

SEMI D83-0223

TEST METHOD FOR WARM-UP PROPERTIES OF DISPLAY PICTURE QUALITY

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1 Purpose

- 1.1 It is very important to measure and evaluate the warm-up properties of picture quality components that viewer can experience as well as the luminance factor.
- 1.2 This Standard specifies measurement conditions and methods for measuring the warm-up properties of picture quality components in display devices.
- 1.3 It contains five optical components of picture quality such as luminance, contrast, gamma, color temperature, and chromaticity value of primary colors.

2 Scope

- 2.1 This Standard is applicable to the color image display devices such as LCD, OLED, micro-LED, etc.
- 2.2 This Standard includes the measurement, representation, calculation, and analysis methods for the warm-up time of picture quality.
- 2.3 All terms are measured over time, also known as warm-up drift.

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3 Limitations

- 3.1 Measurements are subject to errors or imprecision due to the user, environmental factors, and miscalibration of measurement system or measurement system limitations.

4 Referenced Standards and Documents

4.1 CIE Standards¹

CIE 1976 — Uniform color space

4.2 SID Standards²

ICDM 1.03 — Information Display Measurement Standard

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

¹ Commission Internationale De L'eclairage (International Commission On Illumination), Kegelgasse 27, A-1030 Vienna/AUSTRIA. Telephone: +43.1.714.31.87.0, Fax: +43.1.714.31.87.18, <http://www.cie.co.at>

²The Society of Information Display, <https://www.sid.org>

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 *DUT* — device under test

5.1.2 *LMD* — light measurement device

5.2 Definitions

5.2.1 *chromaticity* — ratios of tristimulus values that do not contain any magnitude information.

5.2.2 *CIE $u'v'$* — a better uniform chromaticity coordinate system than CIE 1931 (x, y) recommended by CIE in 1976 (CIE 15.2)

5.2.3 *color difference* — the Euclidean distance between two colors in a specific color space.

5.2.4 *color temperature* — the temperature of an ideal black-body radiator that has the same chromaticity as that of the light source. Color temperature is conventionally expressed in kelvins, using the symbol K , a unit of measure for absolute temperature.

5.2.5 *contact LMD* — measurement probe of LMD is placed perpendicular to the DUT and directly in contact with the surface of it, which includes at least 500 pixels in the measurement aperture.

6 Measurement Conditions

6.1 Measuring Conditions

6.1.1 Environmental Conditions

6.1.1.1 The following environmental conditions are required to make an accurate measurement.

- Temperature: $25 \pm 2^\circ\text{C}$.
- Humidity: 25% to 85% relative humidity.
- Pressure: 86 kPa to 106 kPa.
- Airflow: no wind.

6.1.1.2 The environmental conditions shall not be changed during the warm-up measurement.

6.1.2 Dark Room Conditions

6.1.2.1 All measurements shall be carried out in a dark room less than 1 lux. When a different illuminance or ambient illumination condition is used, it shall be noted in the report.

6.2 Measurement Setup

6.2.1 Measuring Equipment Conditions

6.2.1.1 In this Standard, a light measurement device (LMD) such as a spectroradiometer or a filter photometer shall be used for colorimetric measurement.

6.2.1.2 The photometric accuracy of the LMD shall be within $\pm 2\%$ and colorimetric chromaticity accuracy shall be within ± 0.002 in Δxy for x, y .

6.2.2 Measurement Configuration

6.2.2.1 The measuring equipment shall consist of device under test (DUT), contact LMD, signal generator, and control PC (if used) as shown in Figure 1. The measuring location for warm-up properties is always the screen center of the display.

6.2.2.2 When using noncontact LMD, make sure that there is no difference in chromaticity and luminance due to the white boxes at the four corners in Figure 3. If there is a difference, the difference in the values shall be noted in the report.

6.2.3 Other Setup Conditions

6.2.3.1 There shall not be warm up the DUT prior to making these measurements. If the DUT had been turned on before the measurement was made, it shall be waited three hours or longer with the display turned off before attempting a measurement of the warm-up properties. (Refer to ICDM 1.03.)

6.2.3.2 All warm-up measurements of picture quality items for a specific time shall be carried out within as short a time as possible.

