Committee on Television in 1954 and served as committee chairman from 1959 through 1963. A member of the SMPTE Standards Committee since 1959, he was appointed chairman in 1966 and is now a member-at-large.

He has been a member of the Board of Editors since 1957 and is a member of the Publications Advisory Committee. He is Chairman of the Progress Medal Award, is a member of the Fellow Membership Committee and has been a member of the David Sarnoff Award Committee.

Professional organizations other than the Society of which he is a member include the Acoustical Society of America and the Optical Society of America. He is a Fellow of the American Association for the Advancement of Science as well as of the IEEE where he has been for some time a member of four of the IEEE Professional Groups.

Associates of Mr. Wintringham speak of his logical mind and his meticulous attention to the logic of any given situation, an attribute which has made him an especially valuable member of standardizing committees.

He resides at 56 Elmwood Ave., Chatham, NJ 07928.

standards and recommended practices

Proposed SMPTE Recommended Practices

Three Proposed SMPTE Recommended Practices are published here for a trial period and public review: RP 46, Density of Color Films and Slides for Television, was developed jointly by the Color and Television Committees in an effort to specify density parameters which conform to international agreements through the CCIR.

Two additional Practices were developed by the Television Committee as part of a series of precision patterns. A subcommittee report describing this work was published in the December 1967 *Journal*.

RP 27.6, Specifications for Gray-Scale Operational Alignment Test Pattern for Studio and Field Television Cameras and RP 27.7, Specifications for Gray-Scale Operational Alignment Test Pattern for Telecine Cameras, have been designed to facilitate the operational alignment of television systems on the live stage and telecine components.

Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to May 15, 1972. If no adverse criticism is received by that date, the Proposed Recommended Practices will be submitted to the SMPTE Board of Governors for final approval. — A.E.A.

PROPOSED

SMPTE RECOMMENDED PRACTICE **RP 46**

Density of Color Films and Slides for Television

Introduction

In May, 1964, the Joint Subcommittee of the Color and Television Engineering Committees of the SMPTE issued a report entitled "Considerations in Color Film Production for Color Television" as an appendix for a future recommended practice for contrast and density range of color films for color television. The report, which is considered to be a part of this recommended practice and which is included as an appendix, emphasizes careful control of the original photography, including such items as lighting and stage practice recommendations. The significance of the densities specified in this practice should be considered with regard to the factors discussed in the appendix, particularly the last two paragraphs.

In March, 1966, Issue No. 2 of the SMPTE Color Television Reference Film was released for sale. This issue and Issue No. 3 (released in July, 1967) closely followed the recommendations in the initial article. Successful telecasting of prints of these issues as well as other commercial material conforming to the initial recommendation has lead to the following specifications regarding density levels for color prints which reproduce well on a color or black-and-white television system.

In its Final Interim Meeting in Geneva in September, 1969, the International Radio Consultative Committee (CCIR) recommended, as part of its Standards for the International Exchange of Monochrome and Colour-Television Programmes on Film, CCIR Recommendation 265-2, density and color balance parameters which conform to this experience. Since the CCIR recommendation has been accepted internationally, the SMPTE Recommended Practice is designed to follow it as much as possible.

1. *Scope*

This recommendation specifies important density values of color 16mm and 35mm motion-picture films and slides intended for television transmission.

2. *Density Requirements*

2.1 The method of density measurement shall be in accordance with American National Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960 (Reaffirmed 1969). The spectral quality of the densiometer should conform to ISO Recommendation R 5-1955, Diffuse Transmission Density (Photography), for diffuse visual density, Type V1-b.

2.2 The density corresponding to television white level should be 0.3 to 0.4 (See Note 1). This value is not intended to apply to specular highlights and other small areas where details need not be reproduced.

2.3 The maximum density of a film is determined by scene contrast and the film transfer characteristic. Dark or black areas, in which faithful reproduction of detail may not be essential, may have densities in the order of 2.5 (See Note 2). However, both image gradation and color in such areas may be distorted or lost in television reproduction.

