



ENERGY STAR[®] Program Requirements Product Specification for Displays

Final Draft Test Method Rev. Jul-2015

1 OVERVIEW

The following test method shall be used for determining product compliance with requirements in the ENERGY STAR Eligibility Criteria for Displays.

2 APPLICABILITY

The following test method is applicable to all products eligible for qualification under the ENERGY STAR Product Specification for Displays.

Note: The U.S. Department of Energy (DOE) has published the Test Procedure for Television Sets Final Rule (78 FR 63823). Any product that is included in DOE's scope of coverage for TVs shall ultimately be tested according to the Test Procedure for Television Sets Rulemaking published by DOE in Appendix H to subpart B of 10 CFR 430.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Displays.

A) Host Machine: The machine or device used as the source of video/audio signal for testing Displays. It may be a computer or any other device capable of providing a video signal.

4 TEST SETUP

A) Test Setup and Instrumentation: Test setup and instrumentation for all portions of this method shall be in accordance with the requirements of International Electrotechnical Commission (IEC) 62301 Ed. 2.0, "Measurement of Household Appliance Standby Power," Section 4, "General Conditions for Measurements," unless otherwise noted in this document. In the event of conflicting requirements, the ENERGY STAR Test Method shall take precedence.

B) Ac Input Power: Products capable of being powered from ac mains shall be connected to a voltage source appropriate for the intended market, as specified in Table 1. If an external power supply is shipped with the product, it shall be used to connect the product to the specified voltage source.

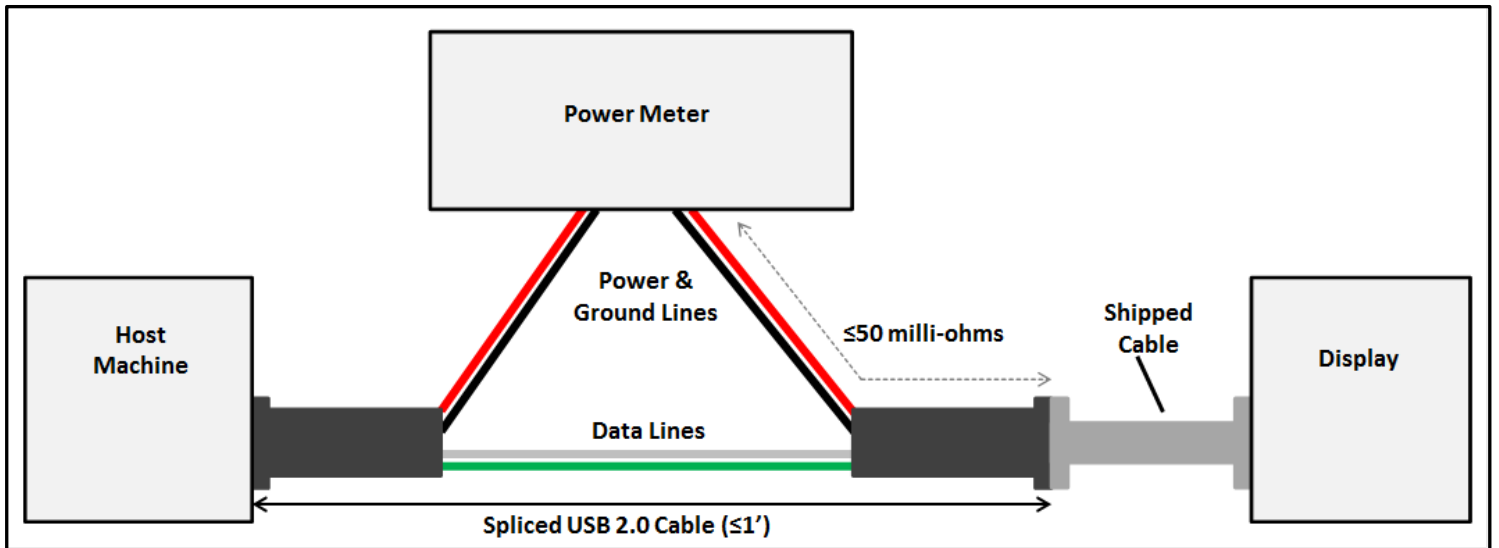
Table 1: Input Power Requirements for Products

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 V ac	+/- 1.0 %	5.0 %	60 Hz	+/- 1.0 %

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
Europe, Australia, New Zealand	230 V ac	+/- 1.0 %	5.0 %	50 Hz	+/- 1.0 %
Japan	100 V ac	+/- 1.0 %	5.0 %	50 Hz or 60 Hz	+/- 1.0 %

