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 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 with pixel density greater than 5,000 pixels per square inch (pixels/in²).
      Note: Monitors are typically intended for one person to view in a desk based environment.
   b) Signage Display: An Electronic Display with pixel density less than or equal to 5,000 pixels per square inch (pixels/in²).
      Note: Signage Displays are typically 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.

Note: EPA seeks feedback as to whether Digital Picture Frames are still sold today and if so, whether energy saving opportunities exist. There are no Digital Picture Frames currently certified to the ENERGY STAR Version 6.0 specification.

EPA is also proposing revised definitions for Monitors and Signage Displays to better demarcate these product types as follows:

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Monitor</th>
<th>Signage Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pixel Density quantitative metric requirement</td>
<td>&gt;5,000 pixels/in²</td>
<td>≤5,000 pixels/in²</td>
</tr>
<tr>
<td>Viewing Environment intended to describe the typical product but may not necessarily apply to all products</td>
<td>desk-based environment, to be viewed primarily by one person</td>
<td>non-desk-based environment to be viewed primarily by multiple people</td>
</tr>
</tbody>
</table>

EPA seeks feedback on the appropriateness of continuing to specify pixel density for these products and whether EPA has characterized the products’ intended viewing environments correctly.
EPA is proposing to maintain separate criteria for enhanced performance displays, acknowledging that such displays have added features that require additional energy. Therefore, EPA proposes to account for enhanced performance displays with an allowance in the On Mode Power Requirements section rather than characterizing them as a separate product category in the Definitions section.

B) Operational Modes:

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

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

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

3) **Off Mode**: 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.

   **Note**: EPA is proposing slightly revised definitions above for On Mode, Sleep Mode, and Off Mode to clarify the types of functions and include notes where helpful. EPA welcomes stakeholder feedback as to whether these modes appropriately capture the operation of Displays.

C) Visual Characteristics:

1) **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/m²).

   a) **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.

   b) **Maximum Measured Luminance**: 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.

2) **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.

   **Note**: EPA is proposing a minor clarification to the definition of Screen Area noting that it is the visible area of the Display and defining how it is calculated. EPA has also included a guidance and clarification for measuring the Area of a curved screen.

3) **Automatic Brightness Control (ABC)**: The self-acting mechanism that controls the brightness of a Display as a function of Ambient Light Conditions.

4) **Ambient Light Conditions**: The combination of light illuminances in the environment surrounding a display, such as a living room or an office.
5) **Native Vertical Resolution**: The number of visible physical lines along the vertical axis of the Display.

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

**Note**: EPA is proposing to include a definition for Native Vertical Resolution consistent with the Draft 2 Version 7.0 Televisions specification which specifies that the count should be of the number of visible lines on the screen and not of those that might be obscured behind a bezel or other components. EPA welcomes stakeholder feedback on this definition as it applies to Displays.

D) **Additional Functions and Features**:

1) **Bridge Connection**: A physical connection between two hub controllers (i.e., 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.

**Note**: EPA has separated the commentary for the definition of Bridge Connection into a note for greater clarity.

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.

**Note**: EPA is proposing to replace the definition of Network Capability with Full Network Connectivity harmonizing with the Draft 2 ENERGY STAR Displays Test Method Section 6.7. The test confirms that the display can maintain and respond to a network presence over Internet Protocol in order to receive the proposed Sleep Mode power allowance. EPA welcomes feedback on the above definition and whether it accurately captures the network functions that may be present in displays on the market today or in development.

3) **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.

4) **Touch Technology**: Enables the user to interact with a product by touching areas on a screen or other surface.

**Note**: EPA has added a proposed definition for Touch Technology to better describe how this function is being integrated in Displays. EPA seeks feedback on this proposed definition and the prevalence of Touch Technology in products.

EPA encourages stakeholder feedback on the prevalence, capability (multi or single point touch), and power use of the following Touch Technologies in Monitors and Signage Displays.
- Resistive
- Capacitive
- Optical and Infrared
- Dispersive Signal
- Surface Acoustic Wave

EPA would also like to understand whether Touch Technology is typically enabled by default for Sleep and On Mode. What processing capability or connections (i.e., USB to host) are necessary for Touch Technology to operate? What accessories are required?