Notes

1. Television white level preferably corresponds to a fully-lighted object in the scene having a reflectance of about 60 percent. This results in reproduction of fully-lighted human faces which have reflectances of 35 to 15 percent at film densities 0.2 to 0.5 greater than the density corresponding to television white.
2. Although this value appears higher than that recommended for black-and-white films (SMPTE Recommended Practice RP 7-1970, Density and Contrast Range of Black-and-White Films and Slides for Television), it is in effect no higher. Silver image films scatter light such that the effective density in the television film chain is increased by an average factor of 1.35, over that measured in singly diffused light. For dye images, this light scatter factor (Callier Q) is approximately 1.0.

THIS PROPOSAL IS PUBLISHED FOR COMMENT ONLY

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 27.6

Specifications for Gray-Scale Operational Alignment Test Pattern for Studio and Field Television Cameras

1. *Scope*

Format, dimensions and optical diffuse densities are specified for a test pattern transparency to be used as an operational alignment tool for studio and field television camera systems.

2. *Purpose*

The test pattern is suitable for the following operational checks in a television system:

(a) Light-signal transfer characteristics of a television camera

(b) Signal compression or clipping in a camera video amplifier system

(c) Operation of camera gamma-correction circuitry

(d) Operational setup and balance of gain and black level controls

(e) Amplitude tracking among the video signal channels of a color television camera.

3. *Format*

3.1 Pattern. A reproduction of the test pattern shown in Fig. 1.

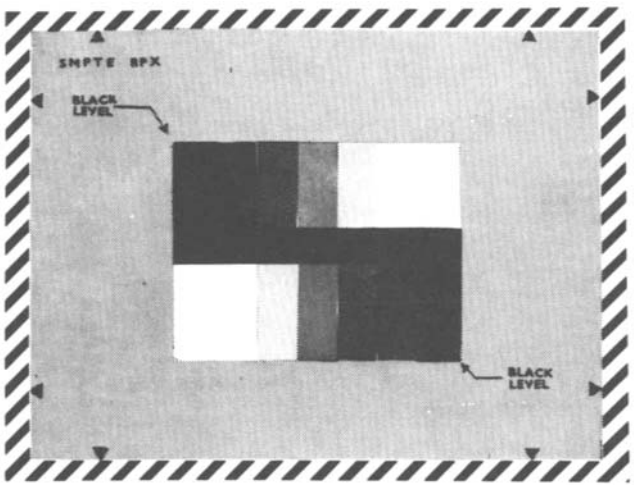


Figure 1
Reproduction of Test Pattern

3.2 Pattern progression of transmission values for the gray-scale follows a 2.5-power law with increments of the variable from the minimum to maximum.

3.3 An additional area (B) of lesser transmission located between the two gray scales provides a "black-than-black" area.

3.4 Surround. The basic surround area (A) is of uniform transmission one-half step between the levels of Steps 5 and 6.

3.5 Arrows and Border. The eight boundary arrows and black-and-white border define the edge of the test pattern area and the scanned area.

3.6 Pattern Identification. The identification number of this document shall appear on the pattern as specified in the figures.

4. *Dimensions*

4.1 The dimensions of the test pattern shall be as shown in Fig. 2 and the table.

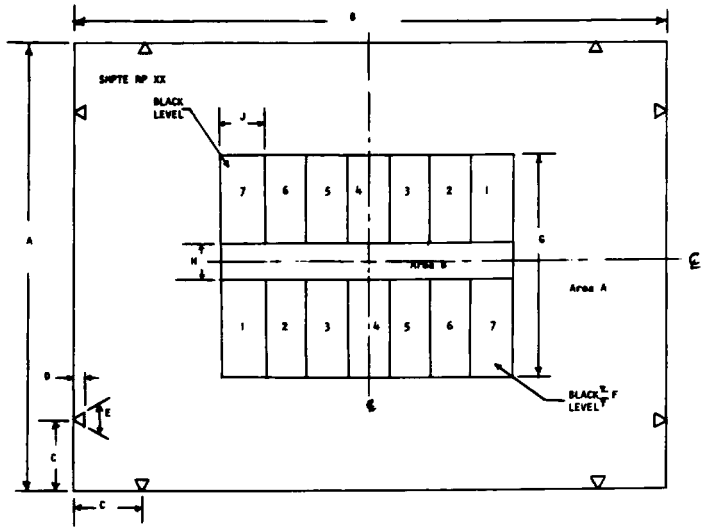


Figure 2
Dimensional Drawing of Test Pattern

	Dimensions	Percent	Inches 2x2	Inches 8x10	
A	Scanned image height	100	0.843	6.30	
B	Scanned image width	133.3333	1.124	8.40	
C	Position of arrow	15.0	0.126	0.94	
D	Arrow length	4.0	0.034	0.25	
E	Arrow shape in degrees				40.0
F	Letter and number height	2.5	0.021	0.16	
G	Overall bar height	50.0	0.422	3.15	
H	Axial bar height	8.0	0.068	0.50	
J	Bar width	9.57	0.081	0.60	

4.1.1 All bars shall be positioned symmetrically in respect to the centerlines of the image area within ± 2 percent of the respective dimension.