22 C) Dc Input Power:

- 23 1) Products may be tested with a dc source (e.g., via network or data connection) only if dc is the
24 only available source of power for the product (i.e., no ac plug or External Power Supply (EPS) is
25 shipped with the product).
- 26 2) Dc-powered products shall be installed and powered as directed by the manufacturer, using a
27 port with the full specifications recommended for the Display (e.g., Universal Serial Bus (USB) 3.0
28 if applicable, even if backwards-compatible with USB 2.0).
- 29 3) The power measurement shall be made between the dc source (e.g., Host Machine) and the
30 cable shipped with the product, including the losses introduced by the shipped cable. If no cable
31 is shipped with the product, any cable between 2 and 6 feet long may be used in its place. The
32 resistance of the cable used to connect the Display to the point of measurement shall be
33 measured and reported.
- 34 **Note:** The measured resistance of dc power cables includes the sum of resistances of both the
35 dc supply voltage wire and the ground wire.
- 36 4) A spliced cable may be used between the shipped cable and dc source in order to connect the
37 power meter. If this method is used, the following requirements must be met:
- 38 a) The spliced cable shall be used in addition to the shipped cable described in Section 4.C)3.
39 b) The spliced cable shall be connected between the dc source and the shipped cable.
40 c) The spliced cable shall be no longer than 1 foot.
41 d) For measuring voltage, the total amount of wiring used between the voltage measurement
42 and the shipped cable shall be less than 50 milli-ohms of resistance. This only applies to the
43 wiring that is carrying load current.
- 44 **Note:** Voltage and current need not necessarily be measured at the same location, so long
45 as the voltage is measured within 50 milli-ohms of the shipped cable.
- 46 e) The current measurement can be made either on the ground wire or the dc supply voltage
47 wire.
- 48 f) Figure 1 depicts an example spliced cable setup using a USB 2.0-powered Display
49 connected to the Host Machine.



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Figure 1: Example Spliced USB 2.0 Cable Arrangement

52 D) Ambient Temperature: Ambient temperature shall be $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

53 E) Relative Humidity: Relative humidity shall be from 10% to 80%.

54 F) UUT Alignment:

- 55 1) All four corners of the face of the Unit Under Test (UUT) shall be equidistant from a vertical
- 56 reference plane (e.g., wall).
- 57 2) The bottom two corners of the face of the UUT shall be equidistant from a horizontal reference
- 58 plane (e.g., floor).

59 G) Light Source:

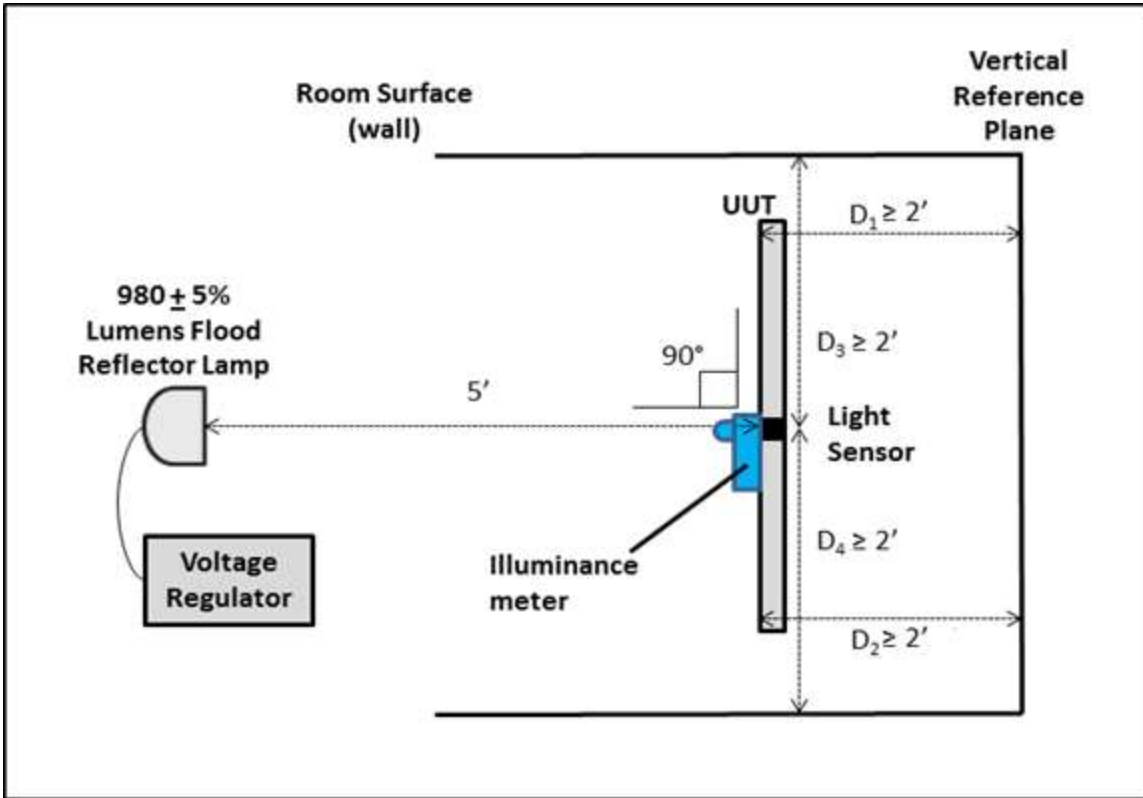
60 1) Lamp Type:

- 61 a) Standard spectrum halogen flood reflector lamp. The lamp shall not meet the definition of
- 62 "Modified spectrum" as defined in 10 CFR 430.2 - Definitions¹.
- 63 b) Rated Brightness: $980 \pm 5\%$ lumens.

