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# SMPTE RECOMMENDED PRACTICE

**RP 128-2002**

Revision of RP 128-1997

## Specifications for Audio Level and Multifrequency Test Film for 70-mm Striped Six-Track Release Print Audio Reproducers, Magnetic Type



Page 1 of 4 pages

### 1 Scope

This practice specifies an audio frequency test film to be used for adjusting the sensitivity and frequency response of 70-mm striped six-track motion-picture magnetic audio reproducers intended for release prints operating at 120 perforations per second or approximately 112 ft (34 m) per minute.

### 2 Normative references

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

AES 6-1982, Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment

AES 7-1982 (R1992), Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths

ANSI/SMPTE 185-1993, Motion-Picture Film (70-mm) — Six Magnetic Records on Release Prints — Position, Dimensions, Reproducing Speed and Identity

SMPTE 119-1999, Motion-Picture Film (70-mm) — Perforated 65-mm, KS-1870

SMPTE 223M-2001, Motion-Picture Film — Safety Film

### 3 Test film signal

#### 3.1 Frequencies

The audio record on the film shall be a recording which will reproduce at the frequencies specified in 6.4 when the linear speed of the film is 120 perforations per second or approximately 112 ft (34 m) per minute (22.4 in [56.9 cm] per second).

#### 3.2 Distortion

The total harmonic distortion of the recorded reference signal shall not exceed 0.2% (see 6.1).

#### 3.3 Audio record

The audio record shall be recorded in accordance with ANSI/SMPTE 185.

### **3.4 Signal fluctuations**

The signal levels shall not fluctuate more than  $\pm 0.5$  dB within each test section length.

### **3.5 Flutter**

The weighted peak flutter of the audio record shall not exceed  $\pm 0.04\%$  when measured in accordance with AES 6.

### **3.6 Azimuth**

The azimuth of the audio records shall be  $90^\circ \pm 3'$  to the reference edge of the film.

### **3.7 Signal identification**

Each test section and segment shall be preceded by voice announcements identifying the content at a level whose peak value does not exceed the peak level of the frequency series.

## **4 Film stock**

**4.1** The film stock shall be splice-free and of the low-shrinkage, safety type in compliance with SMPTE 223M, and striped in accordance with ANSI/SMPTE 185, unless full-coat stock is used.

**4.1.1** Test films shall be made on a base cut and perforated in accordance with dimensions specified in SMPTE 119. Test materials made on acetate shall be clearly marked with a usage date.

**4.2** The film stock shall be conditioned for 10 days at  $20^\circ\text{C} \pm 3^\circ\text{C}$  ( $68^\circ\text{F} \pm 5.4^\circ\text{F}$ ) at a relative humidity of  $(50 \pm 10)\%$  prior to recording.

**4.3** The film shall be recorded and packaged within the temperature and humidity limits specified in 4.2. The recorded film shall be packaged in a metal can and sealed either with a low-moisture permeability plastic tape or a fabric tape having a moisture barrier.

## **5 Identification**

Each test film shall be suitably identified to include the date of manufacture.

## **6 Test section**

### **6.1 Reference level**

A sine wave with a frequency of  $1000\text{ Hz} \pm 2\%$  shall be recorded ahead of the azimuth section, having an absolute short circuit recorded level of  $185\text{ nWb/m} \pm 10\text{ nWb/m}$  for a duration of approximately 30 seconds.

### **6.2 Azimuth**

A frequency of  $16\text{ kHz} \pm 2\%$  shall be recorded ahead of the pink noise section having an absolute short circuit recorded level of  $25.86\text{ nWb/m} \pm 10\text{ nWb/m}$  for a duration of approximately 30 seconds.

### **6.3 Pink noise**

The pink noise test signal used for this section shall have equal energy in equal logarithmic frequency intervals within the audio bandwidth. The lower limit shall correspond to the lower bandwidth of a 31.5 Hz-octave band filter of the ANSI class II type, and the upper limit to the upper bandwidth of a 16 kHz-octave band filter of the

ANSI class II type. (Test bandwidths must be within these limits). The level in each one-third octave band from 40 Hz to 12.5 kHz shall be the same within  $\pm 1$  dB. The pink noise signal shall be recorded so that there shall be a low statistical probability of the extreme peaks within the signal saturating the magnetic film. The peak level of the wide band pink noise spectrum shall be essentially equal to that of the corresponding frequency response test segments. The recorded pink noise shall have the characteristic specified in 6.5 and a duration of approximately 30 seconds. (The pink noise test may also be used for multitrack azimuth adjustment using an oscilloscope lissajous figure from the two outside prime tracks of multitrack equipment.)

