SMPTE 8-1995
Revision of
ANSI/SMPTE 8-1989

# SMPTE STANDARD

# for Video Recording — Quadruplex Recorders Operating at 15 in/s — Audio Level and Multifrequency Test Tape



## 1 Scope

This standard specifies an audio frequency test tape to be used for adjusting the sensitivity and frequency response of audio 1 record (program audio track) and audio 2 record (cue track) of quadruplex video magnetic tape recorders operating at a tape speed of 15 in/s (381 mm/s). The tape shall be used on recorders, operating in accordance with ANSI/SMPTE 3. The operating level and frequency response for audio 2 record are specified in SMPTE RP 102.

## 2 Normative references

The following standards contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI S4.3-1982 (R1992), Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment

ANSI S4.6-1982 (R1992), Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths

ANSI/SMPTE 1-1990, Video Recording — 2-in Magnetic Recording Tape

ANSI/SMPTE 3-1992, Television Analog Recording — Frequency Response and Operating Level of Recorders and Reproducers — Audio 1 Record on 2-in Tape Operating at 15 and 7.5 in/s

ANSI/SMPTE 4-1995, Television Analog Recording — 2-in Magnetic Tape for Quadruplex Recording — Speed

ANSI/SMPTE 6-1993, Video Recording — 2-in Quadruplex Tape — Video, Audio and Tracking-Control Records

ANSI/IEEE 152-1992, Audio Program Level Measurement

SMPTE RP 16-1993, Specifications of Tracking-Control Record for 2-in Quadruplex Video Magnetic Tape Recordings

SMPTE RP 102-1991, Frequency Response and Operating Level of Recorders and Reproducers for Audio 2 Record for 2-in Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s

## 3 General specifications

### 3.1 Dimensions of records

The dimensions of pertinent records constituting this test tape shall conform to ANSI/SMPTE 6.

### 3.2 Tape speed

The nominal linear speed of this test tape shall be 15 in/s (381 mm/s) in accordance with ANSI/SMPTE 4.

### 3.3 Stock

The test sections shall be recorded on transversely oriented television magnetic recording tape, the dimensions of which are specified in ANSI/SMPTE 1.

### 3.4 Video signal

A color black video signal may be recorded.



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### 3.5 Tracking-control signal

A tracking- control signal, conforming to that specified in SMPTE RP 16, as applicable, shall be recorded throughout the tape.

### 3.6 Identification

Voice announcement at the beginning of this tape shall provide identification as to the applicable American National Standard, the test tape manufacturer, and the flux (in nanowebers per meter) of the operating level test tones defined in 4.1 recorded on audio 1 record and audio 2 record. Each test section and segment shall be preceded by voice announcements at a level approximately 5 dB below operating level identifying the content of that particular recorded segment.

### 3.7 Flutter

The weighted peak flutter of this test tape shall not exceed 0.2%.

### 3.8 Azimuth

The azimuth of the signal recorded on the tape shall be 90° ± 3′ to the reference edge of the tape.

## 4 Audio 1 record test sections

### 4.1 Audio operating level section

This section is used to calibrate the sensitivity of the audio reproducing system.

#### 4.1.1 Frequency

The frequency of the recording shall be 1000 Hz ± 2% when the tape is reproduced at exactly 15 in/s (381 mm/s).

#### 4.1.2 Tape flux per unit track width

The audio operating level test recording has an rms short circuit tape flux per unit track width of 110 nWb/m ± 3 nWb/m.

#### 4.1.3 Flux level variation

The flux level variation during the length of the tone shall fall within an envelope whose total width is 0.5 dB.

#### 4.1.4 Distortion

The total harmonic distortion of this section when reproduced shall not exceed 2%.

#### 4.1.5 Duration

The minimum duration of this section shall be one minute.

### 4.2 Frequency response section

Recorded on audio 1 record, this section is to be used to calibrate the frequency response of the audio reproducing system of a quadruplex video magnetic tape recorder.

