

Specification for

# Helical-scan video tape cassette system using 12.65 mm (0.5 in) magnetic tape on type L

The European Standard EN 60961:1994 has the status of a  
British Standard

UDC 621.397.454

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## National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 60961:1994 *Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type L*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 961:1993 published by the International Electrotechnical Commission (IEC). This standard supersedes BS 7260:1989, which is withdrawn.

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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 64, 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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Descriptors: Electroacoustics, electroacoustic equipment, video recording, magnetic recording, video tape recorders, magnetic tapes, cassette for magnetic tapes, recording characteristics, mechanical properties, electrical properties, dimensions

English version

## Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type L

(IEC 961:1993)

Système de magnétoscope à cassette à  
balayage hélicoïdal utilisant la bande  
magnétique de 12,65 mm (0,5 in) de format L  
(CEI 961:1993)

Video-Bandkassettensystem mit  
Schrägschraufzeichnung auf Magnetband  
12,65 mm (0,5 in) L-Format  
(IEC 961:1993)

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B-1050 Brussels**

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## Foreword

The text of document 60B(CO)152, as prepared by Subcommittee 60B: Video recording of IEC Technical Committee 60: Recording, was submitted to the IEC-CENELEC parallel vote in April 1993.

The reference document was approved by CENELEC as EN 60961 on 8 December 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-12-01
- latest date of withdrawal of conflicting national standards (dow) 1994-12-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this standard, Annex A and Annex B are informative and Annex ZA is normative.

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## Section 1. General

### 1 Scope

This International Standard applies to magnetic video recording and/or reproduction using 12,65 mm (0,5 in) tape cassettes on helical-scan video cassette recorders suitable for broadcast applications.

This standard specifies two recording modes. MODE I uses oxide particle tape, MODE II uses metal particle tape and permits frequency modulated (FM) audio signals to be recorded. The standard defines the electrical and mechanical characteristics of equipment which will provide for interchangeability of recorded cassettes. The requirements given are related to 525 line-60 field and/or 625 line-50 field systems.

### 2 Normative references

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

IEC 94-1:1981, *Magnetic tape sound recording and reproducing systems — Part 1: General conditions and requirements*.

IEC 268-17:1990, *Sound system equipment — Part 17: Standard volume indicators*.

IEC 461:1986, *Time and control code for video tape recorders*.

IEC 767:1983, *Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type beta format*.

CCIR Report 624-4, *Characteristics of television systems*.

### 3 Environment and test conditions

#### 3.1 Environment

Test and measurement made on the system to check the requirements of this standard shall be carried out under the following conditions.

|                                |                   |
|--------------------------------|-------------------|
| Temperature (drum diameter):   | 20 °C ± 0,5 °C    |
| Temperature (all other tests): | 20 °C ± 1 °C      |
| Relative humidity:             | 48 % to 52 %      |
| Barometric pressure:           | 86 kPa to 106 kPa |
| Conditioning before testing:   | 24 h              |

#### 3.2 Reference tape

Blank tape to be used for reference recordings may be purchased from the manufacturers listed in Annex B. The electromagnetic compatibility parameters and their specifications should be specified by the manufacturers and controlled accordingly.

*Model name:*

- a) IEC L-format reference tape for MODE I;
- b) IEC L-format reference tape for MODE II.

Electromagnetic compatibility parameters and their specifications are indicated in Annex B.

#### 3.3 Calibration tape

Calibration tapes which have satisfied the following requirements will be available from manufacturers of video tape recorders and players in accordance with this format specification.

### 3.3.1 Record locations and dimensions

For calibration tapes intended for the purpose of calibrating the mechanical accuracy of the recorder or player, in accordance with this format specification, a 50 % reduction in the tolerances shown in Table 7 should, in general, be applied. If necessary, the record locations and dimensions can be specially modified for certain calibration tapes in order to avoid calibration error or to aid calibration.

### 3.3.2 Calibration signals

Two classes of signals should be recorded on the calibration tapes:

- a) a series of conventional test signals for analogue component video tape recorders

| <i>Video</i>                  | <i>Longitudinal audio</i> |         |
|-------------------------------|---------------------------|---------|
| — Colour bars (75 % or 100 %) | — 1 kHz 0 VU              |         |
| — Multi-burst                 | — 15 kHz or 10 kHz 0 VU   |         |
| — Bow-tie (50 %)              | — 40 Hz                   | — 20 VU |
| — Pulse and bar               | — 1 kHz                   | — 20 VU |
| <i>FM audio</i>               | — 7 kHz                   | — 20 VU |
| — 400 Hz, 25 kHz deviation    | — 10 kHz                  | — 20 VU |
| — 400 Hz, 75 kHz deviation    | — 15 kHz                  | — 20 VU |

- b) special test signals developed by each manufacturer for product alignment. These signals are not universally applicable to all manufacturers' products, and will not be specified.

## Section 2. Video tape and video tape cassette

This video tape recording system specifies the use of video tape and video tape cassette in the BETA-format as delineated in sections 2 and 4 of IEC 767 or the use of video tape and video tape cassette in the type-L format as delineated in section 5 of this standard, which is newly specified to provide all-inclusive specifications of video tape and video tape cassette for MODE II recordings and/or long-playing operations including current video tape and video tape cassette (see 16.1 through 18.4 of this standard).

