Record Locations and Dimensions

	Dimensions	Millimeters Minimum	Millimeters Maximum	Inches Minimum	Inches Maximum
A	Audio 3 lower edge	0.000	0.200	0.0000	0.0079
B	Audio 3 upper edge	0.775	1.025	0.0305	0.0404
C	Sync track lower edge	1.385	1.445	0.0545	0.0569
D	Sync track upper edge	2.680	2.740	0.1055	0.1079
E	Control track lower edge	2.870	3.130	0.1130	0.1232
F	Control track upper edge	3.430	3.770	0.1350	0.1484
G_1	Video track lower edge	3.860	3.920	0.1520	0.1543
G_2	Video line 25 start	4.650	4.710	0.1831	0.1854
H	Video track upper edge	22.355	22.475	0.8801	0.8848
J	Audio 1 lower edge	22.700	22.900	0.8937	0.9016
K	Audio 1 upper edge	23.475	23.725	0.9242	0.9341
L	Audio 2 lower edge	24.275	24.525	0.9557	0.9656
M	Audio 2 upper edge	25.100	25.300	0.9882	0.9961
N	Video and sync track width	0.125	0.135	0.0049	0.0053
P	Video offset	4.067 (2.5H) ref		0.1601 ref	
Q	Video track pitch	0.1823 ref		0.00718 ref	
R	Video track length	410.764 (252.5H) ref		16.1718 ref	
S	Control track head distance	116.23	117.03	4.567	4.607
T	Vertical phase odd field	16.270 ref (10.0H)		0.6406 ref	
U	Vertical phase even field	17.080 ref (10.5H)		0.6724 ref	
V	Sync track length	25.620 (15.75H)	26.420 (16.25H)	1.0087	1.0402
W	Vertical phase odd sync field	22.360 (13.75H)	23.170 (14.25H)	0.8803	0.9122
X	Vertical phase even sync field	23.170 (14.25H)	23.980 (14.75H)	0.9122	0.9441
Y	Vertical head offset	1.529 ref		0.0602 ref	
Z	Horizontal head offset	35.350 ref		1.3917 ref	
θ	Track angle	2°34′ ref			

7. Relative Positions of Recorded Signals

7.1 Video, sync, tracking control, and audio signals with information intended to be time coincident shall be positioned as shown in Fig. 2. Dimensions T, U, Y, and Z are for reference purposes only.

7.2 The start of the video record is that location on the video record which would be produced by scanner and guide locations with no electronic switching of the recording signal.

7.3 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 25 H-sync in odd-numbered fields.

7.4 The start and end of the sync record must be produced by electronic switching of the recording signal due to geometric constraints. (See ANSI C98.18M-1979.) Phasing of the sync record electronic switching shall be as per phase Dimension W in odd-numbered fields.

7.5 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.

8. Gap Azimuth

8.1 The azimuth of all head gaps used to produce longitudinal track records shall be perpendicular to the direction of relative head-to-tape motion.

8.2 The azimuth of the video and sync head gaps shall be perpendicular to the direction of head motion.

SMPTE RECOMMENDED PRACTICE — RP 41-1983

Evaluation of Color Films Intended for Television

Introduction

The television monitor and the home receiver present relatively small pictures and are usually viewed with other illuminated objects present. Television programming is usually a succession of separate segments presented contiguously. These differences from theatrical viewing and programming call for a different preview condition. The necessary conditions are a relatively small picture of a specified color and luminance, surrounded by a relatively large field of the same color at a lower luminance. The large, visible surround serves two important functions. It provides (1) a standard correlate of the ambient field of view of the television screen, which has a marked effect on the apparent contrast of the picture, and (2) a constant adaptation field against which to refer the color balance of the picture when making judgments of color balance.

The small picture simulates more closely the size and appearance of a television screen, and permits the use of a relatively large surround.

This practice is followed in Canada and conforms closely to those in other countries (EBU Standard Tech 3091-1970, Optical Viewing Conditions for Films Intended for Color Television: February 1971 Journal of the SMPTE).

