SLOVENSKI STANDARD

SIST HD 477.3.3 S1:2002

prva izdaja

oktober 2002

Methods of measurement of equipment used in terrestrial radio-relay systems - Part 3: Simulated systems - Section 3: Measurements for monochrome and colour television transmission

ICS 33.060.30

Referenčna številka
SIST HD 477.3.3 S1:2002(en)

CENELEC
Rue Bréderode 2, Bte 5 1000 BRUXELLES
Tél.: (+32.2)519 68 71 · Télex. 26257 Cenlec b
Fax (+32 2)519 68 19 · Télétex 206 2210 / CENCEL

HD 477.3.3 S1

September 1989

ENGLISH VERSION

UDC: 621.396.65(100.2-81).029.63/.66
621.396.6.083:621.397.13.004.12(083.71)

KEY WORDS: Terrestrial radio-relay systems; radio equipment; measurement with respect to television; requirements; properties; definitions

METHODS OF MEASUREMENT FOR EQUIPMENT USED IN TERRESTRIAL RADIO-RELAY SYSTEMS PART 3: SIMULATED SYSTEMS SECTION THREE - MEASUREMENTS FOR MONOCHROME AND COLOUR TELEVISION TRANSMISSION

Méthodes de mesure applicables au matériel utilisé dans les faisceaux hertziens terrestres
Troisième partie: Liaisons simulées
Section trois - Mesures concernant la transmission de la télévision monochrome ou en couleur

Meßverfahren für Geräte in terrestrischen Richtfunksystemen
Teil 3: Simulierte Systeme
Hauptabschnitt drei: Messungen für Monochrom- und Farbfernsehübertragung

BODY OF THE HD

The Harmonization Document consists of:

- IEC 487-3-3 (1981) ed 1; IEC/SC 12E, not appended

This Harmonization Document was approved by CENELEC on 13 September 1988.

The English and French versions of this Harmonization Document are provided by the text of the IEC publication and the German version is the official translation of the IEC text.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level by or before 1989-04-01

to publish their new harmonized national standard by or before 1989-10-01

to withdraw all conflicting national standards by or before 1989-10-01.

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC Central Secretariat.

The CENELEC National Committees are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
60487-3-3

Première édition
First edition
1981-01

Méthodes de mesure applicables au matériel utilisé dans les faisceaux hertziens terrestres

Troisième partie: Liaisons simulées

Section trois – Mesures concernant la transmission de la télévision monochrome ou en couleur

Methods of measurement for equipment used in terrestrial radio-relay systems

Part 3: Simulated systems

Section Three – Measurements for monochrome and colour television transmission

International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site http: //www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE U

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHODS OF MEASUREMENT FOR EQUIPMENT USED IN TERRESTRIAL RADIO-RELAY SYSTEMS

Part 3: Simulated systems

Section Three — Measurements for monochrome and colour television transmission

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 12E: Microwave Systems, of IEC Technical Committee No. 12: Radiocommunications.

A draft of Section Three was discussed at the meeting held in Paris in 1975. As a result of this meeting, a draft, Document 12E(Central Office)37, was submitted to the National Committees for approval under the Six Months' Rule in April 1976.

The National Committees of the following countries voted explicitly in favour of publication:

- Australia
- Belgium
- Canada
- Denmark
- Egypt
- France
- Germany
- Italy
- Netherlands
- Poland
- Sweden
- Turkey
- United Kingdom
- United States of America
- Yugoslavia

METHODS OF MEASUREMENT FOR EQUIPMENT USED IN TERRESTRIAL RADIO-RELAY SYSTEMS

Part 3: Simulated systems

SECTION THREE — MEASUREMENTS FOR MONOCHROME AND COLOUR TELEVISION TRANSMISSION

1. Scope

This section deals with methods of measurement for monochrome and colour television transmission over simulated radio-relay systems. The measurements are additional to those already given in Part 3, Section Two of this publication: Measurements in the Baseband, which are common to telephony and to television.

The C.C.I.R. Recommendations which describe test waveforms appropriate to the various television systems in current use are listed in the references given in Clause 7.

2. Introduction

Suitable commercial measuring equipment is generally available, but it is important to ensure that its performance is adequate for carrying out the tests to be described. For example, oscilloscopes should exhibit a flat frequency response and a good return loss (e.g. 30 dB) to at least the upper nominal frequency limit of the video baseband. Time and voltage calibration and display linearity are important factors and it is sometimes difficult to achieve the necessary accuracy when measuring the amplitude of waveforms displayed on the screen. Graticules cannot always provide the necessary precision when an accuracy of 0.1 dB is required; such an accuracy is frequently necessary, for example, when measuring synchronizing pulse distortion, and the problem may be eased by the use of the calibrator described in Appendix A. This arrangement may also save time when there are many measurements to be made.

The various test waveform elements referred to in this section are intended to be superimposed on standard line synchronizing pulses. The commercial waveform generators generally available for providing these waveforms are usually sufficiently free from internal distortion to be used directly without calibration. When this is not the case, or when the limits of accuracy required for the measurement are comparable with those of the test equipment itself, an appropriate correction for the test equipment distortion should be made when presenting the results.

