ENERGY STAR® Program Requirements
Product Specification for Displays

Eligibility Criteria
Version 8.0
(Rev. February-2020)

Following is the Version 8.0 ENERGY STAR product 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 product with a display screen and associated electronics, often encased in a single housing, that as its primary function produces 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) Monitor: An Electronic Display intended for one person to view in a desk-based environment.

   b) Signage Display: An Electronic Display intended for multiple people to view in non-desk-based environments, such as retail or department stores, restaurants, museums, hotels, outdoor venues, airports, conference rooms or classrooms. For the purposes of this specification, a Display shall be classified as a Signage Display if it meets three or more criteria listed below:

   (1) Diagonal screen size is greater than 30 inches;

   (2) Maximum Reported Luminance is greater than 400 candelas per square meter;

   (3) Pixel density is less than or equal to 7,000 pixels per square inch;

   (4) Ships without a mounting stand designed to support the display on a desktop, or is configured to be mounted vertically on a wall; or

   (5) Contains RJ45 or RS232 physical ports.

   c) Tiled Display System: A testable configuration of Signage Displays in which multiple Signage Displays are tiled together contiguously and supported by one or more modular external controllers and one or more modular external power supplies to produce a single larger image.

   (1) Maximum Tiled Configuration: A Tiled Display System configured with the maximum number of Signage Display panels supported by the same set of external support modules (e.g., power supplies, controllers, etc.) that are needed to support a configuration with two panels.

B) Operational Modes:

1) On Mode: The mode in which the Display has been activated and is providing the primary function.

2) <u>Sleep Mode</u>: A low-power mode in which the Display provides one or more non-primary protective functions or continuous functions.

Note: Sleep Mode may serve the following functions: facilitate the activation of On Mode via remote switch, Touch Technology, internal sensor, or timer; provide information or status displays including clocks; support sensor-based functions; or maintain a network presence.

3) <u>Off Mode</u>: The mode where the Display is connected to a power source, produces no visual information, and cannot be switched into any other mode with the remote control unit, an internal signal, or an external signal.

Note: The Display may only exit this mode by direct user actuation of an integrated power switch or control. Some products may not have an Off Mode.

C) <u>Displays Settings and Menus</u>:

1) <u>Preset Picture Setting</u>: A preprogrammed factory setting obtained from the Display menu with pre-determined picture parameters such as brightness, contrast, color, sharpness, etc.

2) <u>Default Picture Setting</u>: The Preset Picture Setting tested and recognized according to the ENERGY STAR test method. The Default Picture Setting is typically the Preset Picture Setting in the model's as-shipped default state. If the Display has a Forced Menu, the Default Picture Setting is the Preset Picture Setting identified according to the ENERGY STAR test method, usually the setting labeled "Standard" or "Home."

3) <u>Forced Menu</u>: A series of menus which require the selection of initial settings before allowing the user to utilize primary functions. These menus may contain an option to select between the Default Picture Setting and other picture settings not tested in the ENERGY STAR test method.

Note: In the case that no standard setting or equivalent exists, the default setting recommended by the manufacturer is considered the Default Picture Setting for the purposes of this specification.

D) <u>Visual Characteristics</u>:

1) <u>Ambient Light Conditions</u>: The combination of light illuminances in the environment surrounding a Display, such as a living room or an office.

2) <u>Automatic Brightness Control (ABC)</u>: The self-acting mechanism that controls the brightness of a Display as a function of Ambient Light Conditions.

Note: ABC functionality must be enabled to control the brightness of a Display.

3) <u>Color Gamut</u>: The range of color supported within the CIE LUV 1976 u' v' color space and calculated per Section 5.18 Gamut Area of the Information Display Measurements Standard Version 1.03.

Note: Any gamut support in non-visible/invisible color areas is not to be counted. The gamut must be expressed as a percentage from 1% to 100% to the nearest 0.1% of the area of the visible CIE LUV color space only.

