ANSI V98.8-1982
Revision and Redesignation of ANSI C98.8-1977

American National Standard specifications for an audio operating level and multifrequency test tape for quadruplex video magnetic tape recorders operating at 15 in/s

Approved June 3, 1982

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 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 American National Standard Frequency Response and Operating Level of Recorders and Reproducers for Audio 1 Record for 2-in Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s, ANSI V98.3-1980. The operating level and frequency response for audio 2 record is specified in SMPTE Recommended Practice on 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, RP 102-1981.

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-in Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, ANSI V98.6-1981.

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, ANSI 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 Recording Tape, ANSI C98.1-1978.

2.4 Video Signal. A color black video signal may 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 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 Sec. 3.1 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.

2.7 Flutter. The weighted peak flutter of this test tape shall not exceed 0.2 percent.

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

3. Audio 1 Record Test Sections

3.1 Audio Operating Level Section. This section is used to calibrate the sensitivity of the 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 audio operating level test recording has an rms short circuit tape flux per unit track width of 110 ± 3 nWb/m.

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 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.

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

$$L_\Phi(f) \text{ re } 110 \text{ nWb/m} = 0.2 + 10 \log_{10} \{ [1 + (F_1/f)^2]/[1 + (f/F_h)^2] \} \text{ [dB]}$$

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 Fig. 1. A table of values of the tape flux and relative flux level is given in Table 1.

3.2.3 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 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 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 Sec. 3.2.2 and shown in Table 1.

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

4. Audio 2 Record Test Sections

4.1 Audio Operating Level Section. This section is used to calibrate the sensitivity of the audio (cue) reproducing system.

4.1.1 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).

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 260 ± 7 nWb/m.

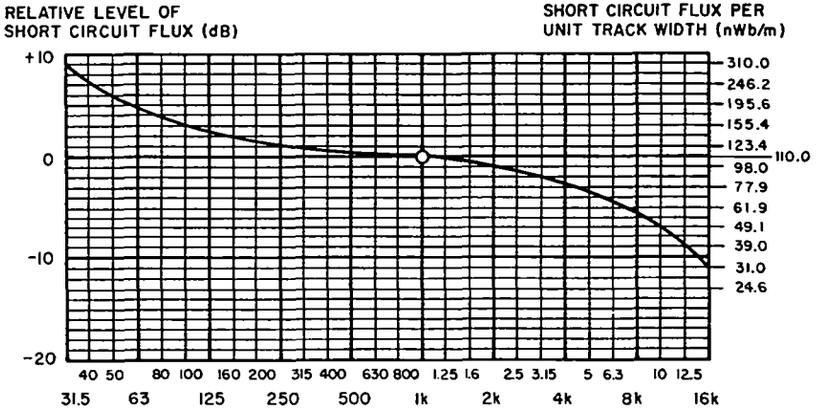

Fig. 1
Short Circuit Tape Flux Per Unit Track Width and Relative Level vs Frequency for Audio 1 Record

Table 1
Flux and Flux Level Versus Frequency

Frequency Hz	Flux (Φ) nWb/m*	Relative Level (LΦ) dB†
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

*Calculated using the equation $\Phi = 110\ \text{antilog}_{10}(L\Phi/20)$.
†Calculated using the equation given in Sec. 3.2.2.

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

4.1.4 Distortion. The total harmonic distortion of this section when reproduced shall not exceed 5 percent.

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

4.2 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.

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 percent 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 given by the following equation:

$$L_\Phi(f)\ \text{re}\ 260\ \text{nWb/m} = -9.8 + 10\log_{10}\left\{[1+(F_1/f)^2]/[1+(f/F_h)^2]\right\}\ [\text{dB}]$$

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 Fig. 2. A table of values of the tape flux and relative flux level is given in Table 2.

4.2.3 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 Sec. 4.2.2. 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.

5. Calibration

5.1 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/IEEE Std 347-1972.

MC KNIGHT, J. G. Flux and flux-frequency response measurements and standardization in magnetic recording. Jour. SMPTE, vol 78, no. 6, June 1969, pp 457-472.

LOVICK, R.C.; BARTOW, R. E.; and SCHEG, R. F. Recording and calibration of super-8 magnetic reproducer test films. Jour. SMPTE, vol 78, no. 6, June 1969, pp 473-481.

