ENERGY STAR® Program Requirements for Displays

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. **Comply with current ENERGY STAR Eligibility Criteria**, which define performance requirements and test procedures for displays. A list of eligible products and their corresponding eligibility criteria can be found at www.energystar.gov/specifications.
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a certification body recognized by EPA for displays. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform displays testing. A list of EPA-recognized laboratories and certification bodies can be found at www.energystar.gov/testingandverification.
3. **Ensure that any model associated with the ENERGY STAR name or mark** meets the following standards:

   3.1. Product material requirements as defined in restriction of hazardous substances (RoHS) regulations, as generally accepted. This includes exemptions in force at the date of product manufacture, where the maximum concentration values tolerated by weight in homogeneous materials are: lead (0.1%), mercury (0.1%), cadmium (0.01%), hexavalent chromium (0.1%), polybrominated biphenyls (PBB) (0.1%), or polybrominated diphenyl ethers (PBDE) (0.1%). Batteries are exempt.

   3.2. The generally accepted attributes of a recyclable product at the date of product manufacture: where products shall be designed for ease of disassembly and recyclability where external enclosures, sub-enclosures, chassis and electronic subassemblies are easily removable with commonly available tools, by hand, or by a recycler's automated processes.

   Notes:

   - The explicit intention is to harmonize with EU RoHS.
   - For purposes of ENERGY STAR third-party certification, these requirements shall not be reviewed when products are initially qualified nor during subsequent verification testing. Rather, EPA reserves the right to request supporting documentation at any time.

Using the ENERGY STAR Name and Marks

4. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
5. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale in the US and/or ENERGY STAR partner countries.
6. Provide clear and consistent labeling of ENERGY STAR qualified displays.

   6.1. The ENERGY STAR mark must be clearly displayed:

6.1.1. On the top or front of the product. Labeling on the top or front of the product may be permanent or temporary. All temporary labeling must be affixed to the top or front of the product with an adhesive or cling-type application;
Electronic Labeling Option: Partners have the option of using an alternative electronic labeling approach in place of this product labeling requirement, as long it meets the following requirements:
− The ENERGY STAR mark in cyan, black, or white (as described in "The ENERGY STAR Identity Guidelines" available at www.energystar.gov/logouse) appears at system start-up. The electronic mark must display for a minimum of 5 seconds;
− The ENERGY STAR mark must be at least 10% of the screen by area, may not be smaller than 76 pixels x 78 pixels, and must be legible.
EPA will consider alternative proposals regarding approach, duration, or size for electronic labeling on a case-by-case basis.

6.1.2. In product literature (i.e., user manuals, specification sheets, etc.);

6.1.3. On product packaging for products sold at retail; and

6.1.4. On the Partner's Internet site where information about ENERGY STAR qualified models is displayed:

6.1.4.1. If information concerning ENERGY STAR is provided on the Partner website, as specified by the ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources section on the ENERGY STAR website at www.energystar.gov), EPA may provide links where appropriate to the Partner website.

Verifying Ongoing Product Qualification

7. Participate in third-party verification testing through a certification body recognized by EPA for displays, providing full cooperation and timely responses. EPA/DOE may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

Providing Information to EPA

8. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
   8.1. Partner must submit the total number of ENERGY STAR qualified displays shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).
   8.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.
   8.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

9. Report to EPA any attempts by recognized laboratories or certification bodies to influence testing or certification results or to engage in discriminatory practices.

10. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.

ENERGY STAR® Program Requirements
Product Specification for Displays

Eligibility Criteria
Version 6.0

Following is the ENERGY STAR product specification ("specification") for Displays. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

A) Product Types:

1) Electronic Display (Display): A commercially-available product with a display screen and associated electronics, often encased in a single housing, that as its primary function displays visual information from (1) a computer, workstation or server via one or more inputs (e.g., VGA, DVI, HDMI, DisplayPort, IEEE 1394, USB), (2) external storage (e.g., USB flash drive, memory card), or (3) a network connection.

a) Computer Monitor: An electronic device, typically with a diagonal screen size greater than 12 inches and a pixel density greater than 5,000 pixels per square inch (pixels/in^2), that displays a computer's user interface and open programs, allowing the user to interact with the computer, typically using a keyboard and mouse.