3. Level of test signals

The test signals called for in this section should be applied at nominal level to the system input port unless otherwise stated. Nominal system input level is that level which produces a frequency deviation in accordance with reference 1.

4. Noise

For measurement purposes, noise in television systems is divided into three categories as follows:

- periodic noise
- continuous random noise
- impulsive noise.

The noise measurements described below are carried out in the absence of input signals.

4.1 *Method of measurement of periodic noise*

Periodic noise is measured in two frequency bands (see reference 2); the first extends from 10 kHz to upper frequency limit of the video band and the second extends below 10 kHz. The nature of periodic noise depends upon its origin and measurements in both time and frequency domains are necessary to ensure that the observed noise is adequately defined. A wideband oscilloscope and suitable band-limiting filters are required for measurements in the time domain.

For measurements in the frequency domain, a selective level-measuring set, having a tuning range sufficient to cover the requisite frequency bands, is required. Such measuring sets are often calibrated in terms of power, and conversion to peak-to-peak voltage can usually be made with sufficient accuracy by adding 9 dB to the level measured.

In the case of colour television, it is necessary to ensure that periodic noise components having frequencies above the upper limit of the video frequency band do not beat with either (or both) the colour sub-carrier and the continuity pilot to give difference components which appear within the video frequency band at a level exceeding that specified. This effect may be checked by applying a sine-wave signal of colour sub-carrier frequency having a peak-to-peak amplitude equal to the nominal peak-to-peak level of the luminance signal and then by searching the whole video frequency band (with the exception of a small band around the colour sub-carrier frequency) using a narrow-band selective level-measuring set. To avoid the possibility of overloading the measuring set, it may be necessary to insert a narrow band-stop filter, tuned to the colour sub-carrier frequency, between the system under test and the measuring set. In this case, an appropriate correction should be made for the insertion loss of the filter. Proof that any periodic noise component found is a result of intermodulation can be obtained by temporarily removing either or both the colour sub-carrier and continuity pilot, when the offending component should disappear. The levels of any intermodulation components found in the video frequency band should not exceed the levels permitted by the detailed equipment specification.

Notes 1. — The level of continuous baseband components which appear outside the video frequency band may be considerably higher than is permitted for in-band components, unless specifically restricted. The out-of-band components may be wanted signals such as programme sound sub-carriers, in which case all the sub-carriers which the system is designed to transmit should be present simultaneously at the correct levels when the periodic noise measurements are made.

2. — Care is required when measuring periodic signals which have an amplitude comparable with that of the random noise. Resolution of these low-level signals for measurement purposes requires an oscilloscope having a time-base which will lock to low-level noisy signals.

4.2 *Method of measurement of continuous random noise*

Continuous random noise is measured at a point of known luminance signal level using appropriate band limiting filters. The filters are used to exclude noise above the highest frequency in the video band (Figure 1, page 40) and below a frequency of approximately 10 kHz (Figure 2, page 41). However, if the maximum frequency of the periodic noise produced by the power supply exceeds 10 kHz, a higher cut-off frequency may be used. To allow for the subjective effect of differing noise distributions with frequency, a noise weighting network is always employed to take account of the reduced sensitivity of the human eye to noise in the upper part of the video frequency band. The weighting network given in Figure 3, page 42, is appropriate to all television systems but when necessary (see reference 3) additional measurements may be made using the network shown in Figure 4, page 43.

In the frequency band above 10 kHz, noise measurement is made with a wideband r.m.s.-responding instrument and it is therefore important to ensure that only continuous random noise is present. If periodic or impulsive noise is present as well as random noise, the results obtained from the r.m.s.-responding instrument may not represent the true value of the continuous random noise. The presence of these other noise components may be ascertained using an oscilloscope, and if necessary their level should be reduced appropriately before measurement of random noise is attempted.

It is not necessary to measure continuous random noise within the frequency band below 10 kHz, since noise in this region is generally periodic and arises from power supplies.

4.3 *Method of measurement for impulsive noise*

The measurement of impulsive noise is carried out using an oscilloscope but without a weighting network.

4.4 *Presentation of results*

The results should be presented in tabular form showing the condition of test for each individual result.

4.4.1 *Periodic noise*

The results should be given as the ratio in decibels of the peak-to-peak amplitudes of the luminance signal to the peak-to-peak amplitude of periodic noise.

When recognizable periodic components are present, the levels and frequencies or repetition rate should be recorded as follows:

Frequency or repetition rate	Level relative to luminance (dB)

4.4.2 *Continuous random noise*

The results should be given as the ratio in decibels of the peak-to-peak luminance signal to the weighted r.m.s. noise (references 2 and 3) for the conditions shown in the following table.