4) <u>High Dynamic Range (HDR):</u> The ability to display images with greater range of contrast and color than what is considered standard dynamic range.

5) <u>Luminance</u>: 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).

   a) <u>Maximum Reported Luminance</u>: 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.

   b) <u>Maximum Measured Luminance</u>: The maximum measured luminance the Display may attain by manually configuring its controls, such as brightness and contrast.

c) As-shipped Luminance: The luminance of the Display at the factory default preset setting the manufacturer selects for normal home or applicable market use.

6) Total Native Resolution**:** Resolution expressed as total pixel count in megapixels calculated as the product of physical lines along the vertical and horizontal axes of the Display within the visible area of the Display.

Note: A Display with a screen resolution of 1920 x 1080 (horizontal x vertical) would have a Total Native Resolution of 2.07 megapixels (MP).

7) Screen Area: The visible area of the Display that produces images.

Note: Screen Area is calculated by multiplying the viewable image width by the viewable image height. For curved screens, measure the width and height along the arc of the Display.

E) Additional Functions and Features:

1) Bridge Connection: A physical connection between two hub controllers (e.g. USB, FireWire).

Note: Bridge Connections allow for expansion of ports typically for the purpose of relocating the ports to a more convenient location or increasing the number of available ports.

2) Full Network Connectivity: The ability of the Display to maintain network presence while in Sleep Mode. Presence of the Display, its network services, and its applications, is maintained even if some components of the Display are powered down. The Display can elect to change power states based on receipt of network data from remote network devices but should otherwise stay in Sleep Mode absent a demand for services from a remote network device.

Note: Full Network Connectivity is not limited to a specific set of protocols. Also referred to as "network proxy" functionality and described in the Ecma-393 standard.

3) Power Delivery: The capability, defined according to the USB Power Delivery Specification,[1] of the Display to supply variable power as well as exchange data with devices connected via a USB connection.

4) Occupancy Sensor: A device used to detect human presence in front of or in the area surrounding a Display.

Note: An Occupancy Sensor is typically used to switch a Display between On Mode and Sleep Mode by detecting human presence or a combination of human presence and a signaling device such as Bluetooth device.

5) Touch Technology: Enables the user to interact with a product by touching areas on the Display screen.

6) Plug-in Module: A modular plugin device for Signage Displays with compute functionality that provides one or more of the following functions:

a) Display remote content streamed to it, such as images or screen mirroring, or otherwise render content on the screen from local or remote sources; or

b) Process touch signals.

Note: Modules providing any other additional input options are not considered Plug-in Modules for the purposes of this specification. Modules typically meet the Open Pluggable Specification (OPS).

7) Embedded Module: A non-modular processor or computing system embedded in a Signage Display that provides one or more of the following functions:

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[1] USB Power Delivery Specification Rev. 3.0, Version 1.2, June 21, 2018.

a) Display remote content streamed to it, such as images or screen mirroring, or otherwise render content on the screen from local or remote sources; or

b) Process touch signals.

F) <u>Product Family</u>: A group of product models that (1) are made by the same manufacturer, (2) share the same Screen Area, Total Native Resolution, and Maximum Reported Luminance, and (3) are of a common basic screen design. Models within a Product Family may differ from each other according to one or more characteristics or features. For Displays, acceptable variations within a Product Family include:

1) External housing;

2) Number and types of interfaces;

3) Number and types of data, network, or peripheral ports; and

4) Processing and memory capability.

G) <u>Representative Model</u>: The product configuration that is tested for ENERGY STAR certification and is intended to be marketed and labeled as ENERGY STAR.

H) <u>Power Sources</u>:

1) <u>External Power Supply (EPS)</u>: An external power supply circuit that is used to convert household electric current into dc current or lower-voltage ac current to operate a consumer product.

2) <u>Standard dc</u>: A method for transmitting dc power defined by a well-known technology standard, enabling plug-and-play interoperability.

