IEC 62595-2-5

Edition 1.0 2021-05

INTERNATIONAL STANDARD

colour inside

Display lighting unit –
Part 2-5: Measurement method for optical quantities of non-planar light sources

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.120; 31.260

ISBN 978-2-8322-9771-1

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

DISPLAY LIGHTING UNIT –

Part 2-5: Measurement method for optical quantities of non-planar light sources

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 62595-2-5 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
110/1296/FDIS	110/1320/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 62595 series, published under the general title *Display lighting unit*, 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

The recent introduction of curved OLED TVs, and the expected rapid spread of flexible displays in portable devices, highlights the necessity of new measurement methods. In recent years flexible displays have been integrated into products such as cellular phones and wearable devices [1] to [5][1]. Development and integration of flexible displays have increased the application of curved devices, for example distinct or curved-back large-size wall displays, foldable signage displays, and commercial wearable or handheld devices. The measurement of optical characteristics of displays with radii larger than 35 mm has been documented.

Recently flexible light sources (LSs) have been used for general lighting applications and as light source for flexible non-emissive displays. Since bending a planar lighting unit alters the optical properties of the unit, assessment of the optical performance of the lighting units in a curved state, i.e., concave or convex condition, is indispensable for manufacturing companies.

A light source can be a planar or non-planar (continuous multiple curvatures), i.e., convex (outer light emitting surface of a curvature), or concave light source (inner light emitting surface of a curvature). When a light source is bent the LS is under strain, i.e., tension or depression, the optical characteristics differ from that of a planar LS. A non-planar LS may have local curvatures on its surface with different surface normal from position to position. Such an LS can be a semiconductor light-emitting diode (LED, OLED, polymer LED (PLED)) or a phosphor excited type using a pump source. An LS can have a narrow-band radiation or more than one narrow band emission.

Issues concerning flexible light sources with surface curvatures, which are different from those issues concerning displays (e.g., resolution, contrast, lateral and directional characteristics or directions of viewing), hitherto have not been documented.

Since the characteristics of a non-planar light source (NPLS) change with the decreasing radius of the curvature, the optical characteristics of LS such as lateral and directional luminance and luminance variations, lateral and directional chromaticity distributions and their variations, luminous intensity distribution, and luminous flux, will be measured and evaluated.

This document establishes the measurement methods for cylindrical light sources that can be a base for the study of non-planar LS, which is assumed to be an integration of small areas. The fundamental element of such a surface can be a convex or a concave curvature with a first order of radius, i.e., a cylindrical shape, which is worth considering in this document.

In addition, a curved light source is used in a variety of conditions. Therefore, the optical measurements of an LS will be performed in a darkroom.

As in the measurement of planar LSs the following measurements are used for convex and concave LS measurements: 1) a lateral scanning measurement and 2) a directional scanning measurement. In the case of lateral scanning, the surface normal coincides with the optical axis of the light measurement device. In the case of directional scanning the local surface normal makes an angle with the optical axis of the measurement device.

Since the aperture of a light measurement device is not zero (non-zero aperture), there exist an optimized measurement distance and angle (i.e., 0,1°, 0,2°, 1°, and 2°) for the measurements. In the measurement of a cylindrical LS, a light measurement device which has sufficient depth-of-field or depth-of-focus is selected, because the measurement field on the LS has a three-dimensional geometry and is different from that of a plane.

---

1 Numbers in square brackets refer to the Bibliography.

DISPLAY LIGHTING UNIT –

Part 2-5: Measurement method for optical quantities of non-planar light sources

1 Scope

This part of IEC 62595 specifies the measurement methods for measuring the optical characteristics of convex and concave cylindrical light sources. These non-planar light sources (NPLSs) can have either a continuous, distinct, segmented or block-wised light radiating surface, for example OLED panels, integrated LEDs, integrated mini-LEDs, micro-LEDs, laser diodes, each being either monochromatic or polychromatic.

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 61747-6-2, *Liquid crystal display devices – Part 6-2: Measuring methods for liquid crystal display modules – Reflective type*

IEC 62595-2-1, *Display lighting unit – Part 2-1: Electro-optical measuring methods of LED backlight unit*

IEC 62595-2-3, *Display lighting unit – Part 2-3: Electro-optical measuring methods for LED frontlight unit*

IEC 62679-3-3, *Electronic paper displays – Part 3-3: Optical measuring methods for displays with integrated lighting units*

IEC 62922, *Organic light emitting diode (OLED) panels for general lighting – Performance requirements*

ISO/CIE 11664-3*, Colorimetry – Part 3: CIE tristimulus values*

ISO/CIE 19476, *Characterization of the performance of illuminance meters and luminance meters*

CIE S 017/E:2020, *International Lighting Vocabulary*

CIE 1931, *Colour space*