#### 4.2.1 Frequencies

The following test segment frequencies (in hertz) shall be recorded in the order given:

| | |
|---|---|
| 1000 (reference) | 4000 |
| 63 | 8000 |
| 125 | 10 000 |
| 250 | 12 500 |
| 500 | 16 000 |
| 1000 | 1000 (reference) |
| 2000 | |

The frequency of each recording shall be within ± 2% of its specified value when the tape is reproduced at exactly 15 in/s (381 mm/s).

#### 4.2.2 Tape flux level vs frequency

The relative short circuit tape flux level versus frequency expressed in decibels shall be as given by the following equation:

$$L_\Phi (f) \text{ re } 110 \text{ nWb/m} = 0.2 + 10 \log_{10} \{ [1 + (F_l/f)^2] / [1 + (f/F_h)^2] \} \text{ [dB]}$$

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, 80 Hz; and $F_h$ is the high-frequency transition frequency, 4500 Hz. A graph of this equation is shown in figure 1. The values of the tape flux and relative flux level are given in table 1.

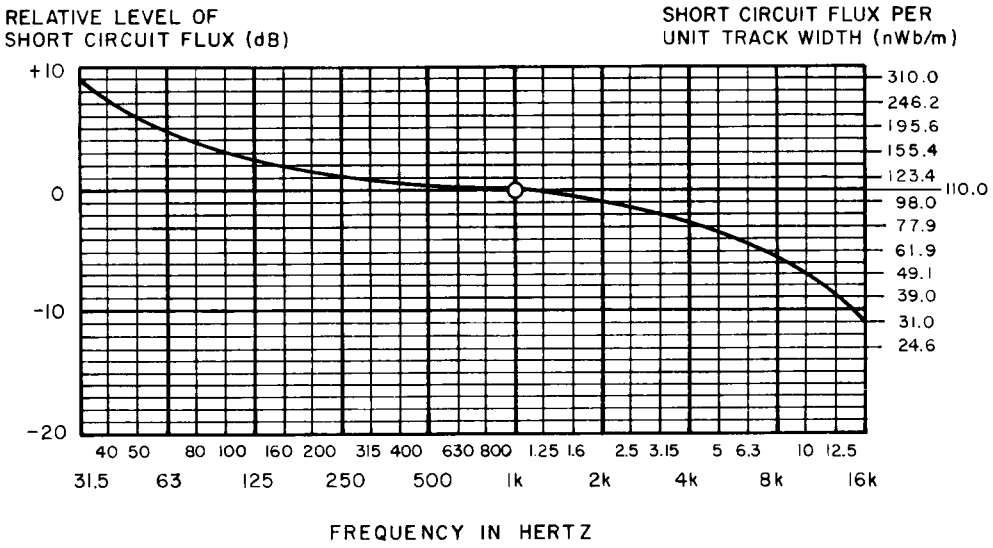


**Figure 1 – Short circuit tape flux per unit track width and relative level vs frequency for audio 1 record**

**Table 1 – Flux and flux level versus frequency**

| Frequency Hz | Flux ($\Phi$) nWb/m [1)] | Relative level ($L_\Phi$) dB [2)] |
|---|---|---|
| 63 | 181.5 | + 4.4 |
| 80 | 158.8 | + 3.2 |
| 100 | 143.8 | + 2.3 |
| 125 | 133.3 | + 1.7 |
| 160 | 125.4 | + 1.1 |
| 200 | 120.9 | + 0.8 |
| 250 | 117.7 | + 0.6 |
| 315 | 115.6 | + 0.4 |
| 400 | 114.1 | + 0.3 |
| 500 | 113.1 | + 0.2 |
| 630 | 112.2 | + 0.2 |
| 800 | 111.2 | + 0.1 |
| 1000 | 110.0 | 0.0 |
| 1250 | 108.4 | – 0.1 |
| 1600 | 105.9 | – 0.3 |
| 2000 | 102.7 | – 0.6 |
| 2500 | 98.3 | – 1.0 |
| 3150 | 92.0 | – 1.6 |
| 4000 | 83.9 | – 2.4 |
| 5000 | 75.1 | – 3.3 |
| 6300 | 65.3 | – 4.5 |
| 8000 | 55.1 | – 6.0 |
| 10 000 | 46.1 | – 7.6 |
| 12 500 | 38.1 | – 9.2 |
| 16 000 | 30.4 | –11.2 |

[1)] Calculated using the equation $\Phi = 110\ \text{antilog}_{10}\ (L_\Phi / 20)$.
[2)] Calculated using the equation given in 4.2.2.