Note: Common examples are USB and Power-over-Ethernet. Usually Standard dc includes both power and communications over the same cable, but as with the 380 V dc standard, that is not required.

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, an External Power Supply, or Standard dc are eligible for ENERGY STAR certification, with the exception of products listed in Section 2.2. Typical products that would be eligible for certification under this specification include:

i. Monitors;

ii. Signage Displays;

iii. Signage Displays with Plug-in Modules;

iv. Signage Displays with Embedded Modules; and

v. Signage Displays in a Tiled Display System configuration.

2.2 Excluded Products

2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for certification under this specification including Televisions and Computers (Thin Clients, Slates/Tablets, Portable All-in-one Computers, and Integrated Desktops). 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 certification under this specification:

<blockquote>
i. Products with an integrated television tuner;

ii. Displays with integrated or replaceable batteries designed to support primary operation without ac mains or external dc power, or device mobility (e.g., electronic readers, battery-powered digital picture frames); and

iii. Products that must meet Food and Drug Administration specifications for medical devices that prohibit power management capabilities and/or do not have a power state meeting the definition of Sleep Mode.

vi. Monitors with keyboard, video, and mouse (KVM) switch functionality;
</blockquote>

3 CERTIFICATION 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 for Monitors and Signage Displays

3.2.1 External Power Supplies (EPSs): Single- and Multiple-voltage EPSs shall meet the Level VI or higher performance requirements under the International Efficiency Marking Protocol when tested according to the Uniform Test Method for Measuring the Energy Consumption of External Power Supplies, Appendix Z to 10 CFR Part 430.

   i. Single- and Multiple-voltage EPSs shall include the Level VI or higher marking.

   ii. Additional information on the Marking Protocol is available at http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0218.

3.2.2 General User Information: The product shall ship with consumer informational materials located in either (1) the hard copy or electronic user manual, or (2) a package or box insert. These materials shall include:

   a) Information about the ENERGY STAR program,

   b) Information on the energy consumption implications of changes to default as-shipped displays configuration and settings, and

   c) Notification that enabling certain optional features and functionalities (e.g., instant-on), may increase energy consumption beyond the limits required for ENERGY STAR certification, as applicable.

3.2.3 Forced Menu: Any product that includes a Forced Menu upon initial start-up shall, upon selection of any mode other than the Default Picture Setting as identified and tested by the ENERGY STAR test procedure, either (1) display a second prompt requiring the user to confirm the choice of the other mode, or (2) display information either with the ENERGY STAR mark or copy on the start-up menu that the Default Picture Setting is the setting in which the product qualifies for ENERGY STAR.

3.2.4   Preset Picture Setting Menu: For any product where consumers have the option of selecting different picture settings from a preset menu at any time:

   a)   The product shall identify on-screen the Default Picture Setting under which the product qualifies for the ENERGY STAR. For example, the product may display an electronic ENERGY STAR mark alongside the name or description of that Default Picture Setting or display a message each time any setting other than the Default Picture Setting is selected.

   b)   The product shall return to the identified Default Picture Setting, including all energy saving features enabled by default, whenever the user selects that Preset Picture Setting.

3.2.5   Sleep Mode Settings: If users can select and enable Sleep Mode functions from a display prompt in On Mode or a settings menu other than a Forced Menu, and if these functions may alter power draw (i.e. quick start) from the default as-shipped Sleep Mode in which the product qualifies for the ENERGY STAR:

   a)   The product shall display on-screen information identifying the settings under which the product qualifies for the ENERGY STAR. For example, such information may be indicated by including an electronic ENERGY STAR mark alongside the name or description of the default as-shipped settings or in the form of a message displayed each time any setting other than a default as-shipped setting is selected.

   b)   Products with a physical ENERGY STAR mark affixed to the front or top of the Display may alternatively display on-screen information that enabling settings other than those under which the product qualifies for the ENERGY STAR may change the energy consumption of the product.

3.2.6   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.   Monitors shall automatically enter Sleep Mode or Off Mode within 5 minutes of being disconnected from a host computer.

