Table 1
Record Location and Dimensions

	Dimensions	Millimeters Minimum	Maximum
A	Audio 3 lower edge	0.050	0.150
B	Audio 3 upper edge	0.825	0.975
C	Sync track lower edge	1.385	1.445
D	Sync track upper edge	2.680	2.740
E	Control track lower edge	2.870	3.130
F	Control track upper edge	3.430	3.770
G	Video track lower edge	3.870	3.910
H	Video track upper edge	22.385	22.445
J	Audio 1 lower edge	22.770	22.830
K	Audio 1 upper edge	23.525	23.675
L	Audio 2 lower edge	24.325	24.475
M	Audio 2 upper edge	25.150	25.250
N	Video and sync track width	0.128	0.132
P	Video offset	4.067 ref (2.5H)	
Q	Video track pitch	0.1823 ref	
R	Video track length	410.764 ref (252.5H)	
S	Control track head distance	101.8	102.2
T	Vertical position, odd field	1.220 (0.75H)	2.030 (1.25H)
U	Vertical position, even field	2.030 (1.25H)	2.850 (1.75H)
V	Sync track length	25.620 (15.75H)	26.420 (16.25H)
W	Vertical position, odd sync field	22.360 (13.75H)	23.170 (14.25H)
X	Vertical position, even sync field	23.170 (14.25H)	23.980 (14.75H)
Y	Vertical head offset	1.529 ref	
Z	Horizontal head offset	35.350 ref	
θ	Track angle	2°34′ ref	

6.3 The vertical interval dropout location with respect to a television frame is determined by the phase dimension, T, measured from the start of video to the negative-going edge of line 16 H-sync in odd-numbered fields.

6.4 The start and end of the sync record must be produced by electronic switching of the recording signal due to geometric constraints. (See American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Recording, ANSI C98.18M-1979.) Phasing of the sync record electronic switching shall be as per phase dimensions V and W in odd-numbered fields.

6.5 Even-numbered fields have a different video and sync phasing (Dimensions U and X) due to the odd number of lines in a television frame.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 99

Video and Audio Reference Tape for 1-in Type C Helical-Scan Video Tape Recorders

1. *Scope*

1.1 This practice specifies a video and audio reference tape to be used with 1-in Type C helical-scan video tape recorders, as defined in American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Recording, ANSI C98.18M-1979. It is to be used for the following:

1.1.1 Indication of video frequency response characteristics for both main and sync channels of the reproducing system

1.1.2 Adjustment of gain of the video reproducing system

1.1.3 Comparison of carrier frequencies of the video recording system

1.1.4 Verification of level and phase of the control track recording system

1.1.5 Adjustment of the gain of the program audio reproducing system

1.1.6 Indication of the audio frequency response of the audio reproducing system

1.1.7 Comparison of the audio recording gain and frequency response characteristics of the audio recording system

1.1.8 Verification of level and other parameters of the time code information recorded on Audio Record No. Three

2. *General Specifications*

2.1 Record VTR. The recorder used to record this tape shall comply with Proposed American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Reference Recorders for Video and Audio Reference Tapes, ANSI V98.27M.

2.2 Record Dimensions. The dimensions of pertinent records making up this reference tape shall conform to Proposed American National Standard Dimensions and Location of Records on Video and Audio Reference Tapes for 1-in Type C Helical-Scan Video Tape Recorders, ANSI V98.28M.

2.3 Tape Stock. The tape stock shall be as specified in Proposed American National Standard Specifications and Conditioning of Raw Tape Stock Used to Record Reference Tapes for 1-in Helical-Scan Video Tape Recorders, ANSI V98.26M.

2.4 Tracking Control Signal. The tracking control signal shall conform to SMPTE Recommended Practice on Tracking-Control Record for 1-in Type C Helical-Scan Video Tape Recording, RP 85-1979, except that the tolerance specified in Sec. 3.1 shall be tightened to ± 0.1 ms.

2.5 Recorded Video Parameters. The recorded video parameters shall conform to those specified in SMPTE Recommended Practice for Video Record Parameters for 1-in Type C Helical-Scan Video Tape Recording, RP 86-1979, except that the tolerances specified in Sec. 5 shall be tightened to ± 0.02 MHz and the nominal values specified in other sections shall be held as close as possible.

2.6 Video Signals. Video synchronizing waveforms and video amplitudes shall conform to EIA Industrial Electronics Tentative Standard No. 1, Color Television Studio Picture Line Amplifier Output Drawing, to ensure proper color framing. Blanking widths shall be 10.7 μs horizontal and 20 lines vertical.

2.7 Recorded Audio Flux Levels. The record reference level and the record flux level versus frequency shall conform to American National Standard Frequency Response and Reference Level of Recorders and Reproducers for Audio Records for 1-in Type C Helical-Scan Video Tape Recording, ANSI C98.20M-1979, except that the short circuit flux recorded on the tape at each frequency shall be within ± 0.5 dB of the level specified. The tolerance, ± 0.5 dB, may be extended to ± 2 dB, provided that the manufacturer supplies a calibration chart with the reference tape.

