RP 166-1995

SMPTE RECOMMENDED PRACTICE

Critical Viewing Conditions for Evaluation of Color Television Pictures

1 Scope

1.1 This practice specifies the environmental and surround conditions that are required in television or video program review areas for the consistent and critical evaluation of 525-line, 59.94-field television signals and other video program material at different technical facilities on properly aligned color picture monitors.

1.2 This practice also is designed to provide for repeatable color grading or correction and the rendering of subjective assessments when used with RP 167.

2 Color monitor characteristics

Parameters for the monitor screen at reference white (100 IRE) are as follows:

– a chromaticity of illuminant D_{65};
– a screen aim luminance of 120 cd/m^2 (35 fL).

3 Observer viewing characteristics

3.1 The observer should have normal color perception.

3.2 Adequate time must be allowed for visual adaptation to the viewing environment.

3.3 The observer's distance from the monitor screen should be 4–6 picture heights.

3.4 The observer should view the monitor screen at a preferred angle in both the horizontal and vertical planes of $0° \pm 5°$, but no greater than $\pm 15°$, from the perpendicular to the midpoint of the screen .

4 General conditions — Viewing area decor

4.1 The viewing area decor should have a generally neutral matte impression, without dominant colors (see A.4). It is most critical that areas in the field of view be devoid of vivid colors.

4.2 Surface reflectances should be nonspecular and should not exceed 10% of the peak luminance value of the monitor white. Surfaces which may be visible in the monitor screens, due to the mirror effect, should have a nonspecular surface reflectance of less than 15%.

4.3 Production desk and control console surfaces should have a generally neutral matte finish without dominant colors or specular features.

5 Surround characteristics

5.1 The surround wall should be either illuminated or reflective (see A.2 and A.3).

5.2 The reflective surround should be a visually neutral surface (preferably white or gray).

5.3 The reflective surround should be illuminated with a light quality closely matching illuminant D_{65}. Generally, the reflective surround receives its illumination from the controlled ambient lighting in the room (see clause 7).

5.4 The reflected light from the surround or background in the field of view should have a peak luminance of 12 cd/m^2 (3.5 fL) which is nominally 10% of the monitor screen(s) reference white (see A.2). Practice has shown that a

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uniform field is not optimum but that a gradation of intensity from top to bottom, or bottom to top, is more pleasing.

5.5 The surround should have an area, outside the monitor screen mask, of ideally at least eight times the monitor screen area (see figure 1).

5.6 If two monitor screens are mounted in one monitoring wall, then the total surround area should ideally be five times the total monitor screen area (see figure 2).

5.7 For monitors mounted in studio control room walls, see annex B.

6 Acceptable methods

6.1 A good practical approach is to have a monitor placed in a free-standing environment 2.5 to 5 screen heights in front of a wall providing the visual surround. The surround receives its illumination from directly controlled and ambient lighting in the room (see A.5).

6.2 Another approach is to mount the monitor in a wall with its face approximately flush with the surface of the wall.

7 Viewing room lighting characteristics (see annex C)

7.1 All light sources in use during picture assessment or adjustment should have a color quality closely matching the monitor screen at reference white; i.e., D_{65} (see A.5).

7.2 The ambient light reflected from the screen of a switched-off monitor should be the lowest possible level (see A.6).

7.3 Reflections on the monitor screen should not cause a perceptible impairment from the normal viewing position (see A.7).

7.4 The production desk and control consoles where a script is read should be illuminated to a light level of about 100 lx (10 fc). The illumination on the general working surfaces of the production desks and consoles should be 30–40 lx (3–4 fc) (see annexes A.8 and C).