#### 4.2.3 Flux level variation

The short circuit flux recorded on the tape at each frequency shall be within ± 0.5 dB of the value specified in 4.2.2. The tolerance of ± 0.5 dB may be extended to ± 2 dB, provided that a calibration chart is supplied with the test tape by the manufacturer.

#### 4.2.4 Test calibration

The calibration values in decibels furnished with the test tape shall represent the levels to be added algebraically to the reproducer output level when the particular test tape is reproduced. With the addition of these values, the output level of the reproducer will be that which would have resulted if the short circuit flux on the test tape at a given frequency had been exactly as specified in 4.2.2 and shown in table 1.

#### 4.2.5 Duration

The duration of frequency response test segments shall be approximately 10 seconds.

## 5 Audio 2 record test sections

### 5.1 Audio operating level section

This section is used to calibrate the sensitivity of the audio (cue) reproducing system.

#### 5.1.1 Frequency

The frequency of the recording shall be 1000 Hz ± 2% when the tape is reproduced at exactly 15 in/s (381 mm/s).

#### 5.1.2 Tape flux per unit track width

The audio operating level test recording has an rms short circuit tape flux per unit track width of 260 nWb/m ± 7 nWb/m.

#### 5.1.3 Flux level variation

The flux level variation during the length of tone shall fall within an envelope whose total width is 0.5 dB.

#### 5.1.4 Distortion

The total harmonic distortion of this section when reproduced shall not exceed 5%.

#### 5.1.5 Duration

The minimum duration of this section shall be one minute.

### 5.2 Frequency response section

Recorded on audio 2 record, this section is to be used to calibrate the frequency response of the audio 2 (cue track) system of a quadruplex video magnetic tape recorder.

#### 5.2.1 Frequencies

The following test segment frequencies (in hertz) shall be recorded in the order given:

| | |
|---|---|
| 1000 (reference) | 4000 |
| 63 | 8000 |
| 125 | 10 000 |
| 250 | 12 500 |
| 500 | 16 000 |
| 1000 | 1000 (reference) |
| 2000 | |

The frequency of each recording shall be within ± 2% of its specified value when the tape is reproduced at exactly 15 in/s (381 mm/s).

#### 5.2.2 Tape flux level vs frequency

The relative short circuit tape flux level versus frequency expressed in decibels shall be as given by the following equation:

$$L_\Phi (f) \text{ re } 260 \text{ nWb/m} = -9.8 + 10 \log_{10} \{ [1 - (F_l/f)^2] / [1 + (f/F_h)^2] \} \text{ [dB]}$$

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, 80 Hz; and $F_h$ is the high-frequency transition frequency, 4500 Hz. A graph of this equation is shown in figure 2. The values of the tape flux and relative flux level are given in table 2.