Number of hops	Relative receiver r.f. input level* (dB)	Signal/noise ratio (dB)	
		Weighted in the video band	Weighted in the chrominance band**
1	+ 6		
	0		
	− 10		
	− 20		
	− 30		
x	+ 3		
	0		
	− 5		
	− 10		
	− 15		

* The figures are given only as an example and 0 dB corresponds to nominal receiver r.f. input power on each hop in accordance with the appropriate performance specification.

** This measurement is normally only required if the noise power per unit bandwidth at 5 MHz exceeds that at 1 MHz by approximately 11 dB (see reference 3). An example of a suitable weighting network is shown in Figure 4, page 43.

4.4.3 *Impulsive noise*

A statement should be made as to whether or not this form of noise was observed and, if so, the duration, level and approximate waveform should be given.

4.5 *Details to be specified*

The following items should be included, as required, in the detailed equipment specification:

a) bandwidth to be used for noise measurement;
b) weighting characteristic to be used;
c) permitted level of continuous random noise;
d) permitted level of periodic noise;
e) permitted level of impulsive noise.

5. Linear waveform distortion

For an ideal system, linear waveform distortion is independent of the level of the applied signal within the normal range of operating levels. The form of the video signal and the effects on a displayed picture are such that the resulting impairments may be classified within four different time scales, which are comparable with the duration of many fields, one field, one line and one picture element respectively. In considering each of these time-scales, impairments appropriate to the other three are excluded by the measuring method.

Linear waveform distortion arises from a number of different causes and to fully evaluate its effect in a system, a number of controlled tests are necessary.

5.1 *Long-time waveform distortion*

5.1.1 *Definition and general considerations*

Long-time waveform distortion arises principally as a result of baseband a.c. coupling and is a measure of the amount by which the linear response of the simulated radio-relay system differs from that of a single C.R. circuit having a time-constant comparable with many fields (reference 4).

If a television test signal simulating a change from a low average picture level (a.p.l.) to a high a.p.l., or from a high a.p.l. to a low a.p.l., is applied to the input of a simulated system, long-time waveform distortion occurs when the blanking level of the output signal does not accurately follow that of the input signal. This effect may be either exponential in form or in the form of a damped very low frequency oscillation which is added to the signal.

This oscillation is measured in terms of:

- the peak amplitude of the overshoot of the signal;
- the time taken for the oscillation to decay to a specified value.

5.1.2 *Method of measurement*

The method of measurement is to apply a signal in which the a.p.l. can be switched between 12.5% and 87.5% at intervals which are long enough to allow the transient to decay to a negligible value before switching again. The peak overshoot of the signal envelope past its final steady-state value (x_1 in Figure 5, page 44) is measured on a d.c.-coupled oscilloscope which is itself free from this type of distortion. The decay time t for the signal to reach and remain below the specified final value x_2 is also measured. The measurements are made from a photograph of the displayed waveform or by the use of a storage oscilloscope.

Normally, the overshoot due to switching from a low a.p.l. to a high a.p.l. is the most critical because it extends beyond the steady-state amplitude range. The overshoot due to switching from high a.p.l. to low a.p.l. lies for the most part within the steady-state range, therefore, the overshoot value which exceeds the steady-state range by the greatest amount should be given as the measured result.

5.1.3 *Presentation of results*

The results should be presented as a statement that the maximum overshoot is y% of the luminance-signal amplitude and that the decay time as defined in the detailed equipment specification is t seconds. A photograph of the oscilloscope display is desirable.

5.1.4 *Details to be specified*

The following items should be included, as required, in the detailed equipment specification:

a) permitted maximum percentage overshoot (e.g. $x_1 = 20\%$);

b) decay time t to reach and remain below a given percentage of the luminance amplitude x_2 (e.g. $t = 5$ s to reach 3%).

Note. — The magnitude of long-time waveform distortion depends upon the number of modulators and demodulators in tandem rather than upon the number of non-demodulating repeaters.

5.2 *Field-time waveform distortion*

5.2.1 *Definition and general considerations*

When a square-wave signal with a duration of the same order as one field and of nominal luminance amplitude is applied to the input port of a simulated system, the field-time waveform distortion is defined as the change in shape of the top of the square-wave at the output port. A period at the beginning and end of the square-wave equivalent to the duration of a few lines is excluded from the measurement.

5.2.2 *Method of measurement*

The method of measurement is to apply a square-wave signal, in accordance with Figure 6, page 45, to the input port of the simulated system and to examine the waveform at the output port of the system with a d.c.-coupled oscilloscope. The maximum departure in level of the top of the bar from the level at the centre of the bar is measured and expressed as a percentage of the bar amplitude. The first and last 250 μs (approximately four lines) are neglected for this measurement.

5.2.3 *Presentation of results*

The results should be presented as a statement that the distortion does not exceed x% of the amplitude of the bar measured at its centre point. A photograph showing the received waveform should be included.

5.2.4 *Details to be specified*

The following items should be included, as required, in the detailed equipment specification:

a) repetition rate of square-wave signal (e.g. 50 Hz or 60 Hz);

b) permitted distortion in per cent.