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Electronic displays –
Part 3-4: Evaluation of optical performances – High dynamic range displays

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ELECTRONIC DISPLAYS –

Part 3-4: Evaluation of optical performances – High dynamic range displays

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

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

- reconfirmed,
- withdrawn,
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- amended.

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INTRODUCTION

High dynamic range (HDR) systems enable more natural images that contain wider variations in brightness. For the wider dynamic range, newly designed electro-optical transfer function (EOTF) replaces the BT.1886 function of standard dynamic range (SDR) HDTV. High dynamic range (HDR) systems utilize non-linear signal encoding that enables reproduction over a wider range of light levels, from subtle grey differences at very low luminance levels up to very bright highlights. This very wide range of light levels occurs in both natural as well as synthetic imagery. In particular, in order to render the native image according to the intent of the content creator, signal codewords of SMPTE ST 2084 [2][1] HDR EOTF, also known as the perceptual quantizer (PQ), are mapped to absolute luminance values within the mastering peak luminance as specified in metadata of the HDR content, versus an SDR signal level which indicates relative brightness according to the display luminance. In this case, tone mapping would be necessary when the display luminance cannot make the darker and the brighter luminance because HDR content preserves details in the darkest and brightest areas of a picture that are lost when using SDR standards (see 3.1.4) [20] such as Recommendation ITU-R BT.709 [12]. The tone mapping curve can depend upon the display manufacturer.

This document intends to describe the measurement and evaluation of the optical performance of HDR displays as a reference for forthcoming standards to make the work of the involved experts more efficient and to avoid duplication of efforts.

There are unique requirements to evaluate HDR displays, and particular attention is given to the measurements, so that they are done properly. For example,

1) very low luminance levels will be measured, with careful control of stray light from both the display as well as ambient light sources;
2) to measure high light output levels, measurements timing and test pattern need to be carefully controlled to correctly and accurately capture peak or high luminance levels since HDR displays can have a peak luminance time limit, and many HDR displays have luminance loading limits;
3) for HDR content, 10 bits or higher bit-depth should be used for sufficient luminance quantization;
4) the HDR test signal has SMPTE ST 2086 [3] HDR static metadata assigned to fixed values. Other metadata is not used in this document.

Proper source content is critical to evaluating HDR performance of the displays including the driver (and interface). In SDR displays, it is possible to separate these issues from the evaluation of “panels”, but for HDR displays it is not possible to separate these issues because HDR displays include one or more internal blocks that process the HDR video signal, such as EOTF and tone mapping, etc., in addition to essential driving stages for the display panel.

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

ELECTRONIC DISPLAYS –

Part 3-4: Evaluation of optical performances – High dynamic range displays

1 Scope

This part of IEC 62977 specifies the standard evaluation methods for determining the optical characteristics of HDR electronic display modules and systems. These methods apply to emissive and transmissive direct-view displays that render real 2D images on a flat panel or on a curved panel with a local radius of curvature larger than 1 500 mm. This document evaluates the optical characteristics of these displays under darkroom conditions. This document applies to the testing of display performance in response to HDR digital input signals that are absolute luminance encoded such as the HDR signal comprising RGB component values of Recommendation ITU-R BT.2020 colorimetry with SMPTE ST 2084 [2] PQ luminance encoding and SMPTE ST 2086 [3] metadata.

NOTE A flat panel or flat panel display is a display with a planar surface that emits light from the surface. The display can consist of light valves modulating a backlight or be self-luminous. Emissive/transmissive/reflective hybrid displays can be non-planar panels or non-planar 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 62977-2-1:2021, *Electronic displays – Part 2-1: Measurements of optical characteristics – Fundamental measurements*

IEC 62977-2-2:2020, *Electronic displays – Part 2-2: Measurement of optical characteristics – Ambient performance*

CIE 015:2004, *Colorimetry*

Recommendation ITU-R BT.2020-2, *Parameter values for ultra-high definition television systems for production and international programme exchange*

Recommendation ITU-R BT.2100-2, *Image parameter values for high dynamic range television for use in production and international programme exchange*