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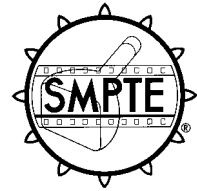
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SMPTE RECOMMENDED PRACTICE

Alignment of NTSC Color Picture Monitors



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1 Scope

1.1 This practice describes an alignment procedure for the consistent and repeatable alignment of television color picture monitors.

1.2 For critical evaluation of picture program material, the aligned monitor shall be used in an environment such as that described in SMPTE RP 166.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE EG 1-1990, Alignment Color Bar Test Signal for Television Picture Monitors

SMPTE RP 166-1995, Critical Viewing Conditions for Evaluation of Color Television Pictures

3 Test signals and equipment

A video test signal generator providing the following signals shall be available:

- SMPTE color bars with PLUGE (picture lineup generating equipment) signal (SMPTE EG 1)
- unmodulated gray scale (50% APL)
- window signal (100 IRE), also variable in level
- unmodulated variable-level flat field
- crosshatch
- pulse and bar
- multiburst
- centrally placed full-field PLUGE signal

Ideally, a spectroradiometer is the optimum instrument for setting color temperature. Operationally, a split-field optical comparator with a photometer and/or tristimulus (color analyzer) device is required.

4 Definition of terms

All color picture monitors are functionally similar, but the designation of the controls varies among models and manufacturers. (Refer to A.1 for a listing of controls that perform similar functions.)

5 Alignment

Although this practice specifies an operational alignment procedure for television color picture monitors, other alignment procedures are equally valid if they achieve the desired result. All the steps are not required every time the color picture monitor is to be aligned. If the desired results cannot be obtained, then the corrective procedures suggested by the manufacturer should be followed.

If the color picture monitors have an NTSC corrective matrix, the matrix should be switched off during alignment (see A.4). Alignment procedures should be followed in the sequence given below:

- initial conditions (see 5.1)
- initial screen adjustments (see 5.2)
- display uniformity (see 5.3)
- scan size (see 5.4)
- geometry and aspect ratio (see 5.5)
- focus (see 5.6)
- convergence (see 5.7)
- aperture correction (see 5.8)
- chrominance amplitude and phase (see 5.9)
- brightness, color temperature, and gray-scale tracking (see 5.10)
- monitor matching (see 5.11)

5.1 Initial conditions

The color picture monitor should be turned on and allowed to stabilize for 20–30 minutes. The room ambient lighting should be the same as it is when the monitor is in normal service. Several minutes must be allowed for visual adaptation. All the color picture monitor controls should be in their preset positions. It is important that the aim luminance value, 120 cd/m^2 (35 fL), be used for all the adjustments, except as noted. It is important that the comb filter and NTSC color matrix, if present, be defeated (see A.4).

5.2 Initial screen adjustments

Switch the monitor to the setup position. In this mode, only horizontal lines or bars appear on the monitor screen. Adjust the red, green, and blue screen controls individually so that red, green, and blue signals are barely visible. These adjustments are only preliminary and will be modified later to achieve correct gray-scale tracking (consult manufacturer's procedures).

5.3 Display uniformity

Good display uniformity is essential for color monitor matching. Perceptible variations in luminance levels or discolorations will make monitor matching difficult or impossible.

5.3.1 Purity

Purity is the ability of the gun to excite only its designated phosphor. It is checked by applying a low-level flat-field signal and activating only one of the three guns at a time. The display should have no noticeable discolorations. Purity can also be checked by turning the contrast control to minimum and increasing the brightness control until a medium bright red, green, or blue raster appears. If discolorations are perceptible, then appropriate corrective action should be taken; i.e., degaussing, movement of purity magnets, etc. (see A.5).

5.4 Scan size

The color picture monitor application establishes whether the overscan or underscan presentation of the display will be selected. An underscanned display is one in which the active video (picture) area, including the corners of the raster, is visible within the screen mask. Normal scan brings the edges of the picture

tangent to the mask position. Overscan should be no more than 5% (see A.6).

5.5 Geometry and aspect ratio

Geometry and aspect ratio of 4:3 are adjusted with the crosshatch signal by scanning the display device with the green beam only.

Correct geometry and linearity are obtained by adjusting the pin-cushion and scan-linearity controls so that the picture appears without evident distortions from the normal viewing distance.

The following options are available:

- place a linearity (ball chart) overlay onto the face of the CRT display;
- project a linearity slide onto the CRT display with a high-quality slide projector (a long focal length is required);
- use a transparent linearity tape with 2% tolerance markings.

5.6 Focus

An ideal focus target is not currently available on most test signal generators; however, multiburst, crosshatch, or white noise can be used as tools to optimize the focus of the displayed picture.

The focus control should be adjusted at the aim luminance level with all the beams on for optimum picture resolution in the central areas of the picture. (There should be no noticeable loss of definition in the corners.)

5.7 Convergence

Convergence is adjusted with a crosshatch signal. Convergence should be optimized for either normal scan or underscan, depending upon the application. The manufacturer generally provides an alignment sequence to ensure all scanning beams coincide.

5.8 Aperture correction

If aperture correction is used, the amount of aperture correction can be estimated visually by ensuring that the $2T \sin^2$ pulse has the same brightness as the luminance bar or the multiburst signal when the 3 MHz and 4.2 MHz bursts have the same sharpness and