#### 6.4 Frequency response

The 1000-Hz frequencies of this multifrequency section shall be recorded 6 dB below (92.50 nWb/m) the 185 nWb/m reference. The following test segment frequencies in hertz  $\pm 2\%$  shall be sine waves recorded in the order given:

1000, 31.5, 40, 63, 125, 250, 500, 1000, 2000, 4000, 6300, 8000, 10 000, 12 500, 14 000, 16 000, 1000.

#### 6.5 Recorded levels

With a constant-amplitude sine-wave signal applied to the input of the recording system, the relative characteristic in effective values of the short circuit magnetic flux versus frequency shall decrease with increasing frequency proportionately to the impedance of a parallel combination of a capacitance and a resistance having a time constant of  $\tau = 35 \mu\text{s}$  and  $3180 \mu\text{s}$ . (A time constant is a shorthand notation, such as illustrated by a frequency response curve, having a shape which results from a time constant of one or more microseconds. This is a convenient way of defining a response curve and is never intended as a recommended electrical circuit.)

The characteristic defined above is obtained by the following calculation:

$$L_{\Phi} = C_0 - 10 \log_{10} \left( \frac{1 + (2\pi\tau_h)^2 f^2}{1 + 1/[(2\pi\tau_l)^2 f^2]} \right)$$

where  $L_{\Phi}$  is the recorded relative short circuit magnetic flux level in decibels,  $f$  is the frequency in hertz for which  $L_{\Phi}$  is computed,  $\tau_l$  is a time constant of  $3180 \mu\text{s}$ ,  $\tau_h$  is a time constant of  $35 \mu\text{s}$ , and  $C_0$  is a constant with a value of 0.194 calculated to make  $L_{\Phi} = 0$  at the reference frequency of 1000 Hz. The approximate numerical values are given in table 1.

#### 6.6 Flux level variation

The film flux level at each frequency from 31.5 Hz through 16 kHz shall be within  $\pm 0.5$  dB of the value specified in 6.5. (See table 1.)

#### 6.7 Duration

The duration of frequency response test segments shall be approximately 10 seconds, except for the 16-kHz tone which shall be approximately 30 seconds for azimuth and high-frequency equalization adjustments.

**Table 1 - Flux levels versus frequency in nanowebers per meter and decibels**

Frequency, Hz f	Short circuit flux <sup>1)</sup> nWb/m	Relative level <sup>2)</sup> L <sub>Φ</sub>
1000	92.50	0
31.5	177.68	+ 5.67
40	133.86	+ 4.29
63	120.82	+ 2.32
125	101.89	+ 0.84
250	96.30	+ 0.35
500	94.55	+ 0.19
1000	92.50	0
2000	86.62	– 0.57
4000	71.06	– 2.29
6300	55.35	– 4.46
8000	46.73	– 5.93
10 000	39.14	– 7.47
12 500	32.33	– 9.13
14 000	29.22	–10.01
16 000	25.86	–11.07
1000	92.50	0
<sup>1)</sup> Calculated using the equation $\Phi = 92.50 \times \text{anilog}_{10} (L_{\Phi}/20)$ . <sup>2)</sup> Calculated using the equation given in 6.5.		

## 7 Calibration

### 7.1 Flux

The short circuit flux on the test film shall be determined by means of the calibrated short-gap ferromagnetic core reproducer technique. This technique is described in AES 7.

### 7.2 Level

The signal level specified in 3.4 shall be measured with an rms voltmeter calibrated in decibels with an accuracy of  $\pm 0.1$  dB over the bandwidth 31.5 Hz to 16 kHz.

### 7.3 Method

The test film shall be calibrated on a reproducing head made in accordance with ANSI/SMPTE 185.

NOTE – It has been shown that a straight 35  $\mu$ s curve should be used for maximum use of the magnetic medium. It is recognized, however, that it is necessary for the immediate future to continue to add 3180  $\mu$ s because some theater equipment is unable to compensate for the low end.