IEC TR 61282-12

Edition 1.0 2016-02

TECHNICAL REPORT

Fibre optic communication system design guides – Part 12: In-band optical signal-to-noise ratio (OSNR)

IEC TR 61282-12:2016-02(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IEC TR 61282-12

Edition 1.0 2016-02

TECHNICAL REPORT

Fibre optic communication system design guides – Part 12: In-band optical signal-to-noise ratio (OSNR)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.180.01

ISBN 978-2-8322-3171-5

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

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

FIBRE OPTIC COMMUNICATION SYSTEM DESIGN GUIDES –

Part 12: In-band optical signal-to-noise ratio (OSNR)

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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 61282-12, which is a technical report, has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86C/1341/DTR	86C/1364/RVC

Full information on the voting for the approval of this technical report 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 61282 series, published under the general title *Fibre optic communication system design guides*, 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 website 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.

A bilingual version of this publication may be issued at a later date.

FIBRE OPTIC COMMUNICATION SYSTEM DESIGN GUIDES –

Part 12: In-band optical signal-to-noise ratio (OSNR)

1 Scope

The purpose of this part of IEC 61282, which is a Technical Report, is to provide a definition for in-band optical signal-to-noise ratio (OSNR) that is applicable to situations where the spectral noise power density is not independent of the optical frequency, as assumed in the OSNR definition of IEC 61280-2-9, but is significantly shaped across the optical bandwidth of the signal. Considering the development of multiple measurement methods for different use cases, as detailed below, it is desirable to establish a definition of in-band OSNR that is independent of the method used and, furthermore, is consistent with the OSNR definition of IEC 61280-2-9 in the case of frequency-independent noise power density.

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 61280-2-9:2009, *Fibre optic communication subsystem test procedures – Part 2-9: Digital systems – Optical signal-to-noise ratio measurement for dense wavelength-division multiplexed systems*

3 Terms and definitions

3.1
optical signal-to-noise ratio
OSNR
ratio of total signal power of an optical signal to the amplified spontaneous emission (ASE) noise power spectral density within the optical spectrum of the signal, wherein the power spectral density is normalized to a chosen reference bandwidth

Note 1 to entry: This definition is consistent with the one in subclause 3.1 of IEC 61280-2-9:2009, when the noise power spectral density is constant across the spectral range of the signal, but is used in this document as a generalized collective term for the following set of in-band OSNR definitions that have differing values when the noise power spectral density is not constant across the spectral range of the signal.

3.2
$OSNR_{int}$
spectrally-integrated in-band optical signal-to-noise ratiospectrally integrated ratio of time-averaged power spectral density of a signal to the power spectral density of the amplified spontaneous emission (ASE) noise, normalized to a chosen reference bandwidth

Note 1 to entry: The spectrally-integrated in-band OSNR, R_{int}, is calculated as

$$R_{\text{int}} = \frac{1}{B_{\text{r}}} \int_{\lambda_1}^{\lambda_2} \frac{s(\lambda)}{\rho(\lambda)} d\lambda \quad (1)$$

where:

$s(\lambda)$ is the time-averaged signal power spectral density, not including ASE, expressed in W/nm;

$\rho(\lambda)$ is the ASE power spectral density, independent of polarization, expressed in W/nm;