



# ENERGY STAR® Program Requirements Product Specification for Displays

## Draft 2 Test Method Rev. Oct-2014

### 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.

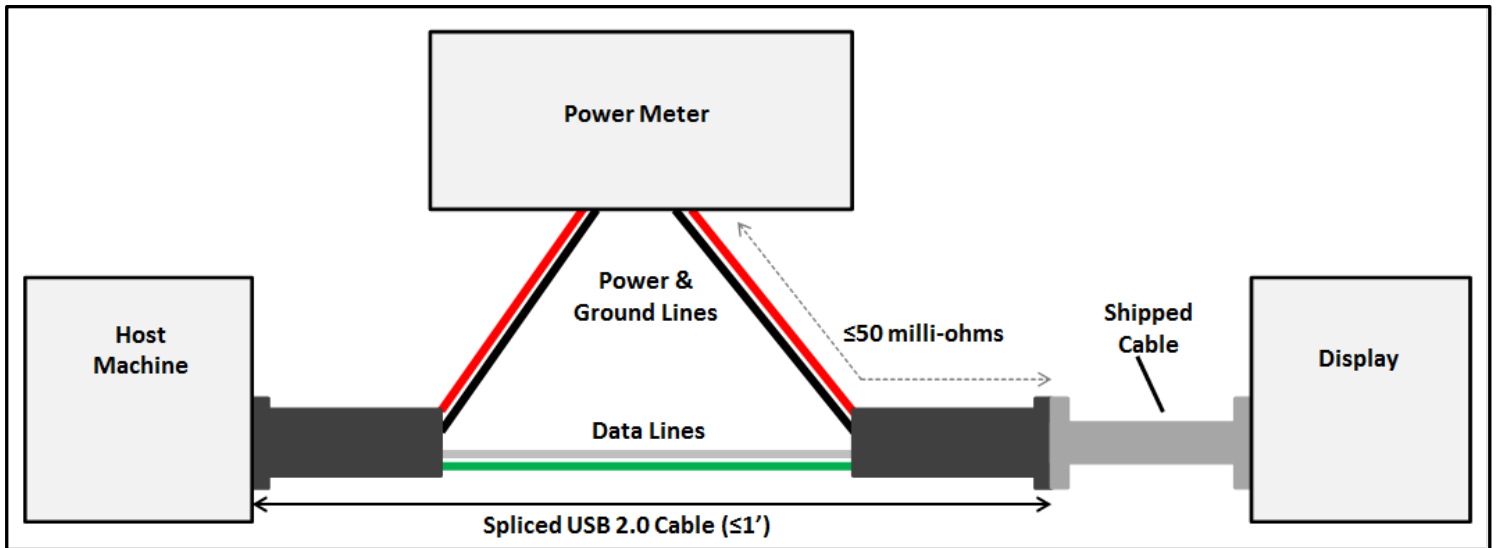
**Note:** ENERGY STAR received a stakeholder comment on the Draft 1 Test Method that Section 4.B indicated products should only be tested with ac power if they ship with an external power supply, and DOE has therefore clarified the language regarding ac input power.

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 %
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 %

25 C) Dc Input Power:

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



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**Figure 1: Example Spliced USB 2.0 Cable Arrangement**

55 **Note:** ENERGY STAR received a stakeholder comment that Section 4.C of the Draft 1 Test Method does  
 56 not address the case where a dc-powered Display is not shipped with a power cable, and DOE has  
 57 therefore included language to cover for this case. In addition, a stakeholder commented that language  
 58 should be added specifying that resistance of cables includes both the dc supply voltage wire and ground  
 59 wires, so DOE has added this as a note as well.

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

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

62 F) UUT Alignment:

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

67 G) Light Source:

68 1) Lamp Type:

69 a) Standard spectrum halogen flood reflector lamp. The lamp shall not meet the definition of  
 70 "Modified spectrum" as defined in 10 CFR 430.2 - Definitions<sup>1</sup>.

71 b) Rated Brightness:  $980 \pm 5\%$  lumens.

