

Broadcast video tape recorders — Methods of measurement —

Part 3: Electrical measurements for analogue component video signals

The European Standard EN 61237-3:1995 has the status of a
British Standard

Committees responsible for this British Standard

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- Association of Professional Recording Services Limited
- Audio Engineering Society
- British Broadcasting Corporation
- British Kinematograph, Sound and Television Society
- British Tape Industry Association
- Federation of the Electronics Industry
- ITV Association (ITVA)
- National Council for Educational Technology (NCET)
- Royal Photographic Society
- Royal Television Society

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National foreword

This British Standard has been prepared by Technical Committee and is the English language version of EN 61237-3:1995 *Broadcast video tape recorders — Methods of measurement — Part 3: Electrical measurements for analogue component video signals*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1237-3:1995 including the corrigendum of April 1995, published by the International Electrotechnical Commission (IEC).

It is envisaged that BS EN 61237 will consist of the following parts:

- *Part 1: Mechanical measurements;*
- *Part 2: Electrical measurements of analogue component video signals;*
- *Part 3: Electrical measurements of analogue component video signals;*
- *Part 4: Measurements of audio performance;*
- *Part 5: Electrical measurements of digital composite video signals and digital audio signals;*
- *Part 6: Electrical measurements of digital component video signals and digital audio signals.*

Cross-references

International Standard	Corresponding British Standard
EN 60961:1994 (IEC 961:1993)	BS EN 60961:1994 <i>Specification for helical-scan video tape cassette system using 12.65 mm (0.5 in) magnetic tape on type L</i>
EN 61105:1993 (IEC 1105:1991)	BS EN 61105:1994 <i>Specification for reference tapes for video tape recorder systems</i>
HD 439 S1:1983 (IEC 698:1981)	BS 6311:1982 <i>Methods for measuring television tape machine parameters</i>

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Broadcast video tape recorders — Methods of measurement Part 3: Electrical measurements for analogue component video signals

(IEC 1237-3:1995)

Magnétocopes de radiodiffusion — Méthodes de
mesure
Partie 3: Mesures électriques pour les signaux
vidéo analogiques à composantes
(CEI 1237-3:1995)

Videobandgeräte für den Rundfunk
Meßverfahren
Teil 3: Elektrische Messungen für Videosignale
mit analogen Komponenten
(IEC 1237-3:1995)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 60B(CO)160 + 160A, future edition 1 of IEC 1237-3, prepared by SC 60B, Video recording, of IEC TC 60, Recording, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61237-3 on 1994-03-08.

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) 1996-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-02-01

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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1 Scope and object

This part of IEC 1237 describes the test signals and measurement methods for equipment mainly dedicated to record/playback of analogue component TV signals on magnetic tape on reels or in cassettes. It may also be applied for measuring methods for general use in television production and transmission. The allowable tolerances for the rated values for acceptable performance are not given in this standard, but may be derived from appropriate system specifications, manufacturers' specifications, etc.

The necessary reference and calibration tapes are either mentioned in the specific IEC Publication of the equipment under test or included in IEC 1105 (reference tapes) and IEC technical report 1295 (calibration tapes) [1]¹⁾.

The methods are applicable to acceptance tests, performance comparisons and, as far as possible, to routine checks.

The principal object of this document is to describe the methods of measurement, test signals and procedures which may apply to characteristics of video recording/playback machines mainly intended for professional use. The measuring methods described hereafter do not directly concern home equipment and it would appear that some will be difficult to apply to them.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1237. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of IEC 1237 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 961:1993, *Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type L*.

IEC 1105:1991, *Reference tapes for video tape recorder systems*.

ITU-R Recommendation 471-1:1990, *Nomenclature and description of colour bar signals*. (Vol. XI-1)

ITU-R Recommendation 567-3:1990, *Transmission performance of television circuits designed for use in international connections*. (Vol. XII)

ITU-R Recommendation 601-2:1990, *Encoding parameters of digital television for studios*. (Vol. XI-1)

ITU-R Recommendation 656:1986, *Interfaces for digital component video signals in 525-line and 625-line television systems*. (Vol. XI-1)

3 General

To ensure that the results obtained at a specific time at a specific place are comparable to other measurements, it is advisable to specify the test signals, measuring devices and types of tapes used together with results obtained.

Since measurements of television tape machines on the basis of a single test-line per field may not be fully representative of the full-field performance (see 5.1 and 5.2), they may give results which differ from those obtained or calculated with full-field test signals.

Therefore it is necessary to additionally specify the measuring method:

- single line measurement (line number);
- block measurement (start-line, step-by-step line(s), number of steps);
- full-field measurement.

Additionally, it should be stated if the selection of lines coincides with a single record/playback head only.

