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 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 two 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;

or

(3) Pixel density is less than or equal to 5,000 pixels per square inch.

Note: Following the publication of Draft 1, stakeholders commented that defining signage displays solely as displays with pixel density less than or equal to 5,000 pixels per square inch does not adequately capture all signage displays. In particular, there are smaller Ultra High Definition models that exceed the pixel density threshold. EPA realizes that the various characteristics (size, brightness, resolution) of monitors and signage displays sometimes overlap. Therefore, EPA is proposing a set of three criteria; a Display would have to meet at least two to be classified as a Signage Display.

EPA is also considering additional criteria, such as area greater than 10 dm² (155 square inches), ability to perform scaling for use in video walls, unique addressing, remote-control disabling, vertical and horizontal orientation, continuous use, and networking, to further distinguish Signage Displays from Computer Monitors.

Finally, EPA is also considering definitions based on application such as specifying that Signage Displays are “designed primarily to display information in public areas including, but not limited to, retail or department stores, restaurants, museums, conference and meeting centers, fairs, train or metro stations, airports, school campuses or healthcare organizations for simultaneous viewing by more users” EPA welcomes stakeholder feedback regarding product types and the applicability of the proposed criteria or any others.

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

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

3) **Color Gamut**: Color gamut area shall be reported in the CIE 1976 $u'v'$ color space per Section 5.18 Gamut Area of the Information Display Measurements Standard Version 1.03.

**Note**: EPA received feedback that much of the color information in its dataset reflects the NTSC gamut designed for analog television where the color space is not consistently noted among models. The stakeholder suggested EPA define color gamut and require consistent reporting in terms of percentage of sRGB coverage in the CIE 1976 ($u'v'$) color space which is more uniform than the CIE 1931 space, reflects the current practice in color science, and helps better differentiate model performance. As such, EPA proposes that color gamut shall be reported in the CIE 1976 $u'v'$ color space. To minimize ambiguity and harmonize with the latest industry standards, EPA has additionally referenced the Section 5.18 Gamut Area of the Information Display Measurements Standard Version 1.03 for guidance on measurement and reporting.

4) **Luminance**: The photometric measure of the luminous intensity per unit area of light travelling in a given direction, expressed in candela 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.

5) **Native Vertical Resolution**: The number of physical lines along the vertical axis of the Display within the visible area of the Display.
6) **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.

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.

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) **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 the Display screen.

   Note: Per stakeholder comment on Draft 1, EPA has added a revised definition for Touch Technology to refer only to technology embedded on the displays screen to exclude any bezel or remote touch components.

5) **Plug-in Module:** A modular plugin device that provides one or more of the following 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: Modules providing additional input options are not considered Plug-in Modules for the purposes of this specification.

   **Note:** EPA has revised the Draft 1 definition of “Internal Processor” to “Plug-in Module” to focus on add-on modularity and to account for plugin enhancements 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, and thus would be considered a computer by the ENERGY STAR Program.
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) External housing;
2) Number and types of interfaces;
3) Number and types of data, network, or peripheral ports; and
4) Processing and memory capability.

**Note:** For clarification, EPA has modified the definition of Product Family slightly to refer to "External housing" to differentiate it from internal screen components.

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.

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.

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

iii. Signage Displays; and

iv. Signage Displays and Monitors with Plug-in Modules.

**Note:** EPA has clarified that products powered via an external power supply are included in the Version 7.0 specification.

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). The list of specifications currently in effect can be found at [www.energystar.gov/products](http://www.energystar.gov/products).
2.2.2 The following products are not eligible for certification under this specification:

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.

Note: Stakeholders expressed support for the above scope exclusions proposed in Draft 1. Per a stakeholder suggestion, EPA has further specified the types of battery-powered devices excluded to encompass those that are intended for mobility such as personal computing or communication devices.

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.


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 5 minutes of being disconnected from a host computer.

**Note:** Following Draft 1, a stakeholder suggested a 5 minute Sleep Mode following disconnection. EPA agrees that the stakeholder's suggested requirement of a 5 minute power is unlikely to impact the user experience, and could save energy, so has included it above.