2.8 Audio Test Calibration. The calibration values in decibels furnished with the reference tape shall represent the levels to be added algebraically to the reproducer output level when the particular reference 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 reference tape at a given frequency had been exactly as specified in ANSI C98.20M-1979.

2.9 Audio Flutter. The unweighted flutter content of this recording shall not exceed 0.1 percent RMS, measured in accordance with NAB Standard for Magnetic Tape Recording and Reproducing (Reel-to-Reel), April 1965.

3. *Recorded Signals*

3.1 Voice Announcements. Voice announcements at the beginning of this tape shall reference this practice. Voice announcements shall be recorded at a level approximately 5 dB below reference level. These announcements shall be recorded on Audio Record No. One and Audio Record No. Two. A video identification signal may be included during the voice announcement section. If no video identification signal is used, sync, burst, and setup or video signal shall be recorded on the video channel during the voice announcement.

3.2 Video Signals. Seven types of video signals, as specified in Secs. 3.2.1 through 3.2.7, shall be recorded on the tape.

3.2.1 Color Bars. 100-percent saturated 75-percent amplitude color bar signal conforming to EIA Standard RS-189-A, Encoded Color Bar Signal.

3.2.2 Multiburst. A white pulse, followed by a series of six sine wave bursts. The white pulse width and the width of each sine wave burst should be one seventh the width of the scan line between the end of H blanking and the start of H blanking. The white bar level shall be at 100 ± 1 IRE units. The axis of the burst shall be at a level of 55 ± 1 IRE units. The peak-to-peak amplitude of the bursts shall be 90 ± 1 IRE units. The frequencies of the bursts in time sequence shall be 500 kHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz.

3.2.3 Ramp. A continuous ramp extending from 0 to 100 IRE units and repeating at line rate. Color subcarrier having a peak-to-peak amplitude of 40 ± 2 IRE units shall be added to the ramp signal.

3.2.4 Window and Pulses. A window signal, a modulated 12.5T (1.56 μs) pulse, and a 2T (0.25 μs) sine-squared pulse. All signals shall extend from 7.5 ± 2.5 to 100 ± 1 IRE units. The window shall have a 1T rise time.

3.2.5 Chroma Field. A flat, full field signal corresponding to the cyan bar of EIA RS-189-A color bars at 75 percent amplitude.

3.2.6 Gray Field. A flat, full field signal at 50 IRE units.

3.2.7 Vertical Interval Test Signals. Vertical interval test signals will be added to both fields as follows:

Line 10 2T and 12.5T pulses and 1T bar
Line 11 linearity
Line 12 linearity
Line 13 linearity
Line 14 multiburst
Line 15 color bars
Line 17 2T and 12.5T pulses and 1T bar
Line 19 multiburst

3.3 Audio Signals. Audio signals as specified in Secs. 3.3.1 through 3.3.3 shall be recorded on the tape.

3.3.1 Frequency Response. This section shall be used to calibrate the frequency response of the audio reproducing system of a video magnetic tape recorder. The 1-kHz signal shall be recorded at a flux level corresponding to 10 dB below reference level. The segment frequencies shall be recorded as follows: 1 kHz (reference), 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, 10 kHz, 12.5 kHz, 16 kHz, and 1 kHz (secondary reference). The frequency of each recording shall be ± 3 percent of its specified value when the tape is reproduced at exactly 244.0 mm/s Each frequency shall be preceded by a voice announcement identifying that frequency.

3.3.2 Stereo Phase. A 4-kHz tone shall be recorded at reference level on each channel. The recorded stereo phase error between channels 1 and 2 shall be less than 5°.

3.3.3 Crosstalk. Tones of 63 Hz, 1 kHz, and 16 kHz shall be recorded on channel one only and then channel two only for a test of audio channel crosstalk. These signals shall be recorded at + 8 dB above the reference level. A recorded cross-talk calibration shall be supplied with the reference tape.

3.3.4 SMPTE Time and Control Code. SMPTE time and control code complying with American National Standard Time and Control Code for Video and Audio Tape for 525 Line/60 Field Television Systems, ANSI C98.12-1975, and SMPTE Recommended Practice on Requirements for Recording American National Standard Time and Control Code on 1-in Types B and C Helical-Scan Video Tape Recorders, RP 93-1980, shall be recorded on Audio Record No. Three.

3.4 Sequence. The video and audio reference signals shall be recorded in the sequence and for the duration shown in Table 1. The vertical interval test signals of Sec. 3.2.7 shall be added to the video from the start 00:00 to 06:00 minutes. The sync record channel shall be turned off so there is no recording from 06:00 to 10:00 minutes.