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

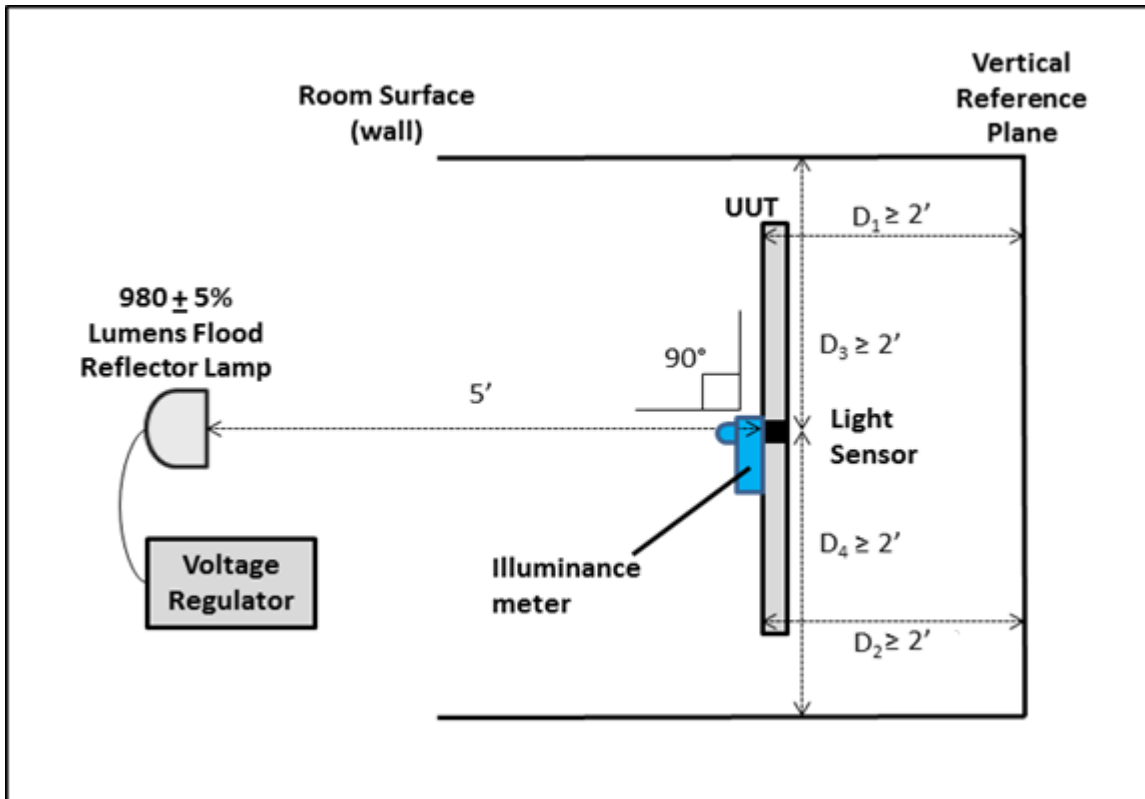
73 a) There shall be no obstructions between the lamp and the UUT's Automatic Brightness  
 74 Control (ABC) sensor (e.g., diffusing media, frosted lamp covers, etc.).

75 b) The center of the lamp shall be placed at a distance of 5 feet from the center of the ABC  
 76 sensor.

77 c) The center of the lamp shall be aligned at a horizontal angle of  $0^{\circ}$  with respect to the center  
 78 of the UUT's ABC sensor.

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

- 79 d) The center of the lamp shall be aligned at a height equal to the center of the UUT's ABC  
 80 sensor with respect to the floor (i.e. the light source shall be placed at a vertical angle of 0°  
 81 with respect to the center of the UUT's ABC sensor).
- 82 e) No test room surface (i.e., floor, ceiling, and wall) shall be within 2 feet of the center of the  
 83 UUT's ABC Sensor.
- 84 f) Illuminance values shall be obtained by varying the input voltage of the lamp.
- 85 g) Figure 2 and Figure 3 and provide more information on UUT and light source alignment.