## Section 3. Video cassette recorders

### 4 Definitions of terms

The following definitions are given to assist in the correct understanding of this International Standard.

#### 4.1

##### **scanner**

the mechanical assembly containing a drum, rotating pole-tips and tape-guiding elements. It is used to record and reproduce video tape recordings

#### 4.2

##### **drum**

the circular cylinder around which tape is at least partially wrapped in order to form the head-to-tape interface of a video tape recording system

#### 4.3

##### **upper drum**

that part of the drum in a helical-scan video recording system which does not come into contact with the reference edge of the tape

#### 4.4

##### **lower drum**

that part of the drum in a helical-scan video recording system which comes into contact with the reference edge of the tape and usually contains tape-guiding elements

**4.5****effective drum diameter**

the value of drum diameter which, when used in theoretical calculations, will correspond to the actual video record produced in a helical-scan video tape recording system. The effective value is equal to or greater than the actual diameter

**4.6****helix angle**

the angle formed between the path of the rotating pole-tips and the tape-reference-edge guiding system on the scanner of a helical-scan video tape recording system

**4.7****track angle**

the angle of the recorded video track with respect to the reference edge of the tape in a helical video tape recording

**4.8****centre span tension**

the calculated value of tape tension at a point midway between tape entrance and exit guides of the scanner in a video tape recording system

**4.9****wrap angle**

the angle at the centre of the drum rotation subtended by the line of contact between the drum and the reference edge of the tape

**4.10****lead signal overlap**

that portion of the helical record which is required to provide a duplicate (overlap) recording

**5 Scanner pole-tips**

There shall be four circumferential pole-tip locations as shown in Figure 1 (top view).

**5.1 Pole-tip projection**

Each pole-tip projection shall be radially  $0,04^{+0,010}_{-0,025}$  mm, measured from the outer surface of the upper drum to the end of the pole-tip.

**5.2 Luminance pole-tips**

Two pole-tips circumferentially spaced at  $180^\circ \pm 0,003^\circ$  shall be provided for recording the luminance signal.

**5.3 Colour-recording pole-tips**

Each luminance pole-tip shall have associated with it a pole-tip for recording the time-multiplexed colour signals and, when applicable, the FM audio signals.

A colour-recording pole-tip shall be located at a chordal distance of  $4,396 \text{ mm} \pm 0,010 \text{ mm}$  in a counter-rotational direction from its associated luminance pole-tip, as shown in Figure 2, and shall be axially displaced from its associated luminance pole-tip by  $0,0745 \text{ mm} \pm 0,003 \text{ mm}$ , in a direction away from the reference edge of the tape as shown in Figure 2.

**5.4 Erase pole-tips**

If the erase pole-tips are employed, each luminance/colour-recording pole-tip pair shall have an associated erase pole-tip located at any angle with respect to the luminance pole-tip of the pair, in the direction of rotation as shown in Figure 1.

**5.5 Channel identification**

Suitable means shall be provided, such as a pulse generator producing one pulse per drum revolution, to permit the identification of the luminance/colour-recording pole-tip pair which records field 1. This pair shall be identified as channel 1, and the remaining pair shall be identified as channel 2.

## 6 Helix angle

The helix angle shall be  $4,600^\circ \pm 0,003^\circ$ .

## 7 Drum diameter and tape tension

Effective drum diameter, tape tension, helix angle, and tape speed completely determine the video record track angle. Different methods of design and/or minor variations in drum diameter and tape tension shall produce equivalent recordings for interchange purposes. Values and operating conditions specified in this clause will produce the reference value of track angle.

### 7.1 Actual upper drum diameter

The actual upper drum diameter shall be  $74,487^{+0,008}_0$  mm ( $2,933^{+0,00032}_0$  in). New technologies and techniques are enabling compatible and interchangeable tapes to be produced by recorders in which some of the dimensions of the transport scanning mechanism are significantly changed. This can enable recorders to be made smaller and lighter for portable applications by the use of a smaller scanning drum assembly. Such an approach has been used for ENG applications.

### 7.2 Actual lower drum diameter

The actual lower drum diameter shall be  $74,487^{+0,000}_{-0,008}$  mm ( $2,933^{+0,00000}_{-0,00032}$  in). New technologies and techniques are enabling compatible and interchangeable tapes to be produced by recorders in which some of the dimensions of the transport scanning mechanism are significantly changed. This can enable recorders to be made smaller and lighter for portable applications by the use of a smaller scanning drum assembly. Such an approach has been used for ENG applications.

### 7.3 Upper drum

The upper drum shall rotate in synchronism with the video head tips.

### 7.4 Centre span tension

The centre span tension shall be  $0,46 \text{ N} \pm 0,05 \text{ N}$ .

## 8 Dimensions and location of records

This clause specifies the dimensions and locations of the video, audio and tracking control records.

### 8.1 Test environment

**8.1.1** In addition to the general environmental requirements of clause 3, the following additional conditions shall be met in order to meet requirements of clause 8:

tape tension:  $0,46 \text{ N} \pm 0,05 \text{ N}$ .

