SMPTE RECOMMENDED PRACTICE — RP 27.7-1987

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.

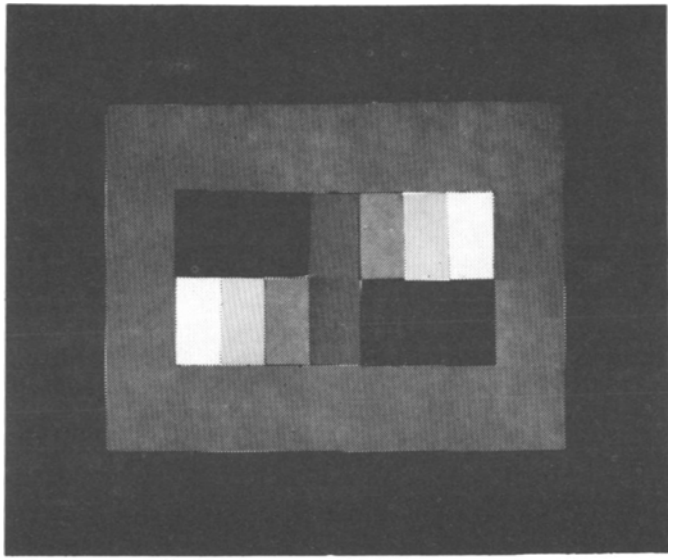

Fig. 1
Reproduction of Test Pattern

Revision of RP 27.7-1972
Approved August 21, 1987

3.2 Steps

3.2.1 The steps in the pattern follow a 2.5-power law increase in transmission, over a 40:1 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 Surround area A is a uniform density at one-half step increment between Steps 4 and 5..

3.3.2 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.

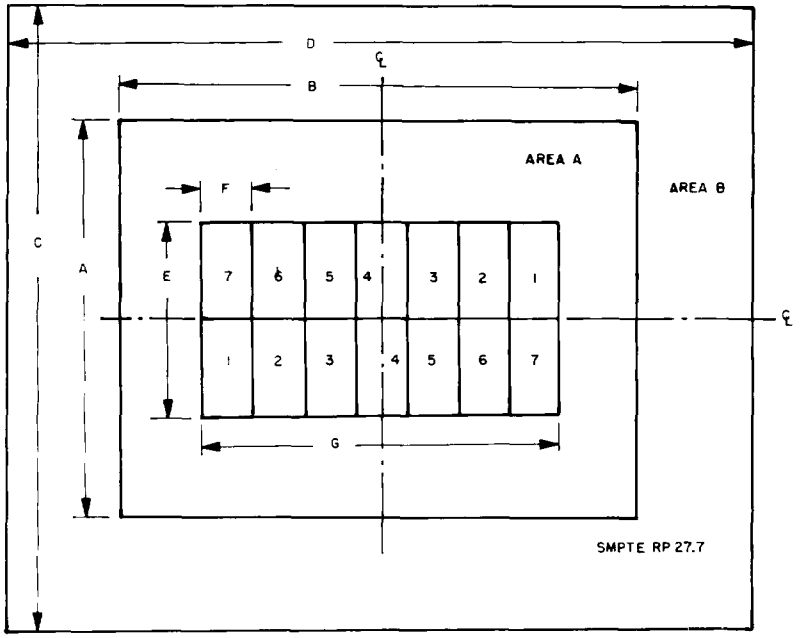

Fig. 2
Dimensional Drawing of Test Pattern

	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 for Television — Image Areas and Mounts for Slides and Opaques, ANSI/SMPTE 94-1985. Applicable dimensions are tabulated below:

Parameter	Dimension
Slide height	3¼ + 1/64 — 1/32 in
Slide width	4 + 1/64 — 1/32 in
Slide thickness	5/32 in maximum

5. *Optical Densities*

5.1 Measurements. All optical densities shall be measured in accordance with American National Standard for Photography (Sensitometry) — Density Measurements — Geometric Conditions for Transmission Density, ANSI/ISO 5/2-1985, ANSI PH2.19-1986. The spectral characteristics of the densitometer used for measuring diffuse visual density, type A, shall conform to American National Standard for Photography (Sensitometry) — Density Measurements — Spectral Conditions, ANSI/ISO 5/3-1984, ANSI PH2.18-1985.

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

(This Appendix is not part of the SMPTE Recommended Practice, but is included for information only.)

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.

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 as it appears at the input of the encoder is shown in Fig. 3.

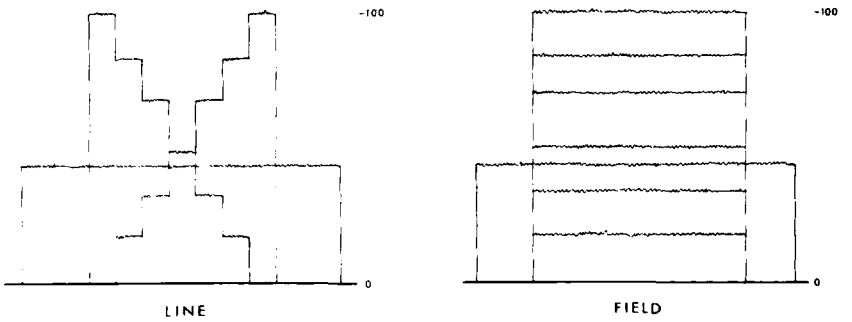

Fig. 3
Waveform-Monitor Presentation

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.