4.2 Image Size. The size of the area indicated by the eight boundary arrows shall be as follows:

4.2.1 2x2 in test slides and 8x10 in transparencies shall have Category 3 dimensions, as specified in American National Standard Dimensions and Optical Specifications of Test Slides and Transparencies for Television, PH22.144-1965 (Reaffirmed 1969).

4.3 Black-and-White Border. The dimensions of the black-and-white border shall be as follows:

4.3.1 Height and width dimensions of the black-and-white border for 2x2 in slides and 8x10 in transparencies are specified in ANSI PH22.144-1965.

5. *Optical Densities*

5.1 Optical Densities. All optical densities shall be measured in accordance with American National Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960 (Reaffirmed 1969). The spectral characteristics of the densitometer used for measuring diffuse visual density, type V1-b, shall conform to ISO Recommendation R5-1955, Diffuse Transmission Density (Photography).

5.2 The densities of the steps and areas shall be as follows:

Steps	Density	Transmission (Percent)
1	0.30 ± 0.02	50.0
2	0.45 ± 0.02	35.4
3	0.62 ± 0.02	23.8
4	0.83 ± 0.05	14.8
5	1.08 ± 0.05	8.22
6	1.42 ± 0.05	3.80
7	1.90 ± 0.05	1.25
Areas		
A	1.24 ± 0.05	5.76
B	2.40 ± 0.10	0.40

The density difference between the steps and areas shall be as follows with a tolerance of ± 0.02:

Step 1 — Step 2	0.15
Step 2 — Step 3	0.17
Step 3 — Step 4	0.21
Step 4 — Step 5	0.25
Step 5 — Area A	0.16
Area A — Step 6	0.18
Step 6 — Step 7	0.48

The density of any step or area shall not vary more than ± 5 percent over the spectral range of 400 to 700 nanometers.

5.3 The density of the arrows and identification shall be between 0.3 and 0.4.

Appendix

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

A1. *Application*

The neutral step pattern is intended to serve several essential functions in the alignment of studio and field television camera systems wherein the normal scene contrast handling capability is limited to 40:1.*

A2. *Transfer Characteristic*

One such function is to provide a simple output signal waveform from which the camera system can be adjusted to a reference transfer characteristic or gamma. The pattern configuration is shown in Fig. 1. The waveform appears as two crossed staircases when viewed at line scan on a waveform monitoring oscilloscope. The stairs consist of seven treads and six risers which will cross on the fourth step.

The progression of transmission values for the steps follows a 2.5-power law with increments of the variable over a contrast range of 40:1. This exponent was chosen as an approximation of the transfer characteristic of a typical color picture display tube. Consequently, the signal waveform from a camera system, gamma-corrected to complement the display tube transfer characteristic, will appear as a smooth progression of steps from reference black level to reference white level.

Adjustment of gamma correction circuits to a specified transfer characteristic can be accomplished by setting the steps at predetermined signal levels, viewed on the waveform monitoring oscilloscope. For example, if the crossover at the fourth step is at approximately 60 IRE units and if no setup is present, the average transfer characteristic will be 1/2.5 or 0.4. If the crossover is higher than this, the transfer characteristic will be less than 0.4; conversely, if the crossover is lower, the transfer characteristic will be greater than 0.4.

A3. *Neutral Color Balance and Contrast Range*

A second function of the pattern is to compare the transfer characteristics of the multiple channels of a color camera in order to facilitate adjustment of neutral color balance among channels over signal levels corresponding to the scene contrast range to be transmitted in normal operation.

