

Edition 4.0 2025-05

INTERNATIONAL STANDARD

Organic light emitting diode (OLED) displays – Part 6-1: Measuring methods of optical and electro-optical parameters

ICS 31.260 ISBN 978-2-8327-0395-3

CONTENTS

F	DREWOR	D	6
1	Scope.		8
2	Normat	ive references	8
3	Terms,	definitions and abbreviated terms	8
		erms and definitions	
		bbreviated terms	
4		re of measuring equipment	
5		rd measuring conditions	
•		tandard measuring environmental conditions	
		tandard measuring dark room conditions	
		tandard setup conditions	
	5.3.1	General	
	5.3.2	Adjustment of OLED displays	
	5.3.3	Starting conditions of measurements	
	5.3.4	Measuring equipment requirements	
	5.4 S	tandard locations of measurement field	12
	5.5 S	tandard test patterns	13
6	Measur	ing methods for optical parameters	17
	6.1 P	rimary luminance, colour, and uniformity of full-colour high-resolution	
	di	splays	
	6.1.1	Purpose	
	6.1.2	Measuring conditions	
	6.1.3	Measuring methods for high-resolution full colours	
	6.1.4	Maximum luminance of white and RGB primaries	
	6.1.5	Average colour of maximum white and RGB primaries	
	6.1.6	Luminance uniformity of white and RGB primaries	
	6.1.7	Chromaticity non-uniformity of maximum white and RGB primaries	
	6.1.8	Colour additivity of maximum white and RGB primaries	
	6.1.9	White correlated colour temperature	
		rimary luminance, chromaticity and uniformity of low-resolution displays	
	6.2.1	Purpose	
	6.2.2 6.2.3	Measuring conditions	
		Measuring methods for low-resolution displays and segmented displays	
	6.3.1	Purpose	
	6.3.2	Measuring conditions	
	6.3.3	Measuring conditions	
		ark room contrast ratio	
	6.4.1	Purpose	
	6.4.2	Measuring conditions	
	6.4.3	Measuring method	
		hromaticity gamut area	
	6.5.1	Purpose	
	6.5.2	Measuring conditions	
	6.5.3	Measuring methods	
	6.5.4	Chromaticity gamut area in CIE 1931 chromaticity diagram	
	6.6 C	olour gamut volume	26

6.6	Purpose	26
6.6	Measuring conditions	27
6.6	Measuring methods	27
7 Me	uring methods for power consumption	30
7.1	Purpose	30
7.2	Measuring conditions	
7.3	Measuring methods	
7.3	· ·	
	display module without signal decoding process	30
7.3	Measuring the power consumption of the OLED display module's embedded video connection terminal with a signal decoding process	31
Annex	normative) Response time of passive matrix display panels	34
A.1	Purpose	34
A.2	Measuring conditions	34
A.3	Measuring methods	34
Annex I	normative) Luminance current efficiency	36
B.1	Purpose	36
B.2	Measuring conditions	36
B.3	Measuring methods	36
Annex	informative) Veiling glare frustum	38
	informative) Methods to obtain the correlated colour temperature (CCT) from ity coordinates	39
D.1	Method 1: Use of McCamy's approximate formula	39
D.2	Method 2: Use of Javier Hernandez-Andres's approximate formula	
D.3	Method 3: Graphical determination of correlated colour temperature	
Annex I	informative) Measuring performance of modern colour-managed displays	43
E.1	Legacy displays	
E.2	Modern displays	
E.3	Results	
E.4	Conclusion	
Annex I	informative) Simple window luminance and colour measurements	
F.1	Background	
F.2	Measuring conditions	
F.3	Maximum full screen luminance	
F.4	4 % window luminance	
F.5	Sampled luminance non-uniformity	
F.6	4 % window centre colour	
F.7	Sampled colour non-uniformity	
	rhy	
9.	•	
Figure	- Layout diagram of measurement setup	11
Figure 2	- Standard measurement positions in the display active area	12
	- Test pattern scaling used to define the area size of the coloured rectangles ve area of the display	13
	- Medium APL loading series of red, green, blue, and white test patterns used uminance, colour, and uniformity measurements	14
	Low and high API loading versions of CTP nattern	15

