American National Standard

specifications for an audio operating level and multifrequency test tape for quadruplex video magnetic tape recorders operating at 15 in/s (381 mm/s)

Approved June 22, 1977

Secretariat: Society of Motion Picture and Television Engineers

1. Scope

This standard specifies an audio frequency test tape to be used for adjusting the sensitivity and the frequency response of the program audio reproducing system and adjusting the sensitivity of Audio Record No. 2 (cue track) of quadruplex video magnetic tape recorders operating at a tape speed of 15 in/s (381 mm/s), in accordance with American National Standard Frequency Response and Operating Level of Recorders and Reproducers for Audio Record One for 2-inch Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s, C98.3-1973.

2. General Specifications

2.1 Dimensions of Records. The dimensions of pertinent records constituting this test tape shall conform to American National Standard Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, C98.6-1973.

2.2 Tape Speed. The nominal linear speed of this test tape shall be 15 in/s (381 mm/s) in accordance with American National Standard Speed of 2-in Tape for Quadruplex Video Magnetic Tape Recording, C98.4-1970 (R1976).

2.3 Stock. The test sections shall be recorded on transversely-oriented television magnetic recording tape, the dimensions of which are specified in American National Standard Dimensions of 2-in Video Magnetic Tape, C98.1-1963 (R1976).

2.4 Video Signal. No video signal of any kind shall be recorded.

2.5 Tracking Control Signal. A tracking control signal, conforming to that specified in SMPTE Recommended Practice on Specifications of Tracking Control Record for 2-in Quadruplex Video Magnetic Tape Recordings, RP 16-1977, as applicable, shall be recorded throughout the tape.

2.6 Test sections shall be recorded on Audio Record No. 1.

2.7 A 1000 Hz ± 2 percent tone shall be recorded throughout the length of the tape on Audio Record No. 2 at a shortcircuit tape flux per unit track width of 260 ± 10 nanowebers per meter.

2.8 Voice announcement at the beginning of this tape shall provide identification as to the applicable American National Standard, the test tape manufacturer, the flux, in nanowebers per meter, of the operating level test tone defined in Sec. 3.1 recorded on Audio Record No. 1 and the test tone defined in Sec. 2.7 on Audio Record No. 2. Each test section and segment shall be preceded by voice announcements identifying the content. Voice announcements shall be recorded on Audio Record No. 1 only at a level approximately 5 dB below operating level. (See 3.1 below.)

2.9 Weighted Peak Flutter. The weighted peak flutter of this test tape shall not exceed 0.2 percent.

3. Test Sections

3.1 SMPTE Quadruplex Audio Operating Level Test. Recorded on Audio Record No. 1, this section is used to calibrate the sensitivity of an audio reproducing system.

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

3.1.2 Tape Flux Per Unit Track Width. The SMPTE Quadruplex Audio Operating Level Test recording has an rms shortcircuit tape flux per unit track width of 110 ± 3 nanowebers per meter. (110 nWb/m corresponds to 110 pWb/mm and 11 mMx/mm.)

3.1.3 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.

3.1.4 Distortion. The total harmonic distortion of this section, when reproduced, shall not exceed 2 percent.

3.1.5 Duration. The minimum duration of this section shall be one minute.

3.2 Frequency Response Test. Recorded on Audio Record No. 1, this section is to be used to calibrate the frequency response of the audio reproducing system of a video magnetic tape recorder.

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

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

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

3.2.2 Tape Flux Level vs Frequency. The relative shortcircuit tape flux level versus frequency expressed in dB shall be as given by the following equation:

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

where L_Φ is the relative tape flux level; f is the frequency at which the response is being computed; F_t 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 the figure. A table of values of the tape flux and relative flux level is also given.

3.2.3 Flux Level Variation. The shortcircuit flux recorded on the tape at each frequency shall be within ± 0.5 dB of the value specified in Sec. 3.2.2. 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.

3.2.4 Test Calibration. The calibration values in dB 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 shortcircuit flux on the test tape at a given frequency had been exactly as specified in Sec. 3.2.2 and shown in the table.

3.2.5 Duration. The duration of frequency response test segments shall be approximately ten seconds.

3.3 Azimuth. The azimuth of the audio record shall be 90° ± 3′ to the reference edge of the tape.

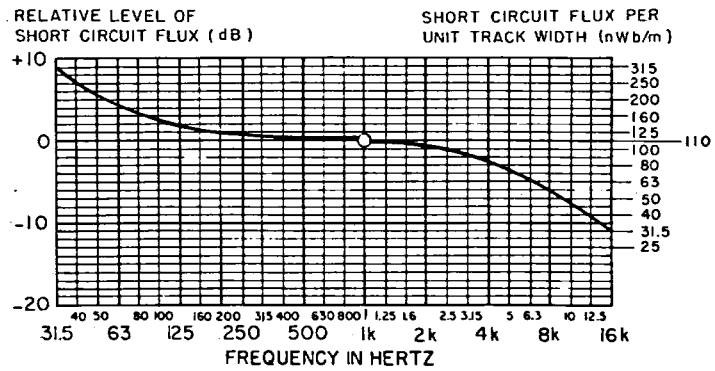
4. Calibration

4.1 Calibration of Shortcircuit Tape Flux. The shortcircuit 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, S4.6-1973.