3.2.7   Signage Displays shall have a true power factor in On Mode of 0.7 or greater per Section 5.2.F in the ENERGY STAR Test Method.

3.3   Energy Requirements for Computer Monitors

3.3.1   The Total Energy Consumption (TEC) in kWh shall be calculated per Equation 1 based on measured values.

Equation 1: Total Energy Consumption Calculation

$$E_{TEC} = 8.76 \times (0.35 \times P_{ON} + 0.65 \times P_{SLEEP})$$

Where:
- *E_{TEC} is the Total Energy Consumption calculation in kWh;*
- *P_{ON} is Measured On Mode power in watts*
- *P_{SLEEP} is Measured Sleep Mode Power in watts; and*
- *The result shall be rounded to the nearest tenth of a kWh for reporting.*

3.3.2   The Maximum TEC (E_{TEC_MAX}) in kWh for Monitors shall be calculated per Table 1.

Table 1: Calculation of Maximum TEC (E_{TEC_MAX}) for Monitors in kWh

Area (in^2)	E_{TEC} Max (kWh) Where: A = Viewable screen area in in^2 r = Screen resolution in megapixels (MP) The result shall be rounded to the nearest tenth of a kWh for reporting.
A < 190	$(4.00 \times r) + (0.172 \times A) + 1.50$
190 ≤ A < 210	$(4.00 \times r) + (0.020 \times A) + 30.40$
210 ≤ A < 315	$(4.00 \times r) + (0.091 \times A) + 15.40$
A ≥ 315	$(4.00 \times r) + (0.182 \times A) - 13.20$

3.3.3   For all Monitors, Calculated TEC (E_{TEC}) in kWh shall be less than or equal the calculation of Maximum TEC (E_{TEC_MAX}) with the applicable allowances and adjustments (each applied at most once) per Equation 2.

Equation 2: Total Energy Consumption Requirement for Monitors

$$E_{TEC} \leq (E_{TEC\_MAX} + E_{EP} + E_{ABC} + E_N + E_T + E_C + E_{HDR} + E_{USB}) \times eff_{AC\_DC}$$

Where:
- *E_{TEC} is TEC in kWh calculated per Equation 1;*
- *E_{TEC_MAX} is the Maximum TEC requirement in kWh calculated per Table 1;*
- *E_{EP} is the enhanced performance display allowance in kWh per Section 3.3.4;*
- *E_{ABC} is the Automatic Brightness Control allowance in kWh per Equation 5;*
- *E_N is the Full Network Connectivity allowance in kWh per Table 2;*
- *E_T is the Touch Technology allowance in kWh per Equation 6;*
- *E_C is the curved Display allowance in kWh per Equation 7;*
- *E_{HDR} is the HDR Display allowance in kWh per Table 3;*
- *E_{USB} is the allowance for Displays with USB-C Power Delivery functionality per Table 4; and*
- *eff_{AC_DC} is the standard adjustment for ac-dc power conversion losses that occur at the device powering the Display and is 1.0 for Ac-powered Displays and 0.85 for Displays with Standard dc.*

3.3.4   For Monitors meeting the enhanced performance display (EPD) requirements below, the energy allowance in Equation 3 shall be applied to the Total Energy Consumption requirement in Equation 2:

   i.   Contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85° from the perpendicular on a flat screen and at least 83° from the perpendicular on a curved screen, with or without a screen cover glass;

   ii.   A native resolution greater than or equal to 2.3 megapixels (MP); and

   iii. Color Gamut greater than or equal to 32.9% of CIE LUV.

