ENERGY STAR® Program Requirements Product Specification for Displays

Draft 1 Test Method Rev. Feb-2014

1 OVERVIEW

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

Note: Based on questions that DOE has received from stakeholders, DOE has made a number of clarifications throughout the draft. These clarifications should not alter the method of test, but are meant to clarify the requirements of the method of test to aid stakeholders and laboratories is properly executing when testing for ENERGY STAR. These clarifications include:

1) Section 2: Updated reference from TV NOPR to TV Final Rule;

2) Section 3: Included new definition for "Host Machine" to clarify its use;

3) Section 4.I): Modified "distance meter" to be "non-contact meter";

4) Sections 4.J), 5.2.H), 6.2.E), and 6.4: Changed condition for using VESA test signal from "cannot be tested with IEC signals" to "cannot display IEC signals" to clarify when to use the VESA signal;

5) Section 6.2.B): Clarified luminance measurement instructions to solely rely on meter's user manual;

6) Section 6.3.A): Reorganized luminance setting requirements;.

7) Section 6.3.B): Modified IEC test procedure reference to only include IEC dynamic broadcast-content test procedure; and

8) Section 6.5.A): Modified requirement for Display to be connected to Host Machine during Sleep Mode to account for Displays which may not be connected during On Mode (e.g., Digital Picture Frames).

In addition, DOE is proposing a method of test for DC-powered displays as part of this revision.

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.

Note: DOE has added a definition for Host Machine to add clarity in the test procedure, and requests comment on the definition.

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 an external power supply, if one is shipped with the unit, and then connected to a voltage source appropriate for the intended market, as specified in Table 1.

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 %

C) Low-voltage Dc Input Power:

1) Products may be tested with a dc source (e.g., via network or data connection) only if the dc source is the only available source of power for the product (i.e., no ac plug or External Power Supply (EPS) is shipped with the product).

2) Dc-powered products shall be installed and powered as directed by the manufacturer, using a port with the full specifications recommended for the Display (i.e., Universal Serial Bus (USB) 3.0 if applicable, even if backwards-compatible with USB 2.0).

3) The power measurement shall be made between the dc source (e.g., Host Machine) and the cable shipped with the product, including the losses introduced by the shipped cable. The resistance of the shipped cable shall be measured and reported.

4) A spliced cable may be used to connect to the power meter. If this method is used, the following requirements must be met:

   a) The spliced cable shall not be the cable shipped with the product.

   b) The spliced cable shall be connected between the Host Machine and the shipped cable.

   c) The spliced cable shall be no longer than 1 foot.

   d) For measuring voltage, the total amount of wiring used to connect the voltage measurement and the shipped cable shall be less than 50 milli-ohms of resistance. This only applies to the wiring that is carrying load current.[1]

   e) The current measurement can be made either on the ground wire or high voltage wire.

   f) Figure 1 depicts an example spliced cable setup using a USB 2.0 cable.

[1] Voltage and current need not necessarily be measured at the same location, so long as the voltage is measured within 50 milli-ohms of the shipped cable. This resistance limit includes the sum of both the high voltage and ground wires in the connection.