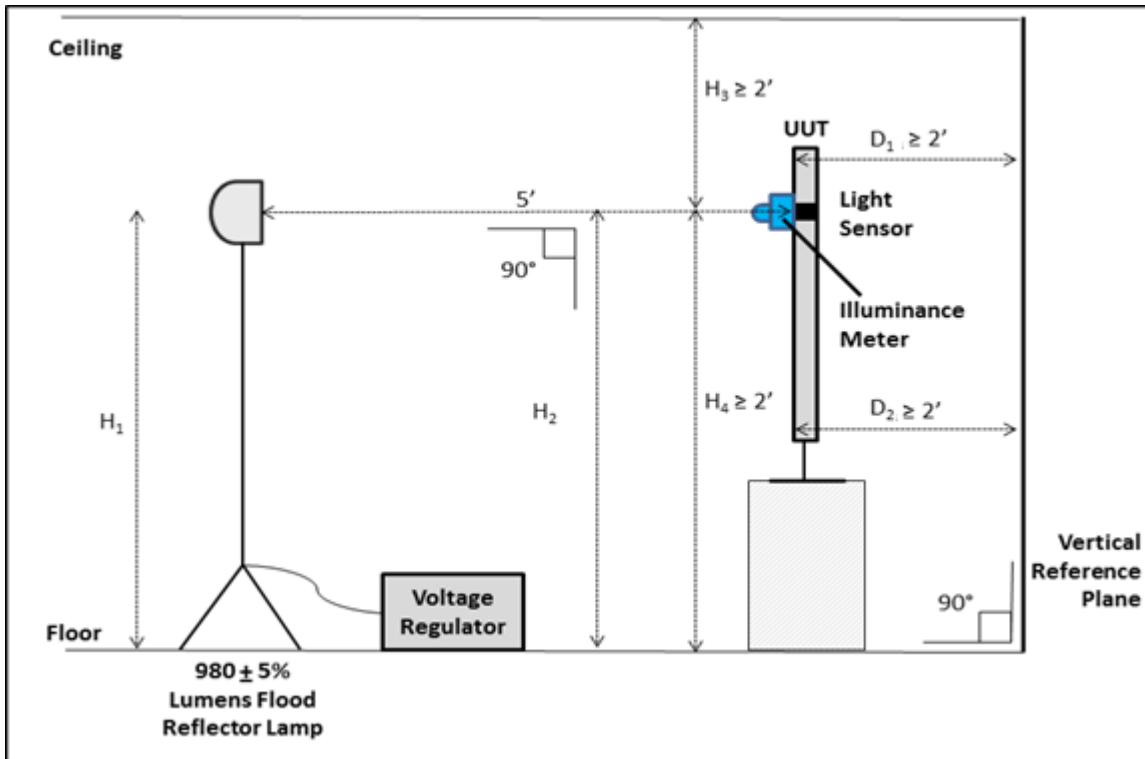


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Figure 2: Test Setup - Top View

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

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

91 1) Crest Factor:

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

94 2) Minimum Frequency Response: 3.0 kHz

95 3) Minimum Resolution:

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

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

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

99 I) Luminance and Illuminance Meters:

100 1) Luminance measurement shall be performed using either

101 a) A contact meter; or

102 b) A non-contact meter.

103 2) All luminance and illuminance meters shall have be accurate to  $\pm 2\%$  ( $\pm 2$  digits) of the digitally  
104 displayed value.

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

106 **Note:** DOE has clarified the requirements for luminance and illuminance meters to avoid confusion  
107 between the two types of meters.

108 The overall accuracy of a meter is found by taking ( $\pm$ ) the absolute sum of 2% of the measurement  
109 and a 2 digit tolerance of the displayed value least significant digit. For example, if an illuminance  
110 meter displays "200.0" when measuring a screen brightness of 200 nits, 2% of 200 nits is 4.0 nits.  
111 The least significant digit is 0.1 nits. "Two digits" implies 0.2 nits. Thus, the displayed value would be  
112  $200 \pm 4.2$  nits (4 nits + 0.2 nits). The accuracy is specific to the illuminance meter and shall not be  
113 considered as tolerance during actual light measurements. Light measurement accuracy shall be  
114 within the tolerance specified in 4.J)4).

115 J) Measurement Accuracy:

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

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

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

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

128 a) At 10 lux, ambient lighting shall be within  $\pm 1.0$  lux; and

129 b) At 300 lux, ambient lighting shall be within  $\pm 9.0$  lux.