Equation 3: Calculation of Energy Allowance for Enhanced Performance Displays

$$E_{EP} = ((1.70 \times \frac{G}{100\%}) - 0.52) * E_{TEC\_MAX}$$

Where:
- *E_{EP} is the enhanced performance display energy allowance in kWh;*
- *G is Color Gamut expressed as a percentage of CIE LUV from 1.0% to 100.0%, reported to the nearest 0.1%; and*
- *E_{TEC_MAX} is the Maximum TEC requirement in kWh calculated per Equation 2.*

Note: For reference, a model supporting 99% of the sRGB color space typically translates to 32.9% of CIE LUV and a model supporting 99% of Adobe RGB typically translates to 38.4% of CIE LUV.

3.3.5   For monitors with Automatic Brightness Control (ABC) enabled by default, an energy allowance (E_{ABC}), as calculated per Equation 5, shall be added to E_{TEC_MAX} in Equation 2, if the On Mode power reduction (R_{ABC}), as calculated per Equation 4, is greater than or equal to 20%.

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

$$R_{ABC} = 100\% \times \left(\frac{P_{300} - P_{12}}{P_{300}} \right)$$

Where:
- *R_{ABC} is the On Mode percent power reduction due to ABC;*
- *P_{300} is the On Mode power in watts, as measured at an ambient light level of 300 lux in Section 6.4 of the Test Method; and*
- *P_{12} is the On Mode power in watts, as measured at an ambient light level of 12 lux in Section 6.4 of the Test Method.*

Equation 5: ABC Energy Allowance (E_{ABC}) for Monitors

$$E_{ABC} = 0.05 \times E_{TEC\_MAX}$$

Where:
- *E_{ABC} is the energy allowance for Automatic Brightness Control in kWh; and*
- *E_{TEC_MAX} is the Maximum TEC in kWh, per Table 1.*

3.3.6   Products with Full Network Connectivity confirmed in Section 6.7 of the ENERGY STAR Test Method shall apply the allowance specified in Table 2.

Table 2: Full Network Connectivity Energy Allowance (E_N) for Monitors

E_N (kWh)
2.9

3.3.7   Products tested with Touch Technology active in On Mode shall apply the allowance specified in Equation 6.

Equation 6: Energy Allowance for Touch Technology (E_T) for Monitors

$$E_T = 0.17 \times E_{TEC\_MAX}$$

Where:
- *E_T is the energy allowance for Touch Technology in kWh; and*
- *E_{TEC_MAX} is the Maximum TEC in kWh, per Table 1.*

3.3.8 Products tested with curved Displays shall apply the allowance specified in Equation 7.

Equation 7: Monitors Curved Display Energy Allowance (E$_C$) for Monitors
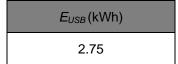
$$E_C = 0.15 \times E_{TEC\_MAX}$$

Where:
- *E$_C$ is the energy allowance for curved Displays in kWh; and*
- *E$_{TEC\_MAX}$ is the Maximum TEC in kWh, per Table 1.*

3.3.9 Monitors that meet either the following DisplayHDR 600 or DisplayHDR 1000 White Luminance Criteria specified in Table 2-1: DisplayHDR Performance Tier Summary of the Video Electronics Standards Association (VESA) High-performance Monitor and Display Compliance Test Specification (DisplayHDR CTS) Version 1.0 shall apply the allowance specified in Table 3.

a) 10% Center Patch Minimum Requirement (cd/m^2);

b) Full-screen Flash Minimum Requirement (cd/m^2); and

c) Full-screen Long-duration Minimum Requirement (cd/m^2).

Table 3: HDR 600 and HDR 1000 Energy Allowances for Monitors

VESA DisplayHDR Certification	E$_{HDR}$ (kWh)
HDR 600	0.05*E$_{TEC\_MAX}$
HDR 1000	0.10*E$_{TEC\_MAX}$

Where:
- *E$_{HDR}$ is the allowance for models meeting the DisplayHDR CTS tiers 600 or 1000; and*
- *E$_{TEC\_MAX}$ is the Maximum TEC per Table 1.*

3.3.10 Products with USB Type C interface compatibility capable of delivering greater than or equal to 45 W of power to connected devices shall apply the allowance specified in Table 4.