A4. *Iris Compensation and Blanking Clipping*

A third function of the pattern is to produce a "blacker-than-black" signal level for setting the iris compensation adjustment found in some cameras, and for checking blanking clipping circuit operation. For this purpose a horizontal strip of high density is provided between the step patterns. Except when making the iris compensation adjustment, this portion of the pattern should not appear in the waveform, since it is darker than the minimum brightness intended to be transmitted and thus will be clipped by the blanking circuitry.

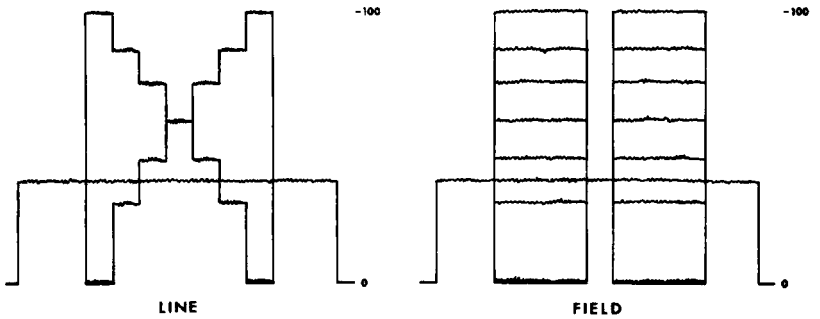
* A second pattern design specified in SMPTE Recommended Practice RP 27.7, Specifications for Gray-Scale Operational Alignment Test Pattern for Telecine Cameras, is intended for use with telecine cameras where motion-picture contrast ranges, considerably in excess of 40:1, are transmitted.

A5. *Shading Correction*

A fourth function of the pattern is to provide a signal suitable for adjustment of shading correction circuits. The mid-range density surrounding the stairsteps permits adjustment for a uniform signal level and for neutral balance among channels over the full scanned raster. This level falls between steps five and six.

A6. *Waveform Presentation*

A typical waveform monitoring oscilloscope presentation at line and field sweep rates is shown below.



A7. *Interpretation of Transmission Densities*

The transmission densities are specified in terms of diffuse measurement, and the pattern is specified to be made of a material which does not introduce any scattering of light. The latter criterion is to obviate the need for a Callier Q correction factor when the pattern is used with an optical system having a specular transmission characteristic. If, however, the pattern is to be used only with a diffuse light source, a diffusing material such as photographic silver may be used.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 27.7

Specifications for Gray-Scale Operational Alignment Test Pattern for Telecine Cameras

1. *Scope*

Format, dimensions and optical diffuse densities are specified for a test pattern transparency designed to facilitate the operational alignment of telecine camera systems used in the transmission of film and transparent slides.

2. *Purpose*

The test pattern is suitable for operational checks of the following characteristics of a television telecine camera system:

(a) Light-signal transfer characteristics of a television camera

(b) Signal compression or clipping in the video signal channels

(c) Operation of camera gamma-correction circuitry

(d) Operational setup and balance of gain and black level controls

(e) Amplitude tracking among the video signal channels of a color television camera.

This pattern is intended to be reproduced on a transparent slide suitable for placement at the field lens of a telecine camera and to be illuminated by a projector normally used with the camera for television transmissions.

3. *Format*

3.1 Pattern. A reproduction of the test pattern is shown in Fig. 1.

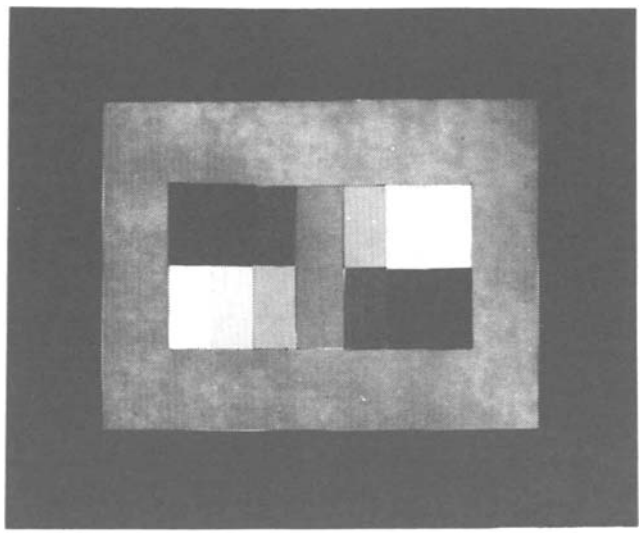


Figure 1
Reproduction of Test Pattern

3.2 Steps

3.2.1 The steps in the pattern follow a 2.5-power law increase in transmission, over a 10:1 contrast range, from the next-to-most dense step to the least dense step.

