INTERNATIONAL STANDARD

IEC 62122

First edition
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Methods of measurement for consumer-use digital VTRs – Electronic and mechanical performances

Méthodes de mesure pour les magnétoscopes numériques destinés au grand public – Performances électroniques et mécaniques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHODS OF MEASUREMENT FOR CONSUMER-USE DIGITAL VTRs – ELECTRONIC AND MECHANICAL PERFORMANCES

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 62122 has been prepared by TA 7: Moderate data rate storage media and equipment, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this standard is based on the following documents:

FDIS	Report on voting
100/452/FDIS	100/480/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2007. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

METHODS OF MEASUREMENT FOR CONSUMER-USE DIGITAL VTRs – ELECTRONIC AND MECHANICAL PERFORMANCES

1 Scope and object

This standard specifies the basic methods of measurement for evaluating the electronic and mechanical performances of consumer-use digital VTRs.

The formats of open reel VTRs, Beta, VHS, and 8 mm VTRs have been standardized. Methods of measurement for these analogue VTRs have been standardized in IEC 61041-1, IEC 61041-2, IEC 61041-3, IEC 61041-4, IEC 61041-5, and IEC 61146-3. Digital VTR 6,35 mm DV format and 12,65 mm D-VHS format have now been brought on the market. The methods of measurement for these consumer-use digital VTRs should be specified and standardized.

With these measurement techniques, some items for the evaluation of performances specific to digital VTRs have also been included.

There are two objectives for the proposed methods of measurement. One is to check the interchangeability and characteristics of the equipment under test which are indispensable to manufacturers, and the other is to evaluate the quality of image and sound, which concerns the customer. The latter is a priority for consumer satisfaction.

Since a consumer can use only general-purpose instruments, any test which needs dismantling of apparatus and requires special instruments is in principle not specified. As error rate is important for digital equipment, an example of a method for measuring error rate is given in annex A.

2 Normative references

The following referenced documents are indispensable for the application 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 60094-3:1979, *Magnetic tape sound recording and reproducing systems – Part 3: Methods of measuring the characteristics of recording and reproducing equipment for sound on magnetic tape*

IEC 60386:1972, *Method of measurement of speed fluctuations in sound recording and reproducing equipment*

IEC 60883:1987, *Measuring method for chrominance signal-to-random noise ratio for video tape recorders*

IEC 61041-1:1990, *Non-broadcast video tape recorders – Methods of measurement – Part 1: General, video (NTSC/PAL) and audio (longitudinal) characteristics*

IEC 61041-5:1997, *Non-broadcast video tape recorders – Methods of measurement – Part 5: High-band video tape recorders including those equipped with Y/C video connectors (NTSC/PAL)*

IEC 61834 (all parts), *Recording – Helical-scan digital video cassette recording system using 6,35 mm magnetic tape for consumer use (525-60, 625-50, 1125-60 and 1250-50 systems)*

ITU-R BT.471-1:1986, *Nomenclature and description of colour bar signals*

ITU-R BT.500-10:2000, *Methodology for the subjective assessment of the quality of television pictures*

ITU-R BT.1204:1995, *Measuring methods for digital video equipment with analogue input/output*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
consumer-use digital VTR
consumer-use video tape recorder using digital recording technology, 6,35 mm to 12,65 mm width videotape and bandwidth compression technology for the image signal. Two tape formats are standardized, as defined in the following two definitions. Although different formats may be introduced in the future, fundamental measuring methods can be adapted to all formats

3.1.1
DV format
6,35 mm helical-scan VTR standardized in IEC 61834

3.1.2
D-VHS format
12,65 mm helical-scan VTR which will be standardized in the near future. Until then, refer to the outline of the D-VHS format in documents [1][1] and [2]

3.2
ferrofluid development
direct observation of the magnetization on the videotape by the adherence of iron powder to its surface by dipping the tape into a fluid containing powder of fine iron in order to observe the recorded pattern using a microscope

3.3
byte
unit which separates the information series 1 into m bits. m usually consists of 8 bits, but not always

3.4
error rate
ratio of the number of erroneous elements to the total number of elements reproduced and/or transmitted during a given time interval

NOTE 1 The elements may be, for example, digits, code words or blocks.