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

5.3 Weighted Peak Flutter. 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, ANSI/IEEE Std 193-1971.

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

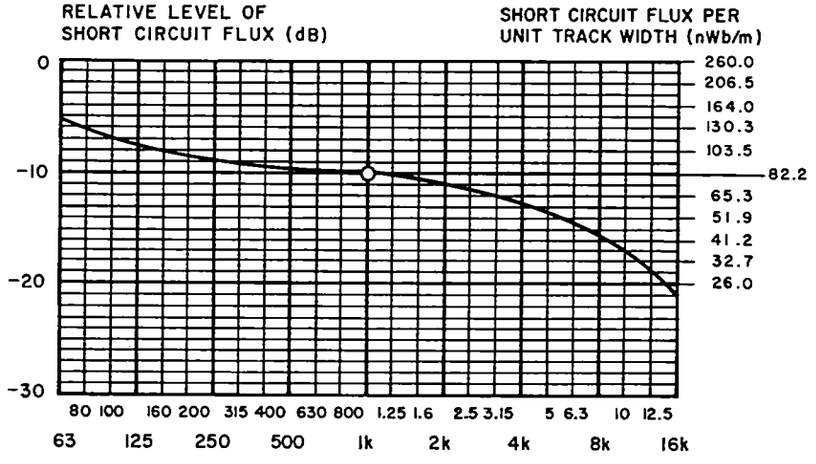

Fig. 2
Short Circuit Tape Flux Per Unit Track Width and Relative Level vs Frequency for Audio 2 Record

Table 2
Flux and Flux Level Versus Frequency

Frequency Hz	Flux (Φ) nWb/m*	Relative Level (LΦ) dB†
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

*Calculated using the equation $\Phi = 260\ \text{antilog}_{10}(L\Phi/20)$.
†Calculated using the equation given in Sec. 4.2.2.

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

Approved June 3, 1982
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 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 7.5 in/s (190.5 mm/s). The tape shall be used on recorders operating in accordance with American National Standard Frequency Response and Operating Level of Recorders and Reproducers for Audio 1 Record for 2-in Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s, ANSI V98.3-1980. The operating level and frequency response for audio 2 record is specified in SMPTE Recommended Practice on 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, RP 102-1981.

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-in Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, ANSI V98.6-1981.

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, ANSI 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 Recording Tape, ANSI C98.1-1978.

2.4 Video Signal. A color black video signal may 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 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 Sec. 3.1 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.

American National Standards Institute, 1430 Broadway, New York, N.Y. 10018
Reprinted with permission of the Society of Motion Picture and Television Engineers.

2.7 Flutter. The weighted peak flutter of this test tape shall not exceed 0.2 percent.

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

3. Audio 1 Record Test Sections

3.1 Audio Operating Level Section. This section is used to calibrate the sensitivity of the 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 audio operating level test recording has an rms short circuit tape flux per unit track width of 110 ± 3 nWb/m.

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 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.

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

$$L_\Phi(f) \text{ re } 110 \text{ nWb/m} = -9.8 + 10 \log_{10} \left\{ [1 + (F_1/f)^2]/[1 + (f/F_2)^2] \right\} \text{[dB]}$$

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_2 is the high-frequency transition frequency, 4500 Hz. A graph of this equation is shown in Fig. 1. A table of values of the tape flux and relative flux level is given in Table 1.

3.2.3 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 Sec. 3.2.2. 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.

3.2.4 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 Sec. 3.2.2 and shown in Table 1.

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

4. Audio 2 Record Test Sections

4.1 Audio Operating Level Section. This section is used to calibrate the sensitivity of the audio (cue) reproducing system.

4.1.1 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).

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 260 ± 7 nWb/m.

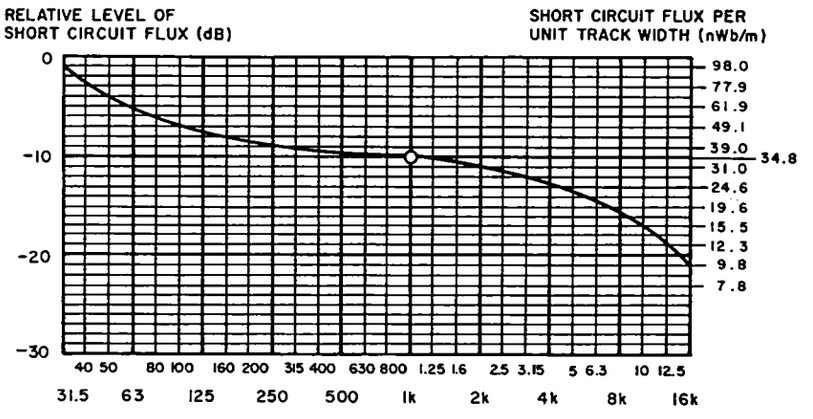

Fig. 1
Short Circuit Tape Flux Per Unit Track Width and Relative Level vs Frequency for Audio 1 Record