6.2.3.3 In case of any different conditions and configurations, they shall be noted on the report.

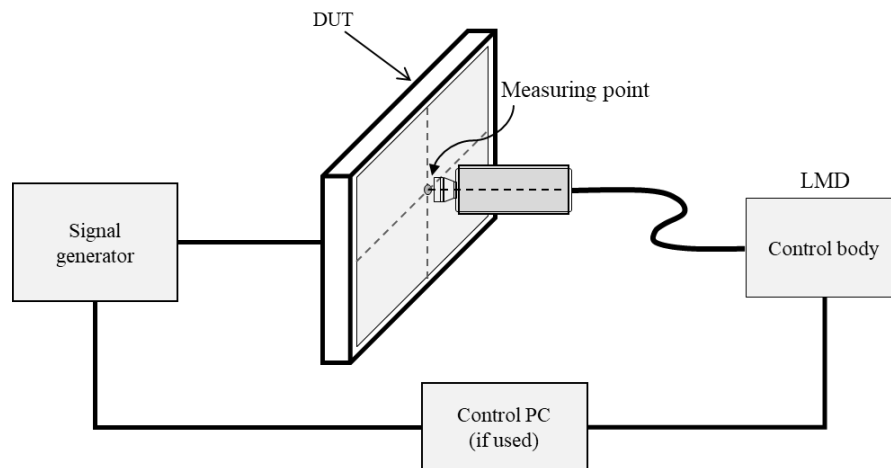


Figure 1
Measuring Configuration

7 Summary of Test Method

7.1 Test Patterns

7.1.1 This section describes all patterns used in this Standard to measure warm-up property items.

7.1.2 Window Patterns for Measuring Luminance and Color Temperature

7.1.2.1 A centered window box of 4% and 25% area with black background are used for measuring luminance as shown in Figure 2. The 100% intensity (e.g., 255 gray levels in 8 bits) for the window box and the 0% intensity (e.g., gray levels in 8 bits) for the background are applied. The 100% area full white pattern can also be used as well. When measuring the luminance of white signal, the color temperature of the pattern can be measured at the same time.

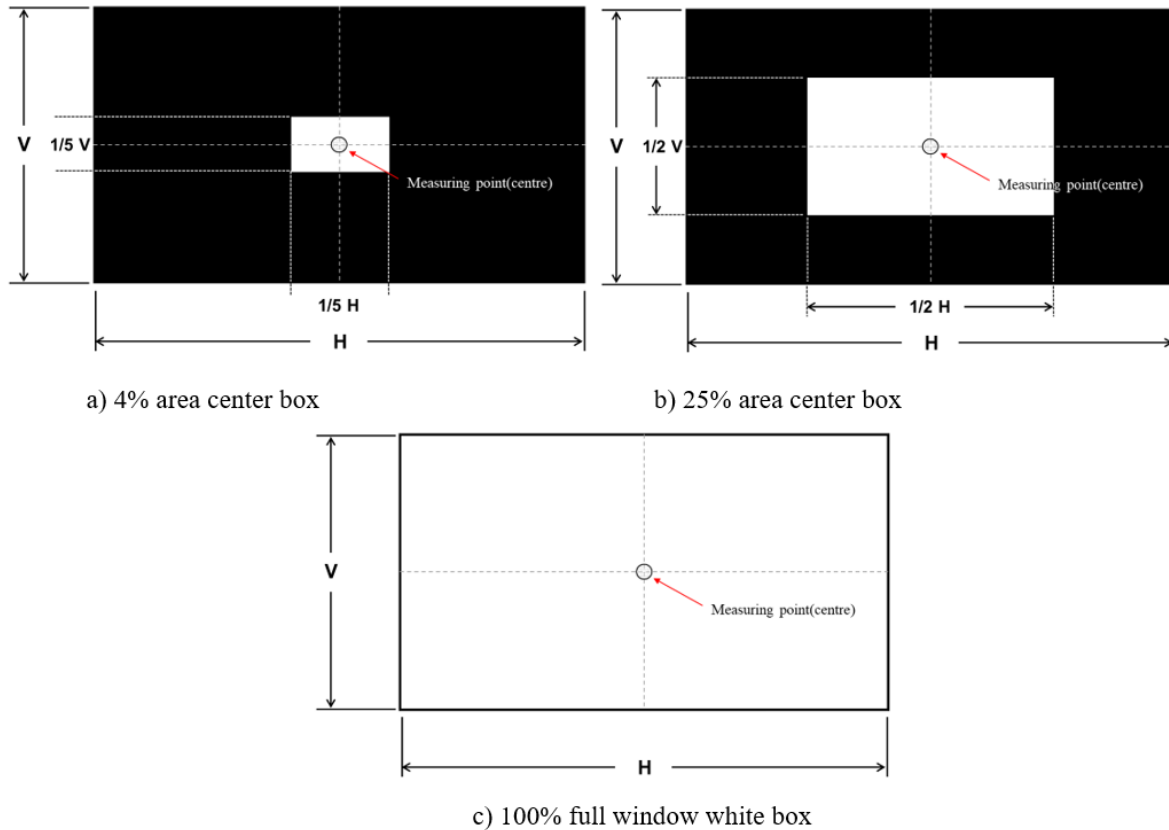


Figure 2
Center Box Test Patterns Using the 4%, 25%, and 100% Area Boxes

7.1.3 Four Corner Box Pattern for Measuring Black Luminance

7.1.3.1 A black background with 1/10 sized white boxes placed in the four corners is used for measuring black luminance as shown in Figure 3. The signal level of the 1/10 size boxes is 255 gray levels in 8 bits (e.g., 100% intensity) and the measuring point is the center of the screen. The reason for using this pattern is to exclude the case that the display turns off the backlight completely when input full black signal during the warm-up measurement.

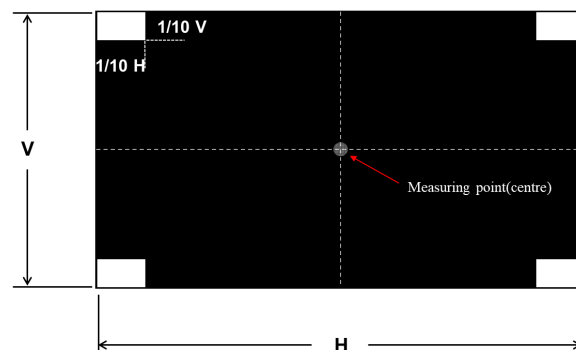


Figure 3
Four Corner Box Test Patterns with 1/10 Size White Boxes in the Four Corners