J. G. McKnight, "Flux and flux-frequency response measurements and standardization in magnetic recording," J. SMPTE, 78: 457-472, June 1969.

R. C. Lovick, R. E. Bartow and R. F. Scheg, "Recording and calibration of super-8 magnetic reproducer test films," J. SMPTE, 78: 473-481, June 1969.



Shortcircuit Tape Flux Per Unit Track Width and Relative Level vs Frequency

FLUX AND FLUX LEVEL VERSUS FREQUENCY

Frequency Hz	nWb/m*	Relative Level dB†
63	182	+4.4
80	159	+3.2
100	144	+2.3
125	134	+1.7
160	126	+1.2
200	121	+0.8
250	118	+0.6
315	116	+0.4
400	114	+0.3
500	113	+0.3
630	112	+0.2
800	111	+0.1
1000	110	0.0
1250	109	−0.1
1600	106	−0.3
2000	103	−0.6
2500	98.4	−1.0
3150	92.2	−1.5
4000	84.1	−2.3
5000	75.3	−3.3
6300	65.4	−4.5
8000	55.2	−6.0
10 000	46.2	−7.5
12 500	38.1	−9.2
16 000	30.5	−11.1

*Calculated using the equation $\log_{10}\Phi = L\Phi/20 + \log_{10}110$.
†Calculated using the equation given in Sec. 3.2.2.

4.2 Flux Level Variation Measurements. 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 American National Standard Volume Measurements of Electrical Speech and Program Waves, ANSI/IEEE Std 152-1953 (R1976).

4.3 Weighted Peak Flutter Measurement. Weighted peak flutter shall be measured in accordance with American National Standard Method of Measurement for Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. A guide to proper usage and an explanation of the calibration techniques should be supplied with each test tape.

A2. Although stated in a different way, the flux specified in Sec. 3.1.2 is the same as previously standardized in American National Standard Specifications for a Primary Audio Reference Level Recording for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s, C98.7-1969, and the flux/frequency response given in Sec. 3.2.2. is the same as that standardized in American National Standard Electrical Characteristics of Audio Record One for 2-in Quadruplex Video Magnetic Tape Recording at 15 and 7.5 in/s, C98.3-1970.

ANSI C98.11-1977
Revision of C98.11-1974

American National Standard specifications for an audio operating level and multifrequency test tape for quadruplex video magnetic tape recorders operating at 7.5 in/s (190.5 mm/s)

Approved June 22, 1977

Secretariat: Society of Motion Picture and Television Engineers

1. Scope

This standard specifies an audio frequency test tape to be used for adjusting the sensitivity and the frequency response of the program audio reproducing system and adjusting the sensitivity of Audio Record No. 2 (cue track) of quadruplex video magnetic tape recorders operating at a tape speed of 7.5 in/s (190.5 mm/s), in accordance with American National Standard Frequency Response and Operating Level of Recorders and Reproducers for Audio Record One for 2-inch Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s, C98.3-1973.

2. General Specifications

2.1 Dimensions of Records. The dimensions of pertinent records constituting this test tape shall conform to American National Standard Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, C98.6-1973.

2.2 Tape Speed. The nominal linear speed of this test tape shall be 7.5 in/s (190.5 mm/s) in accordance with American National Standard Speed of 2-in Tape for Quadruplex Video Magnetic Tape Recording, C98.4-1970 (R1976).

2.3 Stock. The test sections shall be recorded on transversely-oriented television magnetic recording tape, the dimensions of which are specified in American National Standard Dimensions of 2-in Video Magnetic Tape, C98.1-1963 (R1976).

2.4 Video Signal. No video signal of any kind shall be recorded.

2.5 Tracking Control Signal. A tracking control signal, conforming to that specified in SMPTE Recommended Practice on Specifications of Tracking Control Record for 2-in Quadruplex Video Magnetic Tape Recordings, RP 16-1977, as applicable, shall be recorded throughout the tape.

2.6 Test sections shall be recorded on Audio Record No. 1.

2.7 A 1000 Hz ± 2 percent tone shall be recorded throughout the length of the tape on Audio Record No. 2 at a shortcircuit tape flux per unit track width of 260 ± 10 nanowebers per meter.

2.8 Voice announcement at the beginning of this tape shall provide identification as to the applicable American National Standard, the test tape manufacturer, the flux, in nanowebers per meter, of the operating level test tone defined in Sec. 3.1 recorded on Audio Record No. 1 and the test tone defined in Sec. 2.7 on Audio Record No. 2. Each test section and segment shall be preceded by voice announcements identifying the content. Voice announcements shall be recorded on Audio Record No. 1 only at a level approximately 5 dB below operating level. (See 3.1 below.)

2.9 Weighted Peak Flutter. The weighted peak flutter of this test tape shall not exceed 0.2 percent.

3. Test Sections

3.1 SMPTE Quadruplex Audio Operating Level Test. Recorded on Audio Record No. 1, this section is used to calibrate the sensitivity of an audio reproducing system.