(1) Enhanced-Performance Display: A computer monitor that has all of the following features and functionalities:
(a) A contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85°, with or without a screen cover glass;
(b) A native resolution greater than or equal to 2.3 megapixels (MP); and,
(c) A color gamut size of at least sRGB as defined by IEC 61966 2-1. Shifts in color space are allowable as long as 99% or more of defined sRGB colors are supported.

b) Digital Picture Frame: An electronic device, typically with a diagonal screen size less than 12 inches, whose primary function is to display digital images. It may also feature a programmable timer, occupancy sensor, audio, video, or bluetooth or wireless connectivity.

c) Signage Display: An electronic device typically with a diagonal screen size greater than 12 inches and a pixel density less than or equal to 5,000 pixels/in^2. It is typically marketed as commercial signage for use in areas where it is intended to be viewed by multiple people in non-desk based environments, such as retail or department stores, restaurants, museums, hotels, outdoor venues, airports, conference rooms or classrooms.

B) External Power Supply (EPS): Also referred to as an external power adapter. A component contained in a separate physical enclosure external to a display, designed to convert line voltage ac input from the mains to lesser dc voltage(s) in order to provide power to the display. An EPS connects to the display via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.

C) Operational Modes:

1) On Mode: The power mode in which the product has been activated, and is providing one or more of its principal functions. The common terms, "active," "in-use," and "normal operation" also describe this mode. The power in this mode is typically greater than the power in Sleep Mode and Off Mode.

2) Sleep Mode: The power mode the product enters after receiving a signal from a connected device or an internal stimulus. The product may also enter this mode by virtue of a signal produced by user input. The product must wake on receiving a signal from a connected device, a network, a remote control, and/or an internal stimulus. While the product is in this mode, it is not producing a visible picture, with the possible exception of user-oriented or protective functions such as product information or status displays, or sensor-based functions.

Note: Examples of internal stimuli are a timer or occupancy sensor.

Note: A power control is not an example of user input.

3) Off Mode: The power mode in which the product is connected to a power source, and is not providing any On Mode or Sleep Mode functions. This mode may persist for an indefinite time. The product may only exit this mode by direct user actuation of a power switch or control. Some products may not have this mode.

D) Luminance: The photometric measure of the luminous intensity per unit area of light travelling in a given direction, expressed in candelas per square meter (cd/m^2). Luminance refers to the brightness settings of a display.

1) Maximum Reported Luminance: The maximum luminance the display may attain at an On Mode preset setting, and as specified by the manufacturer, for example, in the user manual.

2) Maximum Measured Luminance: The maximum luminance the display may attain by manually configuring its controls, such as brightness and contrast.

3) As-shipped Luminance: The luminance of the display at the factory default preset setting the manufacturer selects for normal home or applicable market use. The As-shipped Luminance of displays with Automatic Brightness Control (ABC) enabled by default may vary based on the Ambient Light Conditions of the location in which the display is installed.

E) Screen Area: The viewable screen width multiplied by the viewable screen height, expressed in square inches (in^2).

F) Automatic Brightness Control (ABC): The self-acting mechanism that controls the brightness of a display as a function of ambient light.

G) Ambient Light Conditions: The combination of light illuminances in the environment surrounding a display, such as a living room or an office.

H) Bridge Connection: A physical connection between two hub controllers, typically, but not limited to, USB or FireWire, which allows for expansion of ports typically for the purpose of relocating the ports to a more convenient location or increasing the number of available ports.

I) Network Capability: An ability to obtain an IP address when connected to the network.

J) Occupancy Sensor: A device used to detect human presence in front of or in the area surrounding a display. An occupancy sensor is typically used to switch a display between On Mode and Sleep or Off Mode.

K) Product Family: A group of displays, made under the same brand, sharing a screen of the same size and resolution, and encased in a single housing that may contain variations in hardware configurations.

Example: Two computer monitors from the same model line with a diagonal screen size of 21 inches and a resolution of 2.074 megapixels (MP), but with variations in features such as built-in speakers or camera, could be qualified as a product family.

L) Representative Model: The product configuration that is tested for ENERGY STAR qualification and is intended to be marketed and labeled as ENERGY STAR.

2 SCOPE

2.1 Included Products

2.1.1 Products that meet the definition of a display as specified herein and are powered directly from ac mains, via an external power supply, or via a bridging or network connection, are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2. Typical products that would be eligible for qualification under this specification include:

i. Computer Monitors;

ii. Digital Picture Frames;

iii. Signage Displays; and,

iv. Additional products including monitors with keyboard, video and mouse (KVM) switch functionality, and other industry-specific displays that meet the definitions and qualification criteria in this specification.