Figure 6 – Standard medium APL RGBCMY test pattern used for centre luminance and colour measurements with 25 % APL	16
Figure 7 – Examples of variable signal loading RGBCMY test patterns used for centre luminance and colour measurements	17
Figure 8 – Sequence for measuring luminance and colour at the nine standard display positions for all coloured tile patterns	18
Figure 9 – Chromaticity of blackbody source at various temperatures as represented on the CIE 1931 chromaticity diagram	22
Figure 10 – Example representation of the primary colours in the CIE 1931 chromaticity diagram	26
Figure 11 – Example of range in colours produced by an sRGB display as represented by the CIELAB colour space and by visualization using gamut rings	29
Figure 12 – Example of measurement setup of power consumption	31
Figure 13 – Example of measurement setup of power consumption with embedded video terminal	32
Figure A.1 – Relationship between driving signal and optical response times	35
Figure B.1 – Example of a measurement configuration for measuring luminance current efficiency	37
Figure C.1 – Pattern for veiling glare frustum	38
Figure D.1 – CIE 1931 XYZ chromaticity diagram	41
Figure D.2 – Blackbody locus (Planckian locus) and isotemperature lines in CIE 1931 chromaticity diagram	42
Figure E.1 – Legacy model where the independent drive electronics provide a direct correlation between the input RGB signals and the display's colour primaries	43
Figure E.2 – Examples of modern drive models using multi-dimensional LUTs for RGB (top) and multi-chromatic (bottom) displays	44
Figure E.3 – Example of signal loading behaviour for an RGBW display (top) and RGB (bottom) OLED display	46
Figure E.4 – Low APL loading test pattern with small box size (1/9 of the screen size dimensions)	47
Figure E.5 – Signal loading profiles for several input colours measured at the centre of the test pattern using Figure 8	48
Figure F.1 – Example of simple 4 % white window pattern at the centre of the screen	50
Table 1 –Standard digital-equivalent input signals for rendering the white, primary and secondary colours in test patterns	17
Table 2 – Example of luminance measured for the same colour patch at the standard nine screen positions and the resulting luminance non-uniformity	19
Table 3 – Example of the chromaticity measured for the same colour patch at the nine standard screen positions and the resulting chromaticity non-uniformity	19
Table 4 – Scaling the size of the colour boxes in the APL loading pattern relative to the screen dimensions	24
Table 5 – Example of report format for CIELAB gamut volume	30
Table 6 – Example of a module power consumption measurements summary sheet	31
Table 7 – Example of module power consumption measurements with contents	33
Table 8 – Example of module power consumption measurements with images	33
Table D.1 – x_e , y_e , A_i and t_i for Formula (D.3) and Formula (D.4)	40

IEC 62341-6-1:2025 © IEC 2025	- 5 -
-------------------------------	--------------

_	
_	

Table E.1 – Example of luminance data for an RGB display and an RGBW OLED	
display	45

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS -

Part 6-1: Measuring methods of optical and electro-optical parameters

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62341-6-1 has been prepared by IEC technical committee 110: Electronic displays. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2022. This edition constitutes a technical revision.

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

- a) The standard average picture level (APL) RGBCMY test pattern is modified, and the variable signal loading RGBCMY test pattern is added.
- b) Chromaticity gamut area and colour gamut volume are modified.

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

Draft	Report on voting
110/1690/CDV	110/1735/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS -

Part 6-1: Measuring methods of optical and electro-optical parameters

1 Scope

This part of IEC 62341 specifies the standard measurement conditions and measuring methods for determining the optical and electro-optical parameters of organic light emitting diode (OLED) displays. Except for the power consumption method, all methods are intended for unbounded input signals measured in the flat regions of the display in a dark room.

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 60050-845, International Electrotechnical Vocabulary – Part 845: Lighting

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