Table 1
Reference Signal Sequence

Video	*Audio 1*	*Audio 2*	*Audio 3*	*Start*	*End*
Multiburst	1 kHz	1 kHz ref	1 kHz	00:00	01:00
Ramp	63 Hz	63 Hz	63 Hz	01:00	02:00
Window & Pulses	4 kHz	4 kHz	4 kHz	02:00	03:00
Color Bars	16 kHz	16 kHz	16 kHz	03:00	04:00
Chroma Field	Silent	Silent	Silent	04:00	05:00
Multiburst	1 kHz* (+8 dB)	0	Time Code	05:00	05:15
Multiburst	63 Hz* (+8 dB)	0	Time Code	05:15	05:30
Multiburst	16 kHz* (+8 dB)	0	Time Code	05:30	05:45
Multiburst	Silent	1 kHz* (+8 dB)	Time Code	05:45	06:00
Ramp	Silent	63 Hz* (+8 dB)	Time Code	06:00	06:15
Ramp	Silent	16 kHz* (+8 dB)	Time Code	06:15	06:30
Ramp	Silent	0	Time Code	06:30	07:00
Window & Pulses	Frequency Response† (—10 dB)	Frequency Response† (—10 dB)	Frequency Response	07:00	08:00
Color Bars	Frequency Response† (—10 dB)	Frequency Response† (—10 dB)	Frequency Response	08:00	09:00
50 IRE Gray Field	Frequency Response† (—10 dB)	Frequency Response† (—10 dB)	Frequency Response	09:00	10:00

Note: Frequency response sequence: 1 kHz (ref.) 30 sec., each tone 12 sec., and final 1 kHz (secondary ref.) 18 sec.

*Above reference level

†Below reference level

3.4.1 Time Tolerance. The tolerance of all times shown in Table 1 shall be + 0.5 seconds or —3.0 seconds.

4. *Calibration*

4.1 Video Calibration. All video measurements of luminance levels shall be made in accordance with American National Standard Method of Measurement of Television Luminance Signal Levels, ANSI/IEEE Std 205-1958 (R1972).

4.2 Audio Calibration. The short circuit tape flux on the reference 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.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 100

Interchange Reference Tape for 1-in Type C Helical-Scan Video Tape Recorders

1. *Scope*

1.1 This practice specifies an interchange reference tape to be used with 1-in Type C helical-scan video tape recorders, as defined in American National Standard Dimensions and Location of Records for 1-in Type C Helical-Scan Video Tape Recording ANSI C98.19M-1979. It is to be used for verification and/or adjustment of parameters including

1.1.1 Angular position and elevation of the video heads

1.1.2 Track straightness

1.1.3 Phase of control track

1.1.4 Audio head azimuths and elevations

1.1.5 Skew errors (verification only)

2. *General Specifications*

2.1 The reference tape shall comply with the following American National Standards and SMPTE Recommended Practices:

Proposed American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Reference Recorders for Video and Audio Reference Tapes, ANSI V98.27M.

Proposed American National Standard Dimensions and Location of Records on Video and Audio Reference Tapes for 1-in Type C Helical-Scan Video Tape Recorders, ANSI V98.28M.

Proposed American National Standard Specifications and Conditioning of Raw Tape Stock Used to Record Reference Tapes for 1-in Helical-Scan Video Tape Recorders, ANSI V98.26M.

SMPTE Recommended Practice on Tracking-Control Record for 1-in Type C Helical-Scan Video Tape Recording, RP 85-1979.

SMPTE Recommended Practice on Video Record Parameters for 1-in Type C Helical-Scan Video Tape Recording, RP 86-1979.

2.2 Video synchronizing waveforms and video amplitudes shall conform to EIA Industrial Electronics Tentative Standard No. 1, Color Television Studio Picture Line Amplifier Output Drawing. Blanking widths shall be 20 lines vertical and less than 10.7 microseconds horizontal.

3. *Reference Signals*

3.1 Video Signal. The video signal shall consist of 40 units of sync conforming to EIA Tentative Standard No. 1 and 100 ± 1 IRE units of a white field video signal from the end of H blanking to the beginning of H blanking on all active video lines.

3.2 Audio Signals

3.2.1 A 4 kHz ± 2 percent tone recorded at reference level conforming to the record pre-emphasis specified in American National Standard Frequency Response and Reference Level of Recorders and Reproducers for Audio Records for 1-in Type C Helical-Scan Video Tape Recording, ANSI C98.20M-1979. Stereo phase error between Channel 1 and Channel 2 shall be less than 5°

3.2.2 A 16 kHz ± 2 percent tone recorded at the level as specified in ANSI C98.20-1979.

3.3 Sequence of Signals. Video and audio signals shall be recorded in the following sequence:

Video	*Audio 1*	*Audio 2*	*Audio 3*	*Time*
Video Test Signal	Voice Announcement	—	—	00:00-00:30
Video Test Signal	4 kHz 0 dB reference level	4 kHz 0 dB reference level	4 kHz 0 dB reference level	00:30-03:30
Video Test Signal	16 kHz 0 dB reference level	16 kHz 0 dB reference level	16 kHz 0 dB reference level	05:30-10:00

4. *Calibration*

4.1 Video Calibration. All video measurements of luminance levels shall be made in accordance with American National Standard Method of Measurement of Television Luminance Signal Levels, ANSI/IEEE Std 205-1958 (R1972).

4.2 Audio Calibration. Calibration of short circuit tape flux on the reference 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.

McKNIGHT, 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.