1. *Scope*

This practice is intended to define the necessary conditions for the color and luminance of open-gate screen illumination, the color and luminance of the surround illumination, the relative size of the surround and screen, and the level of ambient illumination to permit critical evaluation of color balance and contrast of films intended for television use. Such a viewing situation is particularly useful in the selection of the optimum color balance of prints. Because a relatively small screen is specified, such a projection room will not accommodate large audiences. A variation of this practice is recommended which will accommodate large audiences, but which is less critical for quality judgments.

2. *Color and Luminance of Open-Gate Screen*

2.1 Although it is recognized that ultimate reproduction of white in the television system will be at D_{6500}, a screen chromaticity and spectral distribution approximately that of a black body at 5100 +600 −100 K shall be used.

2.2 This screen color results from chromatic distribution of the projector light and of the screen reflectance. (See Appendix A1.1.)

2.3 To facilitate the illumination of a visual surround, it may be desirable to use a screen of low reflectance, or one with directional properties. (See Appendix A1.2.)

2.4 The luminance of the screen shall be 40 ± 4 fL (137 ± 14 cd/m²), measured according to American National Standard Screen Luminance and Viewing Conditions for Indoor Theater Projection of Motion-Picture Prints, ANSI PH22.196-1978. This luminance will produce, with a film conforming to that specified in SMPTE Recommended Practice RP 46-1972, Density of Color Films and Slides for Television, in the gate, a white luminance of about 20 fL (68 cd/m²) which corresponds approximately to peak white luminance of color television monitors.

2.5 The luminance at a distance of 5 percent of the screen width from the side edges of the screen shall be 90 ± 10 percent of the center luminance.

2.6 If a directional screen is used, the viewing audience shall be restricted to that area from which the luminance tolerance is operative.

3. *Screen Dimensions*

3.1 The viewing screen shall be of such size that the viewing audience may be seated at a distance from the screen equal to 4 to 6 times the screen height. Its size shall be sufficiently small so that a visible surround area of approximately 8 times the screen area is possible. (See figure.)

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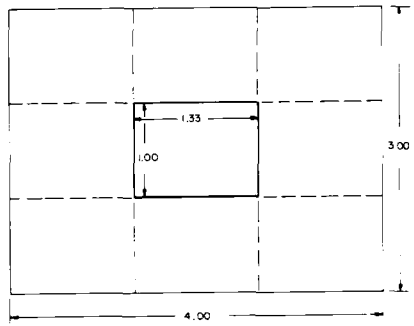
3.2 The ratio of screen width to screen height shall be 1.33:1.



Relative Proportions of Screen and Surround

4. *Viewing Distance*

Observers preferably shall be placed so as to view the screen from a distance equal to 4 to 6 times the screen height.

5. *Light Surround*

5.1 Light surround is defined as the light, visible to the observer, which surrounds but does not include the central screen area.

5.2 The area of the light surround shall be preferably at least 8 times the screen area (see figure).

5.3 The luminance of the light surround shall be approximately 1/10 the open-gate screen illumination. (See Appendix A2.1.)

5.4 The color of the light surround shall match that of the open-gate screen illumination. (See Appendix A2.2.)

6. *Ambient Conditions*

6.1 The level of light other than screen illumination and surround shall be such as to be insignificant in comparison to them.

6.2 Light falling on the screen which is reflected to the viewing position shall be low enough so that the unlighted projection screen measures less than 1 fL (3.4 cd/m²). To achieve this, walls should be of low reflectance.

6.3 The viewing room decor preferably should give a generally neutral impression, without dominant colors being employed.

7. *Review Room for Large Audiences*

7.1 When the audience exceeds 10 to 15 persons, it becomes necessary to use a large screen. A large screen makes it impractical to obtain an illuminated surround having eight times the area of the screen. The following recommendations for viewing films in a darkened theater are given with the caution that elimination of the lighted surround reduces the viewer's sensitivity in making judgments of color balance and density, and also affects judgment of contrast. (See Appendix A3.1.)

7.2 Luminance level of the open screen for darkened room viewing shall be 16 ± 2 fL (55 ± 7 cd/m²), measured within the standard observing area with the projector operating with no film in the aperture. (See Appendix A3.2.)

7.3 Spectral distribution of the reflected light from the screen illuminated by the open-gate projector should approximate the spectral distribution of a black body at a color temperature of 5400 −600 −400 K. (See Appendix A3.3.)