2.2 Excluded Products

2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for qualification under this specification. The list of specifications currently in effect can be found at www.energystar.gov/products.

2.2.2 The following products are not eligible for qualification under this specification:

i. Products with a viewable diagonal screen size greater than 61 inches;

ii. Products with an integrated television tuner;

iii. Products that are marketed and sold as televisions, including products with a computer input port (e.g., VGA) that are marketed and sold primarily as televisions;

iv. Products that are component televisions. A component television is a product that is composed of two or more separate components (e.g., display device and tuner) that are marketed and sold as a television under a single model or system designation. A component television may have more than one power cord;

v. Dual-function televisions / computer monitors that are marketed and sold as such;

vi. Mobile computing and communication devices (e.g., tablet computers, slates, electronic readers, smartphones);

vii. Products that must meet FDA specifications for medical devices that prohibit power management capabilities and/or do not have a power state meeting the definition of Sleep Mode; and,

viii. Thin clients, ultra-thin clients, or zero clients.

3 QUALIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

3.1.2 Unless otherwise specified, compliance with specification requirements shall be evaluated using directly measured or calculated values without any benefit from rounding.

3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification requirements.

3.2 General Requirements

3.2.1 External Power Supply: If the product is shipped with an EPS, the EPS shall meet the level V performance requirements under the International Efficiency Marking Protocol, and include the level V marking. Additional information on the Marking Protocol is available at www.energystar.gov/powersupplies.

- External Power Supplies shall meet level V requirements when tested using the *Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies, Aug. 11, 2004.*

3.2.2 Power Management:

i. Products shall offer at least one power management feature that is enabled by default, and that can be used to automatically transition from On Mode to Sleep Mode either by a connected host device or internally (e.g., support for VESA Display Power Management Signaling (DPMS), enabled by default).

ii. Products that generate content for display from one or more internal sources shall have a sensor or timer enabled by default to automatically engage Sleep or Off Mode.

iii. For products that have an internal default delay time after which the product transitions from On Mode to Sleep Mode or Off Mode, the delay time shall be reported.

iv. Computer monitors shall automatically enter Sleep Mode or Off Mode within 15 minutes of being disconnected from a host computer.

3.3 On Mode Requirements

3.3.1 On Mode power (P_{ON}), as measured per the ENERGY STAR test method (referenced in Table 6), shall be less than or equal to the Maximum On Mode Power Requirement (P_{ON_MAX}), as calculated and rounded per Table 1, below.

i. If the product's pixel density (D_P), as calculated per Equation 1, is greater than 20,000 pixels/in^2, then the screen resolution used to calculate P_{ON_MAX} shall be determined per Equation 2.

Equation 1: Calculation of Pixel Density

$$D_P = \frac{r \times 10^6}{A}$$

Where:

- *D_P is the pixel density of the product rounded to the nearest integer, in pixels/in^2,*
- *r is the screen resolution, in megapixels, and*
- *A is the viewable screen area, in in^2.*

Equation 2: Calculation of Resolution if D_p > 20,000 pixels/in^2

$$r_1 = \frac{20{,}000 \times A}{10^6} \qquad r_2 = \frac{(D_P - 20{,}000) \times A}{10^6}$$

Where:

- *r_1 and r_2 are the screen resolutions, in megapixels, to be used when calculating P_{ON_MAX},*
- *D_P is the pixel density of the product rounded to the nearest integer, in pixels/in^2, and*

- *A is the viewable screen area, in in^2.*

Table 1: Calculation of Maximum On Mode Power Requirements (P_{ON_MAX})

Product Type and Diagonal Screen Size, *d* (in inches)	P_{ON_MAX} where $D_p \leq 20{,}000$ pixels/in^2 (in watts) *Where:* ▪ *r = Screen resolution in megapixels* ▪ *A = Viewable screen area in in^2* ▪ *The result shall be rounded to the nearest tenth of a watt*	P_{ON_MAX} where $D_P > 20{,}000$ pixels/in^2 (in watts) *Where:* ▪ *r = Screen resolution in megapixels* ▪ *A = Viewable screen area in in^2* ▪ *The result shall be rounded to the nearest tenth of a watt*
$d < 12.0$	$(6.0 \times r) + (0.05 \times A) + 3.0$	$\left((6.0 \times r_1) + (3.0 \times r_2) + (0.05 \times A) + 3.0\right)$
$12.0 \leq d < 17.0$	$(6.0 \times r) + (0.01 \times A) + 5.5$	$\left((6.0 \times r_1) + (3.0 \times r_2) + (0.01 \times A) + 5.5\right)$
$17.0 \leq d < 23.0$	$(6.0 \times r) + (0.025 \times A) + 3.7$	$\left((6.0 \times r_1) + (3.0 \times r_2) + (0.025 \times A) + 3.7\right)$
$23.0 \leq d < 25.0$	$(6.0 \times r) + (0.06 \times A) - 4.0$	$\left((6.0 \times r_1) + (3.0 \times r_2) + (0.06 \times A) - 4.0\right)$
$25.0 \leq d \leq 61.0$	$(6.0 \times r) + (0.1 \times A) - 14.5$	$\left((6.0 \times r_1) + (3.0 \times r_2) + (0.1 \times A) - 14.5\right)$
$30.0 \leq d \leq 61.0$ *(for products meeting the definition of a Signage Display only)*	$(0.27 \times A) + 8.0$	$(0.27 \times A) + 8.0$