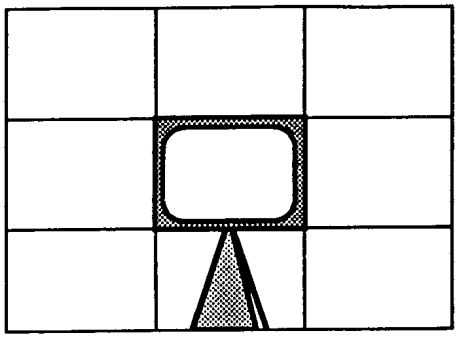


Figure 1 – Single monitor surround area

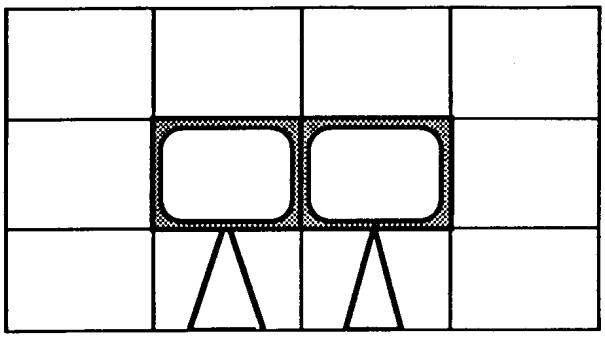


Figure 2 – Two-monitor surround area

Annex A (informative)
Additional data

A.1 Reference white

Reference white is obtained when a color video signal at a specified luminance level with zero color subcarrier is displayed on a properly aligned color picture monitor.

A.2 Surround

The surround is defined as the light, visible to the observer, from a plane or from behind a plane coincident with and surrounding but not including the viewing screen(s).

A.3 Characteristics of surrounds — Chromaticity and luminance

A surround, lit either from behind or from the front, makes picture matching easier to control. The surround, rather than the base luminance, becomes a fixed neutral visual reference. The surround will appear gray (neutral) compared to monitor screen(s) since it is about 10% of the light intensity of the monitor screen(s) reference white and the same color quality. The surround stabilizes the eye to achieve adaptation because it provides the observer(s) with a fixed neutral visual reference for color and brightness judgements, increases the apparent picture contrast, and provides for a more pleasant and less fatiguing work environment.

A.4 Decor

The viewing room should provide a pleasant environment. Areas in the field of view at normal operating positions should be a neutral surface color. For other areas, the use of pastel colors is preferred if a change from neutral is desired. The Munsell color system defines acceptable color choices by a category called “nearly neutral.” (See ASTM D1535-89.)

A.5 Viewing room light source

The preferred luminaires are daylight-type fluorescent lights. Their light output can be controlled over a large range without changing the color of light (see note 1 of A.8). Incandescent light sources filtered to daylight color temperature are also acceptable. Caution should be exercised in the use of this type of lighting in that most incandescent sources significantly change color when dimmed by controlling source voltage.

A.6 Impact of light

For a tutorial on the impact of light on the screen, see “Operations Adjustment of Picture Monitors in Television Studios,” by C. A. Siocos, *J. SMPTE*, 74: 11-14, January 1965.

A.7 Veiling reflection

A veiling reflection is defined as a regular reflection which is superimposed upon diffuse reflections from an object and which partially or totally obscures the details to be seen (on the color monitor screen(s)) by reducing the contrast.

A.8 Illumination

A fluorescent script luminaire without a special louver, mounted about 122 cm (48 in) above a surface will create a light level of about 500 lx (50 fc) on the surface. When a special matte-black egg-crate louver is installed, the lighting level is reduced to 100 lx (10 fc) and the angle of light spread is less than 15°. It is normal to have the illuminated area cut off within 50 mm (2 in) at the edge of the work surface. For additional fixed light intensity control, neutral density filter material can be installed on the upper surface of the special louver to achieve the correct illumination levels.

NOTES

1 A fluorescent compatible dimmer should be used to avoid flicker.

2 Fluorescent luminaires can provide no hard edge of light cutoff; therefore, the control area should be configured within this constraint.

Annex B (informative)
Studio control room monitor walls

It is often necessary to have black-and-white monitors surrounding one or more color monitors in a studio control room environment. These black-and-white monitors should be the same color temperature as the properly adjusted color monitor(s), 6500 K.

Black-and-white monitors are normally equipped with P4 phosphors, about 9300 K. This cooler color temperature prevents the background surrounding the color monitors from remaining neutral, 6500 K. Monitors with CRTs containing P4 phosphors should have their CRTs changed to D_{65}. Most manufacturers provide a CRT with 6500 K phosphors as an option in black-and-white monitors. When used, the peak-light output of these black-and-white monitors should be lower in value than that of the color monitors, usually two-thirds of the color monitor peak white value.

It is often important that the color monitor(s) be the primary viewing object in a wall full of monitors. The light output intensity of surrounding black-and-white monitors can divert attention from the color monitor(s) if the black-and-white monitors are set equal to or above the color monitor(s) intensity.