Appendix

(The Appendix is not a part of this SMPTE Recommended Practice, but is included for information purposes only)

A1. *Screen and Projector Characteristics*

A1.1 The desired color may be obtained using an arc source in the projector. The high intensity carbon arc usually operates at close to 5400 K. The xenon arc will operate closer to 6000 K when fresh, and many change toward 5000 K with age. Another method is to use a blue photometric filter such as the proper thickness of Corning Filter No. 5900 with a projector having a tungsten source, changing its nominal color of about 3500 K to 5400 K.

Color temperature may be verified most easily by comparison with a known reference of 5400 K, or use of a three-color meter, certified to produce useful readings on commonly used projection light sources. Some two- or three-color temperature meters may not give reliable results with sources (xenon and metal arc, e.g.) that depart appreciably from black-body spectral quality.

The luminance and color of the surround illumination may be evaluated by comparison with the previously verified open-gate screen illumination, if the latter is reduced in intensity (by nonselective filter or diaphragm) to one tenth its normal value.

A1.2 The choice of screen material will depend on projection illumination available and the method chosen to provide surround illumination. If the projection source is tungsten, filtered to 5400 K by a supplementary filter over the lens, only a directional, high-gain screen will provide sufficient open-gate screen luminance. If the source is a xenon arc capable of a beam output of the order of 100 lumens, a matte white screen can be used. If 500 lumens are available, a 20-percent reflection gray screen can be used. Both the 20-percent matte gray screen and the directional high-gain screen make it possible to achieve the desired black level on the unlighted screen, in the presence of some ambient light. This practice does not preclude the use of rear projection screens, provided uniformity of illumination can be achieved.

For aesthetic reasons, a screen mask may be desired. If used, it should preferably be black, and not more than three or four inches wide.

A2. *Light Surround*

A2.1 The level of surround luminance ideally should approximate average picture luminance. This is most frequently about 1/8 to 1/4 the picture white luminance, although it can vary widely, so a value of 1/10 the open-gate screen luminance is one valid compromise. This level (of about 4 fL [14 cd/m²]) may be measured directly, or it may be checked relative to screen luminance by placing a 1.0 density neutral, nonscattering filter over the projection lens. This attenuates the screen luminance by the factor of 10, allowing a visual match with the surround.

The uniformity and shape of the surround field is not critical so long as the area surrounding the screen (8X screen area) is in the desired luminance range.

A2.2 It is important that the surround match the screen for color. The use of the 1.0-density filter over the projector, permitting a visual match of screen with surround, is the easiest and most accurate way to verify such a match. It is necessary, however, that the filter used introduce no color. A filter of evaporated metal, such as Inconel, can fill this requirement.

Surround illumination may be obtained in several ways. It can be a transilluminated panel. Front illumination can be used, providing the screen itself is not lighted. This can be achieved by placing the screen in a plane in front of the surround plane, with surround lights behind the screen. It can also be achieved by projecting surround light with specular optics, masking out the screen area. Or, it can be achieved if a directional, high-gain screen is used, by proper placement of overhead light, using readily available fluorescent tubes operating at 5500 K.

A2.3 When problems in room design prevent achievement of the full surround format and geometry, some compromise in uniformity of surround illumination and in centering of the screen in the surround area may still permit the essential performance of this review room.

A3. *Compatibility*

A3.1 Experiments have established that the same color balance and density for prints is preferred under the larger screen, darkened room condition as under the smaller screen, lighted-surround condition. However, it is possible, because of visual adaptation, for an observer in the darkened room to judge as acceptable some prints which would be recognized as less acceptable or unacceptable in the presence of the lighted surround.

A3.2 The luminance level of the review room for large audiences is the same as that previously specified for 16-mm and 35-mm review rooms (ANSI PH22.196-1978).

A3.3 This spectral distribution is the same as that specified for 35-mm review rooms (ANSI PH22.196-1978). This ensures that the color balance of both 16- and 35-mm films intended for television shall be similar.

A3.4 Although these preview room recommendations are intended to enable a viewer to predict the suitability of a film for television use, these recommendations are not intended to simulate television display exactly.

A3.5 Use of a Subjective Color Reference Test Film as a visual reference is recommended. The film is color and density balanced providing a valid comparison reference.

