SLOVENSKI STANDARD

SIST EN 50083-6:1995

01-marec-1995

Kabelski distribucijski sistemi za televizijsko in zvokovno radiofuzijo - 6. del: Komponente za prenos signalov po optičnih vlaknih

Cabled distribution systems for television and sound signals -- Part 6: Optical equipment

Kabelverteilsysteme für Ton- und Fernsehrundfunk-Signale -- Teil 6: Optische Geräte

Systèmes de distribution par câble destinés aux signaux de radiodiffusion sonore et de télévision -- Partie 6: Matériels optiques

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Ta slovenski standard je istoveten z: **EN 50083-6:1994**

ICS:

33.060.40	Kabelski razdelilni sistemi	Cabled distribution systems

SIST EN 50083-6:1995 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50083-6

September 1994

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Descriptors: Telecasting, cable television, sound broadcasting, television broadcasting, optical fibres, components, measurements, characteristics

English version

Cabled distribution systems for television and sound signals Part 6: Optical equipment

Systèmes de distribution par câble destinés aux signaux de radiodiffusion sonore et de télévision Partie 6: Matériels optiques

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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.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

At the request of the 74th Technical Board of CENELEC, this European Standard was reworked by CENELEC Technical Committee TC 109, Cabled distribution systems for television and sound signals, and was submitted to the CENELEC members for a CENELEC Unique Acceptance Procedure (UAP) in May 1993.

The text of the European Standard was approved by CENELEC as EN 50083-6 on 1994-03-08.

The following dates were fixed:

- latest date of publication of an identical national standard	(dop)	1995-03-01
- latest date of withdrawal of conflicting national standards	(dow)	1995-03-01

For products which have complied with the relevant national standard before 1995-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-03-01.

Annexes designated "normative" are part of this standard.

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1 Scope

This standard

- applies to all optical transmitters, receivers, amplifiers, splitters, directional couplers, isolators, multiplexers, connectors and splices used in cabled distribution systems;
- covers the frequency range 5 MHz to 1750 MHz;
- identifies guaranteed performance requirements for certain parameters;
- lays down data publication requirements with guaranteed performance;
- describes methods of measurement for compliance testing.

All requirements and published data relate to minimum performance levels within the specified frequency range and in well matched conditions as might be applicable to cabled distribution systems for television and sound.

2 Definitions

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For the purposes of this standard, the following definitions apply:

2.1 Equipment

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2.1.1 optical transmitter

A device for converting electrical signals into optical signals. It consists of a light source (e.g. laser) and its associated components as well as all components between the coaxial input and optical output connectors.

2.1.2 optical receiver

A device for converting optical signals into electrical signals. It consists of a detector (e.g. PIN-diode) and its associated components as well as all the components between the optical input and coaxial output connectors.

2.1.3 optical amplifier

A device for amplifying optical signals directly. It consists of an active medium, and its associated components, which amplifies the optical signal without demodulation or regeneration.

2.1.4 optical isolator

A device which transports optical power in one direction only.

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2.1.5 optical fibre splice

A permanent joint of two fibre ends.

2.1.6 splitters, directional couplers, and multiplexers

The definitions for splitters, directional couplers, and multiplexers listed in EN 50083-7 do also apply to their optical equivalents.

2.2 Performance characteristics

2.2.1 extinction ratio

The ratio of the high-level Φ_h optical power to the low-level Φ_l optical power of a modulated optical transmitter.

$$e = \frac{\Phi_h}{\Phi_l} \quad (1)$$

This term is mainly used for digital systems.

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2.2.2 optical modulation index

The optical modulation index is defined as:

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$$m = \frac{\Phi_h - \Phi_l}{\Phi_h + \Phi_l} \quad (2)$$

where Φ_h is the highest and Φ_l is the lowest instantaneous optical power of the intensity modulated optical signal. This term is mainly used for analogue systems.

2.2.3 noise figure/factor

Figures of merit describing the internally generated noise of an active device.