3.3.2 For products meeting the definition of an Enhanced-Performance Display, a power allowance (P_{EP}), as calculated per Equation 3, shall be added to P_{ON_MAX}, as calculated per Table 1. In this case, P_{ON}, as measured per the ENERGY STAR test method (referenced in Table 6), shall be less than or equal to the sum of P_{ON_MAX} and P_{EP}.

Equation 3: Calculation of On Mode Power Allowance for Enhanced-Performance Displays

$$P_{EP<27"} = 0.30 \times P_{ON\_MAX}$$

$$P_{EP\geq 27"} = 0.75 \times P_{ON\_MAX}$$

Where:

- *$P_{EP<27"}$ is the On Mode power allowance, in watts, for an Enhanced-Performance Display with a diagonal screen size less than 27 inches,*
- *$P_{EP\geq 27"}$ is the On Mode power allowance, in watts, for an Enhanced-Performance Display with a diagonal screen size greater than or equal to 27 inches, and*
- *P_{ON_MAX} is the maximum On Mode power requirement, in watts.*

3.3.3 For products with Automatic Brightness Control (ABC) enabled by default, a power allowance (P_{ABC}), as calculated per **Equation 5**, shall be added to P_{ON_MAX}, as calculated per Table 1, if the On Mode power reduction (R_{ABC}), as calculated per **Equation 4**, is greater than or equal to 20%.

i. If R_{ABC} is less than 20%, P_{ABC} shall not be added to P_{ON_MAX}.

ii. P_{ON}, as measured with ABC disabled per the ENERGY STAR test method, referenced in Table 6 below, shall be less than or equal to P_{ON_MAX}.

Equation 4: Calculation of On Mode Power Reduction for Products with ABC Enabled by Default

$$R_{ABC} = 100 \times \left(\frac{P_{300} - P_{10}}{P_{300}}\right)$$

Where:

- *R_{ABC} is the On Mode percent power reduction due to ABC,*
- *P_{300} is the measured On Mode power, in watts, when tested with an ambient light level of 300 lux, and*
- *P_{10} is the measured On Mode power, in watts, when tested with an ambient light level of 10 lux.*

Equation 5: Calculation of On Mode Power Allowance for Products with ABC Enabled by Default

$$P_{ABC} = 0.10 \times P_{ON\_MAX}$$

Where:

- *P_{ABC} is the On Mode power allowance, in watts, and*
- *P_{ON_MAX} is the maximum On Mode power requirement, in watts.*

3.3.4 For products powered with a low-voltage dc source, P_{ON}, as calculated per Equation 6, shall be less than or equal to P_{ON_MAX}, as calculated per Table 1.

Equation 6: Calculation of On Mode Power for Products Powered by a Low-voltage Dc Source

$$P_{ON} = P_L - P_S$$

Where:

- *P_{ON} is the calculated On Mode power, in watts,*
- *P_L is the ac power consumption, in watts, of the low-voltage dc source with the unit under test (UUT) as the load, and*
- *P_S is the marginal loss of the ac power supply of the source, in watts.*

3.4 Sleep Mode Requirements

3.4.1 Measured Sleep Mode power (P_{SLEEP}) for products with none of the bridging or network capabilities included in Table 3 or 4 shall be less than or equal to the Maximum Sleep Mode Power Requirement (P_{SLEEP_MAX}), as specified in Table 2.