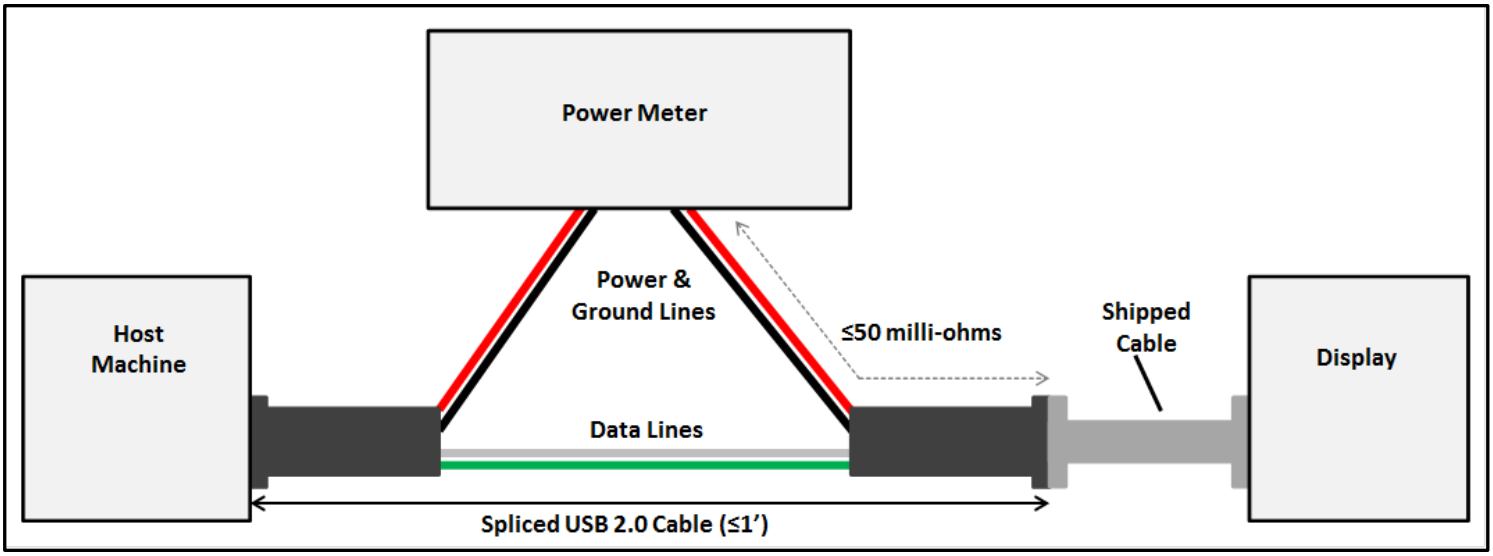

Figure 1: Example Spliced USB 2.0 Cable Arrangement

Note: DOE has updated the test setup for dc-powered Displays to measure the dc power directly. In the previous revision, measured power of dc-powered Displays included the power consumed by a dc source (i.e., USB hub or similar device). Because the powered dc source is not necessarily included with the product, a direct dc power measurement is more representative of the energy used by such Displays. DOE requests comment on the specified test method.

D) Ambient Temperature: Ambient temperature shall be 23^{o} C ± 5^{o} C.

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

F) UUT Alignment:

1) All four corners of the face of the Unit Under Test (UUT) shall be equidistant from a vertical reference plane (e.g., wall)

2) The bottom two corners of the face of the UUT shall be equidistant from a horizontal reference plane (e.g., floor).

G) Light Source:

1) Lamp Type:

a) Standard spectrum halogen flood reflector lamp. The lamp shall not meet the definition of "Modified spectrum" as defined in 10 CFR 430.2 - Definitions[2].

b) Rated Brightness: 980 ± 5% lumens.

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

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

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

c) The center of the lamp shall be aligned at a horizontal angle of 0° with respect to the center of the UUT's ABC sensor.

[2] http://www.gpo.gov/fdsys/pkg/CFR-2011-title10-vol3/pdf/CFR-2011-title10-vol3-sec430-2.pdf

d) The center of the lamp shall be aligned at a height equal to the center of the UUT's ABC sensor with respect to the floor (i.e. the light source shall be placed at a vertical angle of 0° with respect to the center of the UUT's ABC sensor).

e) No test room surface (i.e., floor, ceiling, and wall) shall be within 2 feet of the center of the UUT's ABC Sensor.

f) Illuminance values shall be obtained by varying the input voltage of the lamp.

g) Figure 2 and Figure 3 and provide more information on UUT and light source alignment.

