PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 127

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 5.1) 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 90 perforations per second or approximately 90 ft (27 m) per minute for use with one-, three-, four-, and six-track audio systems.

2. *Test Film Signal*

2.1 Frequencies. The audio record shall be a recording which will reproduce at the frequencies specified in Sec. 3 when the linear speed of the film is 90 perforations per second or approximately 90 ft (27 m) per minute (18 in or 45.7 cm per second).

2.2 Distortion. The total harmonic distortion of the recorded reference signal (see 5.1) shall not exceed 0.2 percent.

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

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

2.5 Flutter. The weighted peak flutter of the audio record shall not exceed ± 0.04 percent when measured in accordance with American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, ANSI/IEEE 193-1971.

2.6 Azimuth. The azimuth of the audio records shall be 90° ± 3′ to the reference edge of the film.

2.7 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.

3. *Film Stock*

3.1 The film stock shall be full-coat, splice-free and of the low-shrinkage, safety type in compliance with American National Standard Specifications for Motion-Picture Safety Film, ANSI PH22.31M-1980.

3.1.1 Test films shall be cut and perforated in accordance with dimensions specified in American National Standard Dimensions for 35-mm Motion-Picture Film Perforated KS, ANSI PH22.-139-1980.

3.2 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 percent prior to recording.

3.3 The film shall be recorded and packaged within the temperature and humidity limits specified in 3.2. 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.

4. *Identification*

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

5. *Test Sections*

5.1 Reference Level. A sine wave with a frequency of 1000 Hz ± 2 percent shall be recorded ahead of the azimuth section, having an absolute short circuit recorded level of 185 ± 10 nanowebers per meter, for a duration of approximately 30 seconds. (This film is classified as a Type U by the ISO because of the 185 nanoweber reference level, as compared with the Type E which specifies a 320 nanoweber reference level.)

5.2 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.

5.3 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 5.5 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.)

5.4 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 ± 2 percent 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.

5.5 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 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:

$$L_\phi \text{ re } 92.50 \text{ nWb/m} = 0.205 - 10 \log_{10} [1 + (2\pi\tau)^2 f^2] \text{ dB}$$

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 0.205 is a constant calculated to make $L_\phi = 0$ at the reference frequency of 1000 Hz. The approximate numerical values are given in the table.

5.6 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 5.5.

5.7 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.

Flux Levels Versus Frequency in Nanowebers per Meter and Decibels

Frequency, Hz f	Short Circuit Flux* nWb/m	Relative Level† L_ϕ
1000	92.50	0.00
31.5	94.71	+ 0.20
40	94.71	+ 0.20
50	94.71	+ 0.20
80	94.70	+ 0.20
100	94.69	+ 0.20
160	94.65	+ 0.20
400	94.35	+ 0.17
1000	92.50	0.00
2500	82.99	— 0.94
4000	71.11	— 2.28
6300	55.43	— 4.45
8000	46.80	— 5.92
10 000	39.20	— 7.46
12 500	32.38	— 9.12
16 000	25.89	—11.06
1000	92.50	0.00

*Calculated using the equation $\phi = 92.50 \times \text{antilog}_{10} (L_\phi / 20)$.
†Calculated using the equation given in 5.5.

6. *Calibration*

6.1 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 American National Standard Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths, ANSI/IEEE 347-1982.

6.2 Level. The signal level measurements specified in 2.4 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.

6.3 Method. The test film shall be calibrated on a reproducing head made in accordance with American National Standard Position, Dimensions and Reproducing Speed of Three 200-Mil Magnetic Sound Records on 35-mm and One Record on 17.5-mm Motion-Picture Film, ANSI PH22.86-1981.

NOTE: A signal level (reference level) test film and a multifrequency test film, made in accordance with this practice and recorded across the width of the film from edge to edge on polyester and triacetate materials, are available from the Society of Motion Picture and Television Engineers.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 128

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

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. *Test Film Signal*

2.1 Frequencies. The audio record on the film shall be a recording which will reproduce at the frequencies specified in Sec. 3 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).

2.2 Distortion. The total harmonic distortion of the recorded reference signal shall not exceed 0.2 percent. (See 5.1.)

2.3 Audio Record. The audio record shall be recorded in accordance with American National Standard Position, Dimensions and Reproducing Speed of Six Magnetic Sound Records on 70-mm Motion-Picture Release Prints, ANSI PH22.185-1980.

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

2.5 Flutter. The weighted peak flutter of the audio record shall not exceed ± 0.04 percent when measured in accordance with American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, ANSI/IEEE 193-1971.

2.6 Azimuth. The azimuth of the audio records shall be 90° ± 3′ to the reference edge of the film.

2.7 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.

3. *Film Stock*

3.1 The film stock shall be splice-free and of the low-shrinkage, safety type in compliance with American National Standard Specifications for Motion-Picture Safety Film, ANSI PH22.31M-1980, and striped in accordance with ANSI PH22.185-1980 unless full-coat stock is used.

3.1.1 Test films shall be made on a base cut and perforated in accordance with dimensions specified in American National Standard Dimensions for 70-mm Motion-Picture Film Perforated 65-mm, KS-1870, ANSI PH22.119-1981.

3.2 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 percent prior to recording.

3.3 The film shall be recorded and packaged within the temperature and humidity limits specified in 3.2. 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.

4. *Identification*

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

5. *Test Section*

5.1 Reference Level. A sine wave with a frequency of 1000 Hz ± 2 percent shall be recorded ahead of the azimuth section, having an absolute short circuit recorded level of 185 ± 10 nanowebers per meter, for a duration of approximately 30 seconds.

5.2 Azimuth. A frequency of 16 kHz ± 2%, shall be recorded ahead of the pink noise section having an absolute short circuit recorded level of 25.86 ± 10 nWb/m for a duration of approximately 30 seconds.

5.3 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 5.5 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.)

5.4 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 ± 2 percent 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.

5.5 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 $\tau = 35$ μs and 3180 μs. (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:

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

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, $\tau_{\mathfrak{L}}$ is a time constant of 3180 μs, τ_h is a time constant of 35 μs, 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 the table.

5.6 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 5.5.

5.7 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.

Flux Levels Versus Frequency in Nanowebers per Meter and Decibels

Frequency, Hz f	Short Circuit Flux* nWb/m	Relative Level† L_ϕ
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

*Calculated using the equation $\phi = 92.50 \times \text{antilog}_{10} (L_\phi/20)$.
†Calculated using the equation given in Section 5.5.

6. *Calibration*

6.1 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 American National Standard Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths, ANSI/IEEE 347-1982.

6.2 Level. The signal level measurements specified in 2.4 shall be measured with an RMS voltmeter calibrated in decibles with an accuracy of ± 0.1 dB over the bandwidth 31.5 Hz to 16 kHz.

6.3 Method. The test film shall be calibrated on a reproducing head made in accordance with ANSI PH22.185-1980.

Note: It has been shown that a straight 35 μs 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 μs because some theater equipment is unable to compensate for the low end.