Table 2: Maximum Sleep Mode Power Requirement (P_{SLEEP_MAX})

P_{SLEEP_MAX} (watts)
0.5

3.4.2 Measured Sleep Mode power (P_{SLEEP}) for products with one or more of the bridging, network, or additional capabilities included in Table 3 or 4 shall be less than or equal to the Maximum Bridging/Network Sleep Mode Power Requirement (P_{SLEEP_AP}), as calculated per Equation 7.

Equation 7: Calculation of Maximum Bridging/Network Sleep Mode

$$P_{SLEEP\_AP} = P_{SLEEP\_MAX} + P_{DN} + P_{ADD}$$

Where:

- *P_{SLEEP_AP} is the Maximum Sleep Mode Power Requirement, in watts, for products that were tested with additional power-consuming capabilities,*
- *P_{SLEEP_MAX} is the Maximum Sleep Mode Power Requirement, in watts, as specified in Table 2,*
- *P_{DN} is the sum of power allowances, in watts, as specified in Table 3, for the bridging and/or network capabilities that are connected and enabled during Sleep Mode testing, and*
- *P_{ADD} is the sum of power allowances, in watts, as specified in Table 4, for the additional capabilities that are enabled during Sleep Mode testing.*

Table 3: Power Allowances in Sleep Mode for Bridging or Network Capabilities

Capability	Included Types	P_{DN} (watts)
Bridging	USB 1.x	0.1
	USB 2.x	0.5
	USB 3.x, DisplayPort (non-video connection), Thunderbolt	0.7
Network	Wi-Fi	2.0
	Fast Ethernet	0.2
	Gigabit Ethernet	1.0

Table 4: Power Allowances in Sleep Mode for Additional Capabilities

Capability	Included Types	P_{ADD} (watts)
Sensor	Occupancy Sensor	0.5
Memory	Flash memory-card/smart-card readers, camera interfaces, PictBridge	0.2

Example 1: A digital picture frame with only one bridging or network capability connected and enabled during Sleep Mode testing, **Wi-Fi**, and no additional capabilities enabled during Sleep Mode testing, would qualify for the 2.0 W Wi-Fi adder. Recalling that $P_{SLEEP\_AP} = P_{SLEEP\_MAX} + P_{DN} + P_{ADD}$, P_{SLEEP_AP} = 0.5 W + 2.0 W + 0 W = **2.5 W**.

Example 2: : A computer monitor with **USB 3.x** and **DisplayPort (non-video connection)** bridging capability shall be tested with only the USB 3.x connected and enabled. Assuming no additional capabilities are enabled during Sleep Mode testing, this display would qualify for the 0.7 W USB 3.x adder. Recalling that $P_{SLEEP\_AP} = P_{SLEEP\_MAX} + P_{DN} + P_{ADD}$, P_{SLEEP_AP} = 0.5 W + 0.7 W + 0 W = **1.2 W**.

Example 3: A computer monitor with one bridging and one network capability, **USB 3.x** and **Wi-Fi**, shall be tested with both capabilities connected and enabled during Sleep Mode testing. Assuming no additional capabilities are enabled during Sleep Mode testing, this display would qualify for the 0.7 W USB 3.x adder and the 2.0 W Wi-Fi adder. Recalling that $P_{SLEEP\_AP} = P_{SLEEP\_MAX} + P_{DN} + P_{ADD}$, P_{SLEEP_AP} = 0.5 W + (0.7 W + 2.0 W) + 0 W = **3.2 W**.

3.4.3 For products that offer more than one Sleep Mode (e.g., "Sleep" and "Deep Sleep"), measured Sleep Mode power (P_{SLEEP}) in any Sleep Mode shall not exceed P_{SLEEP_MAX} in the case of products without bridging or network connection capabilities, or P_{SLEEP_AP} in the case of products tested with additional power-consuming capabilities, such as bridging connections or network connections.

3.5 Off Mode Requirements

3.5.1 A product need not have an Off Mode to be eligible for qualification. For products that do offer Off Mode, measured Off Mode power (P_{OFF}) shall be less than or equal to the Maximum Off Mode Power Requirement (P_{OFF_MAX}) specified in Table 5.

Table 5: Maximum Off Mode Power Requirement (P_{OFF_MAX})

P_{OFF_MAX} (watts)
0.5

3.6 Luminance Reporting Requirements

3.6.1 Maximum reported and maximum measured luminance shall be reported for all products; as-shipped luminance shall be reported for all products except those with ABC enabled by default.

Note: Products intended for sale in the US market are subject to minimum toxicity and recyclability requirements. Please see ENERGY STAR® Program Requirements for Displays: Partner Commitments for details.