Table 4: Allowance for Monitors with USB Type C Compatibility

E$_{USB}$ (kWh)
2.75

Where:
- *E$_{USB}$ is the allowance for models with USB Type C Power Delivery compatibility.*

3.4   Signage Displays Tested in a Tiled Display System Configuration

3.4.1 Signage Displays marketed, shipped, and tested in a Tiled Display System configuration shall meet the Signage Display On Mode and Sleep Mode criteria as calculated per Equation 9 and Equation 11, in which the Screen Area used for all such calculations shall be the total screen area of the Maximum Tiled Configuration.

Note: The total Screen Area of a Tiled Display System with a Maximum Tiled Configuration of 2x2 individual 47.6-inch diagonal Signage Displays (height 23.3 inches and length 41.5 inches) is calculated as (2 x 23.3'') x (2 x 41.5'') equal to 3867.8 square inches. The Tiled Display System shall meet the On Mode criteria for a 3,867.8 square inch Signage Display.

3.5 On Mode Requirements for Signage Displays

3.5.1 The maximum On Mode power (P_{ON_MAX}) in watts shall be calculated per Equation 8.

Equation 8: Calculation of Maximum On Mode Power (P_{ON_MAX}) in Watts for Signage Displays

$$P_{ON\_MAX} = (4.0 \times 10^{-5} \times \eta \times A) + 120 \times tanh(0.0005 \times (A - 140.0) + 0.03) + 20$$

Where:
- *P_{ON_MAX} is the Maximum On Mode power, in watts;*
- *A is the Screen Area in square inches;*
- *ℓ is the Maximum Measured Luminance of the Display in candelas per square meter, as measured in Section 6.2 of the test method; and*
- *The result shall be rounded to the nearest tenth of a watt for reporting.*

Equation 9: On Mode Power Requirement for Signage Displays

$$P_{ON} \leq P_{ON_{MAX}} + P_{ABC} + P_{Module}$$

Where:
- *P_{ON} is On Mode power in watts, as measured in Section 6.3 or 6.4 of the Test Method;*
- *P_{ON_MAX} is the Maximum On Mode power in watts, per Equation 8; and*
- *P_{ABC} is the On Mode power allowance for ABC in watts, per Equation 10; and*
- *P_{Module} is the On Mode power allowance for Signage Displays with Embedded Modules as specified in Table 5.*

3.5.2 For Signage Displays with ABC enabled by default, a power allowance (P_{ABC}), as calculated per Equation 10, shall be added to P_{ON_MAX}, as calculated per Equation 9, if the On Mode power reduction (R_{ABC}), as calculated per Equation 4, is greater than or equal to 20 percent.

Equation 10: Calculation of On Mode Power Allowance for Signage Displays with ABC Enabled by Default
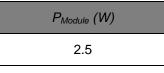
$$P_{ABC} = 0.05 \times P_{ON\_MAX}$$

Where:
- *P_{ABC} is the Measured On Mode Power allowance for ABC in watts; and*
- *P_{ON_MAX} is the Maximum On Mode Power requirement in watts.*

3.5.3 For Signage Displays with an Embedded Module, a power allowance (P_{Module}) determined by Table 5 shall be added to P_{ON_MAX}, as calculated per Equation 9.

Table 5: On Mode Power Allowance for Signage Displays with an Embedded Module

P_{Module} *(W)*
2.5

Where:
- *P_{Module} is the Measured On Mode power allowance for Embedded Modules in Watts.*

3.6 Sleep Mode Requirements for Signage Displays

3.6.1 Measured Sleep Mode power (P_{SLEEP}) in watts shall be less than or equal the sum of the Maximum Sleep Mode power requirement (P_{SLEEP_MAX}) and any allowances (applied at most once) per Equation 11.

