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RP 127-2004
Revision of RP 127-1999

SMPTE RECOMMENDED PRACTICE

Specifications for Type U Audio Level and Multifrequency Test Film for 35-mm Studio Audio Reproducers, Magnetic Full-Coat Type

1 Scope

This practice specifies a type U (see 6.1) audio frequency test film to be used for adjusting the sensitivity and frequency response of 35-mm motion-picture magnetic studio audio reproducers operating at 96 perforations per second or approximately 90 ft (27 m) per minute for use with one-, three-, four-, and six-track audio systems.

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.

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 86-1996, Motion-Picture Film — Magnetic Audio Records — Two, Three, Four and Six Records on 35-mm and One Record on 17.5-mm Magnetic Film

SMPTE 139-2003, Motion-Picture Film (35-mm) — Perforated KS

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

3 Test film signal

3.1 Frequencies

The audio record shall be a recording which will reproduce at the frequencies specified in 6.4 when the linear speed of the film is 96 perforations per second or approximately 90 ft (27 m) per minute (18 in or 45.7 cm per second).

3.2 Distortion

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

3.3 Audio record

The audio record shall be recorded so that it extends from one edge of the film to the other.

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3.4 Signal fluctuations

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

3.5 Flutter

The weighted peak flutter of the audio record shall not exceed ± 0.04% when measured in accordance with ANSI S4.3.

3.6 Azimuth

The azimuth of the audio records shall be 90° ± 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 peak level of the frequency series.

4 Film stock

4.1 The film stock shall be full-coat, splice-free, and of the low-shrinkage, safety type in compliance with SMPTE 223M.

4.1.1 Test films shall be cut and perforated in accordance with dimensions specified in SMPTE 139.

4.2 The film stock shall be conditioned for 10 days at 20°C ± 3°C (68°F ± 5.4°F) at a relative humidity of (50 ± 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 sections

6.1 Reference level

A sine wave with a frequency of 1000 Hz ± 2% shall be recorded ahead of the azimuth section, having an absolute short circuit record level of 185 nWb/m ± 10 nWb/m, for a duration of approximately 30 seconds. (This film is classified as a type U by the ISO because of the 185 nWb reference level, as compared with the type E which specifies a 320 nWb reference level.)

6.2 Azimuth

A frequency of 16 kHz ± 2% shall be recorded ahead of the pink noise section having an absolute short circuit recorded level of 25.89 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 ± 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 may also be used for multitrack azimuth adjustment using an oscilloscope lissajous figure from the two outside tracks of multitrack equipment.)

6.4 Frequency response

The 1000-Hz frequencies of this multifrequency section shall be recorded at the reference level of 185 nWb/m. The following test segment frequencies in hertz ± 2% shall be sine waves recorded in the order given:

1000, 31.5, 40, 50, 80, 100, 160, 400, 1000, 2500, 4000, 6300, 8000, 10 000, 12 500, 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 $\tau = 35\ \mu s$. (A time constant is a shortband 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:

$$L_\phi \text{ re } 185 \text{ nWb/m} = 0.20511 - 10 \log_{10} [1 + (2\pi\tau)^2 f^2] \text{ dB}$$

where L_ϕ is the recorded relative short-circuit magnetic flux level in decibels, f is the frequency in hertz for which L_ϕ is computed, τ is a time constant of 35 μs, and 0.20511 is a constant 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 ± 0.5 dB of the value specified in 6.5.

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 adjustment.

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

Frequency, Hz f	Short circuit flux[1] nWb/m	Relative level[2] L_ϕ
1000	185.00	0.00
31.5	189.42	+ 0.20
40	189.41	+ 0.20
50	189.41	+ 0.20
80	189.39	+ 0.20
100	189.37	+ 0.20
160	189.30	+ 0.20
400	188.69	+ 0.17
1000	185.00	0.00
2500	165.99	– 0.94
4000	142.23	– 2.28
6300	110.86	– 4.45
8000	93.60	– 5.92
10 000	78.41	– 7.46
12 500	64.76	– 9.12
16 000	51.78	–11.06
1000	185.00	0.00

[1]Calculated using the equation $\phi = 185 \times \text{antilog}_{10} (L_\phi/20)$.
[2]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 ANSI S4.6.

7.2 Level

The signal level measurements specified in 3.4 shall be measured with an rms voltmeter calibrated in decibels with an accuracy of ± 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 86.