64 2) Light Source Alignment For Testing Products With ABC Enabled By Default:

- 65 a) There shall be no obstructions between the lamp and the UUT's Automatic Brightness
- 66 Control (ABC) sensor (e.g., diffusing media, frosted lamp covers, etc.).
- 67 b) The center of the lamp shall be placed at a distance of 5 feet from the center of the ABC
- 68 sensor.
- 69 c) The center of the lamp shall be aligned at a horizontal angle of 0° with respect to the center
- 70 of the UUT's ABC sensor.
- 71 d) The center of the lamp shall be aligned at a height equal to the center of the UUT's ABC
- 72 sensor with respect to the floor (i.e. the light source shall be placed at a vertical angle of 0°
- 73 with respect to the center of the UUT's ABC sensor).
- 74 e) No test room surface (i.e., floor, ceiling, and wall) shall be within 2 feet of the center of the
- 75 UUT's ABC Sensor.
- 76 f) Illuminance values shall be obtained by varying the input voltage of the lamp.
- 77 g) Figure 2 and Figure 3 and provide more information on UUT and light source alignment.

¹ <http://www.gpo.gov/fdsys/pkg/CFR-2011-title10-vol3/pdf/CFR-2011-title10-vol3-sec430-2.pdf>

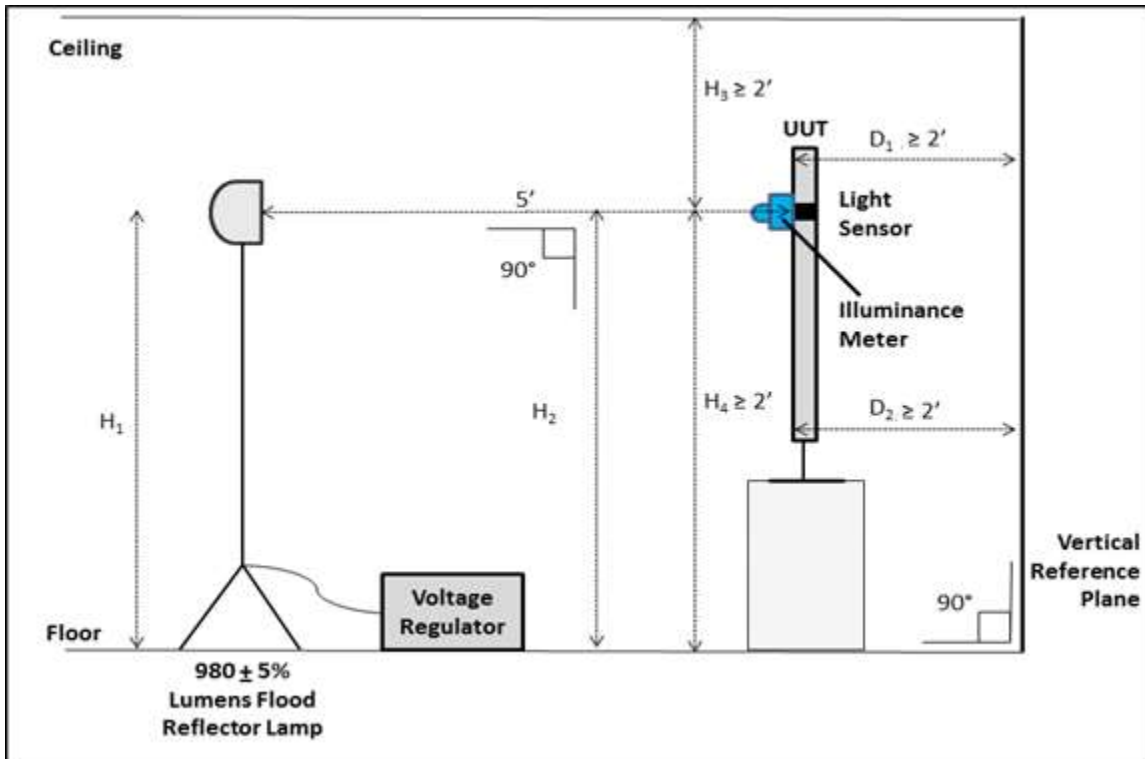


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Figure 2: Test Setup - Top View

Notes:

- $D_1 = D_2$ with respect to vertical reference plane
- D_1 and D_2 indicate that the corners of the face of the UUT shall be at least 2 feet from the vertical reference plane
- D_3 and D_4 indicate that the center of the light sensor shall be at least 2 feet from the room walls



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Figure 3: Test Setup - Side View

Notes:

- $D_1 = D_2$ with respect to vertical reference plane
- D_1 and D_2 indicate that the corners of the face of the UUT shall be at least 2 feet from the vertical reference plane
- Illuminance meter shall be removed for power measurements, after target illuminance achieved
- $H_1 = H_2$ with respect to horizontal reference plane (e.g. floor)
- H_3 and H_4 indicate that the center of the light sensor must be at least 2 feet from the floor and 2 feet from the ceiling
- Illuminance meter removed for power measurements, after target illuminance achieved

82 H) Power Meter: Power meters shall possess the following attributes

83 1) Crest Factor:

- 84 a) An available current crest factor of 3 or more at its rated range value; and
- 85 b) Lower bound on the current range of 10 mA or less.

