# Fibre optic communication subsystem test procedures - Part 1-4: General communication subsystems - Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters

EESTI STANDARDIKESKUS
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## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

| | |
|---|---|
| Käesolev Eesti standard EVS-EN 61280-1-4:2003 sisaldab Euroopa standardi EN 61280-1-4:2003 ingliskeelset teksti. | This Estonian standard EVS-EN 61280-1-4:2003 consists of the English text of the European standard EN 61280-1-4:2003. |
| Standard on kinnitatud Eesti Standardikeskuse 17.07.2003 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas. | This standard is ratified with the order of Estonian Centre for Standardisation dated 17.07.2003 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation. |
| Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 04.04.2003. | Date of Availability of the European standard text 04.04.2003. |
| Standard on kättesaadav Eesti standardiorganisatsioonist. | The standard is available from Estonian standardisation organisation. |



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EUROPEAN STANDARD **EN 61280-1-4**

NORME EUROPÉENNE

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English version

# Fibre optic communication subsystem test procedures Part 1-4: General communication subsystems - Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters

(IEC 61280-1-4:2003)

Procédures d'essai des sous-systèmes de communication à fibres optiques Partie 1-4: Procédures d'essai des sous-systèmes généraux de télécommunication - Recueil et réduction de données à deux dimensions de champs proches pour les émetteurs de laser à fibres multimodales (CEI 61280-1-4:2003)

Prüfverfahren für Lichtwellenleiter-Kommunikationsuntersysteme Teil 1-4: Allgemeine Kommunikationsuntersysteme - Erfassung und Reduzierung zweidimensionaler Mehrmodenfasern für Nahfelddaten von Lasersendern (IEC 61280-1-4:2003)



This European Standard was approved by CENELEC on 2003-03-01. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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 61280-1-4:2003 E

## Foreword

The text of document 86C/465/FDIS, future edition 1 of IEC 61280-1-4, 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 61280-1-4 on 2003-03-01.

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) 2003-12-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-03-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A is informative.
Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61280-1-4:2003 was approved by CENELEC as a European Standard without any modification.

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## Annex ZA
(normative)

## Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 60793-1-20 | - [1)] | Optical fibres<br>Part 1-20: Measurement methods and test procedures - Fibre geometry | EN 60793-1-20 | 2002 [2)] |
| IEC 60793-1-41 | - [1)] | Part 1-41: Measurement methods and test procedures – Bandwidth | EN 60793-1-41 | 2002 [2)] |
| IEC 60793-1-43 | - [1)] | Part 1-43: Measurement methods and test procedures - Numerical aperture | EN 60793-1-43 | 2002 [2)] |
| IEC 60825-2 | - [1)] | Safety of laser products<br>Part 2: Safety of optical fibre communication systems | EN 60825-2 | 2000 [2)] |

1) Undated reference.

2) Valid edition at date of issue.

# INTERNATIONAL STANDARD

# IEC 61280-1-4

First edition
2003-01



## Fibre optic communication subsystem test procedures –

## Part 1-4: General communication subsystems – Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters

*Procédures d'essai des sous-systèmes de télécommunication à fibres optiques –*

*Partie 1-4: Procédures d'essai des sous-systèmes généraux de télécommunication – Recueil et réduction de données à deux dimensions de champs proches pour les émetteurs de laser à fibres multimodales*

Reference number
IEC 61280-1-4:2003(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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## Part 1-4: General communication subsystems – Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters



## 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.
2) The formal decisions or agreements of the 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 National Committees.
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.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61280-1-4 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/465/FDIS | 86C/494/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 2.

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.

# FIBRE OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

## Part 1-4: General communication subsystems – Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters



## 1 General

### 1.1 Scope and object

This part of IEC 61280 sets forth a standard procedure for the collection of two-dimensional fibre optic nearfield grayscale data and subsequent reduction to one-dimensional data expressed as a set of three sampled parametric functions of radius from the fibre's optical center. The object of this standard is to reduce measurement errors and inter-laboratory variation, supporting accurate mathematical prediction of minimum guaranteed link length in gigabit and ten gigabit fibre optic data communications systems.