4 TEST REQUIREMENTS

4.1 Test Methods

4.1.1 Test methods identified in Table 6 shall be used to determine qualification for ENERGY STAR.

Table 6: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
All Product Types and Screen Sizes	ENERGY STAR Test Method for Determining Displays Energy Use Version 6.0 – Final, Sep-2012

4.2 Number of Units Required for Testing

4.2.1 One unit of a Representative Model, as defined in Section 1, shall be selected for testing.

4.2.2 For qualification of a product family, the product configuration that represents the worst-case power consumption for each product category within the family shall be considered the Representative Model.

4.3 International Market Qualification

4.3.1 Products shall be tested for qualification at the relevant input voltage/frequency combination for each market in which they will be sold and promoted as ENERGY STAR.

5 USER INTERFACE

5.1.1 Manufacturers are encouraged to design products in accordance with the user interface standard, *IEEE P1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments*. For details, see http://eetd.LBL.gov/Controls. Note, adoption of *IEEE P1621* is not a requirement for ENERGY STAR qualification, but in the event that the manufacturer does not adopt *IEEE P1621*, EPA requests that the manufacturer provide EPA with its reason for not doing so.

6 EFFECTIVE DATE

6.1.1 Effective Date: The Version 6.0 ENERGY STAR Display Products specification shall take effect on **June 1, 2013**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through stakeholder discussions. In the event of a specification revision, please note ENERGY STAR qualification is not automatically granted for the life of a model

7 CONSIDERATIONS FOR FUTURE REVISIONS

7.1 Displays Larger Than 61” in Diagonal Screen Size

7.1.1 EPA understands that interactive displays greater than 60" in diagonal screen size are currently available in the market and are namely used for commercial and educational purposes. EPA is interested in better understanding the power consumption associated with these products when tested according to the Displays Test Method and will work with stakeholders prior to, and during, the next specification revision development process to access the information. DOE may also explore testing of these products. EPA is interested in exploring expanding the scope of products to those greater than 61" in diagonal screen size in the next specification revision.

7.2 Touch Screen Functionality

7.2.1 EPA is committed to continuing to develop performance levels for displays that account for new features and functionality, and anticipates that displays with touch screen functionality, which are included in the scope of this specification, will become more prevalent in the market, especially among signage displays. Going forward, EPA and DOE will explore with stakeholders whether touch screen functionality impacts On Mode power consumption to determine to what extent the next specification development process should address touch screen functionality.

ENERGY STAR® Program Requirements Product Specification for Displays

Test Method for Determining Displays Energy Use Version 6.0 – Final Sep-2012

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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: DOE has published the Test Procedure for Television Sets Notice of Proposed Rulemaking (77 FR 2830). 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 Final Rulemaking published by DOE.

3 DEFINITIONS

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

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 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 powered with a low-voltage 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 available).

2) Products powered by low-voltage dc shall be configured with an ac source of the dc power for testing (e.g., an ac-powered Universal Serial Bus (USB) hub).

3) The USB hub power adapter must have the following attributes:

a) Voltage Rating: 5 V

b) Current Range: 2 A to 3 A

4) Power for the unit under test (UUT) shall include the following, as measured per Section 5.3 of this method:

a) Ac power consumption of the low-voltage dc source with the UUT as the load (P_L).

b) Ac power consumption of the low-voltage dc source with no load (P_S).

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[1].

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.

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

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.

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 1 and Figure 2 and provide more information on UUT and light source alignment.