86 2) Minimum Frequency Response: 3.0 kHz

87 3) Minimum Resolution:

- 88 a) 0.01 W for measurement values less than or equal to 10 W;

89 b) 0.1 W for measurement values from greater than 10 W to 100 W; and

90 c) 1.0 W for measurement values greater than 100 W.

91 I) Luminance and Illuminance Meters:

92 1) Luminance measurement shall be performed using either

93 a) A contact meter; or

94 b) A non-contact meter.

95 2) All luminance and illuminance meters shall be accurate to $\pm 2\%$ (± 2 digits) of the digitally
96 displayed value.

97 3) Non-contact luminance meters shall have an acceptance angle of 3 degrees or less.

98 The overall accuracy of a meter is found by taking (\pm) the absolute sum of 2% of the measurement
99 and a 2 digit tolerance of the displayed value least significant digit. For example, if an illuminance
100 meter displays "200.0" when measuring a screen brightness of 200 nits, 2% of 200 nits is 4.0 nits.
101 The least significant digit is 0.1 nits. "Two digits" implies 0.2 nits. Thus, the displayed value would be
102 200 ± 4.2 nits (4 nits + 0.2 nits). The accuracy is specific to the illuminance meter and shall not be
103 considered as tolerance during actual light measurements. Light measurement accuracy shall be
104 within the tolerance specified in 4.J)4).

105 J) Measurement Accuracy:

106 1) Power measurements with a value greater than or equal to 0.5 W shall be made with an
107 uncertainty of less than or equal to 2% at the 95% confidence level.

108 2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than
109 or equal to 0.01 W at the 95% confidence level.

110 3) All ambient light values (measured lux) shall be measured at the location of the ABC sensor on
111 the UUT with light entering directly into the sensor and with the main menu from the test signal
112 from IEC 62087 Ed. 3.0, "Methods of measurement for the power consumption of audio, video
113 and related equipment" displayed on the product. For products not compatible with the IEC test
114 signal format, ambient light values shall be measured with the Video Electronics Standard
115 Association (VESA) Flat Panel Display Measurements Standard version 2.0 (FPDM2) FK test
116 signal being displayed on the product.

117 4) Ambient light values shall be measured within the following tolerances:

118 a) At 12 lux, ambient lighting shall be within ± 1.0 lux; and

119 b) At 300 lux, ambient lighting shall be within ± 9.0 lux.

120 **5 TEST CONDUCT**

121 **5.1 Guidance for Power Measurements**

122 A) Testing at Factory Default Settings: Power measurements shall be performed with the product in its
123 as-shipped condition for the duration of Sleep Mode and On Mode testing, with all user-configurable
124 options set to factory defaults, except as otherwise specified by this test method.

125 1) Picture level adjustments shall be performed per the instructions in this test method.

126 2) Products that include a “forced menu” that requires picture setting selection upon initial start-up
127 shall be tested in the “standard” or “home” picture setting. In the case that no standard setting or
128 equivalent exists, the default setting recommended by the manufacturer shall be used for testing
129 and recorded in the test report. Products that do not include a forced menu shall be tested in the
130 default picture setting.

131 B) Point of Deployment (POD) Modules: Optional POD modules shall not be installed.

132 C) Plug-in Modules: Optional Plug-in Modules shall be removed from the Display if the Display can be
133 tested according to the test method without the module installed.

134 **Note:** DOE is aware of various optional modules that can be used to add functions to the Display (e.g.
135 gesture recognition, enhanced touchscreen, etc.). Because these technologies are new and the impact of
136 the energy use is uncertain, DOE has modified the test method to test the Display without the optional
137 Plug-in Modules in order to provide a fair comparison between Displays.

138 D) Sleep Mode with Multiple Functionalities: If the product offers multiple options for device behavior in
139 Sleep Mode (e.g., quick start) or multiple methods by which Sleep Mode may be entered, the power
140 during all Sleep Modes shall be measured and recorded. All Sleep Mode testing shall be carried out
141 as per Section 6.5.

142 **Note:** DOE received a stakeholder comment asking for clarification on “multiple sleep modes.” DOE has
143 clarified the language in 5.1 D) on what is meant by this term.

144 5.2 Conditions for Power Measurements

145 A) Power measurements:

146 1) Power measurements shall be taken from a point between the power source and the UUT. No
147 Uninterruptible Power Supply (UPS) units may be connected between the power meter and the
148 UUT. The power meter shall remain in place until all On Mode, Sleep Mode and Off Mode power
149 data are fully recorded.

150 2) Power measurements shall be recorded in watts as directly measured (unrounded) values at a
151 rate of greater than or equal to 1 reading per second.

152 3) Power measurements shall be recorded after voltage measurements are stable to within 1%.

