



Standard Guide for Modeling the Colorimetric Properties of a CRT-Type Visual Display Unit¹

This standard is issued under the fixed designation E1682; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This guide provides directions and mathematical models for deriving the relationship between digital settings in a computer-controlled visual display unit and the resulting photometric and colorimetric output of the display unit. The accurate determination of this relationship is critical to the goal of accurate, device-independent color simulation on a visual display unit.

1. Scope

1.1 This guide is intended for use in establishing the operating characteristics of a visual display unit (VDU), such as a cathode ray tube (CRT). Those characteristics define the relationship between the digital information supplied by a computer, which defines an image, and the resulting spectral radiant exitance and CIE tristimulus values. The mathematical description of this relationship can be used to provide a nearby device-independent model for the accurate display of color and colored images on the VDU. The CIE tristimulus values referred to here are those calculated from the CIE 1931 2° standard colorimetric (photopic) observer.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E284 Terminology of Appearance

E1336 Test Method for Obtaining Colorimetric Data From a Visual Display Unit by Spectroradiometry

E1455 Practice for Obtaining Colorimetric Data from a Visual Display Unit Using Tristimulus Colorimeters

¹ This guide is under the jurisdiction of ASTM Committee E12 on Color and Appearance and is the direct responsibility of Subcommittee E12.06 on Image Based Color Measurement.

Current edition approved Oct. 1, 2013. Published October 2013. Originally approved in 1995. Last previous edition approved in 2008 as E1682 – 08. DOI: 10.1520/E1682-08R13.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Terminology

3.1 Definitions of appearance terms in Terminology E284 are applicable to this guide.

3.2 *Acronyms:*

3.2.1 *CRT, n*—an abbreviation for the term cathode ray tube, a device for projecting a stream of electrons onto a phosphor-coated screen in such a way as to display characters and graphics.

3.2.2 *DAC, n*—an abbreviation for the term digital to analog converter, a device for accepting a digital computer bit pattern and translating it into an analog voltage of a prescribed value.

3.2.3 *LUT, n*—an abbreviation for the term look up table, a process in which input and output values are mapped in an *n*-dimensional table such that, for a given input value, the appropriate output value is “looked-up” from the table.

3.2.4 *VDU, n*—an abbreviation for the term visual display unit, a device interfaced to a computer for displaying text and graphics.

3.2.4.1 *Discussion*—A CRT is one type of VDU.

4. Summary of Guide

4.1 Every color stimulus generated on a VDU is realized by the linear (additive) superposition of the spectral power distribution of three primaries. Test Method E1336 describes how to measure the spectral power distributions and reduce them to CIE tristimulus values. Practice E1455 describes how to measure the CIE tristimulus values of the primaries directly. An exact characterization of the VDU would require measurement of the spectral power distribution at all possible combinations of primary settings. Modern, computer-controlled VDUs will provide 256 or more levels of each of the three primaries. This results in more than 16 777 000 unique settings, which is far too many combinations to be measured practically (see Note 1). Instead, a characteristic function