

SEMI D61-0723

TEST METHOD OF PERCEPTUAL ANGLE FOR OLED DISPLAYS

This Standard was technically approved by the Flat Panel Display – Metrology Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 18, 2022 and February 1, 2023. Available at www.semiviews.org and www.semi.org in July 2023; originally published November 2010.

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1 Purpose

1.1 This Standard describes a method for measuring angle dependent quality for Organic Light Emitting Diode (OLED) displays.

2 Scope

2.1 This Standard is applicable to the standard quality evaluation of OLED displays. This Standard includes the measuring, analyzing, and calculating methods of perceptual angle.

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3 Referenced Standards and Documents

3.1 IEC® Standards¹

IEC 62341-6-2 — Organic Light Emitting Diode (OLED) Displays – Part 6-2: Measuring Methods of Visual Quality and Ambient Performance

IEC 62977-2-1 — Electronic Displays – Part 2-1: Measurements of Optical Characteristics – Fundamental Measurements

3.2 CIE Standards²

CIE 159 — A Colour Appearance Model for Colour Management Systems: CIECAM02

CIE 200 — CIE Supplementary System of Photometry

3.3 SID Standards³

IDMS 1.1 — Information Display Measurements Standard

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

¹ International Electrotechnical Commission, 3 rue de Varembé, Case Postale 131, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.919.02.11, <http://www.iec.ch>. IEC trademark is owned by International Electrotechnical Commission.

² International Commission on Illumination, CIE Central Bureau, Babenbergstrasse 9/9A, 1010 Vienna, Austria; Telephone: +43.1.714.31.87, <https://cie.co.at>

³ The Society for Information Display, 1475 S. Bascom Ave. #114, Campbell, CA 95008-4006, USA. Telephone: +1.408.879.3901, Fax: +1.408.879.3833, <http://www.sid.org>

4 Terminology

4.1 Definitions

4.1.1 *average picture brightness (APB)* — the brightness value obtained by applying color appearance model to equivalent luminance reflecting H-K effect.

4.1.2 *brightness* — the attribute of a visual perception according to which an area appears to exhibit more or less light.

4.1.3 *color appearance model* — a color appearance model provides perceptual attribute correlates by predicting changes of color appearance of a visual stimulus under various, different viewing conditions.

4.1.4 *color volume* — the volume of a color space in the three-dimensional concept of how much space it occupies correlated with a set of colors.

4.1.5 *Helmholz-Kohlraush Effect (H-K effect)* — the effect of chromatic contribution to brightness, which makes higher-saturated lights appear brighter than lower-saturated lights, even when they are equal in luminance.

4.1.6 *perceptual angle* — the angle at which the color volume and average picture brightness drops to specific level comparing to that of on-axis. The color volume and average picture brightness could represent color quality that human perceives.

4.1.7 *primary color* — a set of colors that can be combined to produce any desired set of intermediate colors, within a limitation called the ‘gamut’.

4.1.7.1 The primary colors for color television are red, green, and blue.

4.1.7.2 The exact red, green, blue colors used are dependent on the television standard.

4.1.7.3 Display devices do not usually use the same primary colors, resulting in minor color changes from ideal.

5 Standard Measurement Condition

5.1 Temperature, Humidity, and Pressure

5.1.1 Measurements shall be carried out under the standard environmental conditions (e.g., at a temperature of 25°C ±3°C, a relative humidity of 25% to 85%, and a pressure of 86 kPa to 106 kPa).

5.1.2 When different environmental conditions are used, these shall be noted on the report.

5.2 Measurements shall be not carried out under vibration and windy conditions.

5.3 Illuminant Conditions

Table 1 Illuminant Conditions

Dark room condition	≤0.01 cd/m ²		
Ambient condition	Indoor	Hemispherical	TV viewing condition: 60 lux Office: 300 lux
		Direct	TV viewing condition: 40 lux Office: 200 lux
	Daylight	Hemispherical	15000 lux
		Direct	65000 lux

5.3.1 Detail conditions follow IEC 62341-6-2.

5.3.2 When different conditions are used, these shall be noted on the report.

5.3.2.1 In order to measure the correct illuminance of the indoor room with the least amount of light reflection from the display, the display shall be moved from the measurement position or be lined with black solid color.

5.3.2.2 The room, including walls, floor, and ceiling, shall be covered in gray or black curtains and rugs.

5.4 Equipment

5.4.1 Display power source.

5.4.2 Display driving equipment and display pattern generator.

5.4.3 Optical performance measurement device.

5.4.3.1 The Measurement device should be calibrated before the measurement is performed.

5.4.4 Two orthogonal axes of rotation that rotates an object to a particular orientation.

6 Standard Measuring Method

6.1 Optical Performance Measurement

6.1.1 Patterns

6.1.1.1 Complementary average picture level (CAPL) test patterns are used for measurement.

6.1.1.2 CAPL test patterns maintain the pre-gamma APL at 25% so it is called CAPL-25 test pattern, and its detailed concept follows 'Test patterns' in IEC 62977-2-1 and 'Color gamut envelope – color capability' in IDMS 1.1.

6.1.1.3 Luminance level of device under test (DUT) may depend on the pattern types due to the loading effect of the OLED display.

6.1.1.4 It shall be noted on the report which patterns are used for measurements.

6.1.1.5 Complementary Average Picture Level (CAPL-25) Test Patterns

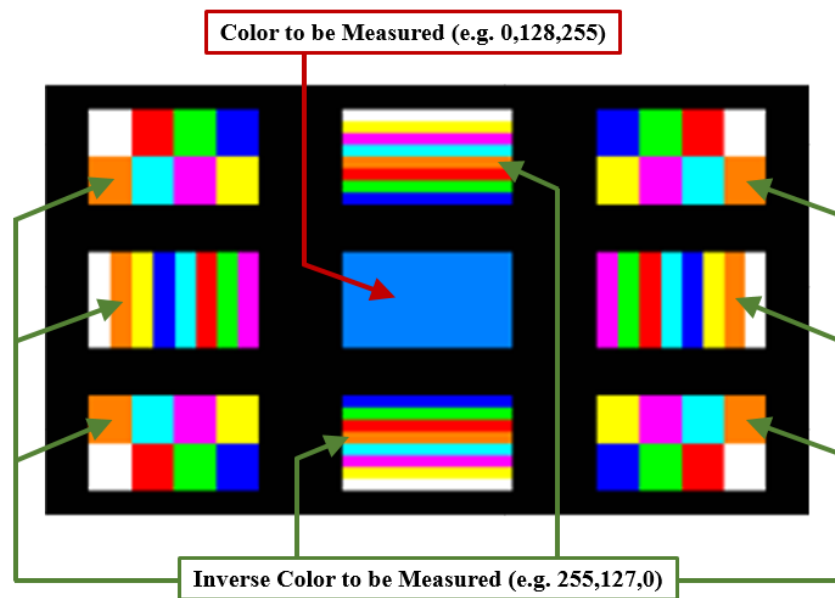


Figure 1
CAPL-25 Test Patterns with an Example Test Color and Inverse