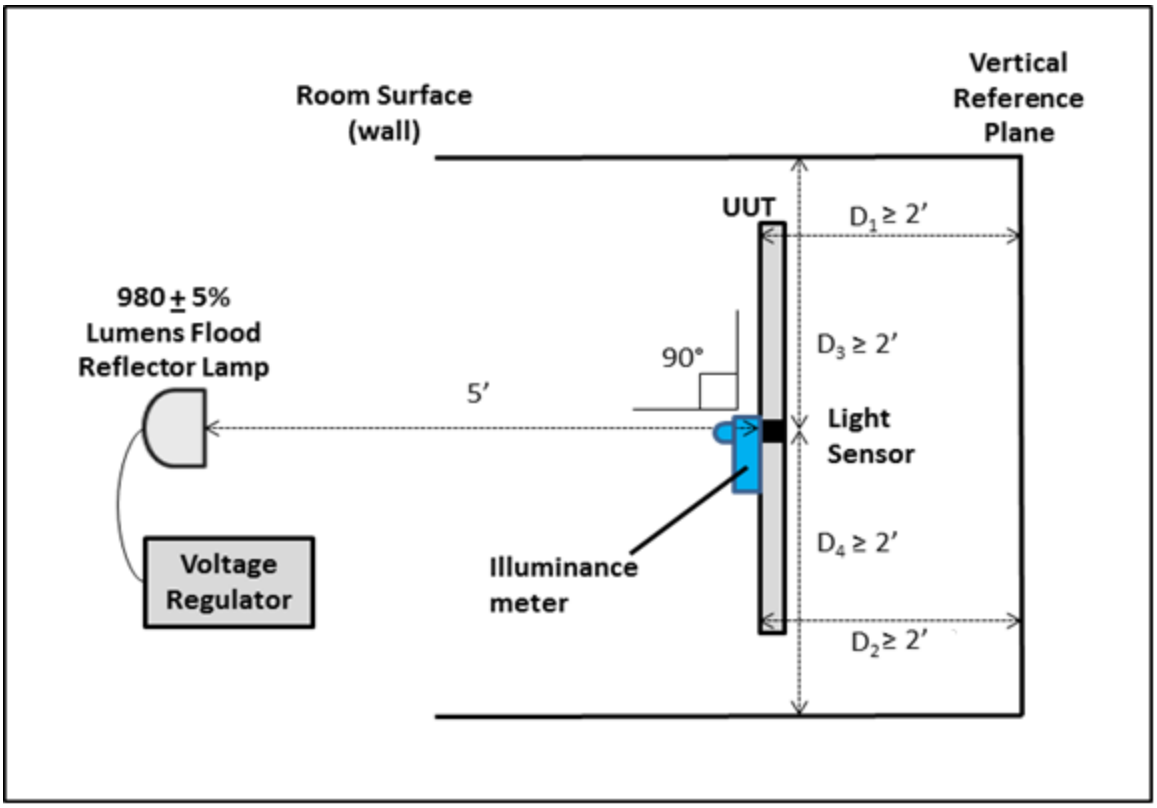

Figure 1: Test Setup - Top View

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

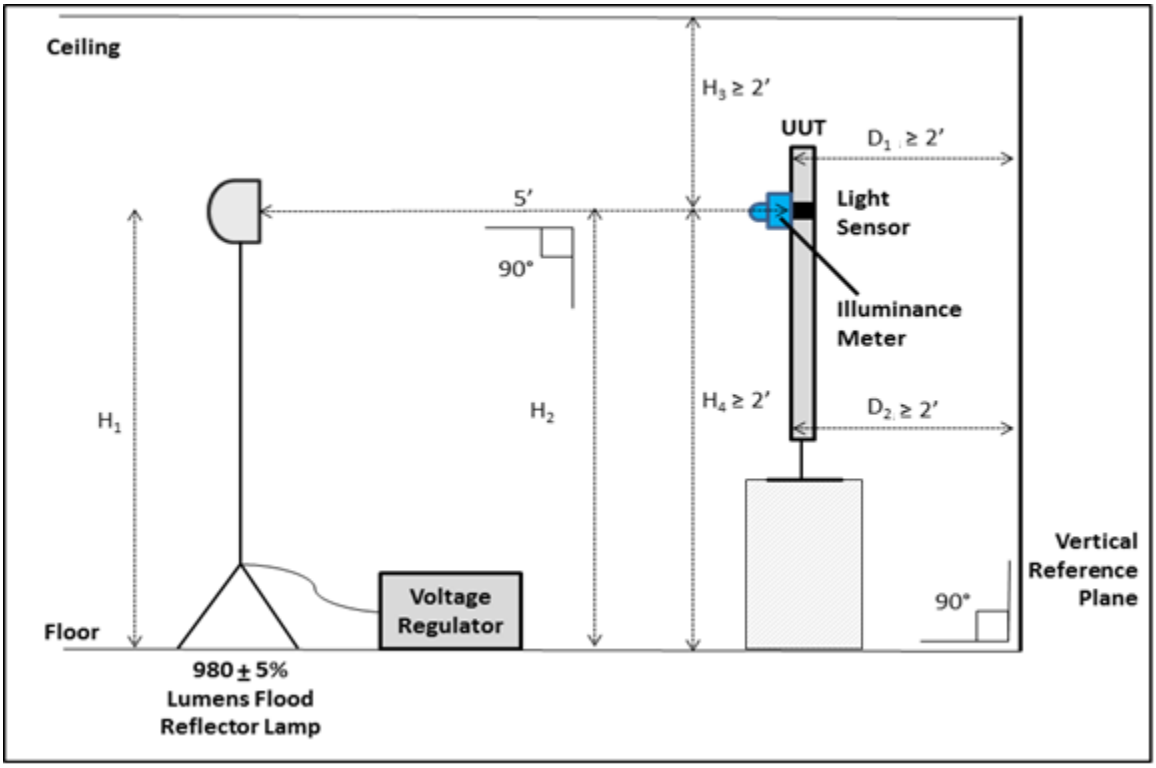

Figure 2: Test Setup - Side View

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.