## 130 **5 TEST CONDUCT**

### 131 **5.1 Guidance for Power Measurements**

- 132 A) Testing at Factory Default Settings: Power measurements shall be performed with the product in its  
133 as-shipped condition for the duration of Sleep Mode and On Mode testing, with all user-configurable  
134 options set to factory defaults, except as otherwise specified by this test method.
- 135 1) Picture level adjustments shall be performed per the instructions in this test method.
- 136 2) Products that include a “forced menu” that requires picture setting selection upon initial start-up  
137 shall be tested in the “standard” or “home” picture setting. In the case that no standard setting or  
138 equivalent exists, the default setting recommended by the manufacturer shall be used for testing  
139 and recorded in the test report. Products that do not include a forced menu shall be tested in the  
140 default picture setting.
- 141 B) Point of Deployment (POD) Modules: Optional POD modules shall not be installed.
- 142 C) Multiple Sleep Modes: If the product offers multiple Sleep Modes, the power during all Sleep Modes  
143 shall be measured and recorded. All Sleep Mode Testing shall be carried out as per Section 6.5.

## 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 Version 6.0, a bridge connection shall be made between the UUT and the  
163 Host Machine. The connection shall be made in the following order of preference. Only one  
164 connection shall be made and the connection shall be maintained for the duration of the test.
- 165 i. Thunderbolt
- 166 ii. USB
- 167 iii. Firewire (IEEE 1394)
- 168 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.*

- 169 c) Networking: If the UUT has networking capability (i.e., it has the ability to obtain an IP  
170 address when configured and connected to a network) the networking capability shall be  
171 activated, and the UUT shall be connected to a live physical network (e.g., WiFi, Ethernet,  
172 etc.). The physical network shall support the highest and lowest data speeds of the UUT's  
173 network function. An active connection is defined as a live physical connection over the  
174 physical layer of the networking protocol. In the case of Ethernet, the connection shall be via  
175 a standard Cat 5e or better Ethernet cable to an Ethernet switch or router. In the case of WiFi  
176 the device shall be connected and tested in proximity to a wireless access point (AP). The  
177 tester shall configure the address layer of the protocol, taking note of the following:
- 178 i. Internet Protocol (IP) v4 and IPv6 have neighbor discovery and will generally configure a  
179 limited, non-routable connection automatically.
  - 180 ii. IP can be configured manually or by using Dynamic Host Configuration Protocol (DHCP)  
181 with an address in the 192.168.1.x Network Address Translation (NAT) address space if  
182 the UUT does not behave normally when autoIP is used. The network shall be configured  
183 to support the NAT address space and/or autoIP.
  - 184 iii. The UUT shall maintain this live connection to the network for the duration of testing,  
185 disregarding any brief lapses, (e.g., when transitioning between link speeds). If the UUT  
186 is equipped with multiple network capabilities, only one connection shall be made in the  
187 following order of preference:
    - 188 a. WiFi (Institution of Electrical and Electronics Engineers - IEEE 802.11- 2007<sup>2</sup>)
    - 189 b. Ethernet (IEEE 802.3). If the UUT supports Energy Efficient Ethernet (IEEE 802.3az-  
190 2010<sup>3</sup>), then it shall be connected to a device that also supports IEEE 802.3az
    - 191 c. Thunderbolt
    - 192 d. USB
    - 193 e. Firewire (IEEE 1394)
    - 194 f. Other
  - 195 d) In the case of a UUT that has a single connection capable of performing both bridging and  
196 networking functionality, a single connector can be used to meet these functionalities  
197 provided it is the highest preferred connection the UUT supports for each functionality.
  - 198 e) In the case of a UUT that has no data/network capabilities, the UUT shall be tested as-  
199 shipped.
  - 200 f) Built-in speakers and other product features and functions not specifically addressed by the  
201 ENERGY STAR eligibility criteria or test method must be configured in the as-shipped power  
202 configuration.
  - 203 g) Availability of other capabilities such as occupancy sensors, flash memory-card/smart-card  
204 readers, camera interfaces, PictBridge shall be recorded.
- 205 2) Signal Interface:
- 206 a) If the UUT has multiple signal interfaces, the UUT shall be tested with the first available  
207 interface from the list below:
    - 208 i. Thunderbolt
    - 209 ii. DisplayPort

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<sup>2</sup> 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