NOTE 2 “Error ratio” is defined in similar terms as in IEV 704-18-03.

3.5
byte error rate
error rate for a signal constructed from byte units

(number of erroneous byte units)/(total number of elements of byte units)

3.6
MPEG-2 transport stream
MPEG-2 TS
data transmission format standardized by ISO/IEC MPEG (Moving Picture image coding Experts Group)

3.7
three dimensional (3D) signal processing
TV video signal process taken from three viewpoints: the horizontal and vertical directions and the time domain. Generally, it contains the operation processing between the fields or between frames using a field memory or a frame memory

———————

[1] Figures in square brackets refer to the Bibliography.

3.8
audio operational output voltage
standard output voltage specified by the manufacturer for the audio analogue signal interface between equipment when the output terminal is terminated by a specified load impedance

3.9
audio operational input voltage
input voltage specified by the manufacturer to generate the audio operational output voltage at the output terminal

3.10
audio maximum output voltage
maximum audio output voltage that a VTR under test can generate. In this standard, it is the voltage for an output signal of 3 % harmonic distortion, or it can be the voltage just before clipping when the output signal is digitally clipped

4 Measuring conditions

4.1 General

All measurements shall be carried out in the environmental conditions specified by the manufacturer.

If not otherwise stated by the manufacturer or by the format standard, the device under test shall be conditioned for at least 3 h before measurement begins. An adequate warm-up time may be used instead of 3 h conditioning.

The environmental conditions during measurement, at least the temperature and the relative humidity, shall be recorded together with the presentation of the results of the measurements.

4.2 Environmental conditions

The environmental conditions for the measurements shall be:

Ambient temperature:	20 °C ± 1 °C
Relative humidity:	50 % ± 2 %
Air pressure:	96 kPa ± 10 kPa

Ambient temperature can be within a range of 5 °C and 35 °C, and relative humidity within a range of 45 % and 75 % if these tolerances do not affect the results of measurement. Record the temperature and humidity at the time of measurement along with the results of the measurement.

4.3 Power supply

Use the power supply that conforms to the power requirements for the VTR under test. Voltage regulation shall be ±2,5 % or better. The frequency fluctuation shall be ±1 % or better and the harmonic content shall be 2 % or less.

4.4 Test signal

Use the test signals specified below for measurement.

4.4.1 Video test signal

Use a video test signal which has a 100 % amplitude level white signal of 4 μs inserted in every horizontal period so that the results of measurement do not include errors caused by disturbance of the video AGC circuitry of the VTR under test. A video test signal which contains

the 100 % level white signal over eight horizontal video periods inserted in every vertical blanking period may be used as an alternative.

4.4.2 Colour bar signal

Use the standard colour bar signal that conforms to the ITU-R BT.471-1 type (b).

4.4.3 Video input signal for measuring audio characteristics

When measuring the audio characteristics for analogue in and analogue out, the colour bar signal of 4.4.2 shall be applied to the VTR and recorded simultaneously with an audio test signal to stabilize the VTR synchronization.

4.5 Measuring instruments

4.5.1 Noise meter

Frequency bandwidth

Luminance:	0,1 kHz to 10 MHz
Chrominance:	3,58 MHz ± 1,5 MHz (NTSC)
	4,43 MHz ± 1,5 MHz (PAL)

Cut-off frequency

HPF:	0,1/100 kHz
LPF:	0,5/3,0/4,2/6,0 MHz/THROUGH

Input signal

For luminance S/N:	white signal with superimposed signal (level of 230 mVp-p or less)
For chrominance S/N:	white signal with superimposed single colour signal, modulated carrier

Measuring method

Luminance:	0 dB = 0,714 V (RMS value) for NTSC
	0 dB = 0,700 V (RMS value) for PAL.
Chrominance AM noise:	RMS value of detected AM noise
Chrominance PM noise:	RMS value of detected PM noise
Gated noise position:	Not gated until 4 µs before rising edge of white signal
Output noise signal:	Not saturated by the input signals specified above
Input terminal:	Composite video input terminal and Y/C separate signal input terminal such as S Video terminal

4.5.2 Audio signal generator

Frequency range:	4 Hz to 20 kHz in sinusoidal wave form
Output voltage:	Not less than 2 V
Total harmonic distortion:	Less than 0,001 % in the frequency range of 20 Hz to 20 kHz

4.5.3 Audio level meter

This meter shall measure the true root mean square voltage of an a.c. waveform. But an a.c. voltmeter with the scaling of root mean square value that measures the average value of rectified voltage is applicable for the measurements of sinusoidal waveform voltage.