3.2.2 The most dense step falls at a one-half step increment below the adjacent step on the 2.5-power law curve.

3.3 Surround

3.3.1 The surround area (A) is a uniform density at one-half step increment between Steps 4 and 5.

3.3.2 The surround area (B) defines the edge of the test pattern area.

3.4 Identification. The number of this Recommended Practice shall appear on the slide over the opaque area, and thus will not be reproducible over the television system.

4. *Dimensions*

4.1 Pattern

4.1.1 The dimensions of the test pattern shall be as shown in Fig. 2 and the table.

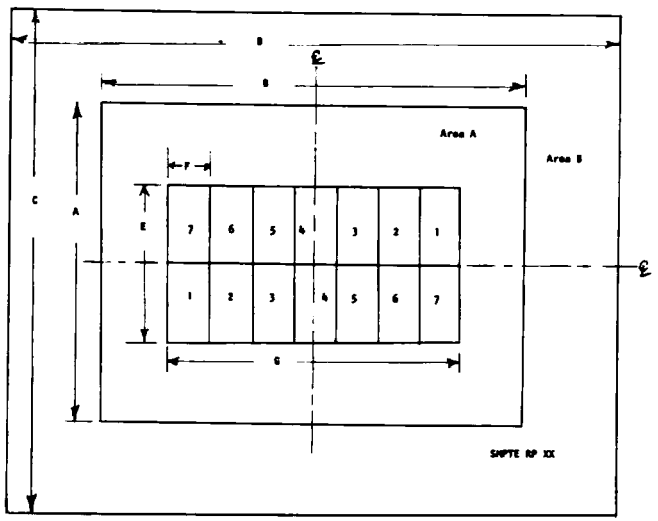


Figure 2
Dimensional Drawing of Test Pattern

	Dimensions	Inches
A	Scanned image height	2.06 ± 0.06
B	Scanned image width	2.75 ± 0.06
C	Height of Area B	3.25*
D	Width of Area B	4.00*
E	Overall bar height	1.00 ± 0.06
F	Bar width	0.25 nom
G	Width of seven bars	2.00 max

* See 4.2.1. for tolerance.

4.1.2 All bars shall be positioned symmetrically in respect to the centerlines of the image area within ± 2 percent of the respective dimension.

4.1.3 To facilitate manufacture of the gray-scale steps, a narrow, opaque black border may be placed around each step. Surround area A may be composed of up to four strips of material. In this case, the junctions between strips may be covered with narrow strips of opaque material.

4.2 Slide

4.2.1 The dimensions of the slide shall be in accordance with American National Standard Slides and Opaques for Television Film Camera Chains, PH22.94-1954 (Reaffirmed 1969). Applicable dimensions from PH22.94-1954 are tabulated below:

Paramter	Dimension
Slide height	$3\frac{1}{4} + \frac{1}{64} - \frac{1}{32}$ in
Slide width	$4 + \frac{1}{64} - \frac{1}{32}$ in
Slide thickness	$\frac{5}{32}$ in maximum

5. *Optical Densities*

5.1 Measurements. All optical densities shall be measured in accordance with American National Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960 (Reaffirmed 1969). The spectral characteristics of the densitometer used for measuring diffuse visual density, type V1-b, shall conform to ISO Recommendation R5-1955, Diffuse Transmission Density (Photography).

5.2 Transmission. The pattern shall be reproduced upon a non-scattering spectrally neutral material which will provide the same transmission characteristics for diffuse and specular light sources.

5.3 Density Values. The densities of the steps and areas shall be as follows:

Steps	Density	Transmission (Percent)
1	0.30 ± 0.01	50.0
2	0.48 ± 0.01	32.9
3	0.70 ± 0.02	19.9
4	0.98 ± 0.02	10.6
5	1.34 ± 0.03	4.5
6	1.90 ± 0.04	1.25
7	2.35 ± 0.05	0.45
Areas		
A	1.14 ± 0.03	7.2
B	Opaque	0

The density of any step or area shall not vary more than ± 5 percent over the spectral range of 400 to 700 nanometers.