#### 8.1.2 *Conditioning before recording and testing*

Environmental: stabilized at the measurement conditions.

Tape tension: wound on a reel at  $0,56 \text{ N} \pm 0,20 \text{ N}$ .

**8.1.3** The reference edge of the tape for dimensions in this standard shall be the lower edge as shown in Figure 3, Figure 4a and Figure 4b. The magnetic coating of the tape faces the observer in all figures.

### 8.2 Tape speed

**8.2.1** The tape speed shall be  $118,582 \text{ mm/s} \pm 0,2 \text{ mm/s}$  for 525 line-60 field systems.

**8.2.2** The tape speed shall be  $101,510 \text{ mm/s} \pm 0,2 \text{ mm/s}$  for 625 line-50 field systems.

### 8.3 Recording locations and dimensions

**8.3.1** Recording locations and dimensions shall be as specified in Figure 3, Figure 4a and Figure 4b and in Table 7.

**8.3.2** Dimensions  $P$ ,  $R$ ,  $W$  and  $\theta$  are shown for reference purposes only.

The actual value of these dimensions is determined by the parameters of the transport, the tape speed and their tolerances. Direct measurement of the actual value of these dimensions and dimension  $Q$  may be impractical; therefore, these dimensions should be made by an indirect measurement method, such as that specified in 8.4.

## 8.4 Curvature of video recordings

The edge of the video recording shall be contained within two parallel straight lines 0,010 mm apart.

## 8.5 Relative positions of recorded signals

**8.5.1** Video luminance, video chrominance, tracking control, audio and time code signals with information intended to be time coincident shall be positioned as shown in Figure 4a and Figure 4b.

**8.5.2** As shown in Figure 4a and Figure 4b, even-numbered fields have a different video luminance and video chrominance phasing, due to the odd number of lines in a television frame.

## 8.6 Gap azimuth

**8.6.1** The azimuth of the audio, tracking control and time code head gaps used to produce longitudinal track records shall be perpendicular to the direction of relative head-to-tape motion.

**8.6.2** The azimuth of the video head gaps for the luminance signal shall be  $-15^{\circ} 15'$  and for the chrominance signal shall be  $+15^{\circ} 15'$  to the perpendicular to the direction of head motion.

## 9 Luminance and colour-recording system

Each pass of a luminance/colour-recording pole-tip pair shall record one television field, plus an overlap.

## 10 Recording characteristics

The recording characteristics of video cassette recorders shall be in accordance with the requirements specified in section 4.

## Section 4. Recording characteristics

### 11 Video recording

The video recording system shall provide separate and distinct signal paths for the luminance and chrominance components. These component signals shall be recorded on two separate tracks, designated as the Y track for the luminance signal, and the C track for the chrominance signal. The C track shall record both R-Y and B-Y colour difference signals in the form of a compressed time division multiplexed signal and, when applicable, FM audio signals. Monochrome signals shall be recorded on the Y track, with the C track recording only a blanking level signal and horizontal timing pulse.

Two modes of operation are defined for the following tape types:

- oxide particle tape: MODE I;
- metal particle tape: MODE II.

Sensing of tape type shall be automatic by means of a sensing hole in the cassette as described in section 5.

#### 11.1 Luminance channel

##### 11.1.1 Signal processing

A signal processing system as specified in this clause shall contain in the order of the signal flow the following elements:

**11.1.1.1** A means of modifying the sync portion of the luminance signal.

**11.1.1.2** A means of inserting a vertical interval subcarrier in MODE II when the signal to be recorded has been decoded from a composite signal source which is defined in CCIR report 624-4. The vertical interval subcarrier (VISC) is not recorded in the SECAM system and shall be optional in MODE I.

**11.1.1.3** A video detail enhancement process.

**11.1.1.4** A video pre-emphasis network.

**11.1.1.5** A means of clipping the video signal after pre-emphasis.

**11.1.1.6** A linear frequency modulator having constant deviation with respect to the amplitude of the modulating frequencies.

**11.1.1.7** An amplifier of the frequency modulated carrier signal to provide alternating current drives to the Y channel record heads.

11.1.2 Modification of the sync portion

A means shall be used to modify the pulse width and amplitude of the horizontal sync portion as shown in Figure 5a and Figure 5b.

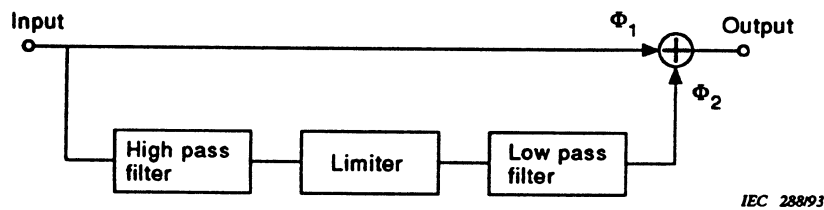
11.1.3 Luminance detail enhancement

The video signal shall receive detail enhancement with the characteristics shown in Table 1.

