



IEC 62341-6-2

Edition 2.0 2015-12

# INTERNATIONAL STANDARD



---

**Organic light emitting diode (OLED) displays –  
Part 6-2: Measuring methods of visual quality and ambient performance**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 31.260

ISBN 978-2-8322-3026-8

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references .....	7
3 Terms, definitions and abbreviations .....	7
3.1 Terms and definitions.....	7
3.2 Abbreviations.....	10
4 Structure of measuring equipment .....	10
5 Standard measuring conditions.....	10
5.1 Standard measuring environmental conditions .....	10
5.2 Standard lighting conditions .....	10
5.2.1 Dark-room conditions.....	10
5.2.2 Ambient illumination conditions.....	11
5.3 Standard setup conditions.....	16
5.3.1 General .....	16
5.3.2 Adjustment of OLED display modules .....	16
5.3.3 Starting conditions of measurements .....	16
5.3.4 Conditions of measuring equipment .....	16
6 Visual inspection of static images .....	17
6.1 General.....	17
6.2 Classification of visible defects .....	17
6.2.1 General .....	17
6.2.2 Reference examples for subpixel defects.....	17
6.2.3 Reference example for line defects.....	19
6.2.4 Reference example for mura defects .....	19
6.3 Visual inspection method and criteria.....	20
6.3.1 Standard inspection conditions .....	20
6.3.2 Standard inspection method .....	21
6.3.3 Inspection criteria .....	23
7 Electro-optical measuring methods under ambient illumination .....	24
7.1 Reflection measurements.....	24
7.1.1 Purpose.....	24
7.1.2 Measuring conditions.....	24
7.1.3 Measuring the hemispherical diffuse reflectance.....	25
7.1.4 Measuring the reflectance factor for a directional light source.....	26
7.2 Ambient contrast ratio .....	28
7.2.1 Purpose.....	28
7.2.2 Measuring conditions.....	28
7.2.3 Measuring method .....	28
7.3 Display daylight colour.....	29
7.3.1 Purpose.....	29
7.3.2 Measuring conditions.....	29
7.3.3 Measuring method .....	29
7.4 Daylight colour gamut volume .....	30
7.4.1 Purpose.....	30
7.4.2 Measuring conditions.....	30
7.4.3 Measuring method .....	31

7.4.4 Reporting.....	32
Annex A (informative) Measuring relative photoluminescence contribution from displays .....	34
A.1 Purpose .....	34
A.2 Measuring conditions .....	34
A.3 Measuring the bi-spectral photoluminescence of the display .....	34
A.4 Determining the relative PL contribution from the display .....	34
Annex B (informative) Diagnostic for observing display luminance dependence from ambient illumination .....	37
B.1 Purpose .....	37
B.2 Measuring method .....	37
Annex C (informative) Calculation method of daylight colour gamut volume .....	38
C.1 Purpose .....	38
C.2 Procedure for calculating the colour gamut volume .....	38
C.3 Surface subdivision method for CIELAB gamut volume calculation.....	40
C.3.1 Purpose.....	40
C.3.2 Assumptions .....	40
C.3.3 Algorithm .....	40
C.3.4 Software example execution .....	40
Bibliography.....	46
Figure 1 –Example of visual inspection room setup for control of ambient room lighting and reflections .....	11
Figure 2 –Example of measurement geometries for a uniform hemispherical diffuse illumination condition using an integrating sphere and sampling sphere .....	13
Figure 3 – Directional source measurement geometry using an isolated source .....	15
Figure 4 – Directional source measurement geometry using a ring light source.....	15
Figure 5 – Layout diagram of measurement setup.....	16
Figure 6 – Classification of visible defects .....	17
Figure 7 – Bright subpixel defects .....	18
Figure 8 – Criteria for classifying bright and dark subpixel defects .....	19
Figure 9 – Bright and dark line defects.....	19
Figure 10 –Sample image of line mura .....	20
Figure 11 – Example of spot mura .....	20
Figure 12 – Setup condition for visual inspection of electro-optical visual defects .....	22
Figure 13 – Shape of scratch and dent defect .....	24
Figure 14 –Example of range in colours produced by a given display as represented by the CIELAB colour space .....	32
Figure A.1 – Scaled bi-spectral photoluminescence response from a display .....	35
Figure A.2 – Decomposed bi-spectral photoluminescence response from a display.....	35
Figure B.1 – Example of display luminance reduction caused by the high illuminance from a high intensity LED flashlight directed at the display surface .....	37
Figure C.1 – Analysis flow chart for calculating the colour gamut volume .....	38
Figure C.2 – Graphical representation of the colour gamut volume for sRGB in the CIELAB colour space .....	39
Table 1 – Definitions for types of scratch and dent defects .....	24

Table 2 – Eigenvalues  $M_1$  and  $M_2$  for CIE daylight Illuminants D50 and D75 ..... 26

Table 3 – Example of minimum colours required for gamut volume calculation of a 3-  
primary 8-bit display ..... 31

Table 4 – Measured tristimulus values for the minimum set of colours (see Table 3)  
required for gamut volume calculation under the specified ambient illumination  
condition ..... 33

Table 5 – Calculated white point in the darkened room and daylight ambient condition ..... 33

Table 6 – Colour gamut volume in the CIELAB colour space ..... 33

Table C.1 – Tristimulus values of the sRGB primary colours ..... 39

Table C.2 –Example of sRGB colour set represented in the CIELAB colour space ..... 39

Table C.3 –Example of sRGB colour gamut volume in the CIELAB colour space ..... 40

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

**ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS –****Part 6-2: Measuring methods of visual quality and ambient performance**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62341-6-2 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) Contents of 7.4 are changed.
- b) Contents and items of Annex C are changed.
- c) Annex B is added.

The text of this standard is based on the following documents:

FDIS	Report on voting
110/695/FDIS	110/718/RVD

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

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

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS –

### Part 6-2: Measuring methods of visual quality and ambient performance

#### 1 Scope

This part of IEC 62341 specifies the standard measurement conditions and measurement methods for determining the visual quality and ambient performance of organic light emitting diode (OLED) display modules and panels. This document mainly applies to colour display modules.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at [www.electropedia.org](http://www.electropedia.org))

IEC 61966-2-1, *Multimedia systems and equipment – Colour measurement and management – Part 2-1: Colour management – Default RGB colour space – sRGB*

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

CIE 15:2004, *Colorimetry*