153 B) Dark Room Conditions:

154 1) Unless otherwise specified, the illuminance measured at the UUT screen with the UUT in Off
155 Mode shall be less than or equal to 1.0 lux. If the UUT does not have an Off Mode, the
156 illuminance shall be measured at the UUT screen with the UUT’s power cord disconnected.

157 C) UUT Configuration and Control:

158 1) Peripherals and Network Connections:

159 a) External peripheral devices (e.g. mouse, keyboard, external hard disk drive (HDD) etc.) shall
160 not be connected to USB ports or other data ports on the UUT.

161 b) Bridging: If the UUT supports bridging per the definition in Section 1 of the ENERGY STAR
162 Eligibility Criteria for Displays Version 7.0, a bridge connection shall be made between the
163 UUT and the Host Machine. The connection shall be made in the following order of
164 preference. Only one connection shall be made and the connection shall be maintained for
165 the duration of the test.

166 i. Thunderbolt

167 ii. USB

168 iii. Firewire (IEEE 1394)

iv. Other

Note: Examples of bridging for Displays may include:

1. *A case where the Display converts data between two different port types (e.g. Thunderbolt and Ethernet). This can allow a device to use Thunderbolt as an Ethernet connection or vice versa.*
2. *Allowing a USB keyboard/mouse to be connected to another system (e.g. Host Machine) through the Display by a USB hub controller.*

- 170 c) Networking: If the UUT has networking capability (i.e., it has the ability to obtain an IP
171 address when configured and connected to a network) the networking capability shall be
172 activated, and the UUT shall be connected to a live physical network (e.g., WiFi, Ethernet,
173 etc.). The physical network shall support the highest and lowest data speeds of the UUT's
174 network function. An active connection is defined as a live physical connection over the
175 physical layer of the networking protocol. In the case of Ethernet, the connection shall be via
176 a standard Cat 5e or better Ethernet cable to an Ethernet switch or router. In the case of WiFi
177 the device shall be connected and tested in proximity to a wireless access point (AP). The
178 tester shall configure the address layer of the protocol, taking note of the following:
- 179 i. Internet Protocol (IP) v4 and IPv6 have neighbor discovery and will generally configure a
180 limited, non-routable connection automatically.
 - 181 ii. IP can be configured manually or by using Dynamic Host Configuration Protocol (DHCP)
182 with an address in the 192.168.1.x Network Address Translation (NAT) address space if
183 the UUT does not behave normally when autoIP is used. The network shall be configured
184 to support the NAT address space and/or autoIP.
 - 185 iii. The UUT shall maintain this live connection to the network for the duration of testing
186 unless otherwise specified in this Test Method, disregarding any brief lapses (e.g., when
187 transitioning between link speeds). If the UUT is equipped with multiple network
188 capabilities, only one connection shall be made in the following order of preference:
 - 189 a. Wi-Fi (Institution of Electrical and Electronics Engineers - IEEE 802.11- 2007²)
 - 190 b. Ethernet (IEEE 802.3). If the UUT supports Energy Efficient Ethernet (IEEE 802.3az-
191 2010³), then it shall be connected to a device that also supports IEEE 802.3az
 - 192 c. Thunderbolt
 - 193 d. USB
 - 194 e. Firewire (IEEE 1394)
 - 195 f. Other

196 **Note:** DOE received a stakeholder comment on the Draft 2 Test Method that Section 5.2 C) required the
197 network connection to be maintained for the duration of testing, but Section 6.7 A) indicated networking
198 features be disabled for additional testing. DOE has clarified in Section 5.2 C) that the network connection
199 be maintained for the duration of testing unless otherwise specified in this test method.

- 200 d) Touchscreen Functionality: If the UUT features a touchscreen that requires a separate data
201 connection, this function shall be set up as directed by the manufacturer's instructions,
202 including connections to the Host Machine and installation of software drivers.

² IEEE 802 – Telecommunications and information exchange between systems—Local and metropolitan area networks – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

³ Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications - Amendment 5: Media Access Control Parameters, Physical Layers, and Management Parameters for Energy-Efficient Ethernet

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Note: DOE added this language because some Displays with touchscreen functionality could be tested with it disabled as there is no data connection to the Host Machine, while others would be tested with it enabled due to bridging and/or DC power connections to the Host Machine via USB. In order to fairly compare Display power consumption between these two cases, DOE has included a requirement that the touchscreen connection be made in all cases, if needed.

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e) In the case of a UUT that has a single connection capable of performing multiple functions (e.g. bridging, networking, and/or touchscreen functionality), a single connector can be used to meet these functionalities provided it is the highest preferred connection the UUT supports for each functionality.

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f) In the case of a UUT that has no data/network capabilities, the UUT shall be tested as-shipped.

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g) Built-in speakers and other product features and functions not specifically addressed by the ENERGY STAR eligibility criteria or test method must be configured in the as-shipped power configuration.

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h) Availability of other capabilities such as occupancy sensors, flash memory-card/smart-card readers, camera interfaces, PictBridge shall be recorded.