3.1.1 Frequency. The frequency of the recording shall be 1000 Hz ± 2 percent when the tape is reproduced at exactly 7.5 in/s (190.5 mm/s).

3.1.2 Tape Flux Per Unit Track Width. The SMPTE Quadruplex Audio Operating Level Test recording has an rms shortcircuit tape flux per unit track width of 110 ± 3 nanowebers per meter. (110 nWb/m corresponds to 110 pWb/mm and 11 mMx/mm.)

3.1.3 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.

3.1.4 Distortion. The total harmonic distortion of this section, when reproduced, shall not exceed 2 percent.

3.1.5 Duration. The minimum duration of this section shall be one minute.

3.2 Frequency Response Test. Recorded on Audio Record No. 1, this section is to be used to calibrate the frequency response of the audio reproducing system of a video magnetic tape recorder.

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

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

The frequency of each recording shall be ± 2 percent of its specified value when the tape is reproduced at exactly 7.5 in/s (190.5 mm/s).

3.2.2 Tape Flux Level vs Frequency. The relative shortcircuit tape flux level versus frequency expressed in dB shall be as given by the following equation:

$$L_\Phi(f)\ \text{re}\ 110\ \text{nWb/m} = -9.8 + 10\log_{10}\left\{[1+(f_1/f)^2]/[1+(f/F_h)^2]\right\}\ [\text{dB}]$$

where L_Φ is the relative tape flux level; f is the frequency at which the response is being computed; F_1 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 the figure. A table of values of the tape flux and relative flux level is also given.

3.2.3 Flux Level Variation. The shortcircuit 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 Sec. 3.2.2. Above 10 kHz, the tolerance shall be increased to ± 1.0 dB. The tolerances may be extended to ± 2 dB provided that a calibration chart is supplied with the test tape by the manufacturer.

3.2.4 Test Calibration. The calibration values in dB 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 shortcircuit flux on the test tape at a given frequency had been exactly as specified in Sec. 3.2.2 and shown in the table.

3.2.5 Duration. The duration of frequency response test segments shall be approximately ten seconds.

3.3 Azimuth. The azimuth of the audio record shall be 90° ± 3′ to the reference edge of the tape.

4. Calibration

4.1 Calibration of Shortcircuit Tape Flux. The shortcircuit 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:

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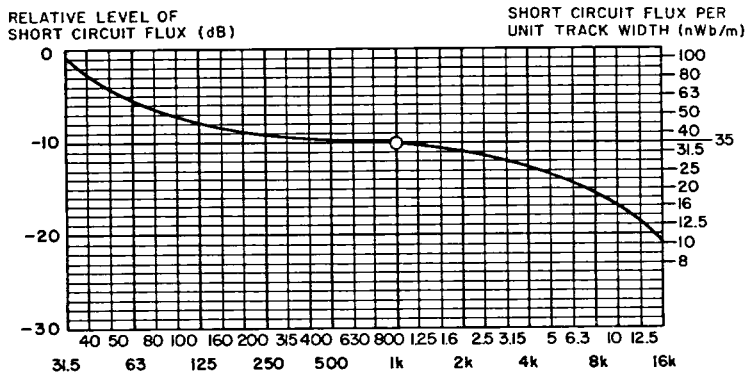

Shortcircuit Tape Flux Per Unit Track Width and Relative Level vs Frequency

FLUX AND FLUX LEVEL VERSUS FREQUENCY

Frequency Hz	nWb/m*	Relative Level dB†
63	57.5	—5.6
80	50.3	—6.8
100	45.6	—7.7
125	42.2	—8.3
160	39.8	—8.8
200	38.3	—9.2
250	37.3	—9.4
315	36.6	—9.5
400	36.2	—9.7
500	35.8	—9.7
630	35.5	—9.8
800	35.2	—9.9
1000	34.9	—10.0
1250	34.3	—10.1
1600	33.6	—10.3
2000	32.6	—10.6
2500	31.1	—11.0
3150	29.2	—11.5
4000	26.6	—12.3
5000	23.8	—13.3
6300	20.7	—14.5
8000	17.5	—16.0
10 000	14.6	—17.5
12 500	12.1	—19.2
16 000	9.6	—21.1

*Calculated using the equation $\log_{10}\Phi = L\Phi/20 + \log_{10}110$.
†Calculated using the equation given in Sec. 3.2.2.

4.2 Flux Level Variation Measurements. 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 American National Standard Volume Measurements of Electrical Speech and Program Waves, ANSI/IEEE Std 152-1953 (R1976).

4.3 Weighted Peak Flutter Measurement. Weighted peak flutter shall be measured in accordance with American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

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A2. Although stated in a different way, the flux specified in Sec. 3.1.2 is the same as previously standardized in American National Standard Specifications for a Primary Audio Reference Level Recording for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s, C98.10-1969, and the flux/frequency response given in Sec. 3.2.2 is the same as that standardized in American National Standard Electrical Characteristics of Audio Record One for 2-in Quadruplex Video Magnetic Tape Recording at 15 and 7.5 in/s, C98.3-1970.