5) Internal Processor: An internal device that provides one or more of the specific functions without the explicit purpose of providing general computing function:
   a) Display images, mirror remote content streamed to it or otherwise render content on the screen from local or remote sources; or
   b) Process touch signals.

Note: EPA has added a proposed definition for Internal Processor to acknowledge capabilities that might be present in Signage Displays or Monitors for either rendering images or processing touch signals. This definition is intended to exclude any processing capability that might meet the threshold of a computer for general computing use for ENERGY STAR purposes.

EPA requests stakeholder feedback on this definition and the presence of Internal Processors in Signage Displays as follows:
- Are Internal Processors shipped with the Display in its default condition?
- Are Internal Processors typically modular?
- What is the typical range of processing capability?
- Can touch screens and other functions operate without a modular processor installed?

E) Product Family: A group of product models that are (1) made by the same manufacturer, (2) share the same Screen Area, Resolution, and Maximum Reported Luminance, and (3) 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) Color,
   2) Housing;
   3) Number and types of interfaces;
   4) Number and types of data, network, or peripheral ports; and
   5) Processing and memory capability.

Note: EPA proposes clarifications to the definition of Product Family to be more specific about the types of acceptable variations. In particular, EPA anticipates that under this definition the models within a Product Family would share similar screen technology but could vary in other characteristics that do not have a large impact on the primary function of displays such as available ports, sensors, and processing and memory capability.

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

G) Power Source
1) **External Power Supply (EPS):** 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.

**Note:** EPA has updated the definition of External Power Supply to harmonize with the U.S. Department of Energy's Code of Federal Regulations 430.2.

2) **Standard dc:** 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.

**Note:** EPA is proposing a definition for Standard dc power and welcomes stakeholder feedback on its applicability.

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 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. Monitors with keyboard, video, and mouse (KVM) switch functionality;

iii. Signage Displays;

iv. Signage Displays and Monitors with Internal Processors.

**Note:** EPA has modified the Included Products language to explicitly mention dc-powered products. Display products that are primarily intended to be dc-powered are expected to become more prevalent on the market with the recent updates to USB and Power-over-Ethernet. In February 2014, the Department of Energy (DOE) released its first draft of the test method for dc-powered products and is releasing the second draft with this Draft 1 specification. Subsequent sections of this specification propose how the power requirements should be applied to dc-powered products.

EPA has specified with a definition of Internal Processor that Signage Displays and Monitors that have minimal processing for image or touch rendering are included in the scope of this specification rather than the ENERGY STAR Computers specification. EPA requests stakeholder comment on any further clarification needed to delineate Displays from Computers.

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). The list of specifications currently in effect can be found at [www.energystar.gov/products](http://www.energystar.gov/products).
Note: EPA has included specific examples of products covered under ENERGY STAR specifications that are excluded from this specification. In particular, please refer to the ENERGY STAR Version 6.0/6.1 Computers Specification for definitions of Thin Clients and Slates/Tablets. EPA welcomes stakeholder feedback on whether or not these exclusions are unclear or if there is any overlap between the product types.

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

i. Products with an integrated television tuner;

ii. Displays designed to operate primarily with integrated or replaceable batteries without the support of ac mains or external dc power (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.

Note: EPA proposes removing the exclusion for products with a viewable diagonal screen size greater than 61 inches. Some Signage Displays sold today are larger than 61 inches. EPA seeks to differentiate for consumers top performing products and therefore proposes to include these larger sizes in the scope of this specification. EPA also proposes excluding products designed to operate with integrated or replaceable batteries which includes many digital picture frames. EPA welcomes stakeholder comment on excluding these types of products.

For simplicity, EPA has further removed the following exclusion language because the exclusion of television tuners covers the types of products described in exclusions formerly numbered i and ii, below.

i. 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;

ii. 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.