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2) Signal Interface:

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a) If the UUT has multiple signal interfaces, the UUT shall be tested with the first available interface from the list below:

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i. Thunderbolt

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ii. DisplayPort

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iii. HDMI

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iv. DVI

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v. VGA

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vi. Other Digital Interface

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vii. Other Analog Interface

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3) Occupancy Sensor: If the UUT has an occupancy sensor, the UUT shall be tested with the occupancy sensor settings in the as-shipped condition. For UUT's with an occupancy sensor enabled as-shipped:

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a) A person shall be within close proximity of the occupancy sensor for the entire warm up, stabilization, luminance testing and On Mode to prevent the UUT from entering a lower power state (e.g. Sleep Mode or Off Mode). The UUT shall remain in On Mode for the duration of the warm up period, stabilization period, luminance test and On Mode test.

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b) No person shall be within close proximity of the occupancy sensor for the duration of the Sleep Mode and Off Mode tests to prevent the UUT from entering a higher power state (e.g. On Mode). The UUT shall remain in Sleep Mode or Off Mode for the duration of the Sleep Mode or Off Mode tests, respectively.

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4) Orientation: If the UUT can be rotated into vertical and horizontal orientations, it shall be tested in the horizontal orientation, with the longest dimension being parallel to the table surface.

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Note: DOE received a stakeholder comment on the Draft 2 Test Method indicating that the term "vertical resolution" is not well defined if the Display is rotatable. To clarify this point, DOE has specified that all rotatable Displays shall be tested in a horizontal orientation.

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D) Resolution and Refresh Rate:

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1) Fixed-pixel Displays:

- 247 a) Pixel format shall be set to the native level as specified in the product manual.
- 248 b) For non-Cathode Ray Tube (CRT) Displays, refresh rate shall be set to 60 Hz, unless a
249 different default refresh rate is specified in the product manual, in which case the specified
250 default refresh rate shall be used.
- 251 c) For CRT Displays, pixel format shall be set to the highest resolution that is designed to be
252 driven at a 75 Hz refresh rate, as specified in the product manual. Typical industry standards
253 for pixel format timing shall be used for testing. Refresh rate shall be set to 75 Hz.

254 E) Battery Operated Products:

- 255 1) For products designed to operate using batteries when not connected to the mains, the battery
256 shall be removed for all tests. For UUTs where operation without a battery pack is not a
257 supported configuration, the batteries shall be fully charged before the start of testing and shall be
258 left in place for the test. To ensure the battery is fully charged, perform the following steps:

259 a) For products that have an indicator to show that the battery is fully charged, continue
260 charging for an additional 5 hours after the charged indicator is present.

261 b) If there is no charge indicator, but the manufacturer's instructions provide a time estimate for
262 when charging this battery or this capacity of battery should be complete, continue charging
263 for an additional 5 hours after the manufacturer's estimate.

264 c) If there is no indicator and no time estimate in the instructions, but the charging current is
265 stated on the UUT or in the instructions, terminate charging 1 hour after the calculated test
266 duration or, if none of the above applies, the duration shall be 24 hours.

267 F) Accuracy of Input Signal Levels: When using analog interfaces, video inputs shall be within $\pm 2\%$ of
268 referenced white and black levels. When using digital interfaces, the source video signal shall not be
269 adjusted for color, or modified by the tester for any purpose other than to compress/inflate and
270 encode/decode for transmission, as required.

271 G) True Power Factor: Partners shall report the true power factor (PF) of the UUT during On Mode
272 measurement. The power factor values shall be recorded at the same rate at which the power values
273 are recorded. The reported power factor shall be averaged over the entire duration of the On Mode
274 testing.

275 H) Test Materials:

276 1) "IEC 62087 Ed. 3.0 Dynamic Broadcast-Content Signal" shall be used for testing, as specified in
277 IEC 62087 Ed. 3.0, Section 11.6, "On (average) mode testing using dynamic broadcast-content
278 video signal."

279 2) "VESA FPDM2" shall be used only for products that cannot display the IEC 62087 Ed. 3.0
280 Dynamic Broadcast-Content Signal.

281 I) Video Input Signal:

282 1) The Host Machine shall generate the video input signal in the native resolution of the Display
283 such that the active area of the video fills the entire screen. This may require the playback
284 software to adjust the aspect ratio of the video.

285 2) The frame rate of the video input signal should match the frame rate most commonly used in the
286 region in which the product is sold (e.g., For the US and Japan a 60 Hz frame rate is used; for
287 Europe and Australia a 50 Hz frame rate is used).

288 3) The audio settings on the Host Machine shall be disabled so that no sound is produced alongside
289 the video input signal.

290 **Note:** DOE received a stakeholder comment on the Draft 2 Test Method indicating that there is no
291 requirement for volume settings if a Display has integrated speakers, which could lead to test variability.
292 DOE has determined that disabling the audio signal will allow power values across all Displays to be fairly
293 compared, including those with integrated speakers.