3.2.3 Signage displays shall have a true power factor in On Mode of 0.7 or greater per Part G of Section 5.2 in the ENERGY STAR Test Method.

**Note:** Signage displays typically have higher power levels than consumer monitors and commercial buildings where signage displays are installed have longer wiring runs than residential buildings. Therefore, EPA is proposing a 0.7 power factor requirement to ensure products address broader losses while improving efficiency. Data indicate that signage displays across all sizes and maximum luminance criteria are capable of meeting this power factor level. EPA welcomes stakeholder feedback on the impact of this proposed requirement.

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; and
- \(P_{SLEEP}\) is Measured Sleep Mode Power in watts.

Note: In Draft 2, EPA is proposing to employ the Total Energy Consumption (TEC) approach introduced in Draft 1 for monitors. Since EPA only has data on the duty cycle for monitors, further below, EPA proposes maintaining a modal approach for signage displays. The TEC approach proposed for monitors has been successfully used in the ENERGY STAR Computers, Set-top Box, and Imaging specifications, where it has led to a variety of benefits without losing efficiency gains in low-power modes. In particular, a TEC approach provides more flexibility for manufacturers to take different design approaches to saving energy overall, rather than focusing only on single modes. As such, a TEC approach focuses on the total energy and cost savings, rather than on specific components.

Commenters generally supported the use of a TEC approach for monitors as outlined in Draft 1. Some stakeholders, however, expressed concern that a TEC approach could potentially disincentivize future efficiency gains in low power modes. EPA is sensitive to this point; however, past experience in other ENERGY STAR product categories suggests that for products with expanding functionalities, a TEC approach ultimately allows for more stringent requirements than a modal approach in combination with adders. Under a modal limit, as products become more fully featured, the likelihood becomes greater that multiple requirements must each be made less stringent to account for the interactions between features. A TEC approach maintains stringency in limits on power consumption, but the amount of Sleep Mode allowances become less critical to the overall energy performance of the product. Under a TEC approach, additional efficiency improvements would be needed in On Mode to counter any potential increases in energy consumption in Sleep Mode. Thus, EPA believes it can set lower TEC levels than would be possible with a modal approach in combination with adders for energy using features.

3.3.2 The Maximum TEC (\(E_{TEC,\text{MAX}}\)) in kWh for Monitors shall be calculated per Equation 2.

Equation 2: Calculation of Monitor Maximum TEC (\(E_{TEC,\text{MAX}}\)) in kWh

\[
E_{TEC,\text{MAX}} = 6.13 \times r + 91 \times \tanh(0.0016 \times [A - 59] + 0.085) + 9
\]

Where:
- \(r\) = Screen resolution in megapixels;
- \(A\) = Viewable screen area in \(in^2\); and
- The result shall be rounded to the nearest tenth of a kWh for reporting.

Note: EPA received mixed feedback in response to the On Mode power requirements in Draft 1. Some stakeholders supported EPA’s proposal and advocated that the requirements be made more stringent, whereas others expressed concern that the requirements were too stringent. In this draft, EPA has retained an efficiency requirement that is more challenging for larger screens, as proposed in Draft 1. This approach continues to allow for a good selection of products across all sizes, including those in the larger sizes, from 35 brands. Since the release of Draft 1, EPA updated its dataset with the latest models for a total of 1051 (up from 962 models). As such, EPA proposes slightly revised On Mode power levels—expressed in a TEC approach—that recognize the current top performing 21 percent of products in the market. EPA seeks to ensure that ENERGY STAR remains a market differentiator for efficiency in monitors when the specification takes effect in 2016.
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 (applied at most once) per Equation 3.