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

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.


Note: EPA has updated the EPS requirements to reflect the energy conservation standards adopted by DOE earlier this year, which cover both single- and multiple-voltage EPSs, and will take effect on February 10, 2016, at approximately the same time or before this specification is anticipated to take effect.

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. 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 The Maximum On Mode Power ($P_{ON\_MAX}$) in watts shall be calculated per Table 1.

Table 1: Calculation of Maximum On Mode Power ($P_{ON\_MAX}$) in Watts

<table>
<thead>
<tr>
<th>Product Type</th>
<th>$P_{ON_MAX}$ (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitors</td>
<td>$(2.0 \times r) + 17.1 \times \tanh(0.0040 \times (A - 63.0) + 0.22) + 0.3$</td>
</tr>
<tr>
<td>Signage Displays</td>
<td>$(75.0 \times l) + 82.0 \times \tanh(0.0010 \times (A - 200.0) + 0.1) + 6.0$</td>
</tr>
</tbody>
</table>

Where:

- $A$ = Screen Area in m$^2$,
- $r$ = Total screen resolution in megapixels; and
- $l$ = Total luminance of display in megacandels calculated as As-Shipped Luminance multiplied by Area.
Note: Monitors: Since the introduction of Version 6.0 in fall 2012, the number of ENERGY STAR certified models of Monitors has grown to represent the majority of the total available models on the market. Market share has grown to approximately 80–90 percent in 2014. This represents an opportunity for the ENERGY STAR program to further differentiate among the highly efficient Monitors on the market, helping to ensure that the ENERGY STAR label remains an effective tool for consumers. With this Draft 1, EPA used as its dataset 962 unique models, and is proposing power requirements that capture, on average, the top 20 percent of available Monitors in the market today. The proposed criteria would recognize a good selection of models across all common sizes from 15 major Monitor manufacturers. Recognizing similarities among Monitors and televisions, EPA proposes an approach to capture the top performing Monitors that allows for products of all sizes to meet the requirements but where larger, more consumptive units must meet more stringent requirements. As seen with televisions, as products have increased in size while maintaining resolution, they have also demonstrated the ability to achieve proportionally greater power consumption reductions and maintain product performance. As manufacturers continue to offer Monitors in larger sizes today than ones offered in the past, EPA seeks to reward and further incentivize improvements in efficiency among larger sizes.

EPA continues to propose an allowance based on resolution, as a higher resolution, all other things being equal, has typically demonstrated a need for additional energy. ENERGY STAR certified Monitor data shows that today's Monitors can deliver higher resolution with a lower power budget than they previously required, such that a smaller coefficient for watts/megapixel is appropriate. Therefore, based on an analysis of resolution and power consumption within EPA's dataset, EPA proposes providing a 2.0 watts per megapixel allowance, rather than the 6.0 watts per megapixel allotted under the current specification.

Note: Signage: EPA's proposal captures the top performing Signage Display products in the market today that are less than or equal to 60 inches in diagonal screen size and that all have as-shipped screen luminances that are typically 500-700 cd/m² or less. EPA used as its dataset products currently certified to the ENERGY STAR. In researching the market, it appears that certified models represent the majority of market for products within the scope of the current specification, namely products less than or equal to 60 inches in screen size, which all appear to be intended primarily for indoor uses, based on their as-shipped screen luminances. EPA understands that the market for Signage includes products larger than 60 inches in diagonal screen size, products with TVs tuners which therefore qualify under the Televisions specification, and niche products that may be sold in separate components for customizable installation. EPA is interested in expanding the scope to capture more Signage Displays of interest to buyers. To this end, under the Version 7.0 Displays specification, EPA proposes expanding the scope to include products greater than 60 inches in screen size and anticipates that the number of certified products will increase once these larger screen sizes become eligible for inclusion.

