



Edition 2.0 2017-11

# INTERNATIONAL STANDARD



## Organic light emitting diode (OLED) displays PREVIEW Part 6-3: Measuring methods of image quality (Standards.itch.ai)

<u>IEC 62341-6-3:2017</u> https://standards.iteh.ai/catalog/standards/sist/6ee34f09-d84a-4335-851c-0d02d8e2c0c9/iec-62341-6-3-2017





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Edition 2.0 2017-11

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# Organic light emitting diode (OLED) displays PREVIEW Part 6-3: Measuring methods of image quality h.ai)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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#### **ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS -**

#### Part 6-3: Measuring methods of image quality

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International Standard IEC 62341-6-3 has been prepared by IEC technical committee 110: Electronic display devices.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the measuring method for viewing angle has been modified. Measurement of the half luminance angle, gamma distortion, and directional colour variation is added;
- b) measurement method for colour characteristics is added;
- c) additional explanation is added in static image resolution clause;
- d) moving image resolution clause has been moved to Annex B.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
110/901/FDIS	110/923/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62341 series, under the general title *Organic light emitting diode (OLED) displays*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
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- replaced by a revised edition, or
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The contents of the corrigendum of October 2019 have been included in this copy.

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## ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS -

## Part 6-3: Measuring methods of image quality

#### 1 Scope

This part of IEC 62341 specifies the standard measurement conditions and measuring methods for determining the image quality of organic light emitting diode (OLED) display panels and modules.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62341-1-2:2014, Organic light emitting diode (OLED) displays – Part 1-2: Terminology and letter symbols

# iTeh STANDARD PREVIEW

# 3 Terms, definitions, and abbreviated terms eh.ai)

#### 3.1 Terms and definitions

#### IEC 62341-6-3:2017

For the purposes of this document, the terms and definitions given in 8 EC 62341-1-2 and the od02d8e2c0c9/icc-62341-6-3-2017

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- IEC Electropedia: available at http://www.electropedia.org/
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# 3.1.1 average picture level

#### APL

average loading percentage of display sub-pixels based on input signal levels

#### 3.1.2

#### static image resolution

maximum number of lines that can be adequately distinguished horizontally and vertically across the screen for static image signal inputs

Note 1 to entry: The unit of resolution is line, but pixel is also available as the unit of resolution.

#### 3.1.3

#### colour fidelity

ability to reproduce the intended colour

#### 3.1.4

#### colour desaturation

difference in chromaticity coordinates between solid colour and grilled pattern caused by image sharpening algorithm

#### 3.1.5

#### directional gamma distortion

ratio of gamma differences between the perpendicular and other viewing direction

#### 3.1.6

colour scale

range of luminance levels between maximum luminance and minimum luminance for the primary colour

#### 3.2 Abbreviated terms

APL	average picture level
CCD	charge coupled device
CFF	critical flicker frequency
CIE	Commission Internationale de l'Eclairage (International Commission on Illumination)
CIELAB	CIE 1976 (L*a*b*) colour space
DUT	device under test
HVS	human visual system
LED	light emitting diode
LMD	light measuring device
MPPR	moving picture perceptual resolution <b>D PREVIEW</b>
OLED	organic light emitting diode
PSF	point spread function
RGB	red, green, blue IEC 62341-6-3:2017
SDF	stray lightydistribution function/standards/sist/6ee34f09-d84a-4335-851c-
SLSF	spectral line spread function

#### 4 Standard measuring equipment and coordinate system

#### 4.1 Light measuring device

The system configuration and/or operating conditions of the measuring equipment shall comply with the structure specified in each item.

