using a known test bit pattern in place of the real signal. On the other hand, in-service measurement can only provide rough estimates through the measurement of digital parameters (e.g., BER estimation, error block detection, and error count in forward error correction) or analogue parameters (e.g., optical SNR and Q-factor).

An in-service optical Q-factor monitoring can be used for accurate quality assessment of transmitted signals on wavelength division multiplexed (WDM) networks. Chromatic dispersion (CD) compensation is required for Q monitoring at measurement point in CD uncompensated optical link. However, conventional Q monitoring method is not suitable for signal evaluation of transmission signals, because it requires timing extraction by complex equipment that is specific to each BER and each format.

The software triggering technique [11-14] reconstructs synchronous eye-diagram waveforms without an external clock signal synchronized to optical transmission signal from digital data obtained through asynchronous sampling. It does not rely on an optical signal's transmission rate and data formats (RZ or NRZ). Measuring method of eye diagrams and Q-factor using the software triggering technique is a cost-effective alternative to BER estimations. With eye diagrams and Q-factor using software triggering test method, signal quality degradations due to optical signal-to-noise ratio (OSNR) degradation, to jitter fluctuations and to waveform distortion can be monitored.

This is one of the promising performance-monitoring approaches for intensity modulated direct detection (IM-DD) optical transmission systems.

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1 Numbers in square brackets refer to the Bibliography.

FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 2-12: Digital systems – Measuring eye diagrams and Q-factor using a software triggering technique for transmission signal quality assessment

1 Scope

This part of IEC 61280 defines the procedure for measuring eye diagrams and Q-factor of optical transmission (RZ and NRZ) signals using software triggering technique as shown in 4.1 [14].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61280-2-2, *Fibre optic communication subsystem basic test procedures – Part 2-2: Test procedure for digital systems – Optical eye pattern, waveform, and extinction ratio measurement*

ITU-T Recommendation G.959.1: 2012, *Optical transport network physical layer interfaces*