

SEMI D70-0314

TEST METHOD OF FPD-BASED STEREOSCOPIC DISPLAY WITH PASSIVE GLASSES

This Standard was technically approved by the Flat Panel Display – Metrology Global Technical Committee.
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1 Purpose

1.1 This Standard is provided specifically to help facilitate supply chain communication between supply channels as well as the communication between manufacturers and consumers.

2 Scope

2.1 This Test Method applies to FPD-based stereoscopic display with passive glasses. Test methods for the optical properties of 3D luminance, 3D luminance difference, 3D contrast ratio, system crosstalk, 3D chromaticity, 3D chromatic difference, 3D color-gamut, 3D angular luminance uniformity, 3D normal luminance uniformity, and 3D viewing angle are included in this Document.

NOTE 1: The passive glasses are limited to linear or circular polarization glasses in this Document.

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 Referenced Standards and Documents

3.1 SEMI Standards and Safety Guidelines

SEMI D59 — 3D Display Terminology

3.2 ISO Standard¹

ISO 11664-5:2009 (CIE S-014-5/E) — Colorimetry – Part 5: CIE 1976 $L^*u^*v^*$ Colour Space and u' , v' Uniform Chromaticity Scale Diagram

3.3 VESA Standard²

VESA FPD 2.0 — Flat Panel Display Measurements Standard

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

4 Terminology

4.1 Abbreviations and Acronyms

4.1.1 $C_{Xi,YZ}(u',v')$ — ‘C’ means chromaticity; the subscript ‘X’ (where $X = L$ or R) means left or right channel; the subscript ‘I’ means the location #i (where $i = 0\sim8$) of measurement point; the subscript ‘Y’ (where $Y = W, K, R, G$ or B) means the white, black, red, green, or blue pattern for the left channel; the subscript ‘Z’ (where $Z = W, K, R, G$ or B) means the white, black, red, green, or blue pattern for the right channel. (u' , v') are the coordinates of color space adopted by the International Commission on Illumination (CIE) in 1976.

4.1.2 FPD — flat panel display

4.1.3 LMD — light measurement device

4.1.4 $L_{Xi,YZ}$ — ‘L’ means luminance; the subscript ‘X’ (where $X = L$ or R) means left or right channel; the subscript ‘i’ means the location #i (where $i = 0\sim8$) of measurement point; the subscript ‘Y’ (where $Y = W$ or K) means the

¹ International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland; Telephone: 41.22.749.01.11, Fax: 41.22.733.34.30, <http://www.iso.org>

² Video Electronics Standards Association, 39899 Balentine Dr., Suite 125, Newark, CA 94560, USA; Telephone: 510.651.5122, Fax: 510.651.5127, <http://www.vesa.org>

white, or black pattern for the left channel; the subscript 'Z' (where $Z = W$ or K) means the white, or black pattern for the right channel.

4.1.5 P_i — measurement point at the location # i ($i = 0 \sim 8$) on the screen.

4.2 Definitions

4.2.1 *3D angular luminance uniformity* — LMD is positioned along the normal line of the center of screen at measuring distance. Then focus on each selected points at corresponding angles, and take the luminance by LMD, as shown in Figure 3. Configuration 'a' is rotate LMD with passive glasses fixed as shown in Figure 3 (a), while configuration 'b' is synchronized rotate LMD and passive glasses in Figure 3 (b).

4.2.2 *3D color gamut* — color range of monocular view for stereoscopic display.

4.2.3 *3D normal luminance uniformity* — LMD is set along the normal line of the screen at measuring distance when the measure luminance of each selected points as shown in Figure 2.

4.2.4 *interlaced pattern* — the pattern rendered by even rows and odd rows of the display panel. For example, the interlaced pattern of the left channel is even rows on the stereoscopic display while the other is the odd rows as shown in Figure 1.