Table 1 — Detail enhancement output (dB)

| Frequency<br>Hz | Input<br>dB |      |      |      |     |     |
|-----------------|-------------|------|------|------|-----|-----|
|                 | − 30        | − 20 | − 15 | − 10 | − 5 | 0   |
| 200 k           | 0,4         | 0,4  | 0,4  | 0,4  | 0,3 | 0,2 |
| 500 k           | 1,9         | 1,7  | 1,7  | 1,4  | 0,8 | 0,4 |
| 1,0 M           | 4,6         | 4,0  | 3,5  | 2,4  | 1,3 | 0,7 |
| 1,5 M           | 6,7         | 5,6  | 4,6  | 3,0  | 1,6 | 0,9 |
| 2,0 M           | 8,0         | 6,6  | 4,9  | 3,3  | 1,8 | 1,1 |
| 3,0 M           | 9,5         | 7,5  | 5,3  | 3,6  | 2,2 | 1,3 |
| 4,0 M           | 9,9         | 7,6  | 5,3  | 3,6  | 2,2 | 1,4 |
| 5,0 M           | 9,9         | 7,3  | 5,1  | 3,3  | 2,0 | 1,2 |

NOTE 1 The video signal input level, including synchronization tip, is 1,0 Vpp.  
NOTE 2 The play-back response is such that the recording response is compensated during play-back.  
NOTE 3 The phase of side chain signal  $\Phi_2$  shall be equal to the phase of input signal  $\Phi_1$  at 3,5 MHz prior to mixing.



11.1.4 Luminance pre-emphasis

The pre-emphasis is defined by the frequency and phase characteristics of the network shown in Figure 6, when fed from a zero impedance source, and feeding an infinite impedance load.

11.1.5 Amplitude clipping

For an input signal where synchronization tip is at 0 % and peak white at 100 %, any positive or negative amplitude excursion exceeding the levels shown in Table 2 shall be clipped.

Table 2 — Amplitude clipping (luminance)

|                          |         | 525 line-60 field |         | 625 line-50 field |         |
|--------------------------|---------|-------------------|---------|-------------------|---------|
|                          |         | MODE I            | MODE II | MODE I            | MODE II |
| Positive excursion limit | Nominal | + 250 %           | + 260 % | + 250 %           | + 300 % |
|                          | Maximum | + 255 %           | + 265 % | + 255 %           | + 305 % |
| Negative excursion limit | Nominal | − 65 %            | − 100 % | − 65 %            | − 150 % |
|                          | Maximum | − 70 %            | − 105 % | − 70 %            | − 155 % |

11.1.6 Recorded carrier frequency

Carrier frequency corresponding to reference levels of the modified luminance signal shall be as defined in Table 3.

Table 3 — Recorded carrier frequency (luminance)

| 525 line-60 field system                                           | MODE I                  | MODE II                 |
|--------------------------------------------------------------------|-------------------------|-------------------------|
| Peak white                                                         | 6,5 MHz                 | 7,7 MHz                 |
| 50 % level                                                         | 5,7 MHz                 | 7,0 MHz                 |
| Blanking                                                           | 4,97 MHz $\pm$ 0,05 MHz | 6,27 MHz $\pm$ 0,05 MHz |
| Synchronization tip                                                | 4,4 MHz                 | 5,7 MHz                 |
| Frequency deviation                                                | 1,43 MHz $\pm$ 0,05 MHz | 1,43 MHz $\pm$ 0,05 MHz |
| 625 line-50 field system                                           | MODE I                  | MODE II                 |
| Peak white                                                         | 6,4 MHz                 | 8,8 MHz                 |
| 50 % level                                                         | 5,7 MHz                 | 8,1 MHz                 |
| Blanking                                                           | 5,00 MHz $\pm$ 0,05 MHz | 7,40 MHz $\pm$ 0,05 MHz |
| Synchronization tip                                                | 4,4 MHz                 | 6,8 MHz                 |
| Frequency deviation                                                | 1,40 MHz $\pm$ 0,05 MHz | 1,40 MHz $\pm$ 0,05 MHz |
| NOTE Frequency deviation is between peak white and blanking level. |                         |                         |

### 11.1.7 Record head current

**11.1.7.1** The amplitude of the recording current for the Y track shall be such that a maximum level of remaining flux on tape is produced when recording a Y signal with a 50 % average picture-level.

**11.1.7.2** The amplitude of the Y track record current shall decrease with increasing frequency in the range 2 MHz to 10 MHz according to a straight line contained within limit lines as shown in Figure 11. This method assures optimum recording irrespective of video head material.

### 11.2 Chrominance channel

#### 11.2.1 Signal processing

A signal processing system as specified in this clause shall contain in the order of the signal flow the following elements.

**11.2.1.1** A means of compressing the time scale of the R-Y and B-Y signals over a period of one horizontal line such that they may be time multiplexed into one horizontal line.

**11.2.1.2** A means of adding a horizontal timing pulse.

**11.2.1.3** A video detail enhancement process.

**11.2.1.4** A video pre-emphasis network.

**11.2.1.5** A means of clipping the video signal after pre-emphasis.

**11.2.1.6** A linear frequency modulator having constant deviation with respect to the amplitude of the modulating frequencies.

**11.2.1.7** A high pass filter to reduce the amplitude of the low-frequency components of the FM chrominance signal.

**11.2.1.8** A means of combining the frequency-modulated audio signal, and the frequency-modulated chrominance signal in MODE II when the FM audio signals are present.