As with its proposed approach for Monitors, EPA proposes an approach to capture the top performing Signage Displays such that larger screens must deliver performance with a similar power budget as smaller displays. As screens grow in size, EPA seeks to recognize products that have optimized efficiencies and therefore limit increased energy consumption. Such an approach builds on the energy savings demonstrated by TV products. In recent years TVs in very large sizes have demonstrated the ability to achieve proportionally greater power consumption reductions and maintain product performance as size has increased, notwithstanding increases in resolution. With this proposal, EPA seeks to reward further incentivize the development of such products among Signage, given technological similarities between TVs and Signage Displays. EPA seeks data from manufacturers, using the Displays Test Method, for Signage Displays greater than 60 inches and seeks feedback from all stakeholders on its approach.
In addition, EPA proposes its On Mode Power limit for Signage Displays based on As-Shipped Luminance, as well as Area, after finding a wide range of as-shipped luminances among Signage Displays. Signage Displays of the same size may have different as-shipped luminances—some brighter, some less bright—depending on their intended use (i.e., indoor vs. outdoor), which also impacts the power consumption of the product. Within the EPA dataset containing a variety of manufacturers’ products, the proposed criteria capture the top-performing Signage Displays evenly across sizes ranging from 30 inches to 60 inches and as-shipped luminance ranging from 50 to 800 cd/m². Under EPA’s proposed approach, products would be granted a scalable allowance based on the screen total luminance in megacandels. EPA seeks feedback on this proposed approach that accounts for products with significant variations in as-shipped luminances. EPA is considering a cap for the luminance allowance to incentivize gains in efficiency and to set an overall limit in total energy consumption for Signage Displays that ship at significantly higher screen luminances (i.e., >2000 cd/m²). In addition, EPA seeks to determine how to best account for variations in any other physical characteristics and intended uses for Signage. Specifically, EPA requests the following information from stakeholders:

1) What physical variations exist among Signage Displays and for what intended uses?

2) What types of products have screen luminances typically over 500 cd/m² and what is their corresponding power consumption, using the ENERGY STAR Displays Test Method?

3.3.2 For all Displays, Measured On Mode Power (P_{ON}) in watts shall be less than or equal the calculation of Maximum On Mode Power (P_{ON\_MAX}) with the applicable allowances and adjustments per Equation 1.

Equation 1: On Mode Power Requirement for All Displays

\[ P_{ON} \leq (P_{ON\_MAX} + P_{EP} + P_{ABC}) \times eff_{AC\_DC\_ON} \]

Where:
- \( P_{ON} \) is Measured On Mode Power in watts;
- \( P_{ON\_MAX} \) is the Maximum On Mode Power in watts;
- \( P_{EP} \) is the On Mode Power allowance in watts for an enhanced performance display;
- \( P_{ABC} \) is the On Mode power allowance for ABC in watt; and
- \( eff_{AC\_DC\_ON} \) is the standard adjustment for ac-dc power conversion losses that occur at the device powering the Display in On Mode, and is 1.0 for Ac-powered Displays and 0.85 for displays tested with Standard dc.
- The result shall be rounded to the nearest tenth of a watt for reporting.

Note: EPA has added the above equation to better depict how the power requirements, allowances, and adjustments are applied. To avoid confusion, \( P_{ON} \) in the specification is always the actual Measured On Mode Power as tested per the ENERGY STAR test method.

For dc-powered Displays, EPA is proposing to factor in the losses due to the computer power supply and dc-dc conversions in the connected computer to permit a fair comparison with ac-powered Displays (EPA assumes most dc-powered displays will be used with computers). EPA determined the 85% conversion efficiency factor for Displays with Standard dc by reviewing data submitted under the ENERGY STAR Computers specification.