Equation 11: Sleep Mode Power Requirement for Signage Displays

$$P_{SLEEP} \leq P_{SLEEP\_MAX} + P_N + P_{OS} + P_T$$

Where:
- *P_{SLEEP} is Measured Sleep Mode power in watts;*

- *P_{SLEEP_MAX} is the Maximum Sleep Mode power requirement in watts per Table 6;*
- *P_N is the Full Network Connectivity allowance in watts per Table 7;*
- *P_{OS} is the Occupancy Sensor allowance in watts per Table 8; and*
- *P_T is the Touch allowance in watts per Table 8.*

Table 6: Maximum Sleep Mode Power Requirement (P_{SLEEP_MAX}) for Signage Displays

P_{SLEEP_MAX} (watts)
0.5

3.6.2 Products with Full Network Connectivity confirmed in Section 6.7 of the ENERGY STAR Test Method shall apply the allowance specified in Table 7.

Table 7: Full Network Connectivity Allowance for Signage Displays

P_N (watts)
3.0

3.6.3 Products tested with an Occupancy Sensor or Touch Technology active in Sleep Mode shall apply the allowances specified in Table 8.

Table 8: Additional Functions Sleep Mode Power Allowance for Signage Displays

Type	Screen Size (in)	Allowance (watts)
Occupancy Sensor P_{OS}	All	0.3
Touch Functionality P_T *(applicable only to Signage Displays where screen size is greater than 30 inches)*	≤ 30	0.0
	> 30	1.5

3.7 Off Mode Requirements for all Displays

3.7.1 A product need not have an Off Mode to be eligible for certification. 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}) in Table 9.

Table 9: Maximum Off Mode Power Requirement (P_{OFF_MAX})

P_{OFF_MAX} (watts)
0.5

3.8 Luminance and Total Native Resolution Reporting Requirements

3.8.1 Maximum Reported, Maximum Measured Luminance, and Total Native Resolution shall be reported for all products; As-Shipped Luminance shall be reported for all products except those with ABC enabled by default.

   a) Testing for the above measurements shall be conducted for the individual Signage Display of a Tiled Display System.

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 10 shall be used to determine certification for ENERGY STAR.

Table 10: Test Methods for ENERGY STAR Certification

Product Type	Test Method
All Product Types and Screen Sizes	ENERGY STAR Test Method for Determining Display Energy – Rev. Feb-2020
Enhanced Performance Displays	International Committee for Display Metrology (ICDM) Information Display Measurements Standard – Version 1.03
Displays Claiming Full Network Connectivity	CTA-2037-A, Determination of Television Set Power Consumption
Displays Claiming High Dynamic Range (HDR)	VESA High-performance Monitor and Display Compliance Test Specification (DisplayHDR CTS) Version 1.0

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.

   i. For Tiled Display Systems, the Maximum Tiled Configuration, as defined in Section 1, shall be used for testing.

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://energy.lbl.gov/controls/.

6 EFFECTIVE DATE

6.1.1 <u>Effective Date</u>: The Version 8 ENERGY STAR Display specification shall take effect on **January 28, 2020.** 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 on which a unit is considered to be completely assembled.

6.1.2 <u>Future Specification Revisions</u>: 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 certification is not automatically granted for the life of a model.

7 CONSIDERATIONS FOR FUTURE REVISIONS

7.1.1 <u>Standby-Active, High Mode</u>: Similar to future revisions of the ENERGY STAR Televisions specification, EPA and the U.S. Department of Energy (DOE) are interested in learning more about Standby-Active, High Mode or Displays with Sleep Modes that demand higher power draw because they are actively running components to reduce latency from Sleep to On Mode, download software updates, or process sensor data. This issue is particularly pertinent with interactive displays that either have a remote or touch screen where the user expects the Display to display content without delay. EPA anticipates exploring this issue and potential power limits and duty cycle requirements in the next specification revision.

7.1.2 <u>Revisions to Test Content</u>: As displays technologies continue to evolve, DOE and EPA support external stakeholder efforts to revise test content (i.e. test clips) to better account for how products perform under more realistic consumer viewing conditions, especially with regard to UHD (4K) content and native HDR content.