l) Light Measuring Device (LMD):

1) Luminance measurement shall be performed using either

a) A contact meter; or

b) A distance 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 IEC 62087 Ed. 3.0 test signal main menu displayed on the product. For products not compatible with the IEC 62087 test signal format, ambient light values shall be measured with the VESA 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 Implementation of IEC 62087 Ed. 3.0

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” upon initial start-up shall be tested in “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 system) 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.

d) 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:

   i. WiFi (Institution of Electrical and Electronics Engineers - IEEE 802.11- 2007[2])

   ii. Ethernet (IEEE 802.3). If the UUT supports Energy Efficient Ethernet (IEEE 802.3az-2010[3]), then it shall be connected to a device that also supports IEEE 802.3az

   iii. Thunderbolt

   iv. USB

   v. Firewire (IEEE 1394)

   vi. Other

e) 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.

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

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.

h) 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 digital interfaces, the UUT shall be tested with the first available interface from the list below:

      i. Thunderbolt

      ii. DisplayPort

[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

iii. HDMI

iv. DVI

v. Other Digital Interface

vi. Analog Component

vii. Analog Composite

viii. Other Analog Interfaces

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 62087-2011 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) "Video Electronics Standard Association (VESA) Flat Panel Display Measurements (FPDM) Standard version 2.0 test patterns" (shall be used only for products that cannot be tested using the IEC 62087-2011 Dynamic Broadcast-Content Signal).

5.3 Low-Voltage Dc Source Measurement

A) Connect the dc source to the power meter and relevant ac supply as specified in Table 1

1) Verify that the dc source is unloaded.

2) Allow the dc source to warm up for a minimum of 30 minutes.

3) Measure and record the unloaded dc source power (P_S) according to IEC 62301 Ed. 2.0

4) Record the brand name, model number, voltage and current rating of the dc source.

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 test signal format, as specified in section 5.2 H) 1), shall be displayed for the entire warm up period. Displays that are not compatible with the IEC 62087 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). Following the LMD manufacturer's instructions, it is recommended that the LMD either be used as close to the screen as possible or measure an area of at least 500 pixels.

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: IEC 62087-2011 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 be tested with signals from IEC 62087: 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 $L_{Max\_Reported}$.

6.3 On Mode Testing for Products without ABC Enabled by Default

A) Prior to On Mode power measurement, the luminance of the UUT shall be set according to the following:

1) For products with viewable diagonal screen size **less than 30 inches and any Computer Monitors 30 inches or more**, adjust appropriate 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.

2) For products with viewable diagonal screen size of **30 inches or more that are Signage Displays**, 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.

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: Measuring Conditions for Television Sets in On (average) Mode; with the additional guidance in Section 5.

1) Section 11.6 "On (average) Mode testing using dynamic broadcast-content video signal" for products capable of playing video.

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 controls until the luminance of the white area of the screen is **200 Cd/m^2**. If the UUT cannot achieve the specified luminance, set product luminance to the nearest achievable value.
8) Record the screen luminance (L_{On}).
9) Record On Mode power (P_{ON}) and total pixel format (horizontal x vertical).

6.4 On Mode Testing for Products with ABC Enabled by Default

The average On Mode power consumption of the product shall be tested with the dynamic broadcast-content as defined in IEC 62087 Ed. 3.0.

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 62301-2011: Household Electrical Appliances – Measurement of Standby Power, with the additional guidance in Section 5.

B) The Sleep Mode test shall be conducted with the UUT connected to the host machine. Sleep Mode shall also be initiated in the host machine to which the UUT is connected.

C) If the product has a variety of Sleep Modes that can be manually selected, measurements shall be performed and recorded in all Sleep Modes. If the product automatically cycles through its various Sleep Modes, the measurement time shall be long enough to obtain a true average of all Sleep Modes, which will be the Sleep Mode power used for qualification.

6.7 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 off mode test. 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.

6.8 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) b), c) and d).