¹⁾ Figures in square brackets refer to Annex A, Bibliography.

4 Test conditions

If not otherwise stated all measurements shall be carried out at the following atmospheric conditions:

Temperature	$(20 \pm 1) ^\circ\text{C}$
Relative humidity	$(50 \pm 2) \%$
Air pressure	86 kPa to 106 kPa
Conditioning before testing	24 h

5 Measuring methods and test signals

5.1 Manual and automatic methods of measurement

If automatic measuring apparatus is designed to give reliable results under the special conditions of television tape playback as e.g. drop-out, jitter, noise, time-base errors, suppression of vertical blanking interval or insufficient head-to-tape contact, a significant improvement in measurement speed, accuracy and comparability of results can be achieved.

Therefore preference was given to measurement methods which can be carried out by automatic measuring equipment or which are suitable for automatic measuring techniques.

Except where a distinction is made in particular clauses between manual and automatic methods of measurement, the measurement procedures given in this standard are valid for both methods. However, although in the case of automatic measurements the procedure is carried out automatically by the test signal analyzer, the various steps are described as if they were performed manually.

5.2 Measurement of differences between adjacent tracks (fields/segments)

All currently standardized recording formats make use of segmented recording techniques. The length of the segments (tracks) varies between approximately 16 lines and one field where the latter is often termed “non-segmented recording” which only indicates that there is no cut within the field.

Since two or more heads are used for record and playback of the video information to and from the tracks, it is desirable to restrict the measurement to segments or tracks related to a specific head. This requires a special signal arrangement which provides identical information to the heads or segments in turn.

A suitable arrangement for most formats is to repeat a packet of up to 16 different signals of a duration of one line within a field and to make the signals identical in both fields [2].

5.3 Procedure of measurement

The measurements shall be carried out by measuring the playback signal after recording on the same machine (best-case configuration). Before testing the overall performance, the playback channel shall be measured by means of a calibration tape (see clause 1).

In certain particular cases, if the multigeneration performance of a video recording system is measured, the measurements shall be carried out by measuring the playback signal after recording on a different machine (worst-case configuration).

If the television tape machine under test is equipped with external controls, e.g. tracking control, gain control, etc., these controls shall be set to their preset- or mid-position for all measurements.

5.4 Test signals

5.4.1 Introduction

A representative range of test signals is shown in Figure 1 to Figure 10. For ease of reference, they are indicated by roman numerals. Other test signals not shown in the figures are collected in 5.4.2.

All signals are defined as a luminance and two colour-difference signals. In practice, these signals are generally represented by the symbols Y, B–Y, R–Y, but in the following a short form of the notation adopted by the ITU-R (E'_Y , E'_{CB} and E'_{CR}) has been used:

$$Y, C_B \text{ and } C_R$$

These components are defined in terms of the primary signals R, G and B by:

$$Y = 0,587 \cdot G + 0,299 \cdot R + 0,114 \cdot B, C_B = 0,564 (B-Y), C_R = 0,713 (R-Y)$$

It should be noted that some of the test signals will produce “illegal” values of R, G, B or composite if dematrixed and/or coded.

5.4.2 Amplitudes and bandwidth of test signals

The amplitude of the signals is given in per cent of full-picture amplitude of the luminance and/or chrominance signals. The nominal full amplitude shall be identical but may differ between systems. The preferred levels given in Table 1 are those defined by the common EBU/SMPTE Standard (EBU N10, SMPTE 253) ([3] and [4]). They are in use in all 625-line countries. In 525-line countries several other luminance and sync levels as well as colour difference offset levels can be found. In those cases the signals delivered to and received from the system under test should comply with the individual machine setting.

Table 1 — Nominal signal amplitudes for 625-line and 525-line standards

	625-line standards		525-line standards	
	mV	%	mV	%
Luminance (Y)	700	100	714	100 or IRE
Colour difference (C_B , C_R)	± 350	± 50	± 350	± 50 or IRE
Sync	– 300	42,8	– 300	42,8

The luminance bandwidth of analogue component VTRs is often higher than the nominal luminance bandwidths of composite coded NTSC, PAL or SECAM signals. It is usually as high as specified for the digital studio standard (ITU-R Recommendation 601-2 and 656), which is 5,75 MHz for Y and 2,8 MHz for C_B , C_R . Especially the NTSC-composite band limit of 4,2 MHz does not exist. This has been taken into consideration in the specification of the test signals, e.g. rise times, pulse widths and multiburst frequencies.

In order to further reduce the differences between 525- and 625-line systems measurements, the test signals are identical for both systems as far as possible. This allows for identical test procedures also in those cases, where the signals are converted into the digital component format or converted from 525 to 625 lines or vice versa.