**11.2.1.9** An amplifier of the frequency-modulated carrier signal to provide alternating current drive to the C channel recording heads.

#### 11.2.2 Time compression and multiplexing

**11.2.2.1** The R-Y and B-Y signals shall each be compressed into a half time scale. The starting point of compression shall be as shown in Figure 7a and Figure 7b.

**11.2.2.2** The compressed R-Y and B-Y signals shall be multiplexed alternately as shown in Figure 8.

**11.2.2.3** The compressed and multiplexed R-Y and B-Y signals shall be delayed by one horizontal line with respect to the luminance signal.

#### 11.2.3 Addition of a horizontal timing pulse

A horizontal timing pulse shall be added to the compressed and multiplexed R-Y and B-Y signals as shown in Figure 7a and Figure 7b. The fall time of the timing pulse shall have an approximate Gaussian shape with a fall time of 220 ns.

#### 11.2.4 Chrominance detail enhancement

The video signal shall receive detail enhancement with the characteristics shown in Table 1.

#### 11.2.5 Chrominance pre-emphasis

The pre-emphasis is defined by the frequency and phase characteristics of the network as shown in Figure 6, when fed from a zero impedance source and feeding an infinite impedance load.

#### 11.2.6 Amplitude clipping

For a signal with timing pulse tip at  $-105\%$  and nominal positive peak at  $+50\%$  corresponding with “100/7, 5/77/7, 5 colour bars” of the 525 line-60 field system, or at  $-120\%$  and nominal positive peak at  $+50\%$  corresponding with “100/0/75/0 colour bars” of the 625 line-50 field system, any positive or negative amplitude excursions exceeding the levels shown in Table 4 shall be clipped.

**Table 4 — Amplitude clipping (chrominance)**

|                          |         | 525 line-60 field |         | 625 line-50 field |         |
|--------------------------|---------|-------------------|---------|-------------------|---------|
|                          |         | MODE I            | MODE II | MODE I            | MODE II |
| Positive excursion limit | Nominal | + 175 %           | + 230 % | + 175 %           | + 260 % |
|                          | Maximum | + 180 %           | + 235 % | + 180 %           | + 265 % |
| Negative excursion limit | Nominal | – 305 %           | – 305 % | – 300 %           | – 380 % |
|                          | Maximum | – 310 %           | – 310 % | – 305 %           | – 385 % |

#### 11.2.7 Recorded carrier frequency

Carrier frequencies corresponding to reference levels of the compressed colour difference signal shall be as defined in Table 5.

**Table 5 — Recorded carrier frequency (chrominance)**

| 525 line-60 field system<br>(100/7, 5/77/7, 5 colour bars)                       | MODE I                 | MODE II                |
|----------------------------------------------------------------------------------|------------------------|------------------------|
| Peak positive video excursion                                                    | 4,0 MHz                | 4,8 MHz                |
| Peak negative video excursion                                                    | 5,0 MHz                | 5,8 MHz                |
| Blanking                                                                         | 4,5 MHz $\pm$ 0,05 MHz | 5,3 MHz $\pm$ 0,05 MHz |
| Timing pulse tip                                                                 | 5,55 MHz               | 6,35 MHz               |
| Frequency deviation                                                              | 1,0 MHz $\pm$ 0,05 MHz | 1,0 MHz $\pm$ 0,05 MHz |
| 625 line-50 field system<br>(100/0/75/0 colour bars)                             | MODE I                 | MODE II                |
| Peak positive video excursion                                                    | 4,0 MHz                | 5,6 MHz                |
| Peak negative video excursion                                                    | 5,0 MHz                | 6,6 MHz                |
| Blanking                                                                         | 4,5 MHz $\pm$ 0,05 MHz | 6,1 MHz $\pm$ 0,05 MHz |
| Timing pulse tip                                                                 | 5,70 MHz               | 7,3 MHz                |
| Frequency deviation                                                              | 1,0 MHz $\pm$ 0,05 MHz | 1,0 MHz $\pm$ 0,05 MHz |
| NOTE Frequency deviation is between peak positive and negative video excursions. |                        |                        |

#### 11.2.8 Record head current

**11.2.8.1** The amplitude of the recording current for the C track shall be such that a maximum flow level is produced when recording a C signal of blanking level.

**11.2.8.2** The amplitude of the C track recording current shall decrease with increasing frequency in the range 2 MHz to 10 MHz according to straight lines contained within limit lines as shown in Figure 11. This method assures optimum recording, irrespective of video head material.

#### 11.2.9 LF amplitude of the FM chrominance signal

In MODE II, if the FM audio signals are recorded, the chrominance signal shall be subject to high-pass filtering prior to combining with the FM audio signals. The filter response is shown in Figure 12.

## 11.3 Decoding and colour-field identification

### 11.3.1 Vertical interval subcarrier reference (VISC)

**11.3.1.1** When operating in MODE II, a VISC signal shall be inserted on lines 11 and 274 (525 line-60 field) or lines 8 and 321 (625 line-50 field) of the Y signal prior to any signal pre-emphasis. This signal shall only be present when the signal to be recorded is the result of decoding a composite NTSC or PAL video signal with a coherent subcarrier. The VISC signal is optional in MODE I.

