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Electronic displays –
Part 3-7: Evaluation of optical performance – Tone characteristics

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ELECTRONIC DISPLAYS –

Part 3-7: Evaluation of optical performance – Tone characteristics

FOREWORD

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

Draft	Report on voting
110/1371/FDIS	110/1397/RVD

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/standardsdev/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- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Images as formed by electronic displays have lateral variations of for example hue, saturation and intensity of visual stimuli. For displays of gradual smooth transitions no unwanted contours and no quantization artefacts should be visible. Therefore, the displays should render the required gradation of an image through tone reproduction. Tone is the variation in luminance, ideally with constant hue and saturation, at (r, g, b) input (n, 0, 0), (0, n, 0), (0, 0, n), and (n, n, n), respectively, where n:{0, 1,…N}, and N + 1 is the number of quantization levels. Similarly, colour saturation tone is defined as the luminance variation, ideally with constant hue, but with varying saturation of the input (= 1 – min (r, g, b) / max (r, g, b)), for input (N, n, n), (n, N, n), and (n, n, N). Tone can also be defined for complementary colour (r, g, b) input (0, n, n), (n, 0, n), (n, n, 0) and (n, N, N), (N, n, N), and (N, N, n), respectively. This is conceptually shown in Figure 1 which is the hue saturation lightness/intensity (HSL or HSI) model with RGB inputs for single colour tone, grey tone and colour saturation tone signal, where the lightness is defined as 0,5 × ((max (r, g, b) + min (r, g, b)). Note that this colour space is different from the device RGB colour space. Grey and RGB tone reproduction, and their additive relation, are fundamental optical properties of displays since they affect the fidelity with which colour is rendered from the input code values.

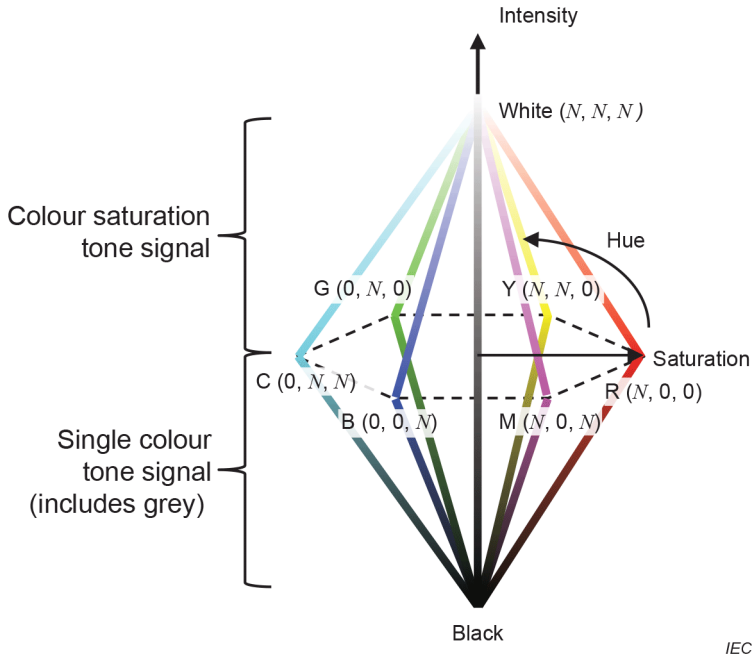


Figure 1 – Hue saturation lightness (HSL) colour model

In contemporary displays, nonlinear transformations into perceptually equidistant spaces are required to reduce visual artefacts while maintaining data economy. Also, the transformations linearize the opto-electrical transfer function, the nonlinearity of which is beneficial for reduction of artefacts such as quantization noise, banding, contouring, as well as for quantization efficiency.

The variation of electro-optical transfer functions (EOTFs) with viewing direction introduces further complications. The resulting impact omnidirectional image quality is more multifaceted compared to the viewing direction dependence of contrast, peak luminance, and colour of a limited number of patches.

This document describes methods for the measurement of EOTF and evaluation, and points out necessary precautions and diagnostics. The document is a reference for forthcoming standards to make the work of the involved experts more efficient and to avoid duplication of efforts.

ELECTRONIC DISPLAYS –

Part 3-7: Evaluation of optical performance – Tone characteristics

1 Scope

This part of IEC 62977 specifies the standard measurement and evaluation of optical performance for grey and colour tone reproduction of electronic displays under darkroom conditions. This document describes the measuring methods and evaluation of tone rendering of neutral grey, primary and secondary input colours. This document applies to displays with unbounded input signals.

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 TS 62977-3-1:2019, *Electronic displays – Part 3-1: Evaluation of optical performances – Colour difference based viewing direction dependence*

IEC 62341-6-3, *Organic light emitting diode (OLED) displays – Part 6-3: Measuring methods of image quality*

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