IEC 61280-2-1

Edition 2.0 2010-03

# INTERNATIONAL STANDARD

## Fibre optic communication subsystem test procedures – Part 2-1: Digital systems – Receiver sensitivity and overload measurement

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE N

ICS 33.180.01

ISBN 978-2-88910-474-1

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD ..... 3
1 Scope and object ..... 5
2 Terms and definitions ..... 5
3 Apparatus ..... 6
3.1 General ..... 6
3.2 BER test set ..... 6
3.2.1 Data generator ..... 7
3.2.2 Error counter ..... 7
3.3 Optical power meter ..... 7
3.4 Variable optical attenuator ..... 7
3.5 Optical splitter ..... 7
3.6 Test cords ..... 7
3.7 Optical transmit interface ..... 7
4 Equipment under test (EUT) ..... 8
5 Test procedure ..... 8
5.1 Operating conditions and test environment ..... 8
5.2 Connector end-face cleaning ..... 8
5.3 Measurement of input sensitivity ..... 8
5.3.1 Optical input power calibration ..... 10
5.3.2 *BER* or *EBR* determination ..... 10
5.4 Measurement of overload level ..... 11
5.4.1 Power level calibration ..... 11
5.4.2 Overload level determination ..... 12
5.4.3 Calculation of overload level ..... 12
6 Measurement uncertainties ..... 13
7 Test results ..... 13
7.1 Required information ..... 13
7.2 Available information ..... 13
Bibliography ..... 14

Figure 1 – Optical fibre system ..... 5
Figure 2 – Setup for the measurement of input sensitivity of a receive terminal ..... 9
Figure 3 – Setup for the measurement of input sensitivity of an amplifier or regenerator ..... 9
Figure 4 – Setup for the measurement of overload level for a receive terminal ..... 11
Figure 5 – Setup for the measurement of overload level for an amplifier or regenerator ..... 12

Table 1 – Minimum monitoring time ..... 10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

## Part 2-1: Digital systems – Receiver sensitivity and overload measurement

## 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.

International Standard IEC 61280-2-1 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 1998, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

– revised to include the requirements associated with data communication equipment, regenerators and amplifiers;
– the term "jumper lead" has been replaced by "test cord":
– a section for definitions has been added;
– a section on measurement uncertainties has been added.

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

| CDV | Report on voting |
|---|---|
| 86C/881/CDV | 86C/945/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 of 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.

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

# FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

## Part 2-1: Digital systems – Receiver sensitivity and overload measurement

## 1 Scope and object

This part of IEC 61280 describes the test procedures applicable to digital fibre optic communication and data systems.

The object of this test procedure is to measure the minimum and maximum optical powers required and allowed at the optical input port of a fibre optic system to ensure its operation within specified limits. Another objective is to verify that the guaranteed error performance is obtained at the minimum and the maximum optical input powers specified by the terminal equipment manufacturer.

Figure 1 shows the typical elements associated with optical fibre systems. Optical amplifiers or regenerators may be used in long haul telecom systems, but are not usually associated with data transport systems such as Ethernet, etc. In bi-directional systems the transmitter and corresponding receiver are usually co-located, as indicated by the dotted lines. This specification is concerned with the characteristics of the optical input interface of the receiver, amplifier or regenerator shown.

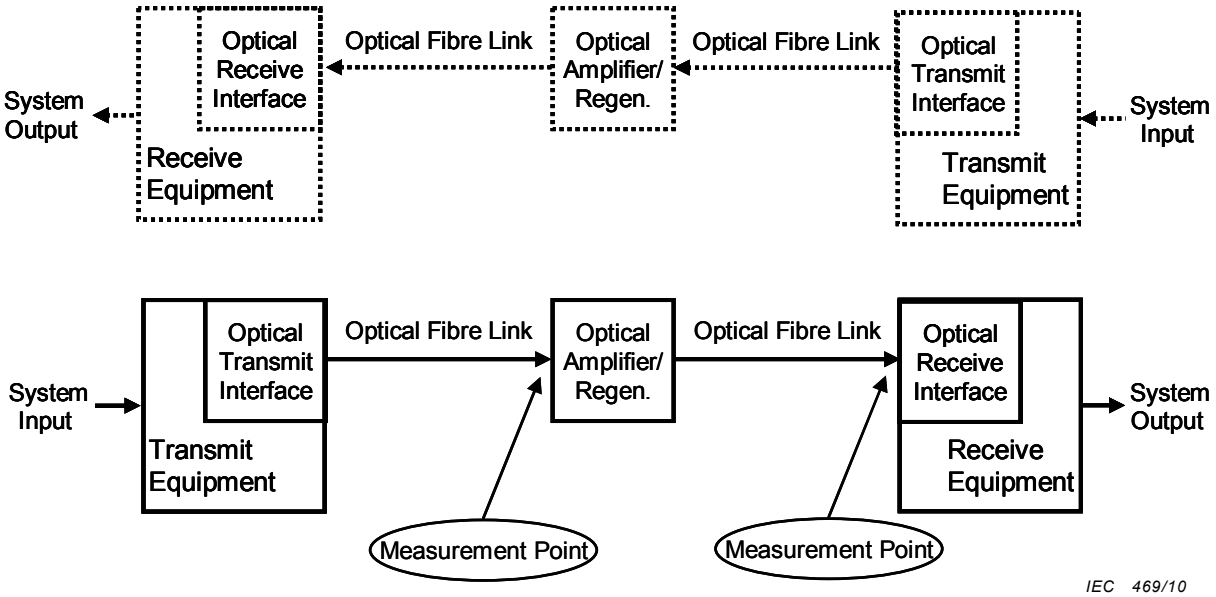



**Figure 1 – Optical fibre system**

It should be noted that the performance of fibre optic receivers may differ for different signal formats. It is therefore necessary to use the signal format that represents actual operating conditions.