These radial functions are intended to characterize fibre optic laser sources for use in mathematical models predicting the minimum guaranteed length of a communications link.

Although available as a byproduct, estimation of the nearfield diameter is not an objective.

### 1.2 Assumptions

The 50-micron or 62,5-micron core near-parabolic graded-index multimode fibre used as the "test jumper assembly" is treated as if it possessed perfect circular symmetry about its optical center, as asymmetries in the launched optical flux distributions will dominate any lopsidedness of the test jumper assembly. It is further assumed that all cladding modes will be stripped by passage through the specified ten meters or more of fibre. The modes of a mode group need not carry equal flux. (In fact, with such short fibres, one thousand meters or less, unequal distribution of flux in the modes of a group is the norm, not the exception.)

The fibre micropositioner that moves the fibre in the receiving camera's field of view, being used to calibrate the camera for geometric distortions, is used as a reference standard. The microscope objective, used to project the magnified nearfield onto the CCD chip, is treated as an optically perfect thick lens.

The flux detectors are required to be both linear and memoryless; this excludes for instance lead sulphide vidicon detectors. Detectors shall meet the detector requirements of IEC 60793-1-43. Absolute radiometric measurement of flux (optical power flow) is not required. A computer is required to perform the needed computations, which are too extensive to be performed manually. Although the present measurement method assumes a CCD camera, mechanically-scanned "slitscan" and pinhole cameras may also be used.

Safety: all procedures in which an LED or laser source is used as the optical source shall be carried out using safety precautions in accordance with IEC 60825-2.

## 2 Normative references

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

IEC 60793-1-20: *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry*

IEC 60793-1-41: *Optical fibres – Part 1-41: Measurement methods and test procedures – Bandwidth*

IEC 60793-1-43: *Optical fibres – Part 1-43: Measurement methods and test procedures – Numerical aperture*

IEC 60825-2: *Safety of laser products – Part 2: Safety of optical fibre communication systems*

## 3 Apparatus

As the objective of this international standard is to optically characterize laser sources, many different laser sources will be used, while the rest of the apparatus is held constant. The apparatus is calibrated using a broadband incoherent calibration source (such as a light-emitting diode (LED) or a xenon arc lamp) in place of the lasers.

### 3.1 Sources

There are two kinds of sources used in the present measurement method: the incoherent broadband overfilled source used for calibration, and the various laser sources being tested, as described in the following paragraphs.

There is always an optical connector between the source and the test jumper assembly.

#### 3.1.1 Calibration source

The purposes of the calibration source are to find the optical center of the test jumper assembly, and also to determine the geometric corrections needed to convert 2D nearfield measurements taken in camera (“TV”) coordinates into the equivalent true geometric measurements, compensating for non-square pixels, imprecisely known magnification factors, and the like. For these purposes, an incoherent broadband source that overfills the modes of the test jumper assembly is used in place of the laser sources under test.

Any spectrally broad non-coherent light source, such as a tungsten-halogen lamp, a xenon arc lamp or a light-emitting diode (LED) may be used to overfill the test jumper assembly’s fibre. The chosen calibration source shall be stable in intensity over a time period sufficient to perform the measurements.

Optionally, an IEC 60793-1-41 mode scrambler may be used with the chosen calibration source to ensure more uniform overfilling of the fibre.

#### 3.1.2 Laser under test

The only requirements on the lasers under test are that they have an operating wavelength compatible with the test jumper assembly and the detector, and have optical connectors or splices compatible with those of the test jumper assembly. The construction details of the laser sources are otherwise unspecified.

The laser drive current shall be sufficient to ensure that the laser always acts as a laser, rather than an LED.