



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 61280-4-2:2023**  
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**Postopki za preskušanje optičnih komunikacijskih podsistemov - 4-2. del:  
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Fibre-optic communication subsystem test procedures - Part 4-2: Installed cable plant -  
Single-mode attenuation and optical return loss measurement

Prüfverfahren für Lichtwellenleiter-Kommunikationsundersysteme - Teil 4-2: Installierte  
Kabelanlagen - Einmoden-Dämpfungs- und optische Rückflusdämpfungsmessung

Procédures d'essai des sous-systèmes de télécommunication à fibres optiques - Partie 4  
-2: Installations câblées - Mesure de l'affaiblissement de réflexion optique et de  
l'affaiblissement des fibres unimodales

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TITLE:

**Fibre-optic communication subsystem test procedures - Part 4-2: Installed cable plant - Single-mode attenuation and optical return loss measurement**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –**

261

262

**Part 4-2: Installed cable plant –**

263

**Single-mode attenuation and optical return loss measurement**

264

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## 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.

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IEC 61280-4-2 has been prepared by subcommittee SC86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics. It is an International Standard.

This third edition cancels and replaces the second edition, published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) addition of the equipment cord method;

b) addition of test limit adjustment related to test cord grades;

c) refinements on measurement uncertainties.

308

309 The text of this International Standard is based on the following documents:

Draft	Report on voting
86C/XX/FDIS	86C/XX/RVD

310  
311 Full information on the voting for its approval can be found in the report on voting indicated in  
312 the above table.

313 The language used for the development of this International Standard is English.

314 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in  
315 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available  
316 at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are  
317 described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

318 A list of all parts in the IEC 61280 series, published under the general title *Fibre optic*  
319 *communication subsystem test procedures*, can be found on the IEC website.

320 The committee has decided that the contents of this document will remain unchanged until the  
321 stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the  
322 specific document. At this date, the document will be

- 323 • reconfirmed,  
324 • withdrawn,  
325 • replaced by a revised edition, or  
326 • amended.

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## INTRODUCTION

331 This document is part of a series of IEC standards for measurements of installed fibre optic  
332 cable plants. This document is applicable for the measurement of installed single-mode fibre.

333 Cabling design standards such as ISO/IEC 11801-1 provide general requirements for this type  
334 of cabling. These standards support cabling lengths of up to 2 km for commercial premises and  
335 data centres and up to 10 km for industrial premises. ISO/IEC 14763-3, which supports ISO/IEC  
336 11801-1, normatively references IEC 61280-4-2.

337 Various recommendations from ITU-T have requirements for longer distance applications,  
338 including short haul (40 km), long haul (80 km), and ultra-long haul (160 km). The testing of  
339 cable plant for these applications is covered in ITU-T Recommendation G.650.3, which refers  
340 to the test methods of this standard.

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## FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

### Part 4-2: Installed cable plant – Single-mode attenuation and optical return loss measurement

#### 1 Scope

This part of IEC 61280-4 is applicable to the measurement of attenuation and optical return loss of installed optical fibre cable plant using single-mode fibre. This cable plant can include single-mode optical fibres, connectors, adapters, splices, and other passive devices. The cabling can be installed in a variety of environments including residential, commercial, industrial and data centre premises, as well as outside plant environments.

This standard is applicable to all single-mode fibre types including those designated by IEC 60793-2-50 as Class B fibres.

The principles of this standard can be applied to cable plants containing branching devices (splitters) and at specific wavelength ranges in situations where passive wavelength selective components are deployed, such as WDM, CWDM and DWDM devices.

This standard is not intended to apply to cable plants that include active devices such as fibre amplifiers or dynamic channel equalizers.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Visual inspection of fibre optic connectors and fibre-stub transceivers*

IEC 61315, *Calibration of fibre-optic power meters*

IEC 61746-1, *Calibration of optical time-domain reflectometers (OTDR) – Part 1: OTDR for single-mode fibres*

IEC TR 62627-01, *Fibre optic interconnecting devices and passive components – Fibre optic connector cleaning methods*

#### 3 Terms, definitions, graphical symbols, and abbreviated terms

For the purposes of this document, the following terms, definitions, graphical symbols, and abbreviated terms apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>