EPA calculated the typical power supply loads when the Display would be in On Mode (equivalent to Short Idle in the Computers specification) as approximately 30% of rated output power. EPA then reviewed efficiency data at the 20% and 50% loading points (for internal power supplies) and the average at the 25%, 50%, 75%, and 100% loading points (for external power supplies). The conversion efficiencies based on this analysis suggests displays with Standard dc will see conversion efficiencies ranging from 85% to 91% in On Mode. EPA chose an efficiency factor at the low end of this range to be conservative. EPA welcomes stakeholder comment on these assumptions.
3.3.3 For Displays meeting the following enhanced performance criteria, a power allowance ($P_{EP}$), as calculated per Equation 2, shall be added to $P_{ON\_MAX}$, as calculated per Equation 1:

i. 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;

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

iii. A color gamut size of at least sRGB as defined by IEC 61966-2-1. Alternate color spaces are allowable as long as 99% or more of defined sRGB colors are supported.

Note: Only the 2-dimensional gamut of $x$ and $y$ coordinates for red, green, and blue are needed to form an eligible color space on the CIE 1931 $xy$ chromaticity diagram.

Note: In response to questions about the Version 6.0 requirement, EPA has included the above note clarifying the color space that shall be considered. EPA welcomes feedback on this clarification and whether the characteristics outlined above reflect today's enhanced performance displays.

**Equation 2: Calculation of On Mode Power Allowance for Enhanced Performance Displays**

$$P_{EP} = 0.30 \times P_{ON\_MAX}$$

Where:

- $P_{EP}$ is the On Mode power allowance in watts for an enhanced performance Display;
- $P_{ON\_MAX}$ is the Maximum On Mode Power requirement in watts; and

**Note:** Since the Version 6.0 went into effect in 2013, EPA has seen a rise in the amount of Enhanced Performance Displays (EPDs) available on the market. As a result, EPA seeks to differentiate for end-users more efficient EPD models. Under the Version 7.0 specification, EPA is proposing to revise the requirements for enhanced performance displays such that single allowance of 30 percent is applied to EPDs of all sizes. In contrast, under Version 6.0, EPDs less than 27 inches receive a 30 percent allowance and EPDs greater than or equal to 27 inches receive a 75 percent allowance. Under the proposed EPD allowance combined with the proposed On Mode levels, 14 out of the 38 ENERGY STAR Version 6.0 certified EPDs across of a variety of sizes would continue to qualify for the ENERGY STAR. EPA welcomes stakeholder feedback to confirm that the existing 38 enhanced performance ENERGY STAR certified Displays represent most EPDs currently on the market and, if not, EPA seeks additional data for any EPDs not already be certified.

3.3.4 For Monitors with ABC enabled by default, a power allowance ($P_{ABC}$), as calculated per Equation 4, shall be added to $P_{ON\_MAX}$, as calculated per Equation 1, if the On Mode power reduction ($R_{ABC}$), as calculated per Equation 3, is greater than or equal to 20%.

**Equation 3: Calculation of On Mode Power Reduction for Monitors 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 measured On Mode power in watts when tested with an ambient light level of 300 lux; and
- $P_{12}$ is the measured On Mode power in watts when tested with an ambient light level of 12 lux.

**Equation 4: Calculation of On Mode Power Allowance for Monitors 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.
3.3.5 For Signage Displays with ABC enabled by default: TBD

**Note:** To determine if ABC is enabled by default and can therefore qualify for an allowance, EPA proposes calculating power consumption at 12 lux in lieu of the current 10 lux. Doing so harmonizes with the lux values required for testing TVs with ABC enabled by default in the Televisions specification—given similarities between how Displays and TVs are tested for the ENERGY STAR—and does not provide a significant change since 10 lux and 12 lux reflect similar room brightnesses. EPA seeks feedback on this approach and whether the 300 and 12 lux values accurately represent an average cross-section of lighting conditions in offices, given that a large majority of Monitors sold today are for office environments. A limited, dated body of research on office lighting conditions prescribes ambient light conditions closer to 400-500 lux, though EPA understands that lighting conditions could have evolved since then to include dimmer settings.

A review of ENERGY STAR-certified product data shows that Monitors shipping with ABC enabled by default can deliver ABC functionality with a much lower allowance. Therefore, for Monitors, EPA proposes reducing the ABC allowance from 10 percent to 5 percent. Of products currently qualified with ABC enabled by default, 40 percent would continue to qualify with a reduced adder of 5 percent and 30 percent would continue to qualify with no adder provided.