The noise factor NF is the ratio of the carrier to noise ratio at the input, to the carrier to noise ratio at the output of an active device, assuming the incoming carrier is noise free.

$$NF = \frac{C_1/N_1}{C_2/N_2} \quad (3)$$

where:
- C_1 = signal power at the input
- C_2 = signal power at the output
- N_1 = noise power at the input (ideal thermal noise for electrical devices; quantum noise for optical devices)
- N_2 = noise power at the output

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in other words, the noise factor is the ratio of noise power at the output of an active device to the noise power at the same point if the device had been ideal and added no noise.

$$NF = \frac{N_2 \text{ actual}}{N_2 \text{ ideal}} \qquad (4)$$

The noise factor is dimensionless and is often expressed as noise figure F in dB.

$$F = 10 \lg NF \qquad (5)$$

2.2.4 **relative intensity noise (*RIN*)**

The ratio of the mean square of the intensity fluctuations in the optical power of a light source to the square of the mean of the optical output power.

NOTE: The value for the *RIN* can be calculated from the results of a carrier to noise measurement for the system (see 3.19).

2.2.5 **noise equivalent power (*NEP*)**

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The notional noise input power which, when applied to the input of an ideal noiseless device, would give rise to an output noise power equal to that observed at the output of an actual device under consideration.

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NOTE: The *NEP* can be calculated from the carrier to noise ratio C/N (see 3.19) of a device or system using:

$$NEP = \frac{C}{10^{\frac{1}{10}C/N}} \qquad (6)$$

In this equation, C is the amplitude of the carrier at the input of the device or system. The *NEP* shall be expressed in units of $\mathrm{W}/\sqrt{\mathrm{Hz}}$.

2.2.6 **equivalent input noise current density**

The notional input noise current density which, when applied to the input of an ideal noiseless device, would produce an output noise current density equal in value to that observed at the output of the actual device under consideration.

NOTE: It can be calculated from the carrier to noise ratio C/N (see 3.19) of a device or system using:

$$I_r = \sqrt{\frac{C}{Z 10^{\frac{1}{10}C/N}}} \qquad (7)$$

In this equation, C is the amplitude of the carrier at the input of the device or system and Z is its input impedance. The equivalent input noise current density shall be expressed in units of $\mathrm{A}/\sqrt{\mathrm{Hz}}$.

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2.2.7 bit error rate (*BER*)

The number of erroneous bits at the output of a system divided by the total number of received bits. This term is used in digital transmission systems.

2.2.8 responsivity

The ratio of the output current of a photodiode to the incident optical power.

$$r_s = \frac{I}{P} \quad \text{(static responsivity)}$$

$$r_d = \frac{dI}{dP} \quad \text{(dynamic responsivity)}$$

For practical purposes static and dynamic responsivities can be assumed to be equal.

2.2.9 voltage responsivity of an optical receiver

The ratio of the change of output voltage to the change of the incident optical power.

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$$r_V = \frac{dU}{dP} \quad (8)$$

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2.2.10 chromatic dispersion

The velocity at which an optical pulse travels on a fibre depends on its wavelength. Chromatic dispersion is defined as minus the change of group travel time per unit length of fibre per change of wavelength.

2.2.11 wavelength

The wavelength λ of light in vacuum is given by:

$$\lambda = \frac{c}{f} \quad (9)$$

where

$c = 2{,}99793 \times 10^8$ m/s (speed of light in vacuum)

f = optical frequency

Although the wavelength in dielectric material such as fibres is shorter than in vacuum, only the wavelength of light in vacuum is used.

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2.2.12 **chirp**

The incidental frequency modulation caused by intensity modulation of a laser diode.

NOTE: Chirping effectively broadens the laser spectral bandwidth. Due to the chromatic dispersion of the fibre, parts of the spectrum travel at different speeds resulting in harmonic distortion of the transferred signal.

2.2.13 **polarization**

The projection of the electric vector on a plane perpendicular to the direction of transmission of the polarized light wave.

2.2.14 **linewidth**

The spectral bandwidth of an individual mode of a laser. It is defined as the difference between those optical frequencies at which the amplitude reaches or first falls to half of the maximum amplitude.

2.2.15 **coherence time and coherence length**

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The coherence time is the time which light needs to travel the coherence length. The coherence time is the reciprocal of 2π times the linewidth. Both values are used to describe the phase stability of a light source.

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2.2.16 **well cleaved**

A well cleaved end of fibre has a clean plane front perpendicular to the axis of the fibre.

2.2.17 **amplified spontaneous emission** (*ASE*)

Part of an optical amplifier's output power caused by photons emitted from excited ions whose lifetime was over before their energy was used for amplification.