<sup>3</sup> 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



- 210           iii. HDMI
- 211           iv. DVI
- 212           v. VGA
- 213           vi. Other Digital Interface
- 214           vii. Other Analog Interface
- 215       3) Occupancy Sensor: If the UUT has an occupancy sensor, the UUT shall be tested with the
- 216       occupancy sensor settings in the as-shipped condition. For UUT's with an occupancy sensor
- 217       enabled as-shipped:
- 218           a) A person shall be within close proximity of the occupancy sensor for the entire warm up,
- 219           stabilization, luminance testing and On Mode to prevent the UUT from entering a lower power
- 220           state (e.g. Sleep Mode or Off Mode). The UUT shall remain in On Mode for the duration of
- 221           the warm up period, stabilization period, luminance test and On Mode test.
- 222           b) No person shall be within close proximity of the occupancy sensor for the duration of the
- 223           Sleep Mode and Off Mode tests to prevent the UUT from entering a higher power state (e.g.
- 224           On Mode). The UUT shall remain in Sleep Mode or Off Mode for the duration of the Sleep
- 225           Mode or Off Mode tests, respectively.
- 226   D) Resolution and Refresh Rate:
- 227       1) Fixed-pixel Displays:
- 228           a) Pixel format shall be set to the native level as specified in the product manual.
- 229           b) For non-Cathode Ray Tube (CRT) Displays, refresh rate shall be set to 60 Hz, unless a
- 230           different default refresh rate is specified in the product manual, in which case the specified
- 231           default refresh rate shall be used.
- 232           c) For CRT Displays, pixel format shall be set to the highest resolution that is designed to be
- 233           driven at a 75 Hz refresh rate, as specified in the product manual. Typical industry standards
- 234           for pixel format timing shall be used for testing. Refresh rate shall be set to 75 Hz.
- 235   E) Battery Operated Products:
- 236       1) For products designed to operate using batteries when not connected to the mains, the battery
- 237       shall be removed for all tests. For UUTs where operation without a battery pack is not a
- 238       supported configuration, the batteries shall be fully charged before the start of testing and shall be
- 239       left in place for the test. To ensure the battery is fully charged, perform the following steps:
- 240           a) For products that have an indicator to show that the battery is fully charged, continue
- 241           charging for an additional 5 hours after the charged indicator is present.
- 242           b) If there is no charge indicator, but the manufacturer's instructions provide a time estimate for
- 243           when charging this battery or this capacity of battery should be complete, continue charging
- 244           for an additional 5 hours after the manufacturer's estimate.
- 245           c) If there is no indicator and no time estimate in the instructions, but the charging current is
- 246           stated on the UUT or in the instructions, terminate charging 1 hour after the calculated test
- 247           duration or, if none of the above applies, the duration shall be 24 hours.
- 248   F) Accuracy of Input Signal Levels: When using analog interfaces, video inputs shall be within  $\pm 2\%$  of
- 249   referenced white and black levels. When using digital interfaces, the source video signal shall not be
- 250   adjusted for color, or modified by the tester for any purpose other than to compress/inflate and
- 251   encode/decode for transmission, as required.
- 252   G) True Power Factor: Partners shall report the true power factor (PF) of the UUT during On Mode
- 253   measurement. The power factor values shall be recorded at the same rate at which the power values
- 254   are recorded. The reported power factor shall be averaged over the entire duration of the On Mode
- 255   testing.

256 H) Test Materials:

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

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

262 I) Video Input Signal:

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

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

269 **6 TEST PROCEDURES FOR ALL PRODUCTS**

270 **6.1 Pre-Test UUT Initialization**

271 A) Prior to the start of testing, the UUT shall be initialized as follows:

272 1) Set up the UUT per the instructions in the supplied product manual.

273 2) Connect an acceptable watt meter to the power source and connect the UUT to the power outlet  
274 on the watt meter.

275 3) With the UUT off, set the ambient light level such that the measured screen illuminance is less  
276 than 1.0 lux (see Section 5.2B)).

277 4) Power on the UUT and perform initial system configuration, as applicable.

278 5) Ensure UUT settings are in their as-shipped configuration, unless otherwise specified in this Test  
279 Method.

280 6) Warm up the UUT for 20 minutes, or the time it takes the UUT to complete initialization and  
281 become ready for use, whichever is longer. The IEC 62087 Ed. 3.0 test signal format, as  
282 specified in Section 5.2H)1), shall be displayed for the entire warm up period. Displays that  
283 cannot display the IEC 62087 Ed. 3.0 test signal format shall have the VESA FPDM2 L80 test  
284 signal, as specified in Section 5.2H)2), displayed on the screen.