294 6 TEST PROCEDURES FOR ALL PRODUCTS

295 6.1 Pre-Test UUT Initialization

- 296 A) Prior to the start of testing, the UUT shall be initialized as follows:
- 297 1) Set up the UUT per the instructions in the supplied product manual.
 - 298 2) Connect an acceptable watt meter to the power source and connect the UUT to the power outlet
299 on the watt meter.
 - 300 3) With the UUT off, set the ambient light level such that the measured screen illuminance is less
301 than 1.0 lux (see Section 5.2B)).
 - 302 4) Power on the UUT and perform initial system configuration, as applicable.
 - 303 5) Ensure UUT settings are in their as-shipped configuration, unless otherwise specified in this test
304 method.
 - 305 6) Warm up the UUT for 20 minutes, or the time it takes the UUT to complete initialization and
306 become ready for use, whichever is longer. The IEC 62087 Ed. 3.0 test signal format, as
307 specified in Section 5.2H)1), shall be displayed for the entire warm up period. Displays that
308 cannot display the IEC 62087 Ed. 3.0 test signal format shall have the VESA FPDM2 L80 test
309 signal, as specified in Section 5.2H)2), displayed on the screen.
 - 310 7) Report the ac input voltage and frequency or dc input voltage.
 - 311 8) Report the test room ambient temperature and relative humidity.

312 **Note:** DOE received a stakeholder comment on the Draft 2 Test Method that Section 6 contained
313 language that did not necessarily apply to dc-powered Displays. DOE has clarified in Section 6.1 A)7) that
314 input voltage be reported regardless of whether it is ac or dc.

315 6.2 Luminance Testing

- 316 A) Luminance testing shall be performed immediately following the warm up period and in dark room
317 conditions. Product screen illuminance, as measured with the UUT in Off Mode, shall be less than or
318 equal to 1.0 lux.
- 319 B) Luminance shall be measured perpendicular to the center of the product screen using a luminance
320 meter in accordance with the meter's user manual.
- 321 C) The position of the luminance meter relative to the product screen shall remain fixed throughout the
322 duration of testing.
- 323 D) For products with ABC, luminance measurements shall be performed with ABC disabled. If ABC
324 cannot be disabled, luminance measurements shall be measured perpendicular to the center of the
325 product screen with light entering directly into the UUT's ambient light sensor at greater than or equal
326 to 300 lux.
- 327 E) Luminance measurements shall be performed as follows:
- 328 1) Verify that the UUT is in the default as-shipped luminance value or "Home" picture setting.
 - 329 2) Display the test video signal for the specific product class, as described below:
 - 330 a) **All products, except as specified in b):** Three-bar video signal specified in IEC 62087 Ed.
331 3.0, Section 11.5.5 (three bars of white (100%) over a black (0%) background).
 - 332 b) **Products that cannot display signals from IEC 62087 Ed. 3.0:** VESA FPDM2 L80 test
333 signal for the maximum resolution supported by the product.

- 334 3) Display the test video signal for no less than 10 minutes to allow the UUT luminance to stabilize.
335 This 10 minute stabilization period may be reduced if luminance measurements are stable to
336 within 2% over a period of not less than 60 seconds.
- 337 4) Measure and record the luminance in default as-shipped setting $L_{As-shipped}$.
- 338 5) Set the brightness and contrast levels of the UUT to their maximum values.
- 339 6) Measure and record the luminance as $L_{Max_Measured}$.
- 340 7) Record the manufacturer-reported maximum luminance $L_{Max_Reported}$.
- 341 F) The contrast setting shall be left at the maximum level for the subsequent On Mode tests unless
342 otherwise specified.

343 **6.3 On Mode Testing for Products without ABC Enabled by Default**

- 344 A) After the Luminance Testing and prior to On Mode power measurement, the luminance of the UUT
345 shall be set according to the following:
- 346 1) **For Signage Displays with viewable diagonal screen size of 30 inches or more**, the product
347 shall be tested with luminance set at a value greater than or equal to 65% of the manufacturer-
348 reported maximum luminance ($L_{Max_Reported}$). Luminance values shall be measured as per Section
349 6.2. This luminance value L_{On} shall be recorded.
- 350 2) **For all other products**, adjust appropriate luminance controls until the luminance of the screen is
351 **200 candelas per square meter (cd/m^2)**. If the UUT cannot achieve this luminance, set the
352 product luminance to the nearest achievable value. Luminance values shall be measured as per
353 Section 6.2. This luminance value L_{On} shall be reported. Appropriate luminance controls refer to
354 any controls that adjust the brightness of the Display, but do not include contrast settings.
- 355 B) For a UUT capable of displaying the IEC signals, On Mode power (P_{ON}) shall be measured according
356 to IEC 62087 Ed 3.0 Section 11.6.1 "Measurements using dynamic broadcast-content video signal."
357 For a UUT not capable of displaying the IEC signals, On Mode power (P_{ON}) shall be measured as
358 follows:
- 359 1) Ensure that the UUT has been initialized per Section 6.1.
- 360 2) Display the VESA FPDM2, A112-2F, SET01K test pattern (8 shades of gray from full black
361 (0 volts) to full white (0.7 volts)).
- 362 3) Verify that input signal levels conform to VESA Video Signal Standard (VSIS), Version 1.0, Rev.
363 2.0, December 2002.
- 364 4) With the brightness and contrast controls at maximum, verify that the white and near-white grey
365 levels can be distinguished. If necessary, adjust contrast controls until the white and near-white
366 grey levels can be distinguished.
- 367 5) Display the VESA FPDM2, A112-2H, L80 test pattern (full white (0.7 volts) box that occupies 80%
368 of the image).
- 369 6) Ensure that the luminance measurement area falls entirely within the white portion of the test
370 pattern.
- 371 7) Adjust appropriate luminance controls until the luminance of the white area of the screen is set as
372 described in Section 6.3A).
- 373 8) Record the screen luminance (L_{On}).
- 374 9) Record On Mode power (P_{ON}) and total pixel format (horizontal x vertical). The On Mode power
375 shall be measured over a 10 minute period similar to the IEC 62087 Ed 3.0 dynamic broadcast-
376 content test.