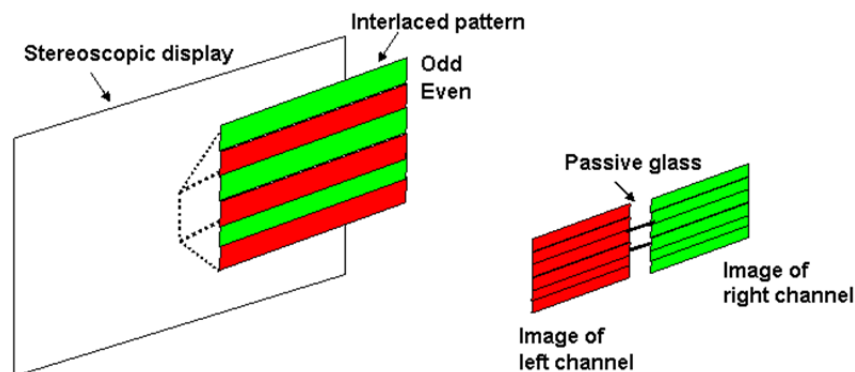


Figure 1
The Interlaced Pattern of Stereoscopic Display with Passive Glasses

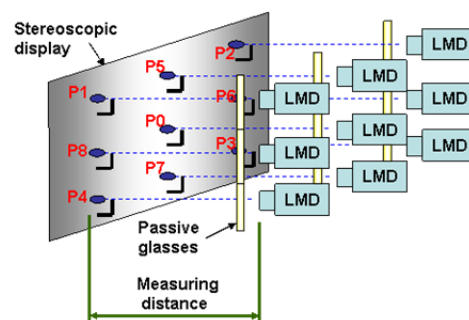


Figure 2
Measuring Layout for 3D Normal Luminance Uniformity

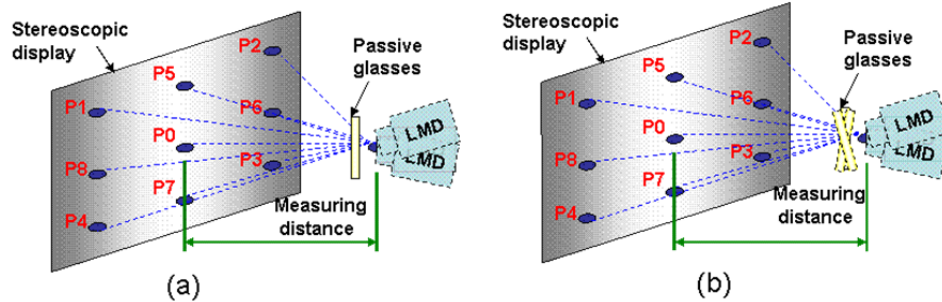


Figure 3
Measuring Layout for 3D Angular Luminance Uniformity
(a) Rotate LMD with Passive Glasses Fixed
(b) Synchronized Rotate LMD and Passive Glasses

5 Summary of Method

5.1 Environmental Conditions

- Temperature: $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$
- Humidity: 25% to 75% RH
- Illumination of surrounding: dark room ≤ 1 lux.

5.2 Measurement Structure

5.2.1 The measurement structure for testing the stereoscopic display with passive glasses in horizontal and vertical directions are shown in Figure 4 and Figure 5, respectively.

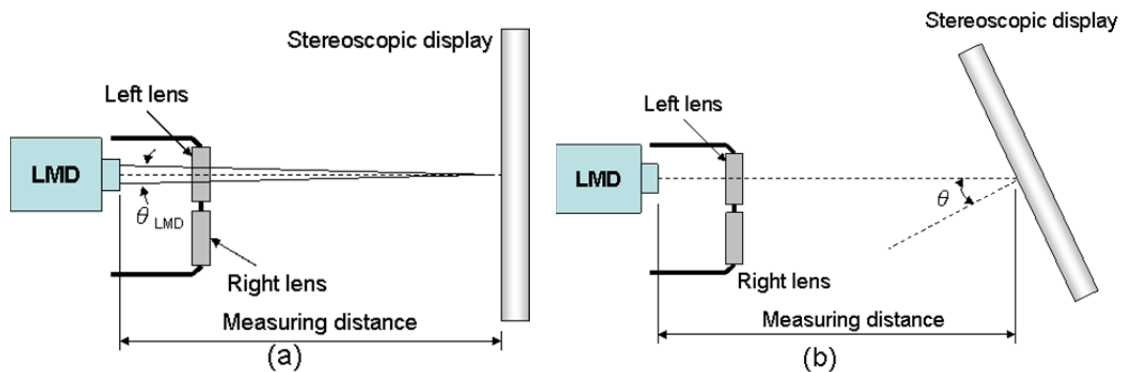


Figure 4
Measurement Structure for Testing Stereoscopic Display in Horizontal Direction
(a) Normal Line
(b) Rotation of Stereoscopic Display (Top View)

