EESTI STANDARD EVS-EN 60793-1-48:2017

Optical fibres - Part 1-48: Measurement methods and test procedures - Polarization mode dispersion

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Lichtwellenleiter - Teil 1-48: Messmethoden und Prüfverfahren - Polarisationsmodendispersion (IEC 60793-1-48:2017)

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European foreword

The text of document 86A/1678/CDV, future edition 3 of IEC 60793-1-48 , prepared by SC 86A "Fibres and cables" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60793-1-48:2017.

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)	2018-06-27
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-09-27

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In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60793-1-44	NOTE	Harmonized as EN 60793-1-44.
IEC 60793-1-50	NOTE	Harmonized as EN 60793-1-50.
IEC 60793-2-50	NOTE	Harmonized as EN 60793-2-50.
IEC 60794-3	NOTE	Harmonized as EN 60794-3.
IEC 61280-4-4	NOTE	Harmonized as EN 61280-4-4.
IEC 61290-11-1	NOTE	Harmonized as EN 61290-11-1.
IEC 61290-11-2	NOTE	Harmonized as EN 61290-11-2.
IEC 61300-3-32	NOTE	Harmonized as EN 61300-3-32.

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where 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 60793-1-1	-	Optical fibres - Part 1-1: Measurement methods and test procedures - General and guidance	EN 60793-1-1	-
IEC/TR 61292-5	-	Optical amplifiers - Part 5: Polarization mode dispersion parameter - General information	-	-
ITU-T Recommendation G.650.2	-	Definitions and test methods for statistical and non-linear related attributes of single-mode fibre and cable	-	-

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INTRODUCTION

Polarization mode dispersion (PMD) causes an optical pulse to spread in the time domain. This dispersion could impair the performance of a telecommunications system. The effect can be related to differential phase and group velocities and corresponding arrival times $\delta\tau$ of different polarization components of the signal. For a sufficiently narrow band source, the effect can be related to a differential group delay (DGD), $\Delta\tau$, between pairs of orthogonally polarized principal states of polarization (PSP) at a given wavelength. For broadband transmission, the delays bifurcate and result in an output pulse that is spread out in the time domain. In this case, the spreading can be related to the average of DGD values.

In long fibre spans, DGD is random in both time and wavelength since it depends on the details of the birefringence along the entire fibre length. It is also sensitive to time-dependent temperature and mechanical perturbations on the fibre. For this reason, a useful way to characterize PMD in long fibres is in terms of an average DGD value over an appropriately large optical frequency range, either RMS $<\Delta\tau>$, the rms DGD over this frequency range, or MEAN $<\Delta\tau>$, the (linear) mean of the DGD over this same frequency range. In principle, the average DGD value (RMS $<\Delta\tau>$ or MEAN $<\Delta\tau>$) does not undergo large changes for a given fibre from day to day or from source to source, unlike the parameters $\delta\tau$ or $\Delta\tau$. In addition, the average DGD value is a useful predictor of lightwave system performance.

The term "PMD" is used both in the general sense of two polarization modes having different group velocities, and in the specific sense of the average DGD value (RMS $<\Delta\tau>$ or MEAN $<\Delta\tau>$). Although the DGD $\Delta\tau$ or pulse broadening $\Delta\delta$ is preferably averaged over frequency, for certain situations it may be averaged over time, or temperature.

The coupling length l_c is the length of fibre or cable at which appreciable coupling between the two polarization states begins to occur. If the fibre length L satisfies the condition $L << l_c$, mode coupling is negligible, and $<\Delta\tau>$ scales with fibre length. The corresponding PMD coefficient is

$$\text{short-length PMD coefficient} = <\Delta\tau>/L.$$

Fibres in practical systems nearly always have fibre lengths much greater than the coupling length and random mode coupling. When mode coupling is random, $<\Delta\tau>$ scales with the square root of fibre length, and

$$\text{long-length PMD coefficient} = <\Delta\tau>/\sqrt{L}\ .$$

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