IEC 62977-2-1

Edition 1.0 2021-01

INTERNATIONAL STANDARD

colour inside

Electronic displays –
Part 2-1: Measurements of optical characteristics – Fundamental measurements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.120; 31.260

ISBN 978-2-8322-9225-9

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ELECTRONIC DISPLAYS –

Part 2-1: Measurements of optical characteristics – Fundamental measurements

FOREWORD

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International Standard IEC 62977-2-1 has been prepared by IEC technical committee 110: Electronic displays.

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

FDIS	Report on voting
110/1256/FDIS	110/1275/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 parts in the IEC 62977 series, published under the general title *Electronic 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,
- withdrawn,
- replaced by a revised edition, or
- amended.

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.

INTRODUCTION

This document describes the common optical measurement methods applicable in the field of electronic display devices, which can overlap with some of the parts of existing documents developed within TC 110 (IEC 61747-30-1 [1] [1], IEC 62341-6-1, IEC 61988-2-1 [2], IEC 62715-5-1 [3]), that describe the optical measurement methods of the individual technologies, such as LCD, OLED, PDP and others. This document on common optical measurement methods is intended to be used as the reference document in future documents and in revisions of existing documents (e.g. IEC 61747-30-1, IEC 62341-6-1, IEC 61988-2-1, IEC 62715-5-1). The existing documents will be revised in their maintenance time to refer to this document to the largest extent possible.

All documents in IEC TC 110 that are concerned with the measurement of optical properties of electronic displays refer to a set of methods and procedures that are similar to each other, or sometimes even identical. This document is intended to identify these methods and to describe them, together with suitable precautions and diagnostics, as a reference for forthcoming documents to make the work of the involved experts more efficient and to avoid duplication of efforts.

Introduction of the common optical measurement method (COMM) is also related to a structure where each kind of optical measurement finds its unambiguous position for identification of similarities to other methods or for clarification of distinctions. This structural classification together with a general taxonomy is supposed to make the process of document production easier, faster and thus more effective.

The above characteristics are summarized in Table 1. The display characteristics that are addressed in this part of IEC 62977 are indicated by a check mark √ in the table.

Table 1 – Summary of display characteristics

Variables	**Time**		**Location** (x, y)	**Direction** (θ, ϕ)	**Test pattern, electrical driving, input signal**	**Illumination conditions**	**Temperature, humidity**
Data sampling condition	**Fast**	**Slow**	**Slow** √	**Slow**	**Slow** √		
Evaluation							
Results	transitions from one optical state to another state	temporal stability (uniformity)	uniformity √	uniformity, √	static pattern, √ characteristic function (electro-optic transfer function, EOTF) characteristic values (e.g. threshold, saturation)	darkroom, √ indoor, outdoor	standard environment √
Evaluation 1st order	turn-on, turn-off, delay (latency) time periods, temporal modulations				luminance, √ contrast, √ chromaticity, √ threshold, saturation values, steepness of transitions, etc.		
Evaluation 2nd order	flicker prediction, moving picture response time, etc.				EOTF from which the exponent gamma is evaluated chromaticity/ colour gamut area, √ colour gamut volume, √		

[1] Numbers in square brackets refer to the Bibliography.

ELECTRONIC DISPLAYS –

Part 2-1: Measurements of optical characteristics – Fundamental measurements

1 Scope

This part of IEC 62977 specifies standard measurement conditions and measuring methods for determining the optical characteristics of electronic display modules and systems. These methods apply to emissive and transmissive direct view displays that render real 2D images on a flat panel. This document evaluates the optical characteristics of these displays under darkroom conditions. This document applies to the testing of display performance in response to standard analogue or digital input signals that are not absolute luminance encoded. The input signal is relative RGB without metadata information that codes for real luminance, colour space or colour coordinates. These methods are limited to input signals with typical OETFs such as defined in IEC 61966-2-1, ITU BT. Rec. 601, ITU BT. Rec.709, and ITU BT. Rec.2020. The tests in this document are not approved for use with HDR input signals.

NOTE A flat panel or flat panel display is a display with a flat surface and minimal depth that emits visible light from the surface. The display is subdivided into an array of electronically driven pixels which can be light valves modulating a backlight, or self-luminous. Emissive/transmissive/reflective hybrid displays can be flat panel or flat panel displays.

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* (available at 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 62341-6-1, *Organic light emitting diode (OLED) displays – Part 6-1: Measuring methods of optical and electro-optical parameters*

IEC TR 62977-2-3, *Electronic display devices – Part 2-3: Measurements of optical properties – Multi-colour test patterns*

ISO 9241-305, *Ergonomics of human-system interaction – Part 305: Optical laboratory test methods for electronic visual displays*

ISO 15076-1:2010, *Image technology colour management – Architecture, profile format and data structure – Part 1: Based on ICC.1:2010*

ISO/CIE 11664-1, *Colorimetry – Part 1: CIE standard colorimetric observers*

ISO/CIE 11664-4, *Colorimetry – Part 4: CIE 1976 L*a*b* colour space*

CIE 15:2004, *Colorimetry, 3rd edition*

CIE 168:2005, *Criteria for the evaluation of extended-gamut colour encodings*

CIE 233:2019, *Calibration, characterization and use or array spectroradiometers*

ITU-R BT.601, *Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios*

ITU-R BT.709, *Parameters values for the HDTV standards for production and international programme exchange*

ITU-R BT.2020, *Parameters values for ultra-high definition television systems for production and international programme exchange*