2.2.18 **directivity**

The attenuation between the output port and interface port minus the attenuation between input and interface port, of any equipment or system.

2.2.19 **central wavelength**

The average of those wavelengths at which the amplitude of a light source reaches or last falls to half of the maximum amplitude.

2.2.20 **spectral width**

The difference of those wavelengths at which the amplitude of a light source reaches or last falls to half of the maximum amplitude.

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3 Methods of measurement

3.1 General measurement requirements

For all methods of measurements described in this section the following requirements shall be considered:

3.1.1 Input specification

The following conditions shall be obtained from the device specification:

- supply voltage(s);
- control signal(s), if any, with correct impedance, level and frequency.

3.1.2 Measurement conditions

Unless otherwise specified, all measurements shall be carried out under following conditions:

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- the ambient or reference point temperature shall be 25 ± 5°C;
- the ambient humidity shall be in the range 40 to 70%;
- sufficient care shall be taken to ensure that optical reflection does not impair the accuracy of the measurement;
- during measurement any control input signal(s) shall be held constant.

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3.2 Optical power

3.2.1 Purpose

The purpose of this test method is to measure the average optical power emanating from the end of a test fibre. The test fibre and the coupling means shall be as specified by the manufacturer. The optical power shall be expressed in dBm.

3.2.2 Equipment required

3.2.2.1 An optical power meter with a range suitable for the expected power. The detector system of the power meter shall have a sufficiently large area to collect all the radiation from the test fibre and a spectral sensitivity compatible with the light source. A minimum accuracy of ±10% is recommended.

3.2.2.2 A length of fibre for connecting the light source to the power meter.

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3.2.2.3 A cladding mode stripper if the fibre has no cladding mode stripping coating.

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3.2.2.4 Test signal generator(s).

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3.2.3 General measurement requirements

3.2.3.1 A digital transmitter shall be modulated with a Pseudo Random Bit Sequence (PRBS) with a sequence length of at least $2^{15}-1$, with the specified pulse repetition frequency and pulse width at the specified extinction ratio. Analogue transmitters shall be modulated with at least one modulation carrier at the specified optical modulation index.

3.2.3.2 Cladding modes shall be stripped from the fibre by means of suitable cladding mode stripping techniques.

3.2.4 Procedure

3.2.4.1 Set the supply voltage(s) and any control input signal(s) to the specified value(s).

3.2.4.2 Connect the equipment as shown in figure 1.

3.2.4.3 Connect the optical output of the device under test to the detector (a power meter) through the test fibre and the specified coupling means.

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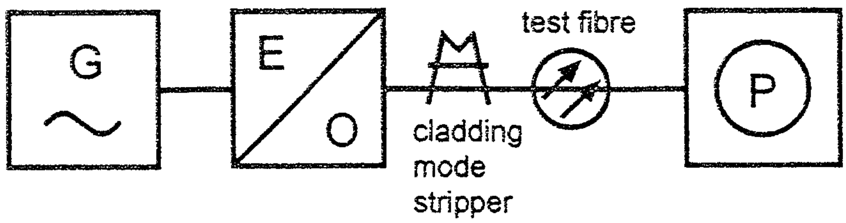

Figure 1: Measurement of optical power.

3.2.4.4 Measure and record the output power using the power meter.

3.2.5 Potential sources of error

3.2.5.1 The inaccuracy of the power meter, for example if its dark current is not sufficiently low.

3.2.5.2 The attenuation of the test fibre and the specified coupling means.

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3.3 Loss, isolation, directivity, and coupling ratio

The measurement of the following parameters is based on the measurement of optical power and therefore no special methods of measurement are given for these items:

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- loss of fibres, connectors, multiplexers, and optical isolators;
- gain of optical amplifiers;
- directivity of optical couplers;
- isolation of optical isolators, multiplexers and optical couplers.

3.3.1 General measurement requirements

3.3.1.1 Optical couplers, multiplexers and isolators shall be tested with a light source suitable for the specified wavelength range.

3.3.1.2 All optical inputs or outputs not involved during the measurement shall be terminated to make sure that no reflected light can impair the accuracy of the measurement.

3.3.2 Principle of measurement

3.3.2.1 Connect the light source to the power meter and measure the optical output power P_1 of the light source (see 3.2).