

SEMI D55-0310

GUIDE FOR EVALUATION METHOD OF COLOR PERFORMANCE FOR COLOR FILTER ASSEMBLIES (EVALUATION METHOD OF COLOR PURITY)

This Standard was technically approved by the Flat Panel Display – Color Filter & Optical Elements Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 16, 2010. Available at www.semi.org in March 2010.

NOTICE: This Standard or Safety Guideline has an Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Purpose

1.1 This Standard is the guidance for evaluating color representation of the color filter using the color property of the FPD color filter measured in accordance with SEMI D22.

2 Scope

2.1 This Document defines methods used for evaluating color property of the FPD color filters.

2.2 The measurement methods for chromatic characteristics comply with SEMI D22.

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 D13 — Terminology for FPD Color Filter Assemblies

SEMI D22 — Test Method for the Determination of Color, Transmittance of FPD Color Filter Assemblies

3.2 CIE Standards¹

CIE 1931 — Standard Colorimetric Observer

CIE 1976 — Uniform Chromaticity Scale Diagram

3.3 EBU Standard²

EBU Tech 3213-E — Standard for Chromaticity Tolerances for Studio Monitors

3.4 IEC Standard³

IEC 61966-2-1 ed1.0 — Multimedia Systems and Equipment – Colour Measurement and Management – Part 2-1: Colour Management – Default RGB Colour Space – sRGB

3.5 ISO Standard⁴

ISO/CIE 10526:1991 — CIE Standard Colorimetric Illuminants

¹ International Commission On Illumination, CIE Central Bureau, Kegelgasse 27, A-1030 Vienna, Austria. Telephone : +43.1.714.31.87.1 ; Fax : +43.1.714.31.87.18; <http://www.cie.co.at>

² European Broadcasting Union, L'Ancienne-Route 17A, CH-1218 Grand-Saconnex, Switzerland. Telephone: +41.0.22.717.2111; Fax: +41.0.22.747.4000; <http://www.ebu.ch/>

³ International Electrotechnical Commission, 3 rue de Varembe, Case Postale 131, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.919.02.11, Fax: +41.22.919.03.00, <http://www.iec.ch>

⁴ 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>

3.6 JIS Standard⁵

JIS Z 8720:2000 — Standard Illuminants and Sources for Colorimetry

3.7 NTSC Standard⁶

National Television Standards Committee, Issued December 23, 1953

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

4 Calculation Methods for Obtaining Different Color Representations

4.1 Guidance for Obtaining NTSC Color Space Ratio (%)

4.1.1 Measure the color properties of Red, Green and Blue based on SEMI D22.

4.1.2 Plot the above results to CIE 1931 x, y chromaticity diagram.

4.1.3 Plot the Red, Green and Blue points based on the NTSC Standards to the same CIE 1931 x, y chromaticity diagram.

4.1.4 Calculate the area of the triangle formed by connecting the above NTSC Standards RGB plotted points. Set this value as A.

4.1.5 Calculate the area of the triangle formed by connecting the evaluated RGB plotted points. Set this value as B.

4.1.6 Calculate B/A to obtain C.

4.1.7 Convert C to %.

4.1.8 For example, assume the Green coordinates (Gx, Gy), Red coordinates (Rx, Ry) and Blue coordinates (Bx, By). Then the NTSC color space ratio is calculated by the following formula:

$$\frac{(Rx - Bx) \times (Gy - By) - \frac{(Rx - Bx) \times (Ry - By) + (Rx - Gx) \times (Gy - Ry) + (Gx - Bx) \times (Gy - By)}{2}}{0.1582} \times 100 \quad (1)$$

NOTE 1: NTSC Standard — NTSC is a color broadcasting standard and indicates reproducible colors by a triangle range, which is formed by connecting the chromaticity points of R (0.670, 0.330), G (0.210, 0.710) and B (0.140, 0.080) in the CIE (x, y) chromaticity diagram. The NTSC Standard has a long history and is still used today as a guideline to indicate the color reproduction range. Today, about 72% of CRT TVs are NTSC.

4.2 Comparison with Other Color Spaces

4.2.1 Comparative evaluation with other color spaces can also be made by using the same method as above in § 4.1.

4.2.1.1 *EBU Standards Ratio (%)* — Adopted as the color specification for CRT and is a color standard specification that shows color reproducibility appropriate for color TV. The RGB chromaticity points (x, y) are R (0.640, 0.330), G (0.290, 0.600) and B (0.150, 0.060).

4.2.1.1.1 For example, assume the Green coordinates (Gx, Gy), Red coordinates (Rx, Ry) and Blue coordinates (Bx, By). Then the EBU Standard color space ratio is calculated by the following formula:

$$\frac{(Rx - Bx) \times (Gy - By) - \frac{(Rx - Bx) \times (Ry - By) + (Rx - Gx) \times (Gy - Ry) + (Gx - Bx) \times (Gy - By)}{2}}{0.1155} \times 100 \quad (2)$$

4.2.1.2 *sRGB Specification Color Space Ratio (%)* — This is the color standard specification proposed by U.S. companies^{7,8} for multimedia systems and recognized as the CIE International Color Standard. The RGB chromaticity points (x, y) are R (0.640, 0.330), G (0.300, 0.600) and B (0.150, 0.060).

⁵ Japanese Standards Association, 4-1-24 Akasaka, Minato-ku, Tokyo 107-8440, Japan; Telephone: +81.3.3583.8005, Fax: +81.3.3586.2014, <http://www.jsa.or.jp>

⁶ National Television System Committee; <http://www.ntsc-tv.com/ntsc-index-01.htm>

⁷ Microsoft Corporation; <http://www.microsoft.com/>

⁸ Hewlett-Packard Company; <http://www.hp.com/>