**11.3.1.2** The format of the VISC signal is shown in Figure 13a and Figure 13b.

**11.3.1.3** The frequency of the VISC signal shall be equal to the subcarrier of each composite video signal for the 525 line-60 field system, or half for the 625 line-50 field system.

**11.3.1.4** The phase of the VISC signal for the NTSC system shall be within  $\pm 5^\circ$  of the burst phase of the composite NTSC video signal prior to decoding. The phase of the VISC signal for the PAL system shall be such that the zero crossings denoting a half cycle of VISC shall be coincident with the positive going zero crossings denoting a full cycle of subcarrier, within a tolerance of  $\pm 5^\circ$  of subcarrier phase of the composite PAL video signal prior to decoding.

### 11.3.2 Colour-field identification

**11.3.2.1** When operating in MODE I and MODE II, a colour-field identification signal shall be inserted into the chrominance as shown in Figure 9a and Figure 9b, when the signal to be recorded is the result of decoding a composite NTSC or PAL/SECAM video signal meeting CCIR Report 624-4.

**11.3.2.2** When operating in MODE II and recording signals that originated direct from colour components, an identification signal shall identify a four-field sequence for the 525 line-60 field system, or an eight-field sequence for the 625 line-50 field system, as shown in Figure 9a and Figure 9b.

**11.3.2.3** When there is no way to detect the beginning of a four-field or an eight-field colour sequence, the sequence may start arbitrarily.

**11.3.2.4** When operating on MODE I, the colour-field identification signal referred to in 11.3.2.2 and 11.3.2.3 is optional.

## 12 Longitudinal audio signal recording (channels 1 and 2)

### 12.1 Reference levels

#### 12.1.1 Recording method

All recordings shall be made using the anhysteretic (bias) method.

#### 12.1.2 Recording and reproducing level indicator

Longitudinal audio signal recording and reproducing levels of the video tape recorder shall be adjusted with reference to a standard volume indicator or equivalent as specified in IEC 268-17.

#### 12.1.3 Recorder reference level

When a recording is made from a sinusoidal signal having a frequency of 1 000 Hz such that the r.m.s. short circuit tape flux per unit track width in the record is  $100 \text{ nWb/m} \pm 3 \text{ nWb/m}$  for MODE I and MODE II of 525 line-60 field system,  $100 \pm 3 \text{ nWb/m}$  for MODE I and  $125 \pm 3 \text{ nWb/m}$  for MODE II of 625 line-50 field system, of track width, as defined in IEC 94-1, the recording volume indicator shall be adjusted to deflect to its reference level (0 VU) scale mark.

### 12.2 Frequency response

#### 12.2.1 Recorder flux/frequency response

When a tape is recorded from a constant voltage level applied to the input terminals of the recording system, the relative tape flux level (short-circuit condition)  $L\Phi(f)$  versus frequency,  $f/F_l$ , shall be as given in the equation:

$$L\Phi(f) = 10 \log_{10} \frac{1 + (f / F_l)^2}{1 + (f / F_h)^2} \text{ dB}$$

where

$L\Phi$  is the relative tape flux level

$f$  is the frequency at which the response is being computed  
 $F_l$  is the low-frequency transition frequency, 50 Hz  
 $F_h$  is the high-frequency transition frequency, 4 547 Hz (525 line-60 field), 3 183 Hz (625 line-50 field) in MODE I  
and 4 547 Hz (525 line-60 field), 9 362 Hz (625 line-50 field) in MODE II (with “feed in coil” measurement method for core loss)

12.2.2 Reproducer flux/frequency response

When a tape recording having a short-circuit tape flux level versus frequency is reproduced as shown in 12.2.1, the output voltage level versus frequency of the reproducer shall be constant.

12.2.3 Noise reduction characteristics

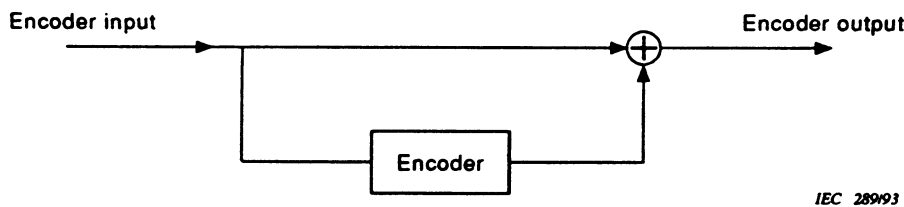
Noise reduction, if applied, shall have the encoding characteristics shown in Table 6.