Appendix

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

A1. *Application*

The neutral step pattern is intended to serve several essential functions in the alignment of telecine camera systems wherein the scene contrast handling capability may exceed to a significant degree the 40:1 limit normally imposed upon live cameras.* It is provided in a 3¼ x 4 in size for use at the field lens position of telecine cameras with illumination from the associated film projector.

A2. *Transfer Characteristic*

One such function is to provide a simple output signal waveform from which the camera system can be adjusted to a reference transfer characteristic or gamma. The pattern configuration is shown in Fig. 1. The waveform appears as two crossed staircases when viewed at line scan on a waveform monitoring oscilloscope. The stairs consist of seven treads and six risers which will cross on the fourth step.

The progression of transmission values for steps one through six follows a 2.5-power law; with increments of the variable, over a contrast range of 40:1. This exponent was chosen as an approximation of the transfer characteristic of a typical color picture display tube. Consequently, for these steps the signal waveform from a camera system, gamma-corrected to complement the display tube transfer characteristic, will appear as a smooth progression of steps from near black level to reference white level.

The transmission of step seven has been chosen to fall at one-half an increment below step six on a 2.5-power law. This provides an additional contrast range relative to step one of slightly over 100:1 which normally is encountered in motion-picture film. It is to be noted, however, that in present-day operational equipment, tonal gradations over the range of densities between the value of steps six and seven usually are not reproduced faithfully because of black compression and gamma-correction circuit limitations.

Adjustment of gamma-correction circuits to a specific transfer characteristic can be accomplished by setting the steps at predetermined signal levels, viewed on the waveform monitoring oscilloscope. For example, if the crossover at the fourth step is at approximately 50 IRE units, the average transfer characteristic will be 1/2.5 or 0.4. If the crossover is higher than this, the transfer characteristic will be less than 0.4; conversely, if the crossover is lower, the transfer characteristic will be greater than 0.4.

A3. *Neutral Color Balance and Contrast Range*

A second function of the pattern is to compare the transfer characteristics of the multiple channels of a color camera in order to facilitate adjustment of neutral color balance among channels over signal levels corresponding to the film contrast range to be transmitted in normal operation.

* An alternate pattern design specified in SMPTE Recommended Practice RP 27.6, Specifications for Gray-Scale Operational Alignment Test Pattern for Studio and Field Television Cameras, is intended for use with live cameras where the maximum acceptable scene range is 40:1.

A4. *Blanking Clipping*

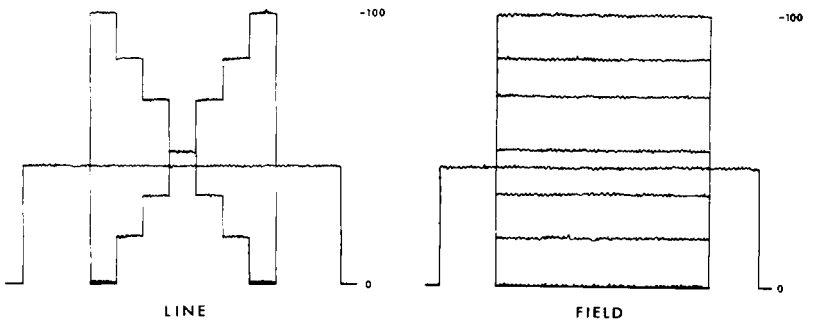
A third function of the pattern is to check blanking clipping circuit operation. For this purpose, clipping action on step seven can be observed on a waveform monitoring oscilloscope as blanking or black level controls are adjusted. For normal setup, step seven should be set at blanking level.

A5. *Shading Correction*

A fourth function of the pattern is to provide a signal suitable for adjustment of shading correction circuits. The mid-range density surrounding the stairsteps permits adjustment for a uniform signal level and for neutral balance among channels over the full scanned raster. This level falls between steps four and five.

A6. *Waveform Presentation*

A typical waveform monitoring oscilloscope presentation at line and field sweep rates is shown below.



A7. *Interpretation of Transmission Densities*

The transmission densities are specified in terms of diffuse measurement, and the pattern is specified to be made of a material which does not introduce any scattering of light. The latter criterion is to obviate the need for a Callier Q correction factor when the pattern is used with an optical system having a specular transmission characteristic.