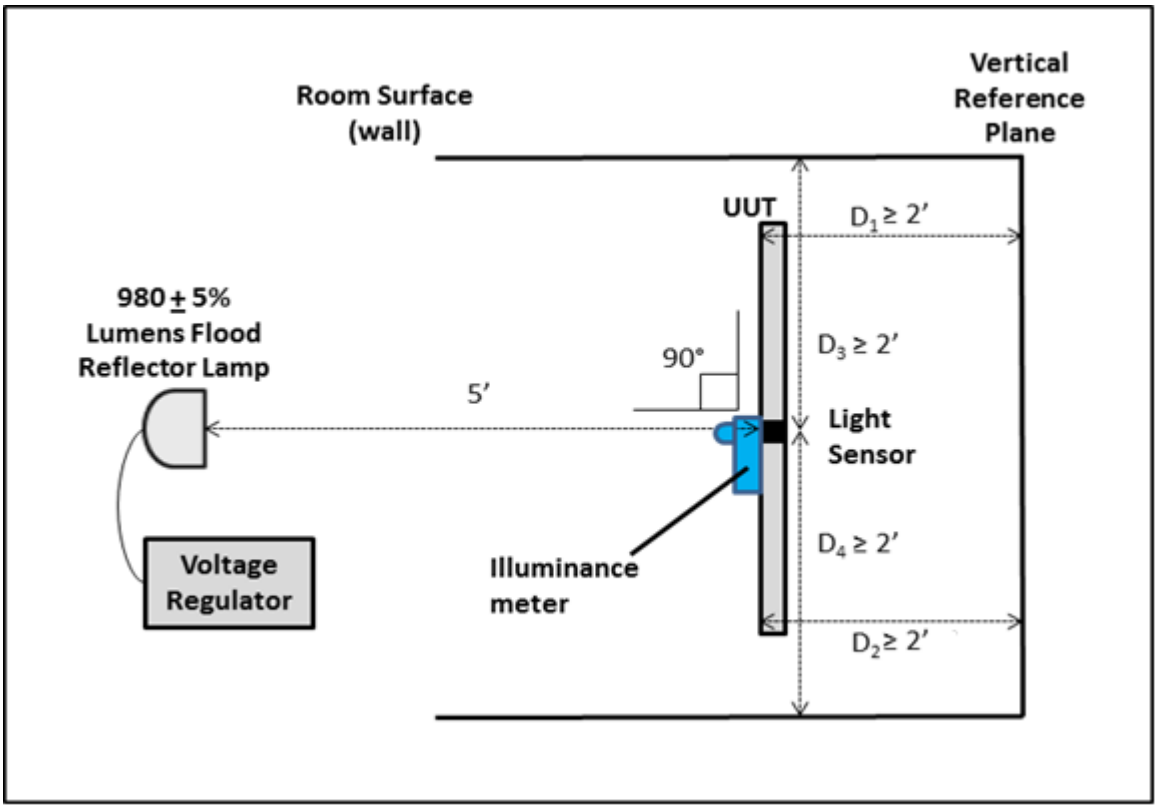

Figure 2: Test Setup - Top View

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

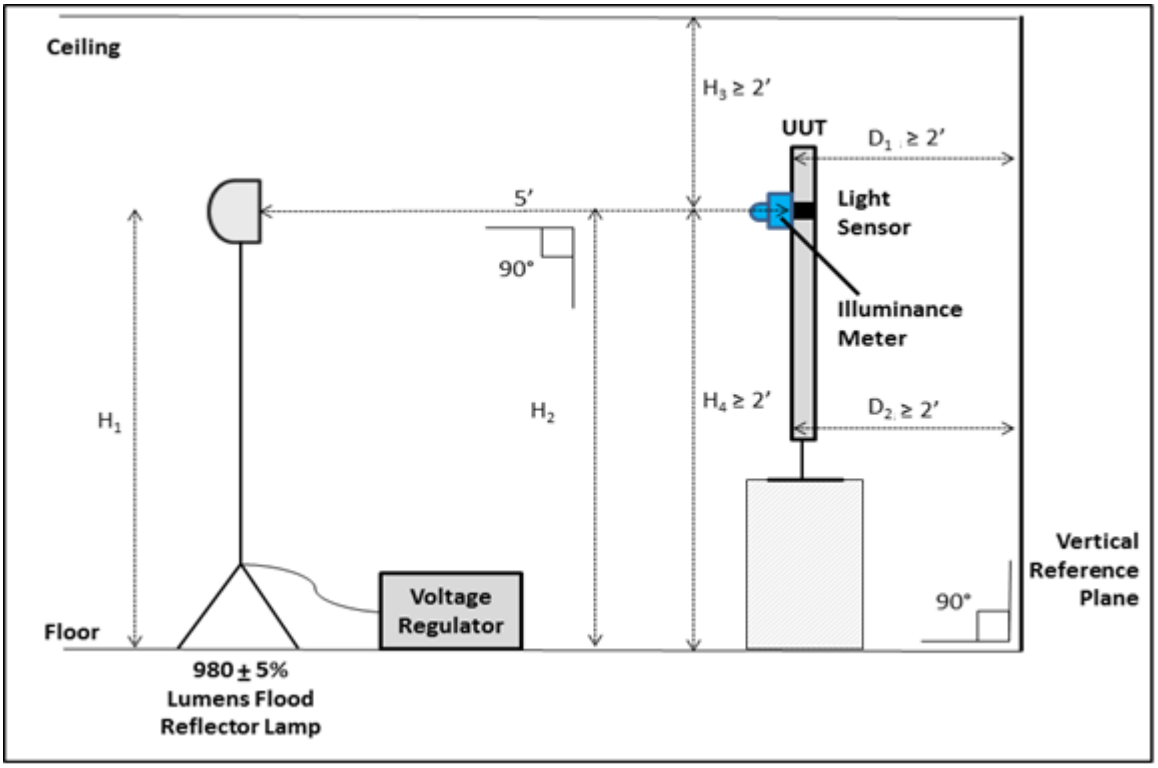

Figure 3: Test Setup - Side View

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

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

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.

2) Minimum Frequency Response: 3.0 kHz

3) Minimum Resolution:

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

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

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

I) Light Measuring Device (LMD):

1) Luminance measurement shall be performed using either

a) A contact meter; or

b) A non-contact meter.

2) All LMDs shall meet the following specifications:

a) Accuracy: ± 2% (± 2 digits) of the digitally displayed value

b) Acceptance Angle: 3 degrees or less

The overall accuracy of LMDs is found by taking (±) the absolute sum of 2% of the targeted illuminance and a 2 digit tolerance of the displayed value least significant digit. For example, if the LMD displays “200.0” when measuring a screen brightness of 200 nits, 2% of 200 nits is 4.0 nits. The least significant digit is 0.1 nits. “Two digits” implies 0.2 nits. Thus, the displayed value would be 200 ± 4.2 nits (4 nits + 0.2 nits).The accuracy is specific to the LMD and shall not be considered as tolerance during actual light measurements. Light measurement accuracy shall be within the tolerance specified in 4.J)4).

J) Measurement Accuracy:

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

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

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

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

a) At 10 lux, ambient lighting shall be within ± 1.0 lux; and

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

5 TEST CONDUCT

5.1 Guidance for Power Measurements

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

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

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

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

C) Multiple Sleep Modes: If the product offers multiple Sleep Modes, the power during all Sleep Modes shall be measured and recorded. All Sleep Mode Testing shall be carried out as per Section 6.5.