Table 6 — Audio noise reduction encoding characteristics (dB)

Tolerance: ± 1,5 dB

| Frequency<br>Hz | Input level<br>dB |       |      |      |      |      |      |
|-----------------|-------------------|-------|------|------|------|------|------|
|                 | 0                 | − 10  | − 20 | − 30 | − 40 | − 50 | − 60 |
| 100             | 0,2               | 0,9   | 2,7  | 2,9  | 2,9  | 2,9  | 2,9  |
| 200             | 0,1               | 1,5   | 5,3  | 8,0  | 8,1  | 8,1  | 8,1  |
| 300             | 0                 | 1,6   | 6,1  | 10,7 | 12,0 | 12,0 | 12,0 |
| 500             | 0                 | 1,7   | 6,3  | 11,8 | 15,6 | 16,2 | 16,2 |
| 1 k             | − 0,3             | 1,5   | 5,9  | 11,4 | 16,2 | 19,4 | 19,6 |
| 3 k             | − 1,6             | − 0,1 | 3,7  | 9,2  | 13,9 | 19,2 | 20,7 |
| 5 k             | − 2,3             | − 0,6 | 2,9  | 8,4  | 13,5 | 18,7 | 20,4 |
| 10 k            | − 3,5             | − 1,4 | 2,6  | 8,2  | 13,6 | 18,1 | 19,2 |
| 15 k            | − 6,3             | − 3,3 | 1,5  | 7,3  | 12,2 | 15,0 | 15,0 |

NOTE 1 The input level of 0 dB is the reference audio input level at 1 000 Hz.  
NOTE 2 The encode level of 0 dB is the recorded reference audio level specified in 12.1.3.  
NOTE 3 A block diagram for encoding is shown below.  
NOTE 4 The frequency response of play-back decoder shall be complementary to the record encoder.



12.3 Track usage

12.3.1 Non-stereophonic audio

The primary programme audio channel shall be recorded on the audio 1 track.

12.3.2 Stereophonic audio

When separate channels are used for stereophonic audio, the left channel shall be recorded on the audio 1 track and the right channel on the audio 2 track. When sum and difference channels are used for stereophonic audio, the left plus right channel shall be recorded on the audio 1 track and the left minus right channel on the audio 2 track.

12.3.3 Program audio head phasing

When the same signal is recorded on the audio 1 and audio 2 tracks, the records shall be so phased that when reproduced with a head wide enough to sense the recorded flux on both tracks, the result will be additive.

### 12.3.4 *Recording polarity*

When a positive going waveform is present on pin-2 against pin-3 of the input circular connector, as defined in IEC XXX or EBU R-50, the audio head shall generate a magnetic flux such that the direction of remanent flux on the tape is from north to south, with the south pole pointing in the direction of the tape travel.

## 13 FM audio signal recording (channels 3 and 4)

FM audio signals can only be recorded in MODE II. Audio signals for the two channels shall be used to individually frequency modulate two carriers. The carriers shall be located in the low-frequency range and added to the frequency-modulated chrominance signal.

### 13.1 Signal processing

A signal processing system as specified by this standard shall contain the following elements.

**13.1.1** An audio noise reduction scheme incorporating compression.

**13.1.2** A linear frequency modulator having constant deviation with respect to the amplitude of the modulating frequencies.

**13.1.3** A means of adding the two FM audio signals to the chrominance signal in the ratio specified.

### 13.2 Reference levels

#### 13.2.1 *Recording and reproducing level indicator*

FM audio signal recording and reproducing levels of the video tape recorder shall be adjusted with reference to a standard volume indicator or equivalent, as specified in IEC 268-17.

#### 13.2.2 *Recorder reference level*

When a recording is made from a sinusoidal signal having a frequency of 400 Hz with the reference deviation, the recording volume indicator shall be adjusted to deflect to its reference level scale mark.

### 13.3 Noise reduction

A noise reduction scheme will be employed with the following characteristics.

#### 13.3.1 *Compression ratio*

The compression ratio shall be 2 : 1 in logarithmic scale for all input levels.

#### 13.3.2 *Frequency response*

The frequency response of the compressor at reference input level shall be in accordance with the following:

| Frequency (Hz) | 50 | 100 | 200 | 400 | 700   | 1 k   | 2 k   | 4 k   | 7 k   | 10 k  | 14 k  |
|----------------|----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|
| Response (dB)  | 0  | 0   | 0   | 0   | + 0,1 | + 0,3 | + 1,2 | + 2,7 | + 4,1 | + 4,8 | + 5,3 |

NOTE Figure 14 represents a possible implementation.

#### 13.3.3 *Transient response*

The transient response shall be as follows:

- attack time: 1,8 ms  $\pm$  0,4 ms
- recovery time: 40 ms  $\pm$  8 ms
- hold time: 15 ms  $\pm$  3 ms

The dynamic characteristics of the compression are shown in Figure 15.

### 13.4 Frequency modulation

#### 13.4.1 *Carrier frequencies*

The carrier frequencies shall be as shown below:

- left channel (CH3): 310 kHz  $\pm$  5 kHz
- right channel (CH4): 540 kHz  $\pm$  5 kHz

### **13.4.2 Frequency deviation**

#### **13.4.2.1 Reference deviation**

The recording reference deviation shall be  $\pm (25 \pm 0,75)$  kHz at a reference frequency of 400 Hz.

#### **13.4.2.2 Maximum deviation**

The maximum deviation shall not exceed  $\pm 75$  kHz.

### **13.5 Recording current**

The recording current for the two FM audio carriers relative to the chrominance recording current specified in 11.2.8.1 shall be  $-24 \text{ dB} \pm 2 \text{ dB}$  for channel 3, and  $-26 \text{ dB} \pm 2 \text{ dB}$  for channel 4.