SMPTE RECOMMENDED PRACTICE — RP 43–1983

Video Test Tape for Quadruplex Video Frequency Magnetic Tape Recorders Operating at 15 in/s and Practice HB of SMPTE Recommended Practice RP 6

1. *Scope*

This practice specifies a video frequency test tape to be used with quadruplex television video tape recorders operating at 15 in/s (38.1 cm/s) and Practice HB of SMPTE Recommended Practice RP 6-1979, *Recorded Carrier Frequencies and Pre-Emphasis Characteristics for 2-in Quadruplex Video Magnetic Tape Recording for 525-Line/60-Field Television Systems*. It is to be used for:

(a) Positioning of the vacuum guide.

(b) *Indication of video frequency response characteristics* of the reproducing system.

(c) Adjustment of gain of the video reproducing system.

(d) Comparison of carrier frequencies of the video recording system.

(e) Verification of level and phase of the control track recording system.

(f) Adjustment of the gain of the program audio reproducing system.

2. *General Specifications*

2.1 Dimensions of Records. The dimensions of pertinent records making up 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 in accordance with American National Standard for Video Recording —2-in Magnetic Tape for Quadruplex Recording —Speed, ANSI V98.4-1983.

2.3 Tape Stock. The test sections shall be recorded on transversely-oriented television magnetic recording tape optimized for use with Practice HB of SMPTE Recommended Practice RP 6. The dimensions of the tape stock shall be as specified in American National Standard Dimensions of 2-in Video Magnetic Recording Tape, ANSI C98.1-1978.

2.4 Tracking Control Signal. A tracking control signal, *conforming to that in SMPTE Recommended* Practice RP 16-1982, Specifications of Tracking Control Record for 2-in Quadruplex Video Magnetic Tape Recordings, shall be recorded throughout the tape.

2.5 *Voice announcements at the beginning of this* tape shall reference this recommended practice. Voice announcements shall be recorded at a level approximately 5 dB below reference level, as defined in American National Standard Specifications for an Audio Operating Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s, ANSI V98.8-1982. Announcement shall be recorded on Audio Record No. 1 only. A video identification signal may be included during the voice announcement section. If no video identification signal is used, sync and set-up, or test signal shall be recorded on the video channel during the voice announcement.

2.6 Recorded carrier frequencies shall conform to those specified by Practice HB of SMPTE RP 6-1979; recording pre-emphasis shall match the pre-emphasis characteristic specified by Practice HB of SMPTE RP 6-1979.

2.7 Tape vacuum guide radius and position shall conform to SMPTE Recommended Practice RP 11-1968, Tape Vacuum Guide Radius and Position for 2-in Quadruplex Video Magnetic Tape Recording.

2.8 Audio Record No. 1 shall be 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.

2.9 Video synchronizing waveforms and signal amplitudes shall conform to the rules and regulations of the Federal Communications Commission for color transmissions. Color subcarrier synchronizing burst shall be included throughout the recording. The timing of the synchronizing waveforms shall be *uninterrupted* during the transition from the identification signals specified in 2.5 to the video test signals specified in 3.1 and 3.2, and shall be uninterrupted during the transitions between video test signals specified in 3.2.

2.10 *Geometric distortion on the test tape caused* by lack of exact 90° angular separation (quadrature error) of the transducers on the video head wheel making the recording shall not exceed 0.03 microseconds peak to peak.

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2.11 The position of the tape neutral plane shall be in accordance with SMPTE Recommended Practice RP 36-1978, Positioning the Headwheel and Adjacent *Tape Guides for 2-in* Quadruplex Video Magnetic Tape Recorders.

3. *Test Section*

3.1 Video Test Signals. Five types of test signals, as specified in 3.1.1 through 3.1.5, shall be recorded on the tape.

3.1.1 Color Bars. An encoded color-bar signal conforming to FCC Rules and Regulations, Part 73, Subpart E, March 1980. An encoded color-bar signal conforming to SMPTE Engineering Committee Recommendation ECR 1-1978 (R1983), Alignment Color Bar Test Signal for Television Picture Monitors, shall be permissible.