285 7) Report the ac input voltage and frequency.

286 8) Report the test room ambient temperature and relative humidity.

287 **6.2 Luminance Testing**

288 A) Luminance testing shall be performed immediately following the warm up period and in dark room  
289 conditions. Product screen illuminance, as measured with the UUT in Off Mode, shall be less than or  
290 equal to 1.0 lux.

291 B) Luminance shall be measured perpendicular to the center of the product screen using a luminance  
292 meter in accordance with the meter's user manual.

293 C) The position of the luminance meter relative to the product screen shall remain fixed throughout the  
294 duration of testing.

- 295 D) For products with ABC, luminance measurements shall be performed with ABC disabled. If ABC  
296 cannot be disabled, luminance measurements shall be measured perpendicular to the center of the  
297 product screen with light entering directly into the UUT's ambient light sensor at greater than or equal  
298 to 300 lux.
- 299 E) Luminance measurements shall be performed as follows:
- 300 1) Verify that the UUT is in the default as-shipped luminance value or "Home" picture setting.
- 301 2) Display the test video signal for the specific product class, as described below:
- 302 a) **All products, except as specified in b):** Three-bar video signal specified in IEC 62087 Ed.  
303 3.0, Section 11.5.5 (three bars of white (100%) over a black (0%) background).
- 304 b) **Products that cannot display signals from IEC 62087 Ed. 3.0:** VESA FPDM2 L80 test  
305 signal for the maximum resolution supported by the product.
- 306 3) Display the test video signal for no less than 10 minutes to allow the UUT luminance to stabilize.  
307 This 10 minute stabilization period may be reduced if luminance measurements are stable to  
308 within 2% over a period of not less than 60 seconds.
- 309 4) Measure and record the luminance in default as-shipped setting  $L_{As-shipped}$ .
- 310 5) Set the brightness and contrast levels of the UUT to their maximum values.
- 311 6) Measure and record the luminance as  $L_{Max\_Measured}$ .
- 312 7) Record the manufacturer-reported maximum luminance  $L_{Max\_Reported}$ .
- 313 F) The contrast setting shall be left at the maximum level for the subsequent On Mode tests unless  
314 otherwise specified.

### 315 **6.3 On Mode Testing for Products without ABC Enabled by Default**

- 316 A) After the Luminance Testing and prior to On Mode power measurement, the luminance of the UUT  
317 shall be set according to the following:
- 318 1) **For Signage Displays with viewable diagonal screen size of 30 inches or more**, the product  
319 shall be tested with luminance set at a value greater than or equal to 65% of the manufacturer-  
320 reported maximum luminance ( $L_{Max\_Reported}$ ). Luminance values shall be measured as per Section  
321 6.2. This luminance value  $L_{On}$  shall be recorded.
- 322 2) **For all other products**, adjust appropriate luminance controls until the luminance of the screen is  
323 **200 candelas per square meter ( $cd/m^2$ )**. If the UUT cannot achieve this luminance, set the  
324 product luminance to the nearest achievable value. Luminance values shall be measured as per  
325 Section 6.2. This luminance value  $L_{On}$  shall be reported. Appropriate luminance controls refer to  
326 any controls that adjust the brightness of the Display, but do not include contrast settings.
- 327 B) For a UUT capable of displaying the IEC signals, On Mode power ( $P_{ON}$ ) shall be measured according  
328 to IEC 62087 Ed 3.0 Section 11.6.1 "Measurements using dynamic broadcast-content video signal."  
329 For a UUT not capable of displaying the IEC signals, On Mode power ( $P_{ON}$ ) shall be measured as  
330 follows:
- 331 1) Ensure that the UUT has been initialized per Section 6.1.
- 332 2) Display the VESA FPDM2, A112-2F, SET01K test pattern (8 shades of gray from full black  
333 (0 volts) to full white (0.7 volts)).
- 334 3) Verify that input signal levels conform to VESA Video Signal Standard (VSIS), Version 1.0, Rev.  
335 2.0, December 2002.
- 336 4) With the brightness and contrast controls at maximum, verify that the white and near-white grey  
337 levels can be distinguished. If necessary, adjust contrast controls until the white and near-white  
338 grey levels can be distinguished.
- 339 5) Display the VESA FPDM2, A112-2H, L80 test pattern (full white (0.7 volts) box that occupies 80%  
340 of the image).