In order to determine if the proposed ABC allowances are applicable to Signage Displays or if different criteria need to be developed, EPA seeks feedback on which lux levels accurately represent a variety of lighting conditions where Signage Displays are typically used, in both indoor and outdoor commercial environments. EPA seeks feedback on the current implementation of, or the feasibility of implementing, additional power management features, such as Automatic Brightness Control, sensors, and Auto Power Down, where the product automatically enters a lower power mode after a prescribed period of time, that could lead to significant energy savings. For example, in the case of Signage Displays that need to be brightly lit for long periods of time (e.g., in public transportation settings) EPA seeks feedback on which power management features could apply. Finally, DOE and EPA also seek feedback on the extent to which very bright environments could be replicated for testing purposes indoors.

### 3.4 Sleep Mode Requirements

3.4.1 For all Displays, Measured Sleep Mode Power ($P_{SLEEP}$) in watts shall be less than or equal the calculation of Maximum Sleep Mode Power Requirement ($P_{ON, MAX}$) with the applicable allowances and adjustments per Equation 5.

**Equation 5: Sleep Mode Power Requirement for All Displays**

$$P_{SLEEP} \leq (P_{SLEEP, MAX} + P_N + P_T + P_{OS}) \times eff_{AC,DC, SLEEP}$$

*Where:*
- $P_{SLEEP}$ is Measured Sleep Mode Power in watts;
- $P_{SLEEP, MAX}$ is the Maximum Sleep Mode Power requirement in watts specified in Table 2;
- $P_N$ is the Full Network Connectivity allowance in watts specified in Table 3;
- $P_T$ is the Touch Technology allowance in watts specified in Table 4;
- $P_{OS}$ is the Occupancy Sensor allowance in watts specified in Table 4; and
- $eff_{AC,DC, SLEEP}$ is the standard adjustment for ac-dc power conversion losses that occur at the device powering the Display in Sleep Mode, and is 1.0 for Ac-powered Displays and 0.81 for displays tested with Standard dc.

*The result shall be rounded to the nearest tenth of a watt for reporting.*
Note: As in Section 3.3.2, EPA is proposing to factor in the losses due to the computer power supply and dc-dc conversions in the connected computer to permit a fair comparison with ac-powered Displays in Sleep Mode. EPA determined the 81% efficiency factor for Displays with Standard dc by reviewing data submitted under the ENERGY STAR Computers specification, calculating the typical power supply loads when a computer is in Sleep and Long Idle modes, which correspond to Display Sleep Mode.

The resulting load was approximately 8% of rated power supply output power, so EPA reviewed efficiency data at the 10% loading point (the closest data point available). The efficiencies at this loading point ranged from 81% to 86%. EPA chose an efficiency factor at the low end of this range to be conservative. EPA welcomes stakeholder comment on these assumptions.

Table 2: Maximum Sleep Mode Power Requirement ($P_{SLEEP \, MAX}$)

<table>
<thead>
<tr>
<th>$P_{SLEEP , MAX}$ (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
</tr>
</tbody>
</table>

3.4.2 Products with Full Network Connectivity confirmed in Section 6.7 of the ENERGY STAR Test Method shall apply the allowance specified in Table 3.

Table 3: Full Network Connectivity Allowance

<table>
<thead>
<tr>
<th>$P_N$ (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
</tr>
</tbody>
</table>

3.4.3 Products tested with an Occupancy Sensor or Touch Technology active shall apply the allowances specified in Table 4.