To ensure reliable measurements, the following requirements apply to the light measuring equipment:

- Luminance meter [1]<sup>1</sup>: the instrument's spectral responsivity shall comply with the CIE photonic luminous efficiency function with a CIE-*f*1' value no greater than 3 % [2]; the relative luminance uncertainty of measured luminance (relative to CIE Illuminant A source) shall not be greater than 4 % for luminance values over 0,1 cd/m<sup>2</sup> and not greater than 10 % for luminance values 0,1 cd/m<sup>2</sup> and below.
- 2) Colorimeter: the detector's spectral responsivity shall comply with the colour matching functions for the CIE 1931 standard colorimetric observer with a colorimetric accuracy of 0,002 for the CIE chromaticity coordinates x and y (relative to CIE Illuminant A source) for luminance values over 1 cd/m<sup>2</sup>. A correction factor can be used for the required accuracy by application of a standard source with similar spectral distribution as the display to be measured.

<sup>1</sup> Numbers in square brackets refer to the Bibliography.

- 3) Spectroradiometer: the wavelength range shall be at least from 380 nm to 780 nm, and the wavelength scale accuracy shall be less than 1 nm. The relative luminance uncertainty of measured luminance (relative to CIE Illuminant A source) shall not be greater than 4 % for luminance values over 0,1 cd/m<sup>2</sup> and not greater than 10 % for luminance values 0,1 cd/m<sup>2</sup> and below. Note that errors from spectral stray light within a spectroradiometer can be significant and shall be corrected. A simple matrix method may be used to correct the stray light errors, by which stray light errors can be reduced by one to two orders of magnitudes. Details of this correction method are discussed in [3].
- 4) Goniophotometric mechanism: the DUT or LMD can be driven rotating around a horizontal axis and vertical axis; angle accuracy shall be better than 0,5°.
- 5) Fast-response photometer: the linearity shall be better than 0,5 % and the frequency response higher than 1 kHz.

#### 4.2 Viewing direction coordinate system

The viewing direction is the direction in which the observer looks at the spot of interest on the DUT (see also IEC 62341-1-2:2014, Figure A.2). During the measurement, the LMD replaces the observer, looking from the same direction at a specified spot (i.e. measuring spot, measurement field) on the DUT. The viewing direction is conveniently defined by two angles: the angle of inclination  $\theta$  (related to the surface normal of the DUT) and the angle of rotation  $\phi$  (also called azimuth angle) as illustrated in Figure 1. The azimuth angle is related to the directions on a watch-dial as follows:  $\phi = 0^{\circ}$  is referred to as the 3-o'clock direction ("right"),  $\phi = 90^{\circ}$  as the 12-o'clock direction ("top"),  $\phi = 180^{\circ}$  as the 9-o'clock direction ("left") and  $\phi = 270^{\circ}$  as the 6-o'clock direction ("bottom").

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3 o'clock: right edge of the screen as seen from the perspective of the user 6 o'clock: bottom edge of the screen as seen from the perspective of the user

 ${\rm 9}$  o'clock: left edge of the screen as seen from the perspective of the user

12 o'clock: top edge of the screen as seen from the perspective of the user

NOTE This coordination is defined by the angle of inclination and the angle of rotation (azimuth angle) in a polar coordinate system.

#### Figure 1 – Representation of the viewing direction

#### 4.3 Standard measuring environmental conditions

Measurements shall be carried out under the standard environmental conditions:

- temperature:  $25 \text{ °C} \pm 3 \text{ °C}$ ,
- relative humidity: 25 % RH to 85 % RH,
- atmospheric pressure: 86 kPa to 106 kPa.

When different environmental conditions are used, they shall be noted in the measurement report.

#### 4.4 Power supply

The power supply for driving the DUT shall be adjusted to the rated voltage  $\pm$  0,5 %. In addition, the frequency of the power supply shall provide the rated frequency  $\pm$  0,2 %.

#### 4.5 Warm-up time

Measurements shall be carried out after sufficient warm-up. Warm-up time is defined as the time elapsed from when the supply source is switched on, and a 100 % grey level of input signal is applied to the DUT, until repeated measurements of the display show a variation in luminance of no more than 2 % per minute and 5 % per hour.