- 341 6) Ensure that the luminance measurement area falls entirely within the white portion of the test  
342 pattern.
- 343 7) Adjust appropriate luminance controls until the luminance of the white area of the screen is set as  
344 described in Section 6.3A).
- 345 8) Record the screen luminance ( $L_{ON}$ ).
- 346 9) Record On Mode power ( $P_{ON}$ ) and total pixel format (horizontal x vertical). The On Mode power  
347 shall be measured over a 10 minute period similar to the IEC 62087 Ed 3.0 dynamic broadcast-  
348 content test.

#### 349 **6.4 On Mode Testing for Products with ABC Enabled by Default**

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

- 354 A) Stabilize the UUT for 30 minutes. This shall be done with three repetitions of the 10 minute IEC  
355 dynamic broadcast-content video signal.
- 356 B) Set the light output of the lamp used for testing to 10 lux as measured at the face of the ambient light  
357 sensor.
- 358 C) Display the 10 minute dynamic broadcast-content video signal. Measure and record the power  
359 consumption,  $P_{10}$ , during the 10 minute dynamic broadcast-content video signal.
- 360 D) Repeat steps 6.4B) and 6.4C) for an ambient light level of 300 lux, to measure  $P_{300}$ .
- 361 E) Disable ABC and measure On Mode power ( $P_{ON}$ ) per Section 6.3. If ABC cannot be disabled, power  
362 measurements shall be conducted as follows:
- 363 1) If the brightness can be set to a fixed value as specified in Section 6.3, then On Mode power for  
364 these products shall be measured as per Section 6.3 with light entering directly into the UUT's  
365 ambient light sensor at greater than or equal to 300 lux.
- 366 2) If the brightness cannot be set to a fixed value, then On Mode power for these products shall be  
367 measured as per Section 6.3 with light entering directly into the UUT's ambient light sensor at  
368 greater than or equal to 300 lux and without modifying the screen brightness.

#### 369 **6.5 Sleep Mode Testing**

- 370 A) Sleep Mode power ( $P_{SLEEP}$ ) shall be measured according to IEC 62301 Ed. 2.0, with the additional  
371 guidance in Section 5.
- 372 B) The Sleep Mode test shall be conducted with the UUT connected to the Host Machine in the same  
373 manner as in the On Mode test. If possible, Sleep Mode shall be enacted by putting the Host Machine  
374 to sleep. For a computer Host Machine, Sleep Mode is defined in the Version 5.2 ENERGY STAR  
375 Computers specification.
- 376 C) If the product has a variety of Sleep Modes that may be manually selected, or if the product can enter  
377 Sleep Mode via different methods (e.g., remote control or putting the Host Machine to sleep),  
378 measurements shall be performed and recorded in all Sleep Modes.
- 379 If the product automatically transitions through its various Sleep Modes, the measurement time shall  
380 be long enough to obtain an average of all Sleep Modes. The measurement shall still meet  
381 requirements (e.g., stability, measurement period, etc.) outlined in Section 5.3 of IEC 62301 Ed. 2.0.

382 **6.6 Off Mode Testing**

- 383 A) For products having Off Mode capability, at the conclusion of the Sleep Mode test, initiate Off Mode  
384 via the most easily accessible power switch.
- 385 B) Measure Off Mode power ( $P_{OFF}$ ) according to Section 5.3.1 of the IEC 62301 Ed. 2.0. Document the  
386 method of adjustment and sequence of events required to reach Off Mode.
- 387 C) Any input synchronizing signal check cycle may be ignored when measuring Off Mode power.
- 388 D) Off Mode power for products without a physical power switch shall be measured with the UUT  
389 connected to the Host Machine, with the Host Machine in the power Off Mode.

390 **6.7 Additional Testing**

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

400 **Note:** DOE has included a test for the presence of Full Network Connectivity to accompany the new  
401 definition in the Specification and the corresponding energy allowance. The test is consistent with the  
402 Draft 2 Version 7.0 Televisions Specification.

403