5.2 Conditions for Power Measurements

A) Power measurements:

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

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

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

B) Dark Room Conditions:

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

C) UUT Configuration and Control:

1) Peripherals and Network Connections:

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

b) Bridging: If the UUT supports bridging per the definition in Section 1 of the ENERGY STAR Eligibility Criteria Version 6.0, a bridge connection shall be made between the UUT and the Host Machine. The connection shall be made in the following order of preference. Only one connection shall be made and the connection shall be maintained for the duration of the test.

i. Thunderbolt

ii. USB

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.*

c) Networking: If the UUT has networking capability (i.e., it has the ability to obtain an IP address when configured and connected to a network) the networking capability shall be activated, and the UUT shall be connected to a live physical network (e.g., WiFi, Ethernet, etc.). The physical network shall support the highest and lowest data speeds of the UUT's network function. An active connection is defined as a live physical connection over the physical layer of the networking protocol. In the case of Ethernet, the connection shall be via a standard Cat 5e or better Ethernet cable to an Ethernet switch or router. In the case of WiFi the device shall be connected and tested in proximity to a wireless access point (AP). The tester shall configure the address layer of the protocol, taking note of the following:

i. Internet Protocol (IP) v4 and IPv6 have neighbor discovery and will generally configure a limited, non-routable connection automatically.

ii. IP can be configured manually or by using Dynamic Host Configuration Protocol (DHCP) with an address in the 192.168.1.x Network Address Translation (NAT) address space if the UUT does not behave normally when autoIP is used. The network shall be configured to support the NAT address space and/or autoIP.

iii. The UUT shall maintain this live connection to the network for the duration of testing, disregarding any brief lapses, (e.g., when transitioning between link speeds). If the UUT is equipped with multiple network capabilities, only one connection shall be made in the following order of preference:

a. WiFi (Institution of Electrical and Electronics Engineers - IEEE 802.11- 2007[3])

b. Ethernet (IEEE 802.3). If the UUT supports Energy Efficient Ethernet (IEEE 802.3az-2010[4]), then it shall be connected to a device that also supports IEEE 802.3az

c. Thunderbolt

d. USB

e. Firewire (IEEE 1394)

f. Other

d) In the case of a UUT that has a single connection capable of performing both bridging and networking functionality, a single connector can be used to meet these functionalities provided it is the highest preferred connection the UUT supports for each functionality.

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

f) 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.

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

2) Signal Interface:

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

i. Thunderbolt

ii. DisplayPort

[3] 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

[4] 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

iii. HDMI

iv. DVI

v. VGA

vi. Other Digital Interface

vii. Other Analog Interface

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:

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.

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.

D) Resolution and Refresh Rate:

1) Fixed-pixel Displays:

a) Pixel format shall be set to the native level as specified in the product manual.

b) For non-Cathode Ray Tube (CRT) Displays, refresh rate shall be set to 60 Hz, unless a different default refresh rate is specified in the product manual, in which case the specified default refresh rate shall be used.

c) For CRT Displays, pixel format shall be set to the highest resolution that is designed to be driven at a 75 Hz refresh rate, as specified in the product manual. Typical industry standards for pixel format timing shall be used for testing. Refresh rate shall be set to 75 Hz.

E) Battery Operated Products:

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

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

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

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

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

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

H) Test Materials:

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

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

I) Video Input Signal:

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

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

Note: Due to the change in test setup for dc-powered devices, the section regarding testing conditions for a low-voltage dc source is no longer needed and has been removed.

6 TEST PROCEDURES FOR ALL PRODUCTS

6.1 Pre-Test UUT Initialization

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

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

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

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

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

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

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

7) Report the ac input voltage and frequency.

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

6.2 Luminance Testing

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

B) Luminance shall be measured perpendicular to the center of the product screen using a light measuring device (LMD) in accordance with the meter's user manual.

C) The position of the LMD relative to the product screen shall remain fixed throughout the duration of testing.

D) For products with ABC, luminance measurements shall be performed with ABC disabled. If ABC cannot be disabled, luminance measurements shall be measured perpendicular to the center of the product screen with light entering directly into the UUT's ambient light sensor at greater than or equal to 300 lux.

E) Luminance measurements shall be performed as follows:

1) Verify that the UUT is in the default as-shipped luminance value or "Home" picture setting.

2) Display the test video signal for the specific product class, as described below:

a) **All products, except as specified in b)**: Three-bar video signal specified in IEC 62087 Ed. 3.0, Section 11.5.5 (three bars of white (100%) over a black (0%) background).

b) **Products that cannot display signals from IEC 62087 Ed. 3.0**: VESA FPDM2 L80 test signal for the maximum resolution supported by the product.

