

SEMI D57-0823

GUIDE FOR DEFINITION OF MEASUREMENT INDEX VISUAL CONTRAST THRESHOLD (VCT) FOR MURA IN FPD IMAGE QUALITY INSPECTION

This Standard was technically approved by the Flat Panel Display – Metrology Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 10, 2023. Available at www.semiviews.org and www.semi.org in August 2023; originally published March 2010.

1 Purpose

1.1 Specific definitions and quantifications of Mura are not consistent for many FPD manufacturers. Though there are standards for quantification of Mura, they are only used for limited types of Mura and are not practical in real varied cases. Currently it is still difficult to implement instruments to replace human inspectors for Mura inspections of LCDs. Therefore, it is necessary to standardize the classification of Mura for LCD.

2 Scope

2.1 This Standard focuses on the definition of measurement index visual contrast threshold (VCT) for Mura in FPD Image Quality Inspection.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 This Standard focuses on grayish Mura.

4 Referenced Standards and Documents

SEMI Standards and Safety Guidelines

SEMI D31 — Guide for Definition of Measurement Index (DSEMU) for Luminance Mura in FPD Image Quality Inspection

SEMI D41 — Measurement Method of SEMI Mura in Flat Panel Display Image Quality Inspection

4.1 *ISO® Standards*¹

ISO 13406-2:2001 — Ergonomic Requirements for Work with Visual Displays Based on Flat Panels – Part 2: Ergonomic Requirements for Flat Panel Display

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

Abbreviations and Acronyms

5.1.1 *VA* — visual angle

5.1.2 *VCT* — visual contrast threshold

5.2 *Definitions*

5.2.1 *Mura* — a display defect characterized by low contrast and unclear boundaries.

5.2.2 *visual angle (VA)* — used to describe Mura size in degrees.

¹ International Organization for Standardization, ISO Central Secretariat, Chemin de Blandonnet 8, CP 401-1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>. ISO trademark is owned by International Organization for Standardization.

5.2.2.1 VA can be calculated by the following equation:

$$S = \tan\left(\frac{VA}{2}\right) \times 2D \quad (1)$$

where S is the distance between object and edge, VA is visual angle, and D is viewing distance.

5.2.3 VCT — the contrast of Mura at just noticeable difference (JND) = 1 (correction rate of 75%).

$$VCT(\%) = \frac{|L_{mura} - L_b|}{L_b} \times 100\% \quad (2)$$

where L_{mura} and L_b represent luminance of Mura and background respectively.

5.2.4 The relationship between Mura size (VA) and the VCT under different Mura positions can be illustrated as regression equations below (refer to Related Information 1):

$$VCT_{center}(\%) = 0.48/VA + 0.71 \quad (3)$$

$$VCT_{edge}(\%) = 0.61/VA + 0.78 \quad (4)$$

$$VCT_{corner}(\%) = 1.23/VA + 0.76 \quad (5)$$

where:

VCT_{center} = visual contrast threshold of center Mura,

VCT_{edge} = visual contrast threshold of edge Mura, and

VCT_{corner} = visual contrast threshold of corner Mura.

6 Related Documents

6.1 ISO® Standards **Error! Bookmark not defined.**

ISO 13406-2:2001 — Ergonomic Requirements for Work with Visual Displays Based on Flat Panels – Part 2: Ergonomic Requirements for Flat Panel Displays

6.2 Chun-Chih Chen, Sheue-Ling Hwang and Chao-Hua Wen, “Measurement of human visual perception for Mura with some features,” *Journal of the SID* 16/9 (2008): pp. 969–976.