5.4.3 Characteristics of test signals

The luminance signal Y shall include sync pulses and line and field blanking in accordance with the CCIR television standard relevant to the television tape machine under test.

The two colour-difference signals C_B and C_R shall include line and field blanking in accordance with the ITU-R television standard relevant to the television tape machine under test. Neither of them shall include sync pulses.

All three signals (Y, C_a and C_R) shall be simultaneous in real time and carry time-coincident picture information.

5.4.4 Test signal arrangement

For manual or automatic measurement under identical conditions, the active field period shall contain a specific picture test signal for measurement of the video characteristics.

However, particularly in case of automatic measurements, a signal arrangement as mentioned in 5.2 may be used.

This supports simultaneous measurements of different parameters and renders reliable results by averaging values obtained from the specific picture test signal of successive packets within a field.

Unless otherwise stated the specific picture test signal shall be identical in each horizontal line of the active field period, e.g. regarding amplitude, frequency, phase, timing, etc.

5.4.5 Description of test signals I to XI

Test signal I, shown in Figure 1, is the 100/0/100/0 colour-bar signal as defined in ITU-R Recommendation 471. It is used for measuring absolute levels, level differences and timing differences between channels.

Test signal II, shown in Figure 2, is a five-riser staircase used for static non-linearity measurements. If digital signal processing is involved, test signal III is recommended in order to suppress the influence of quantization errors from the measurement.

Test signal III, shown in Figure 3, is a line-repetitive sawtooth of full amplitude. It is recommended for non-linearity and noise measurements in equipment where digital signal processing is included.

Test signal IV, shown in Figure 4, is a multiburst signal. The amplitude is 60 % of full amplitude to reduce the influence of linear and non-linear pre-emphasis circuits. It is used for frequency response and crosstalk measurements.

Test signal V, shown in Figure 5, is a line-rate sweep signal which can be used as an alternative to test signal IV. A field rate sweep is also possible and preferable for more accurate measurement.

Test signal VI, shown in Figure 6, contains a 25 µs bar signal and a 2T-pulse in the luminance channel. For the signal in the colour-difference channels the recommended rise time and pulse width is 5T with the exception of system L, MODE I (IEC 961) where only 8T-signals can be handled without severe distortion. No complete arrangement of signal elements is given in order to allow different combinations of elements. The amplitudes of the elements shall be 100 %. For more stringent tests, negative pulses may be used.

Test signal VII, shown in Figure 7, is a multi-pulse signal suitable for group-delay measurements at six discrete frequencies.

Test signal VIII, shown in Figure 8, is the bow-tie signal composed of a 500 kHz sinusoid on a 50 % pedestal in the luminance channel and a 502 kHz sinusoid in the colour-difference channels phased to produce cancellation at the mid-point of the active line when either colour-difference signal is subtracted from the luminance signal.

Test signal IX, shown in Figure 9, is a noise-coring test waveform used to measure the frequency dependent amount of loss of picture detail due to noise suppression.

Test signal X, shown in Figure 10, is a three-level HF-signal on a pedestal used for HF signal non-linearity and HF signal intermodulation measurement, which are likely to occur in systems with restricted FM bandwidth.

NOTE The width of the pulses from currently available test equipment may differ between 525- and 625-signals due to widespread current practice from prior NTSC, PAL or SECAM composite measurement techniques. This should be avoided however for future component measurements.

5.4.6 Other test signals

For measurements in 6.12 and 6.16 variations of test signals IV or V and constant-level component signals are required. They are described in Table 2 and Table 3.

6 Measurement of characteristics

6.1 Luminance bar amplitude error

6.1.1 Introduction

The luminance bar amplitude error is the difference between the actual luminance bar amplitude and its nominal value, expressed as a percentage of the nominal value.

The sign of the error is positive if the bar amplitude is greater than the nominal value.

6.1.2 Measurement procedure

- Select test signal I.
- Measure the difference in level between points b_1 and b_2 , and record this value $U_{1,2}$ in millivolts.
- Calculate the error from the expression:

$$100 \frac{U_{1,2} - U_n}{U_n} (\%)$$

where U_n is the nominal value of the luminance bar amplitude given in Table 1.

NOTE The level of the colour-difference signals can be measured in the same way as described for the luminance channel using test signal I. It is however better to define these levels relative to the luminance bar as defined in 6.7.

6.2 Synchronizing pulse amplitude error

6.2.1 Introduction

The synchronizing pulse amplitude error is the difference between the actual amplitude of the synchronizing pulse and its nominal value, expressed as a percentage of the nominal value.

The sign of the error is positive if the synchronizing pulses are larger than the nominal value.