Annex B (informative)
Bibliography

SMPTE RP 27.3-1989, Specifications for Safe Action and Safe Title Areas Test Pattern for Television Systems

PROPOSED SMPTE RECOMMENDED PRACTICE

RP 94
Revision of RP 94-1993

Gain Determination of Front Projection Screens

Introduction

Screen gain is the ratio of the test luminance to the luminance of a lambert diffuser under the same viewing conditions and angle. Screen gain varies with the angle of view, because of the laws of reflection and the nature of the screen surface. Screen gain is basically directional and, thus, the maximum screen gain number is misleading because it is an incomplete description as it relates to an entire screen. The *hot-spot* on a screen is the full screen gain in operation at that spot.

1 Scope

This practice specifies a method for measurement of screen gain.

2 Formula

Screen gain is a ratio:

$$\text{Gain} = \frac{\text{Luminance of test screen}}{\text{Luminance of lambert diffuser}}$$

3 Measurement

3.1 The test screen sample shall be illuminated with discrete projection lamp light rays at or near perpendicular to the screen surface, in a darkened room area (see annex A.2).

3.2 The luminance of the screen sample shall be measured at 5-degree intervals. The measurements shall be in the horizontal plane (and vertical, if different) that pass through the perpendicular to the screen surface.

3.3 The maximum gain shall be labeled as such. The maximum gain advantage is assumed to have rolled off to below 1.0 at 30° off axis unless otherwise noted.

3.4 In testing screens already installed in theaters, the methods specified in 3.1 and 3.2 may be altered to accept the existing projection angle and seating arrangements (see annex A.1).

4 Instruments

4.1 The goniophotometer shall measure only the luminance of the perpendicularly illuminated area on the screen.

4.2 The photometer (see 4.1) shall have a spectral response of a standard observer with photopic vision (see annex A.6).

4.3 A diffuse reference standard similar to a lambert diffuser, which reflects all incident light so that the luminance is the same regardless of the angle of view, shall be used and shall be specified with the screen gain. The standard could be magnesium oxide (MgO), barium sulfate ($BaSO_4$), magnesium carbonate ($MgCO_3$), standardized matte white cardboard, or a matte white screen of calibrated reflectance.

Annex A (informative)
Additional data

A.1 In order to obtain an estimated gain value for an installed screen, one might measure the screen light at the screen center from the middle seat, and then repeat the screen center light reading from the end of the middle row (estimated to be 30°). The light ratio of center over side reading will approximate the estimated gain. Or a head-on light reading can be compared with a nongloss sheet of paper over the same spot.

A.2 When a goniophotometer is used to measure luminance, the photometer may see all of the perpendicularly illuminated spot on the screen sample at all angles. Therefore, the luminance readings may have to be corrected by dividing by the cosine of the angle. If the photometer sees only the small center of the perpendicularly illuminated area, the correction is not required.

A.3 Useful angles in achieving good audience coverage for a gain screen are the angles which provide the necessary recommended screen luminance (see ANSI/SMPTE 196M). In most cases, the angles would be limited to those which provide more than one-half the maximum gain. In a situation where the gain is over 1.3, the gain screen should be curved to allow the sides to reflect best to the center seating area (see SMPTE RP 95).

A.4 Some subjective gain errors may occur because a typical theater audience has a mesopic eye response, determined by how long the viewer is in the theater, the ambient light, the subtended screen size, film subject matter, and the projector lumen output. Therefore, some observers may not agree with the numerically calculated gain.

A.5 Retroflective screens, such as glass-beaded screens, reflect maximum gain back to the projector, regardless of projection angle.

A.6 References to instrument spectral response and required theater illumination are listed in ANSI/SMPTE 196M.

Annex B (informative)
Bibliography

ANSI/SMPTE 196M-1995, Motion-Picture Film — Indoor Theater and Review Room Projection — Screen Luminance and Viewing Conditions

SMPTE RP 95-1994, Installation of Gain Screens

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