Accuracy:	Within ±2 % in the frequency range of 4 Hz to 20 kHz
Range:	–90 dB(V) to +20 dB(V)

4.5.4 Audio mixed frequency oscillator

This instrument shall generate a waveform of two sinusoidal signals that are mixed in a specific ratio. Total harmonic distortion of each sinusoidal signal shall be less than 0,001 %.

4.5.5 Audio harmonic distortion meter

This meter shall measure residual harmonic and noise components with the exception of the fundamental component.

Indication accuracy:	Within ±3 %
Minimum measurable value:	Less than 0,001 % (The full-scale is 0,01 %)
Input impedance:	More than 100 kΩ

4.6 Video test tape

Use the video test tape which conforms to the video tape specifications of the VTR under test. Record the type of the tape and the name of the manufacturer of the tape with the results of measurement.

5 Methods of measurement for mechanical characteristics

5.1 General

The calibration tape that is prepared by the format supplier can confirm general interchangeability.

The tape pattern of a digital VTR is the same helical-scan system as that used in an analogue VTR, and can be observed by ferrofluid development. Digital VTR has a different tracking system from existing systems and has a high-density recording system. The measuring conditions will be clarified and the means of obtaining high measurement accuracy will be described.

5.2 Tape speed

To obtain the tape speed, observe the magnetization pattern of the tape by a ferrofluid developed tape on which a specified test signal is recorded.

5.2.1 Test signal

a) For DV format:
The test signal shall be a sinusoidal waveform whose wavelength is about 1,6 μm on the tape. In the case of the DV format 9 000 min^{-1} system, the frequency is 6 MHz.

b) For D-VHS format:
The test signal shall be a MPEG-2 TS.

5.2.2 Measurement

Record the test signal and develop the tape by the ferrofluid development. Then using a microscope, observe the magnetized pattern along the longitudinal line in the middle of the tape for more than 30 mm. Obtain the same azimuth track interval p using the following

equation and referring to figure 2. For the D-VHS format, obtain the CTL pulse pitch p in the same way.

$$p = \frac{l}{n} \quad \text{mm}$$

where

l is the distance of the measurement;

n is the number of the same azimuth tracks (or the number of the CTL pulses) over the distance l.

Use the following equation to obtain the tape speed v:

$$v = \frac{p}{p_r} \times v_r \quad \text{mm/s}$$

where, for the DV format

Reference pitch per 2 tracks	$p_r = 2 \times 10 \times 10^{-3}/\sin(\theta_r)$	mm	
Track angle	$\theta_r = 9{,}1668°$		
Reference speed	$v_r = 18{,}831/1{,}001$	mm/s	for NTSC
	18,831	mm/s	for PAL

For the D-VHS format:

p_r, θ_r, v_r: refer to the D-VHS format.

If the VTR under test can be operated at more than one tape speed, measurements shall be repeated at each of the speeds and the mode used for each test shall be stated.

5.2.3 Presentation of the results

Tape speed: mm/s (mode)

5.3 Flatness of the RF envelope

This is the ratio of the minimum amplitude of the RF envelope at the head amplifier output with respect to the maximum amplitude.

5.3.1 Test signal

a) For DV format, the test signal shall be the colour bar signal of 4.4.2.

b) For D-VHS format, the test signal shall be a MPEG-2 TS.

5.3.2 Block diagram

See figure 3.

5.3.3 Measurement

Record and reproduce the test signal, and observe the RF signal at the head amplifier output on the oscilloscope. Obtain the maximum amplitude of the RF envelope, e_{max}, and the minimum amplitude, e_{min} (figure 4).

The flatness of the RF envelope is:

$$\text{Flatness} = \frac{e_{min}}{e_{max}} \times 100 \ \%$$