3.1.2 Multiburst. A white pulse followed by a series of six sine-wave bursts. The white pulse width and the width of each burst shall be $\frac{1}{7}$ the width of the scan line between the end of H blanking and the start of H blanking. The white bar level shall be 100 ± 1 IRE units. The axis of the bursts shall be at a level of 55 ± 1 IRE units, and 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, 3.6 MHz, and 4.2 MHz. Harmonic distortion of the sine wave burst signals *shall be less than 1 percent.*

3.1.3 Ramp. A continuous ramp (or stairstep signal consisting of 10 equal-height steps) extending from 0 to 100 IRE units, and repeating at a line rate. Color subcarrier having a peak-to-peak amplitude of 20 ± 2 IRE units shall be combined additively with the ramp (or stairstep signal).

3.1.4 Window and Pulses. A window signal, a modulated 12½T (1.56 μsec) pulse, and a 2T (0.25 μsec) sine-squared pulse. All signals shall extend from 7½ ± 2½ IRE units to 100 ± 1 IRE units. The three signals shall occur on each line. The leading and trailing edges of the window shall correspond in shape and rise time to the leading and trailing edges of the 2T pulse, respectively. The timings of the pulses and window shall be measured at their half-amplitude points, and shall be as specified below:

(i) Leading edge of 12½T pulse: 0.13H after trailing edge of preceding horizontal sync pulse.

(ii) *Leading edge of* 2T pulse: 0.25H after trailing edge of preceding horizontal sync pulse.

(iii) Leading edge of window: 0.33H after trailing edge of preceding horizontal sync pulse.

(iv) Width of window: 0.40H.

(v) Tolerances: All dimensions given in (i) through (iv) shall be held within ± 0.03H.

3.1.5 Black. A signal consisting of sync, burst, and 7½ ± 2½ IRE units of set-up.

3.2 Sequence of Video Signals. The video signals shall be recorded in the sequence indicated as follows:

Signal	*Duration*	*Nominal Time from Start of Test Signals*	
		Begin	*End*
Black	0:20	0:00	0:20
Multiburst	0:30	0:20	0:50
Ramp	0:25	0:50	1:15
Window and Pulses	0:25	1:15	1:40
Color Bars	0:30	1:40	2:10
Black	0:10	2:10	2:20
Multiburst	1:30	2:20	3:50
Black	0:10	3:50	4:00
Ramp	2:20	4:00	6:20
Black	0:10	6:20	6:30
Window and Pulses	1:20	6:30	7:50
Black	0:10	7:50	8:00
Color Bars	2:20	8:00	10:20
Black	0:10	10:20	10:30

3.2.1 The tolerance on all durations shall be ± 2 seconds, with the exception of the black signals, which shall have a tolerance of +4 seconds, —0 seconds.

3.3 Audio Test Signals

3.3.1 Audio Record No. 1. A 1 kHz ± 5 percent tone shall be recorded at a short circuit tape flux level of 110 ± 5 nanowebers per meter of track width throughout the test section on Audio 1 Record, except as interrupted for the announcements defined in 3.4.

3.3.2 Audio Record No. 2. A 1 kHz ± 5 percent tone shall be recorded throughout the length of the tape at a short circuit tape flux level of 260 ± 10 nanowebers per meter of track width on Audio Record No. 2 (cue track).

3.4 Voice Announcements. Each time the type of signal recorded on the tape is changed, an appropriate voice announcement identifying the new signal shall be made. Instructional or precautionary information may be included in such announcements. No identifying announcements shall be required during the black signal portions of the tape. All voice announcements shall be made under the same conditions as stated in 2.5, except that the video test signal shall not be interrupted.

4. *Calibration*

4.1 Calibration of audio level on all test tapes for field use shall be accomplished by comparison on a calibrated reproducer with a test tape made in accordance with ANSI V98.8-1982.

4.2 Audio Level Measurements. All level measurments shall be made by means of a standard volume indicator, as specified in American National Standard Volume Measurements of Electrical Speech and Program Waves, ANSI/IEEE 152-1953 (R1976).

4.3 Video Level Measurements. All video measurements of luminance levels shall be made in accordance with IEEE 205-1958 (R1976), Television: Measurement of Luminance Signal Levels.

Note: The frequency response of a recovered video signal is a function of such variables as recording current and type of tape stock used; therefore, the optimum reproducing-equalization setting for this tape will not necessarily be the optimum reproducing-equalization setting for all other recordings.