Equation 3: Total Energy Consumption Requirement for Monitors

\[ E_{TEC} \leq (E_{TEC,MAX} + E_{EP} + E_{ABC} + E_{EN} + E_{OS} + E_{effAC,DC}) \]

Where:
- \( E_{TEC} \) is TEC in kWh calculated per Equation 1;
- \( E_{TEC,MAX} \) is the Maximum TEC requirement in kWh calculated per Equation 2;
- \( E_{EP} \) is the enhanced performance display allowance in kWh per Table 2;
- \( E_{ABC} \) is the Automatic Brightness Control allowance in kWh per Equation 5;
- \( E_{EN} \) is the Full Network Connectivity allowance in kWh per Table 3;
- \( E_{OS} \) is the Occupancy Sensor allowance in kWh per Table 4; and
- \( E_{effAC,DC} \) 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; and

The result shall be rounded to the nearest tenth of a kWh for reporting.

3.3.4 For Monitors contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85° from the perpendicular, with or without a screen cover glass and a native resolution greater than or equal to 2.3 megapixels (MP), shall add only one of the following Table 1 allowances to Equation 2 if the minimum Color Gamut criteria are met:

Table 1: Calculation of Energy Allowance for Enhanced Performance Displays

<table>
<thead>
<tr>
<th>Color Gamut Criteria</th>
<th>( E_{EP} ) (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Gamut is sRGB or greater as defined by IEC 61966-2-1. Alternate color spaces are allowable as long as 99% or more of defined sRGB colors are supported.</td>
<td>( 0.25 \times E_{TEC,MAX} )</td>
</tr>
<tr>
<td>Color Gamut is 96% or greater of Adobe® RGB Version 2005-05.</td>
<td>( 0.65 \times E_{TEC,MAX} )</td>
</tr>
</tbody>
</table>

Note: In Draft 1, EPA requested feedback on whether the characteristics currently describing Enhanced Performance Displays (EPDs) in Version 6.0 were still relevant. EPA did not receive any feedback to the contrary and therefore proposes to retain the description of enhanced performance displays in Section 3.3.4. In Draft 1, EPA also added a clarification that color space shall be considered, such that “alternate color spaces are allowable as long as 99 percent or more of defined sRGB colors are supported.”
Based on stakeholder feedback, for Draft 2 EPA further classified models based on color gamut performance using the Version 6.0 dataset. Although data were submitted using varying standards (NTSC, sRGB, Adobe RGB), EPA normalized the data to make it comparable by converting the percentage of the color space of each standard into percentage of the color space of the CIE standard. EPA welcomes stakeholder feedback on the accuracy of this approach.

In further reviewing color gamut data, EPA found that nearly half of all monitors in the dataset cover the sRGB color gamut, indicating that this level of performance is no longer limited to a small subset of premium models. Holding resolution and area constant, the data indicate that increased color gamut performance typically requires more power. Models supporting 99 percent or more defined sRGB colors indicate a need for additional power over models with a smaller color space. Models covering at least 96 percent of Adobe RGB— an even greater coverage in color space—appear to require more power than those where 99 percent or more defined sRGB colors are supported. EPA is therefore proposing a tiered allowance approach for Enhanced Performance Displays based on criteria for color gamut as follows:

- 30 percent allowance for models meeting current EPD criteria with color gamut greater than 99 percent of sRGB.
- 65 percent allowance for models meeting the current EPD criteria with color gamut greater than 99 percent of sRGB and at least 96 percent Adobe RGB.

Of models that already meet the EPD requirements for contrast ratio and resolution, under EPA’s proposed approach for EPD allowances based on color gamut, 12 models from four manufacturers out of the 40 models in EPA’s dataset of enhanced performance displays would continue to qualify. With a 30 percent allowance for EPDs with at least 99 percent sRGB, 28 percent of EPA’s dataset of EPDs would continue to qualify. With the additional 65 percent allowance for models with at least 96 percent Adobe RGB, 3 out of 10 models, or 30 percent in the Adobe RGB category, would meet the proposed criteria. EPA considers that its EPD dataset is reflective of the market given the diversity of intended high-end uses (entertainment, printing-business models), sizes, and high resolution models.

Since color performance is a continuous variable (for example, some models are 94 percent Adobe RGB, 101 percent sRGB, 102 percent sRGB) rather than a discrete binary category (Adobe RGB vs. sRGB) EPA seeks feedback on the appropriateness of the binning proposed here. EPA requests additional stakeholder feedback and data regarding how viewing angle and color and brightness uniformity might affect power consumption. In particular, EPA is interested in understanding the predominant industry-accepted standard measurements for viewing angle and uniformity, and how these distinguish premium from entry-level models.