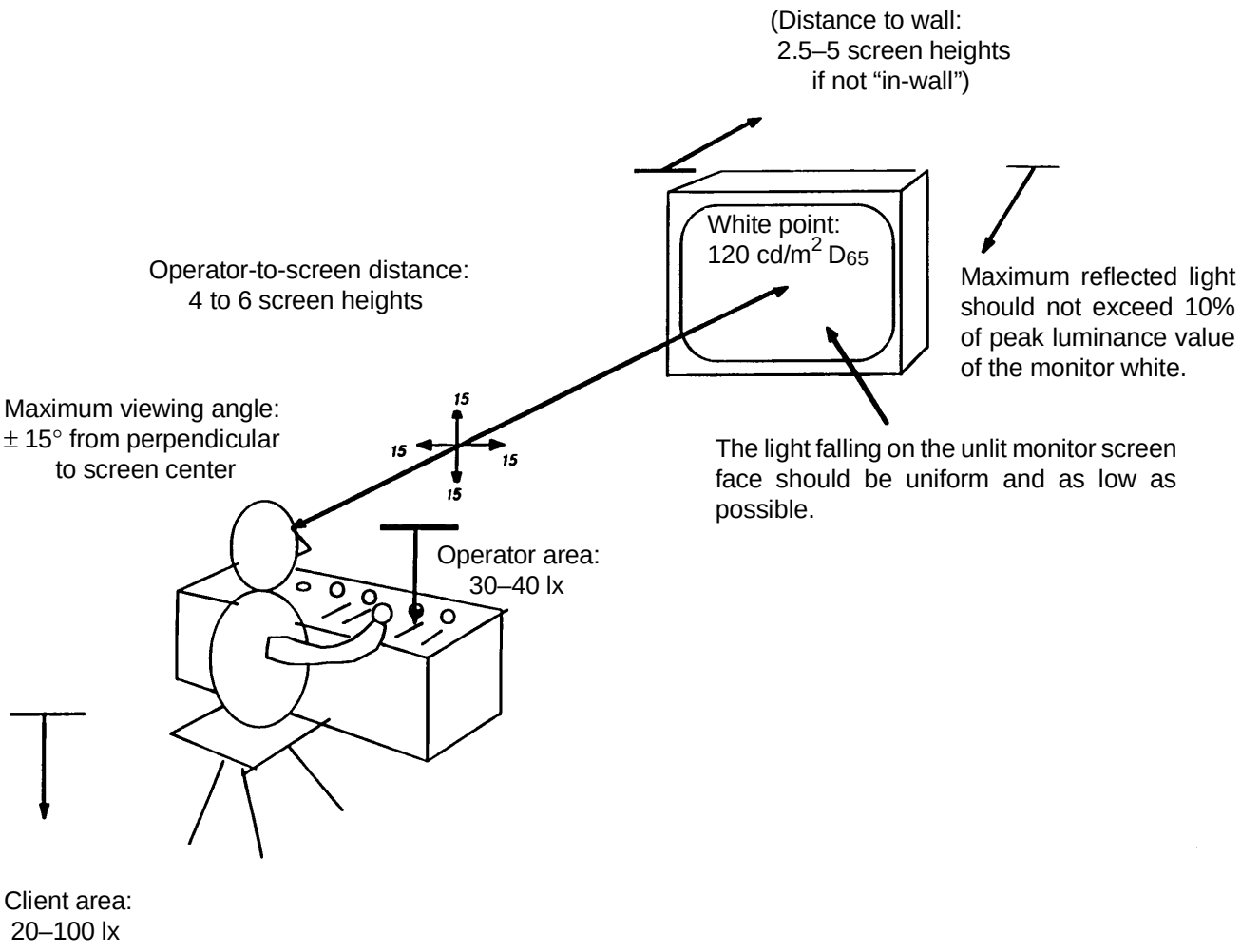
Annex C (informative)
Surround specifications

C.1 Background

The monitor is set in front of or into a wall. If in front of a wall, the tube face is typically 2.5 to 5 picture heights from the wall. The color of the monitor wall and the side walls within the field of view should be neutral.

C.2 Illuminant

The illuminant should approximate D_{65}.



Annex D (informative)
Bibliography

SMPTE RP 167-1995, Alignment of NTSC Color Picture Monitors

ASTM D1535-89, Standard Test Method for Specifying Color by the Munsell System