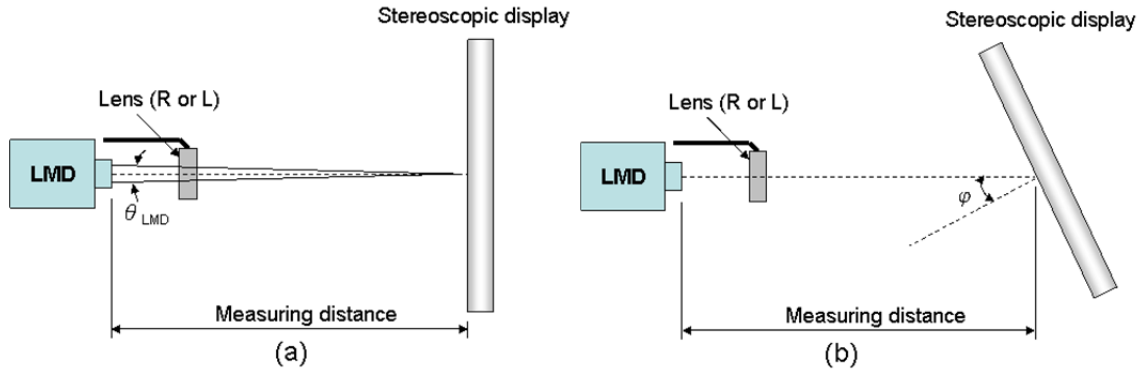
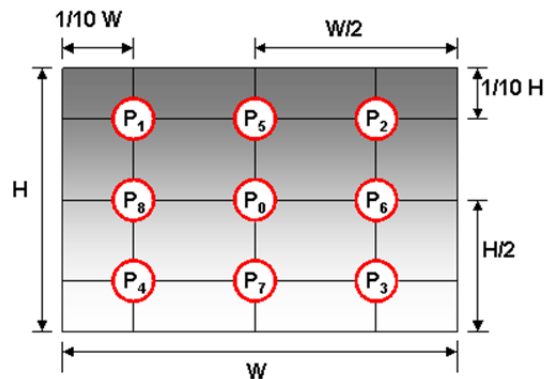


Figure 5
Measurement Structure for Testing Stereoscopic Display in Vertical Direction
(a) Normal Line
(b) Tilt of Stereoscopic Display (Side View)

5.3 Measuring Points

5.3.1 The 9 points measurement is recommended. The measuring points are notated from P_0 to P_8 respectively as shown in Figure 6.



W: The width of active area.
H: The height of active area.

Figure 6
Layout of Measuring Points

5.4 Measurement Setup

5.4.1 After warming up the stereoscopic display, apply the interlaced pattern to the left and right channels.

5.4.2 Put LMD along the normal line of the center of the screen at measuring distance. Then rotate the angle θ of stereoscopic display on the horizontal direction as shown in Figure 4. Then tilt the angle ϕ of the stereoscopic display on the vertical direction shown in Figure 5.

NOTE 2: Both of measuring distance and rotate angle are specified by mutual agreement between customer and manufacturer.

5.4.3 Set the lens of the passive glasses front and perpendicular to the optical axis of LMD, and make sure that the lens of the passive glasses shall cover the subtense angle (θ_{LMD}) of LMD. Use a shade to block any stray light if necessary. It is recommended to set the distance between passive glasses and LMD as close as possible.

5.4.4 Measure at least 500 pixels or 10% of the panel pixels (exceptions shall be verified and reported).

6 Apparatus

6.1 *Luminance Measurement* — Use a luminance meter or spectro-radiometer to measure the luminance.

6.2 *Color Measurement* — Use a spectro-radiometer or colorimeter to measure the chromaticity.

7 Test Pattern and Measuring Item

7.1 Send the interlaced pattern to the stereoscopic display. These patterns are full screen signals and the input signal levels are 100% for white, red, green and blue, while the input signal level is 0% for black, on left and right channels (see Table 1).

Table 1 Interlaced Pattern and Measuring Items

<i>Interlaced Pattern</i>		<i>Measuring Item (Luminance)</i>		<i>Measuring Item (Chromaticity)</i>	
<i>Left Channel Interlaced Pattern</i>	<i>Right Channel Interlaced Pattern</i>	<i>Left View</i>	<i>Right View</i>	<i>Left View</i>	<i>Right View</i>
White	Black	$L_{Li,WK}$	$L_{Ri,WK}$		
White	White	$L_{Li,WW}$	$L_{Ri,WW}$	$C_{Li,WW}(u',v')$	$C_{Ri,WW}(u',v')$
Black	Black	$L_{Li,KK}$	$L_{Ri,KK}$	$C_{Li,KK}(u',v')$	$C_{Ri,KK}(u',v')$
Black	White	$L_{Li,KW}$	$L_{Ri,KW}$		
Red	Red			$C_{Li,RR}(u',v')$	$C_{Ri,RR}(u',v')$
Green	Green			$C_{Li,GG}(u',v')$	$C_{Ri,GG}(u',v')$
Blue	Blue			$C_{Li,BB}(u',v')$	$C_{Ri,BB}(u',v')$

8 Preparation of Apparatus

8.1 Warm up the measuring equipment for a specified period of time and stabilize the display luminance output (according to the instruction manual of measuring equipment or follow VESA FPDm 2.0).

9 Calibration and Standardization

9.1 The LMD used for luminance and chromaticity measurements shall be calibrated and traced to the accredited laboratory.

10 Procedure

10.1 3D Luminance

10.1.1 Set the LMD at the measuring distance, and set the left lens in front of the LMD.

10.1.2 Apply the white/white test pattern to the stereoscopic display, measure and record the luminance at center point of the screen.

10.1.3 Set the right lens in front of the LMD.