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}, as calculated per 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: Monitors 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 Equation 2.

Note: EPA is proposing an incentive for ABC to promote its wider adoption in Displays, as the technology has proven successful in reducing energy (and thereby extending battery life) in notebook computers, to such an extent that it is ubiquitous. However, as the technology is still infrequent among Displays, EPA seeks more data on settings where Displays will be used, in particular office and outdoor lighting conditions, as well as how to identify and incentivize ABC usability to ensure real-world savings.

Table 2: Full Network Connectivity Energy Allowance (\( E_{N} \)) for Monitors

<table>
<thead>
<tr>
<th>Type</th>
<th>Allowance (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy Sensor</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Table 3: Additional Functions Energy Allowance (\( E_{OS} \)) for Monitors

<table>
<thead>
<tr>
<th>Type</th>
<th>Allowance (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy Sensor</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Note: The proposed Full Network Connectivity and Additional Allowances are consistent with Draft 1, but have been converted to an annual kilowatt-hour allowance. With Draft 2, EPA is no longer proposing an allowance for touch functionality due to a lack of clarity on whether monitors with touch technology were tested with it enabled, resulting in insufficient data on which to base an allowance. EPA welcomes stakeholder clarification on whether existing test data in EPA’s dataset accounts for touch functionality enabled by default and any additional data referencing power consumption related to touch functionality.
3.4 On Mode Requirements for Signage Displays

3.4.1 The Maximum On Mode Power ($P_{\text{ON,MAX}}$) in watts shall be calculated per Equation 6.

**Equation 6: Calculation of Maximum On Mode Power ($P_{\text{ON,MAX}}$) in Watts for Signage Displays**

$$P_{\text{ON,MAX}} = (7.5 \times 10^{-5} \times \ell \times A) + 82 \times \text{tanh}(0.001 \times (A - 200.0) + 0.1) + 6.0$$

Where:
- $A$ = Screen Area in square inches; and
- $\ell$ = Maximum Measured Luminance of the display in candelas per square meter, as measured in Section 6.2 of the test method.

**Note:** Absent additional data, EPA proposes to retain the luminance allowance (or a capacity measure for luminance) from Draft 1 to account for brighter displays needing additional power. The proposed luminance allowance accounts for a correlation between energy consumption and increased screen brightness that scales with size, given that many signage displays are significantly brighter that monitors or products intended solely for indoor use. EPA has also added a $0.0254^2$ correction to account for luminance expressed in $\text{cd/m}^2$ and area in $\text{in}^2$ rather than expressing the equation in megacandelas, per the equation in Draft 1. The resultant allowance of 0.116 per total candela is shown in Equation 6.

In Draft 2, EPA has also corrected an error in the equation for Maximum On Mode Power for Signage Displays such that the requirement now accurately reflects the performance of the top 25 percent of signage products in EPA’s dataset, as was intended in Draft 1. One stakeholder expressed concern that an allowance based on as-shipped luminance would incentivize manufacturers to ship displays brighter. EPA notes that the luminance allowance is based on the Maximum Measured Luminance and therefore will not affect the As-shipped Luminance value.

3.4.2 Measured On Mode Power ($P_{\text{ON}}$) in watts shall be less than or equal the calculation of Maximum On Mode Power ($P_{\text{ON,MAX}}$) with the applicable allowances and adjustments per Equation 7.

**Equation 7: On Mode Power Requirement for Signage Displays**

$$P_{\text{ON}} \leq P_{\text{ON,MAX}} + P_{\text{ABC}}$$

Where:
- $P_{\text{ON}}$ is On Mode Power in watts, as measured in Section 6.3 or 6.4 of the Test Method;
- $P_{\text{ON,MAX}}$ is the Maximum On Mode Power in watts, per Equation 7;
- $P_{\text{ABC}}$ is the On Mode power allowance for ABC in watts, per Equation 8; and
- The result shall be rounded to the nearest tenth of a watt for reporting.