### **13.6 Track usage**

#### **13.6.1 Non-stereophonic audio**

The primary programme audio channel shall be recorded on channel 3.

#### **13.6.2 Stereophonic audio**

When separate channels are used for stereophonic audio, the left channel shall be recorded on channel 3 and the right channel on channel 4. When sum and difference channels are used for stereophonic audio, the left plus right channel shall be recorded on channel 3 and the left minus right channel on channel 4.

#### **13.6.3 Recording polarity**

When a positive going wave-form is present on pin-2 against pin-3 of the input circular connector, as defined in IEC XXX or EBU R-50 the recording frequency for the FM audio signal shall increase.

## **14 Time and control code recording**

### **14.1 Designated track for time and control code**

The longitudinal track identified as time and control code track shall be used for recording of time and control code signals as specified in IEC 461.

### **14.2 Recording method**

The recording level shall be at saturation of the magnetic domains which is defined as that point above which a 0,5 dB increase in output level results from a 1 dB increase of input level, as indicated on an r.m.s. reading meter.

## **15 Tracking control recording**

### **15.1 Tracking control signal**

**15.1.1** The tracking control recording shall be a series of constant flux levels alternating in polarity at field rate, and completing one cycle per frame, as shown in Figure 10a and Figure 10b.

**15.1.2** The polarity of the tracking control recording flux shall be such that transitions from the south poles of the magnetic domains to the north poles of the magnetic domains occur during the vertical intervals identifying the first field, and the transitions of the north poles of the magnetic domains to the south poles of the magnetic domains occur during the vertical intervals identifying the second field.

### **15.2 Tracking control and video timing**

Recording current transitions representing video fields shall occur  $1,5 \text{ lines} \pm 1,0 \text{ line}$  after the negative going transitions of the edge of the field-synchronizing pulse, as shown in Figure 10a and Figure 10b.

### **15.3 Recording method**

The recording level shall be at saturation of the magnetic domains which is defined as that point above which a 0,5 dB increase in output level results from a 1 dB increase of input level, as indicated on an r.m.s. reading meter.

## Section 5. Type-L format video tape and video tape cassette

### 16 Mechanical characteristics of video tape cassette

#### 16.1 Cassette outside dimensions

Two sizes of cassette shall be identified as follows:

| Model              | Dimensions (mm)            | Figures                |
|--------------------|----------------------------|------------------------|
| S (small) cassette | $96 \times 156 \times 25$  | Figure 16 to Figure 23 |
| L (large) cassette | $145 \times 254 \times 25$ | Figure 25 to Figure 33 |

#### 16.2 Datum planes

**16.2.1** Datum plane Z is determined by three datum spots A, B and C, as shown in Figure 18a and Figure 27a.

**16.2.2** Datum plane X shall be perpendicular to datum plane Z and include the centres of datum holes (a) and (b), as shown in Figure 17 and Figure 26.

**16.2.3** Datum plane Y shall be perpendicular to both datum planes X and Z and include the centre of datum hole (a), as shown in Figure 17 and Figure 26.

#### 16.3 Window area and label area

The cross-hatched areas in Figure 16 and Figure 25 are defined as the label/window area and shall not protrude beyond the height of the cassette surface.

#### 16.4 Manufacturer's identification holes

Three manufacturer's holes, referred to as "recognition holes", shall be provided (refer to Figure 17 and Figure 26). The closed status of the hole shall express state "1". The open status of the hole shall express state "0".

##### 16.4.1 Tape type identification hole

Hole one shall identify the tape type within the cassette. State "1" shall indicate oxide particle tape and state "0" shall indicate metal particle tape. Detection of tape type by the machine shall determine MODE I or MODE II operation.

##### 16.4.2 Type thickness identification hole

Hole two shall identify tape thickness. State "1" shall identify 20  $\mu\text{m}$  tape and state shall identify 15  $\mu\text{m}$  tape.

##### 16.4.3 Reel hub diameter identification hole

Hole three shall identify the reel hub diameter. State "1" shall identify a small hub and state "0" shall identify a large hub.

For details concerning usage, refer to Figure 21 and Figure 30.

#### 16.5 Safety tab and safety plug

**16.5.1** The use of the safety tab (for oxide tapes) and safety plug (for metal tapes) is intended to activate or produce a record lockout condition in the event that the safety tab/plug is activated.

##### 16.5.2 S cassette

The S cassette may contain either oxide or metal particle tape. When loaded with oxide tape the safety tab (for oxide), as shown in Figure 17, shall activate the MODE I record lockout condition if the safety tab is removed. A hole having a minimum depth of 10 mm from the datum plane Z (section C-C in Figure 17), defines the mechanical tolerances for the sensing device.

When loaded with metal particle tape, the safety tab (for oxide) shall be removed, thus preventing the record condition for machines capable of MODE I operation. The safety plug, indicated by section D-D in Figure 17, defines the mechanical tolerances for sensing device. Detection of no hole shall cause record lockout condition for MODE II operation.

##### 16.5.3 L cassette

The L cassette contains only one safety plug. If the safety plug is depressed the record lockout is activated in both MODE I and MODE II. Dimensions of the safety plug are shown in section C-C of Figure 26.