Table 4: Additional Functions Sleep Mode Power Allowances

<table>
<thead>
<tr>
<th>Type</th>
<th>Allowance (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touch Technology $P_T$</td>
<td>0.3</td>
</tr>
<tr>
<td>Occupancy Sensor $P_{OS}$</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Note: EPA is proposing the following Sleep Mode allowance revisions:
<table>
<thead>
<tr>
<th>Allowance Category</th>
<th>Type</th>
<th>Allowance (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging</td>
<td>USB 1.x</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>USB 2.x</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>USB 3.x, DisplayPort (non-video-connection), Thunderbolt</td>
<td>0.7</td>
</tr>
<tr>
<td>Network</td>
<td>Wi-Fi</td>
<td>2.0, 0.5</td>
</tr>
<tr>
<td></td>
<td>Fast Ethernet</td>
<td>0.2, 0.5</td>
</tr>
<tr>
<td></td>
<td>Gigabit Ethernet</td>
<td>4.0, 0.5</td>
</tr>
<tr>
<td>Sensor</td>
<td>Occupancy Sensor</td>
<td>0.5, 0.3</td>
</tr>
<tr>
<td>Memory</td>
<td>Flash memory, card, smart card, readers, camera interfaces, PictBridge</td>
<td>0.2</td>
</tr>
</tbody>
</table>

EPA is also adding Touch Technology as an additional function and proposes a 0.3 watt allowance, based on its understanding of how much power may be required to maintain Touch Technology, as informed by research and discussions with manufacturers of touch screen functionality. EPA also proposes to reduce the Occupancy Sensor allowance because those ENERGY STAR certified models with an Occupancy Sensor all have measured Sleep Mode power below 1.0 W. A limited number of products eligible for Memory allowances, such as flash memory, have demonstrated the ability to meet Sleep requirements without need for an adder. Therefore EPA proposes to remove the adder for Memory features and functionalities. EPA welcomes feedback on these proposed power requirements for Sleep Mode.

3.4.4 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 the requirements as stated in Equation 5 with the applicable allowances. If the product has a variety of Sleep Modes that may be manually selected, or if the product can enter Sleep Mode via different methods (e.g., remote control or putting the host PC to sleep), the measured Sleep Mode power $P_{SLEEP}$ of the Sleep Mode with the highest $P_{SLEEP}$, as measured per Section 6.5 of the Test Method, shall be the $P_{SLEEP}$ reported for certification. If the product automatically transitions through its various Sleep Modes, the average $P_{SLEEP}$ of all Sleep Modes as measured in Section 6.5 of the Test Method shall be the $P_{SLEEP}$ reported for certification.

3.5 Off Mode Requirements

3.5.1 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 5.

Table 3: Maximum Off Mode Power Requirement ($P_{OFF MAX}$)

<table>
<thead>
<tr>
<th>$P_{OFF MAX}$ (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
</tr>
</tbody>
</table>
Note: EPA is proposing to maintain the existing Off Mode requirement. EPA requests feedback as to whether Standard do products have a mode that meets the definition of Off Mode. If so, EPA is proposing to factor in the losses due to the computer power supply and dc-dc conversions in the connected computer to permit a fair comparison with ac-powered Displays in Off Mode as in Sections 3.3.2 and 3.4.2.

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 certification for ENERGY STAR.

Table 4: Test Methods for ENERGY STAR Certification

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Test Method</th>
</tr>
</thead>
</table>

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 certification of a Product Family, the product configuration that represents the worst-case power consumption for each product category within the Product 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: EPA is reviewing the above User Interface requirements under this specification revision. In order to better track these data, EPA is proposing that EPA-recognized certification bodies report to EPA whether or not they comply with the standard. The reporting requirement would be in the form of a “Yes/No.” EPA welcomes feedback both this proposed requirement and whether the majority of products today comply with the standard.
6 EFFECTIVE DATE

6.1.1 Effective Date: The Version 6.0 ENERGY STAR Display specification shall take effect on XX, 2015. 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 certification is not automatically granted for the life of a model.

7 CONSIDERATIONS FOR FUTURE REVISIONS

7.1.1 On Mode DC Power Limit: EPA is in interested in considering a separate On Mode Power Maximum requirement for Standard dc products that does not necessitate an ac-dc conversion calculation. EPA anticipates these products will become more popular on the market with the latest USB standard and looks forward to receiving additional direct dc-tested data for these products.