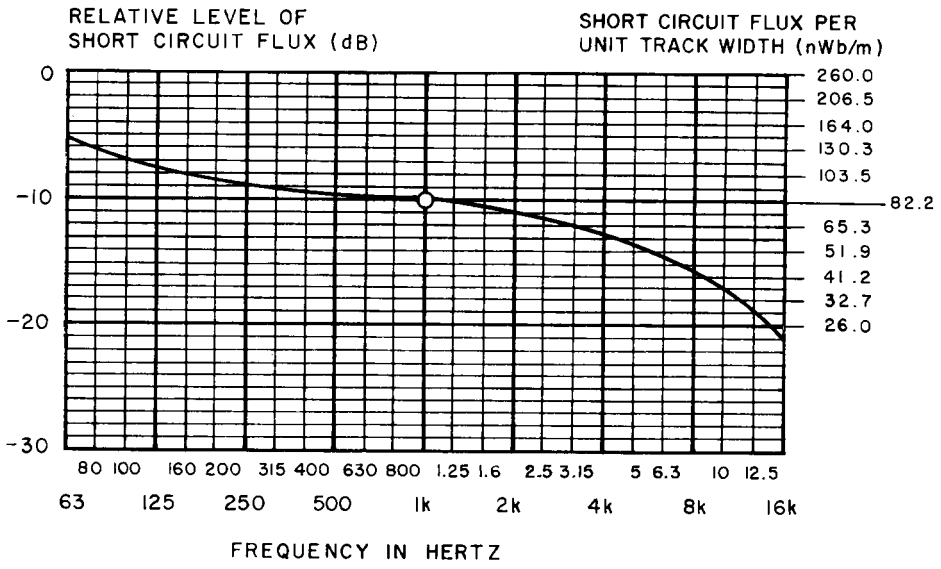


**Figure 2 – Short circuit tape flux per unit track width and relative level vs frequency for audio 2 record**

**Table 2 – Flux and flux level versus frequency**

| Frequency Hz | Flux ($\Phi$) nWb/m [1)] | Relative level ($L_\Phi$) dB [2)] |
|---|---|---|
| 63 | 135.7 | – 5.6 |
| 80 | 118.7 | – 6.8 |
| 100 | 107.5 | – 7.7 |
| 125 | 99.6 | – 8.3 |
| 160 | 93.8 | – 8.9 |
| 200 | 90.4 | – 9.2 |
| 250 | 88.0 | – 9.4 |
| 315 | 86.4 | – 9.6 |
| 400 | 85.3 | – 9.7 |
| 500 | 84.5 | – 9.8 |
| 630 | 83.8 | – 9.8 |
| 800 | 83.1 | – 9.9 |
| 1000 | 82.2 | –10.0 |
| 1250 | 81.0 | –10.1 |
| 1600 | 79.2 | –10.3 |
| 2000 | 76.7 | –10.6 |
| 2500 | 73.4 | –11.0 |
| 3150 | 68.8 | –11.6 |
| 4000 | 62.7 | –12.4 |
| 5000 | 56.2 | –13.3 |
| 6300 | 48.8 | –14.5 |
| 8000 | 41.2 | –16.0 |
| 10 000 | 34.4 | –17.6 |
| 12 500 | 28.4 | –19.2 |
| 16 000 | 22.7 | –21.2 |

[1)] Calculated using the equation $\Phi = 260 \text{ antilog}_{10} (L_\Phi / 20)$.
[2)] Calculated using the equation given in 5.2.2.

### 5.2.3 Flux level variation

The short circuit flux recorded on the tape at each frequency, up to and including 10 kHz, shall be within ± 0.5 dB of the value specified in 5.2.2. Above 10 kHz, the tolerance shall be increased to ± 1 dB. The tolerance may be extended to ± 2 dB, provided that a calibration chart is supplied with the test tape by the manufacturer.

## 6 Calibration

### 6.1 Short circuit tape flux

The short circuit tape flux on the test tape shall be determined by means of the calibrated short-gap ferromagnetic core reproducer technique. This technique is described in the following references:

American National Standard Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths, ANSI S4.6-1982 (R1992).

McKnight, J.G. Flux and flux-frequency response measurements and standardization in magnetic recording. Journal of the SMPTE 78(6): 457-472; June 1969.

Lovick, R.C.; Bartow, R.E.; and Scheg, R.F. Recording and calibration of super-8 magnetic reproducer test films. Journal of the SMPTE 78(6): 473-481; June 1969.

### 6.2 Flux level variation

All flux level variations shall be measured with a meter or graphic level recorder which has a full-wave rectified average measurement law and the dynamics of the standard volume indicator (vu meter), as specified in ANSI/IEEE 152.

### 6.3 Weighted peak flutter

Weighted peak flutter shall be measured in accordance with ANSI S4.3.

NOTE – A guide to proper usage and an explanation of the calibration techniques shall be supplied with each test tape.