- ISO Online browsing platform: available at <http://www.iso.org/obp>

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383

384 **3.1 Terms and definitions**385 **3.1.1**386 **adapter**

387 device that enables interconnection between terminated optical fibre cables

388 **3.1.2**389 **attenuation**390 reduction of optical power induced through a medium like cabling given as  $A$ :

391

$$A = 10 \times \log_{10} (P_{in}/P_{out})$$

392 where

393  $P_{in}$  and  $P_{out}$  are the power, typically measured in mW, into and out of the cabling

394 Note 1 to entry: Attenuation is expressed in dB

395 Note 2 to entry: Alternatively, attenuation can be expressed as  $A = -10 \times \log_{10} (P_{out}/P_{in})$ . Both formulae are  
396 mathematically equivalent, resulting in positive decibel values.397 **3.1.3**398 **bi-directional measurement**399 two measurements of the same optical fibre made by launching light into opposite ends of that  
400 fibre401 **3.1.4**402 **configuration**

403 form or arrangement of parts or elements such as terminations, connections, and splices

404 **3.1.5**405 **connector**406 component normally attached to an optical cable or piece of apparatus, for the purpose of  
407 providing frequent optical interconnection/disconnection of optical fibres or cables

408 [SOURCE: IEC TR 61931:1998, 2.6.1]

409 **3.1.6**410 **light source power meter**411 **LSPM**412 test system consisting of a light source (LS), power meter (PM) and associated test cords used  
413 to measure the attenuation of installed cable plant414 **3.1.7**415 **optical return loss**416 **ORL**417  $R_{ORL}$ 418 ratio of the input power,  $P_{in}$ , of the cabling under test to the backward power,  $P_r$ , reflected by  
419 the cabling under test, expressed in decibels:

420

$$R_{ORL} = 10 \times \log_{10}(P_{in}/P_r)$$

421 Note 1 to entry: Optical return loss is a positive number.

422 **3.1.8**423 **optical time domain reflectometer**424 **OTDR**

425 test system consisting of an optical time-domain reflectometer and associated test cords, used  
426 to characterize and measure the attenuation and optical return loss of installed cable plant and  
427 specific elements within that cable plant

428 **3.1.9**429 **plug**

430 free connector

431 male part of a connector

432 [SOURCE: IEC TR 61931:1998, 2.6.2]

433 **3.1.10**434 **reference-grade termination**

435 connector plug with tightened tolerances terminated onto a single-mode optical fibre with  
436 tightened tolerances such that the expected attenuation of a connection formed by mating two  
437 such assemblies is lower and more repeatable than a standard-grade termination

438 Note 1 to entry: An adapter, required to assure this performance, can be considered to be part of the reference-  
439 grade termination where required by the test configuration.

440 Note 2 to entry: IEC 61755-2-4 for non-angled (PC) and IEC 61755-2-5 for angled (APC) cylindrical ferrule  
441 connectors define reference-grade terminations. These standards can be referenced for further information.

442 **3.1.11**443 **reference test method**444 **RTM**

445 test method for measuring a given characteristic strictly according to the definition of this  
446 characteristic, and giving results which are accurate, reproducible, and relatable to practical  
447 use

448 [SOURCE: IEC TR 61931:1998, 2.8.1, modified – The words in brackets, "for optical fibres",  
449 have been omitted from the term.]

450 **3.1.12**451 **reflectance**452  $R_{\text{comp}}$ 

453 for a discrete component in the cabling, the ratio of the backward power,  $P_r$ , reflected by the  
454 component, to the input power,  $P_{\text{in}}$ , into the component, expressed in decibels:

$$455 \quad R_{\text{comp}} = 10 \times \log_{10}(P_r / P_{\text{in}})$$

456 Note 1 to entry: Reflectance is a negative number.

457 Note 2 to entry: Alternatively, this is referred to (e.g., by IEC 61300-3-6) as the return loss of individual components  
458 and is expressed as  $R_L = -10 \times \log_{10}(P_r / P_{\text{in}})$ , which is a positive number.

459 **3.1.13**460 **return loss test set**461 **RLTS**

462 test system consisting of a light source (LS) and internal power meter (PM), directional coupler  
463 and additional external power meter and associated test cords used to measure the optical  
464 return loss of an installed cabling plant