#### 4.6 Standard measuring dark-room conditions

The luminance contribution from the background illumination reflected off the test display shall be <  $0,01 \text{ cd/m}^2$ . If these conditions are not satisfied, then background subtraction is required and it shall be noted in the measurement report. In addition, if the sensitivity of the LMD is inadequate to measure these low levels, then the lower limit of the LMD shall be noted in the measurement report.

#### 4.7 Standard set-up conditions

By default, the display shall be installed in the vertical position (Figure 2a)), but the horizontal alternative (Figure 2b)) is also allowed. When the latter alternative is used, it shall be noted in the measurement report.

Luminance, contrast and chromaticity of the white field and other relevant parameters of the displays have to be adjusted to nominal status in the detailed specification and they shall be noted in the measurement report. When there is no level specified, the maximum contrast and/or luminance level shall be used. These adjustments shall be held constant for all measurements, unless noted otherwise in the measurement report. Additional conditions are specified separately for each measuring method.



a) Primary installation

b) Alternative installation

Figure 2 – DUT installation conditions

## 5 Measuring methods

### 5.1 Measuring methods for spatial image quality

### 5.1.1 Viewing angle

### 5.1.1.1 Purpose

The purpose of this method is to measure the viewing angle of an OLED display module in the horizontal ( $\phi = 0^{\circ}$ ,  $\phi = 180^{\circ}$ ) and vertical ( $\phi = 90^{\circ}$ ,  $\phi = 270$ ) viewing direction.

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#### 5.1.1.2 Measuring conditions

Standard measuring is implemented under standard dark-room and set-up conditions.

#### 5.1.1.3 Set-up

For this measurement, the LMD and DUT shall be set up as follows:

- 1) Apparatus: an LMD to measure luminance and chromaticity of the DUT; a driving power source; a driving signal equipment; a geometric mechanism illustrated in Figure 3.
- 2) Mount the display and LMD in a mechanical system that allows the display to be measured along its vertical and horizontal planes, which lie normal to the display surface. Figure 3 illustrates the geometry to be used in this measurement. The angle relative to the display normal in the horizontal plane, the 3 o'clock and 9 o'clock direction, is expressed as  $\theta_{\rm H}$ , and the angle in the vertical plane, the 6 o'clock and 12 o'clock direction, by  $\theta_{\rm V}$ . Either the display can be tilted to scan both planes, or the LMD can be moved within these planes. During the measuring procedure, the LMD shall be directed at the same field of measurement for all angles of inclination. In either case, the centre of the measurement field shall remain at the same location on the DUT surface for all angles of inclination. The angular positioning of the display in the goniophotometric system shall be accurate to  $\pm 0,5^{\circ}$ , and the measuring range shall be implemented from -90° to +90° both in the vertical and horizontal planes.



#### Figure 3 – Conceptual geometry used for measuring the viewing angle range

3) Align the LMD perpendicular to the display surface ( $\theta = 0, \phi = 0$ ), and position it to the centre of the display.

#### 5.1.1.4 Measurement of the half luminance angle

The measurement shall be as follows:

- 1) Apply a 4 % window size white screen with a 100 % signal level (R = G = B = 255 for an 8-bit input signal) to the DUT as shown in Figure 4.
- 2) Measure the centre luminance  $(L_0)$  perpendicular to the display surface  $(\theta = 0^\circ, \phi = 0^\circ)$ . The measurement area shall cover at least 500 pixels, or demonstrate equivalent results with fewer sampled pixels.
- 3) Take luminance  $(L_{0,\phi})$  measurements as the LMD steps through the various angles in the horizontal ( $\phi = 0^{\circ}, \phi = 180^{\circ}$ ) and vertical ( $\phi = 90^{\circ}, \phi = 270^{\circ}$ ) viewing planes. The measurement area should not expand past the 4 % window at large viewing directions.