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TECHNICAL REPORT

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Electronic display devices – Part 3-2: Evaluation of optical characteristics – Mura

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRONIC DISPLAY DEVICES –

Part 3-2: Evaluation of optical characteristics – Mura

FOREWORD

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IEC TR 62977-3-2, which is a technical report, has been prepared by IEC technical committee 110: Electronic display devices.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
110/674A/DTR	110/701A/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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INTRODUCTION

Electronic displays, for example liquid crystal displays (LCDs), plasma display panels (PDPs), organic light emission displays (OLEDs), and so on, have grown popular as displays for high-quality images. It is therefore increasingly important to measure the image quality of electronic displays. One factor degrading the image quality is non-uniformity, known as 'mura'. The mura is classified into three types. The first is luminance mura, the second is colour mura. The third is called merely "mura" and includes luminance mura and colour mura simultaneously. It is impossible to recognize luminance mura and colour mura as completely separate objects.

Various measurement methods about luminance mura and colour mura have been reported in various academic conferences. There are also some standards for these mura. For example, uniformity of luminance and chromaticity are specified in IEC IEC 61747-30-1, SEMU (SEMI mura) is specified in SEMI D31-0213 and uniformity measurement is specified in IDMS ver.1.03 sec. 8. However there is no report which clearly provides the quantitative method for the mura that is called merely "mura" (see Annex D).

Therefore the majority of electronic display manufacturers are still using the limit sample for visual inspection.

This Technical Report, which intends to verify one mura measurement method, shows the detailed mura measurement method and its inspection experiment results.

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ELECTRONIC DISPLAY DEVICES –

Part 3-2: Evaluation of optical characteristics – Mura

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1 Scope

This part of IEC 62977, which is a Technical Report, provides an optical measuring method of mura for electronic displays. It defines general measuring procedures for mura measurement and an evaluation method of electronic displays.

2 Normative references

The following documents, in whole or in part, are referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Void.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
lightness mura
luminance unevenness whose lightness differs partially from the background lightness of a display screen with the exception of pixel defects

3.2
chroma mura
colour unevenness whose chroma differs partially from the background of a display screen with the exception of pixel defects

3.3
mura
both luminance and colour unevenness whose lightness and chroma differ partially from the background of a display screen with the exception of pixel defects

Note 1 to entry: In general, lightness mura and chroma mura exist simultaneously. Mura evaluation shows the degree of screen uniformity considering how both lightness mura and chroma mura affect human perception.

3.4
lightness edge area
ratio of lightness gradient area that is rapidly changed lightness to whole screen area

3.5
lightness mura area
area of uneven lightness that is bright or dark regions against the background of a display screen

3.6
maximum lightness difference
maximum lightness difference from the average L^* of a whole display screen

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3.7
chroma edge area
ratio of the chroma gradient area that is rapidly changed from the chroma to the whole screen area

3.8
chroma mura area
area of uneven chroma that is coloured regions against the background of a display screen

3.9
maximum chroma
maximum C^* value in a whole display screen

3.10
opponent colour space
three dimensions that are described as w/k, r/g, and b/y channels

Note 1 to entry: The w/k channel is a luminance component. The r/g and b/y channels are a chromaticity component of red to green, blue to yellow, respectively.

4 Standard measuring conditions

4.1 Standard measuring conditions

4.1.1 Standard measuring environmental conditions

The standard measuring environmental conditions specified in IEC 62341-6-1:2009, 5.1, should be applied. [1][1]

4.1.2 Standard measuring darkroom conditions

The standard measuring darkroom conditions specified in IEC 62341-6-1:2009, 5.2, should be applied. [1]

4.2 Light measuring device (LMD)

The LMD used for measurements of the displays should be checked for the following criteria and specified accordingly:

- sensitivity of the measured quantity;
- errors caused by veiling glare and lens flare (i.e. stray light in optical system);
- errors caused by camera noise (i.e. dark charge noise of a charge coupled device (CCD));
- timing of data-acquisition and aliasing-effects;
- linearity of detection and data conversion;
- resolution when using a two-dimensional LMD.

A two-dimensional LMD such as a CCD area detector should be used for these measurements. When using a two-dimensional LMD, it should be calibrated, so that the measurement results correspond to those by the point-measurement LMD.

A two-dimensional LMD measures a map of luminance and/or colour coordinate values over the measurement area of the screen. The specification of the LMD used should be noted in the report as shown in Table 1 for example.

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

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