3) Display the test video signal for no less than 10 minutes to allow the UUT luminance to stabilize. This 10 minute stabilization period may be reduced if luminance measurements are stable to within 2% over a period of not less than 60 seconds.

4) Measure and record the luminance in default as-shipped setting $L_{As\text{-}shipped}$.

5) Set the brightness and contrast levels of the UUT to their maximum values.

6) Measure and record the luminance as $L_{Max\_Measured}$.

7) Record the manufacturer-reported maximum luminance $L_{Max\_Reported}$.

F) The contrast setting shall be left at the maximum level for the subsequent On Mode tests unless otherwise specified.

6.3 On Mode Testing for Products without ABC Enabled by Default

A) After the Luminance Testing and prior to On Mode power measurement, the luminance of the UUT shall be set according to the following:

1) **For Signage Displays with viewable diagonal screen size of 30 inches or more**, the product shall be tested with luminance set at a value greater than or equal to 65% of the manufacturer-reported maximum luminance ($L_{Max\_Reported}$). Luminance values shall be measured as per Section 6.2. This luminance value L_{On} shall be recorded.

2) **For all other products**, adjust appropriate luminance controls until the luminance of the screen is **200 candelas per square meter (cd/m^2)**. If the UUT cannot achieve this luminance, set the product luminance to the nearest achievable value. Luminance values shall be measured as per Section 6.2. This luminance value L_{On} shall be reported. Appropriate luminance controls refer to any controls that adjust the brightness of the Display, but do not include contrast settings.

B) For a UUT capable of displaying the IEC signals, On Mode power (P_{ON}) shall be measured according to IEC 62087 Ed 3.0 Section 11.6.1 "Measurements using dynamic broadcast-content video signal."

C) For a UUT not capable of displaying the IEC signals, On Mode power (P_{ON}) shall be measured as follows:

1) Ensure that the UUT has been initialized per Section 6.1.

2) Display the VESA FPDM2, A112-2F, SET01K test pattern (8 shades of gray from full black (0 volts) to full white (0.7 volts)).

3) Verify that input signal levels conform to VESA Video Signal Standard (VSIS), Version 1.0, Rev. 2.0, December 2002.

4) With the brightness and contrast controls at maximum, verify that the white and near-white grey levels can be distinguished. If necessary, adjust contrast controls until the white and near-white grey levels can be distinguished.

5) Display the VESA FPDM2, A112-2H, L80 test pattern (full white (0.7 volts) box that occupies 80% of the image).

6) Ensure that the LMD measurement area falls entirely within the white portion of the test pattern.

7) Adjust appropriate luminance controls until the luminance of the white area of the screen is set as described in Section 6.3A).

8) Record the screen luminance (L_{On}).

9) Record On Mode power (P_{ON}) and total pixel format (horizontal x vertical). The On Mode power shall be measured over a 10 minute period similar to the IEC 62087 Ed 3.0 dynamic broadcast-content test.

6.4 On Mode Testing for Products with ABC Enabled by Default

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

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

B) Set the light output of the lamp used for testing to 10 lux as measured at the face of the ambient light sensor.

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

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

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

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

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

6.5 Sleep Mode Testing

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

B) The Sleep Mode test shall be conducted with the UUT connected to the Host Machine in the same manner as in the On Mode test. The Host Machine shall be placed into Sleep Mode. For a computer Host Machine, Sleep Mode is defined in the Version 5.2 ENERGY STAR Computers specification.

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

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

6.6 Off Mode Testing

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

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

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

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

6.7 Additional Testing

A) For products with data/networking capabilities, in addition to tests performed with data/networking capabilities activated and a bridge connection established (see Section 5.2C)1)), Sleep Mode Testing shall be performed with data/networking features deactivated and without any bridge connection established, per Section 5.2C)1)b) and c).