3.4.3 For Signage Displays with ABC enabled by default, a power allowance ($P_{\text{ABC}}$), as calculated per Equation 8, shall be added to $P_{\text{ON,MAX}}$, as calculated per Equation 7, if the On Mode power reduction ($R_{\text{ABC}}$), as calculated per Equation 4, is greater than or equal to 20 percent.

**Equation 8: Calculation of On Mode Power Allowance for Signage Displays with ABC Enabled by Default**

$$P_{\text{ABC}} = 0.05 \times P_{\text{ON,MAX}}$$

Where:
- $P_{\text{ABC}}$ is the Measured On Mode Power allowance for ABC in watts; and
- $P_{\text{ON,MAX}}$ is the Maximum On Mode Power requirement in watts.

**Note:** EPA anticipates savings opportunities resulting from the implementation of Automatic Brightness Control (ABC) and has proposed an allowance of 5 percent, consistent with its allowance for monitors. EPA seeks to drive implementation of ABC as a way to deliver additional savings, especially among products that will be used in variable ambient light conditions. EPA welcomes any data on the savings opportunity and feedback on the proposed ABC allowance.
3.5 **Sleep Mode Requirements for Signage Displays**

3.5.1 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 (applied at most once) per Equation 9.

**Equation 9: Sleep Mode Power Requirement for Signage Displays**

$$P_{SLEEP} \leq P_{SLEEP,MAX} + P_N + P_{OS}$$

Where:
- $P_{SLEEP}$ is Measured Sleep Mode Power in watts;
- $P_{SLEEP,MAX}$ is the Maximum Sleep Mode Power requirement in watts per Table 4;
- $P_N$ is the Full Network Connectivity allowance in watts per Table 5;
- $P_{OS}$ is the Occupancy Sensor allowance in watts per Table 6; and
- The result shall be rounded to the nearest tenth of a watt for reporting.

**Table 4: Maximum Sleep Mode Power Requirement ($P_{SLEEP,MAX}$) for Signage Displays**

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

3.5.2 Products with Full Network Connectivity confirmed in Section 6.7 of the ENERGY STAR Test Method shall apply the allowance specified in Table 5.

**Table 5: Full Network Connectivity Allowance for Signage Displays**

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

3.5.3 Products tested with an Occupancy Sensor active shall apply the allowances specified in Table 6.

**Table 6: Additional Functions Sleep Mode Power Allowance for Signage Displays**

<table>
<thead>
<tr>
<th>Type</th>
<th>Allowance (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy Sensor</td>
<td>0.3</td>
</tr>
</tbody>
</table>

**Note:** EPA is no longer proposing an allowance for touch functionality due to a lack of clarity whether monitors with touch technology were tested with it enabled, resulting in insufficient data on which to base an allowance. EPA welcomes stakeholder clarification on whether existing test data in EPA’s dataset accounts for touch functionality enabled by default and any additional data referencing power consumption related to touch functionality.
3.6 Off Mode Requirements for all Displays

3.6.1 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 7.

Table 7: 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>

3.7 Luminance Reporting Requirements

3.7.1 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 8 shall be used to determine certification for ENERGY STAR.

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced Performance Monitors</td>
<td>International Committee for Display Metrology (ICDM) Information Display Measurements Standard – Version 1.03</td>
</tr>
</tbody>
</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
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/.

**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 products they certify 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

**Effective Date:** The Version 6.0 ENERGY STAR Display specification shall take effect on April 15, 2016. 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.

**Note:** EPA intends to finalize Version 7.0 in early summer 2015, where the specification would take effect in spring 2016.

**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

**On Mode DC Power Limit:** EPA is 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.

**Proxzzzzying:** EPA is interested in the extent to which display products with network connectivity and not already connected to a host device could employ proxzzzzying to enter low power states and garner additional energy savings. EPA will continue to monitor the market to determine the applicability of incentivizing the use of proxzzzzying in display products in future revisions to the specification.