Table 1
Flux and Flux Level Versus Frequency

Frequency Hz	Flux (Φ) nWb/m*	Relative Level (LΦ) dB†
63	57.4	—5.6
80	50.2	—6.8
100	45.5	—7.7
125	42.2	—8.3
160	39.7	—8.9
200	38.2	—9.2
250	37.2	—9.4
315	36.6	—9.6
400	36.1	—9.7
500	35.8	—9.8
630	35.5	—9.8
800	35.2	—9.9
1000	34.8	—10.0
1250	34.3	—10.1
1600	33.5	—10.3
2000	32.5	—10.6
2500	31.1	—11.0
3150	29.1	—11.6
4000	26.5	—12.4
5000	23.8	—13.3
6300	20.7	—14.5
8000	17.4	—16.0
10 000	14.6	—17.6
12 500	12.0	—19.2
16 000	9.6	—21.2

*Calculated using the equation $\Phi = 110 \text{ antilog}_{10}(L\Phi/20)$.
†Calculated using the equation given in Sec. 3.2.2.

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

4.1.4 Distortion. The total harmonic distortion of this section when reproduced shall not exceed 5 percent.

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

4.2 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.

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 percent of its specified value when the tape is reproduced at exactly 7.5 in/s (190.5 mm/s).

4.2.2 Tape Flux Level vs Frequency. The relative short circuit tape flux level versus frequency expressed in decibels shall be given by the following equation:

$$L_\Phi(f) \text{ re } 260 \text{ nWb/m} = -9.8 + 10 \log_{10} \{ [1 + (F_1/f)^2]/[1 + (f/F_h)^2] \} \text{ [dB]}$$

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 Fig. 2. A table of values of the tape flux and relative flux level is given in Table 2.

4.2.3 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 Sec. 4.2.2. 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.

5. Calibration

5.1 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/IEEE Std 347-1972.

MC KNIGHT, J. G. Flux and flux-frequency response measurements and standardization in magnetic recording. Jour. SMPTE, vol 78, no. 6, June 1969, pp 457-472.

LOVICK, R. C.; BARTOW, R.E.; and SCHEG, R. F. Recording and calibration of super-8 magnetic reproducer test films. Jour. SMPTE, vol 78, no. 6, June 1969, pp 473-481.

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

5.3 Weighted Peak Flutter. 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, ANSI/IEEE Std 193-1971.

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

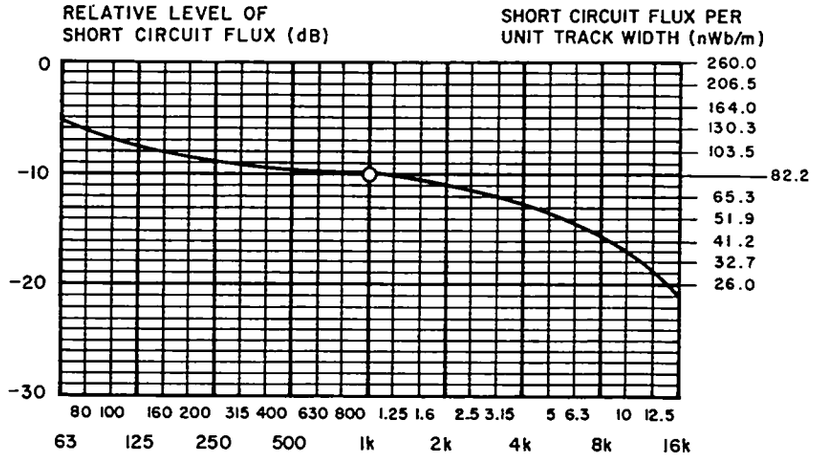

Fig. 2
Short Circuit Tape Flux Per Unit Track Width and Relative Level vs Frequency for Audio 2 Record

Table 2
Flux and Flux Level Versus Frequency

Frequency Hz	Flux (Φ) nWb/m*	Relative Level (LΦ) dB†
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

*Calculated using the equation $\Phi = 260 \text{ antilog}_{10} (L\Phi/20)$.
†Calculated using the equation given in Sec. 4.2.2.