377 **6.4 On Mode Testing for Products with ABC Enabled by Default**

378 The average On Mode power consumption of the product shall be determined with the dynamic
379 broadcast-content as defined in IEC 62087 Ed. 3.0. If the product cannot display the IEC signal, then the
380 VESA FPDM2 L80 test pattern, as described in Section 6.3B)5), shall be used for all of the following
381 steps.

382 A) Stabilize the UUT for 30 minutes. This shall be done with three repetitions of the 10 minute IEC
383 dynamic broadcast-content video signal.

384 B) Set the light output of the lamp used for testing to 12 lux as measured at the face of the ambient light
385 sensor.

386 C) Display the 10 minute dynamic broadcast-content video signal. Measure and record the power
387 consumption, P_{12} , during the 10 minute dynamic broadcast-content video signal.

388 D) Repeat steps 6.4B) and 6.4C) for an ambient light level of 300 lux, to measure P_{300} .

389 E) Disable ABC and measure On Mode power (P_{ON}) per Section 6.3. If ABC cannot be disabled, power
390 measurements shall be conducted as follows:

391 1) If the brightness can be set to a fixed value as specified in Section 6.3, then On Mode power for
392 these products shall be measured as per Section 6.3 with light entering directly into the UUT's
393 ambient light sensor at greater than or equal to 300 lux.

394 2) If the brightness cannot be set to a fixed value, then On Mode power for these products shall be
395 measured as per Section 6.3 with light entering directly into the UUT's ambient light sensor at
396 greater than or equal to 300 lux and without modifying the screen brightness.

397 **Note:** DOE received a stakeholder comment noting that the Version 7.0 Draft 1 Specification had updated
398 the 10 lux illuminance value to 12 lux while the Draft 2 Test Method maintained 10 lux. This illuminance
399 point has been updated to 12 lux in the Draft 3 Test Method.

400 **6.5 Sleep Mode Testing**

401 A) Sleep Mode power (P_{SLEEP}) shall be measured according to IEC 62301 Ed. 2.0, with the additional
402 guidance in Section 5.

403 B) The Sleep Mode test shall be conducted with the UUT connected to the Host Machine in the same
404 manner as in the On Mode test. If possible, Sleep Mode shall be enacted by putting the Host Machine
405 to sleep. For a computer Host Machine, Sleep Mode is defined in the Version 5.2 ENERGY STAR
406 Computers specification.

407 C) If the product has a variety of Sleep Modes that may be manually selected, or if the product can enter
408 Sleep Mode via different methods (e.g., remote control or putting the Host Machine to sleep),
409 measurements shall be performed and recorded in all Sleep Modes.

410 If the product automatically transitions through its various Sleep Modes, the measurement time shall
411 be long enough to obtain an average of all Sleep Modes. The measurement shall still meet
412 requirements (e.g., stability, measurement period, etc.) outlined in Section 5.3 of IEC 62301 Ed. 2.0.

413 **6.6 Off Mode Testing**

414 A) For products having Off Mode capability, at the conclusion of the Sleep Mode test, initiate Off Mode
415 via the most easily accessible power switch.

416 B) Measure Off Mode power (P_{OFF}) according to Section 5.3.1 of the IEC 62301 Ed. 2.0. Document the
417 method of adjustment and sequence of events required to reach Off Mode.

418 C) Any input synchronizing signal check cycle may be ignored when measuring Off Mode power.

419 D) Off Mode power for products without a physical power switch shall be measured with the UUT
420 connected to the Host Machine, with the Host Machine in the power Off Mode.

421 **6.7 Additional Testing**

- 422 A) For products with data/networking capabilities or a bridge connection, in addition to tests performed
423 with data/networking capabilities activated and a bridge connection established (see Section 5.2C)1)),
424 Sleep Mode Testing shall be performed with data/networking features deactivated and without any
425 bridge connection established, per Section 5.2C)1)b) and c).
- 426 B) The presence of Full Network Connectivity shall be determined by testing the Display for network
427 activity in Sleep Mode according to section 6.7.5.2 of CEA-2037-A, Determination of Television Set
428 Power Consumption, with the following guidance:
- 429 1) The Display shall be connected to a network per Section 5.2C)1)c) prior to the test.
- 430 2) The Display shall be placed into Sleep Mode in place of standby-active, low.