



# ENERGY STAR® Program Requirements Product Specification for Displays

## Eligibility Criteria Draft 3 Version 6.0

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

### 3 **1 DEFINITIONS**

#### 4 A) Product Types:

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

10 a) Computer Monitor: An electronic device, typically with a diagonal screen size greater than  
11 12 inches and a pixel density greater than 5,000 pixels per square inch (pixels/in<sup>2</sup>), that  
12 displays a computer's user interface and open programs, allowing the user to interact  
13 with the computer, typically using a keyboard and mouse

14 (1) Enhanced-Performance Display: A Computer Monitor that has all of the following  
15 features and functionalities:

- 16 (a) A contrast ratio of at least 60:1 at horizontal viewing angles of at least 85°,
- 17 (b) A native resolution greater than or equal to 2.3 megapixels (MP), and
- 18 (c) A color gamut of at least sRGB (IEC 61699 2-1).

19 b) Digital Picture Frame: An electronic device, typically with a diagonal screen size less than  
20 12 inches, whose primary function is to display digital images. It may also feature a  
21 programmable timer, occupancy sensor, audio, video, or bluetooth or wireless  
22 connectivity.

23 c) Signage Display: An electronic device typically with a diagonal screen size greater than  
24 12 inches and a pixel density less than 5,000 pixels per square inch (pixels/in<sup>2</sup>). It is  
25 typically marketed as commercial signage for use in areas where it is intended to be  
26 viewed by multiple people in non-desk based environments, such as retail and  
27 department stores, restaurants, museums, hotels, outdoor venues, airports, conference  
28 rooms and classrooms.

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**Note:**

**Enhanced-Performance Displays:** Based on further discussions with stakeholders and examination of both objective distinguishing features of select displays as well as new product features that consumers may seek for specific applications, EPA is proposing a definition for products that are “high performance” or “enhanced-performance” displays. Such displays would have a mix of features and functionality, such as enhanced viewing angle and high resolution, that are distinct from conventional models. To this end, EPA has first proposed a definition for such products, harmonizing in part with the definition of “high performance displays” in the European Commission’s draft Ecodesign regulation and the definition under consideration by the Canadian Standard Association, and reflecting extensive discussions with manufacturers of such products. EPA’s proposed definition can be met by displays that use different technologies, namely in-plane switching (IPS) and vertical alignment (VA), as well as twisted nematic (TN). EPA seeks stakeholder feedback on the proposed definition for Enhanced-Performance Displays.

**Signage Displays:** Based on a stakeholder suggestion to avoid unintentional exclusion of products, EPA proposes a revised definition for a signage display to include various types of products considered to be signage. For future specifications, EPA intends to harmonize with other industry-accepted definitions for a signage display as they are developed.

In an effort to effectively distinguish product types, EPA proposes additions to the definitions of monitors, digital picture frames, and signage displays based on the associated typical size range of each product type. A reference to typical pixel density is also provided for monitors and signage displays based on analysis of current ENERGY STAR qualified displays, which shows 5,000 pixels/in<sup>2</sup> as an appropriate distinguishing point between the product types. EPA welcomes stakeholder feedback on the proposed revisions to product type definitions.

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

C) **Operational Modes:**

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

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

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

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

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

75 **Note:** Based on stakeholder feedback received during the September 27, 2011 ENERGY STAR webinar  
76 and written stakeholder comments, the Sleep Mode definition has been revised to indicate how the  
77 product enters and exits the mode, and includes a sample description of the product capabilities. EPA  
78 welcomes stakeholder feedback on the revised definition.

79 EPA and DOE also bring to stakeholders' attention that the recently released DOE TV Test Procedure  
80 Notice of Proposed Rulemaking (NOPR) incorporates "standby" mode terminology. EPA and DOE  
81 request feedback from stakeholders on whether the ENERGY STAR Displays definition should be  
82 modified to be consistent with DOE's definition. Should DOE's final test procedure include display  
83 products, EPA will work with stakeholders to address any needed changes for purposes of ENERGY  
84 STAR testing.

85 The On Mode definition has also been revised to accommodate products that are dc-powered by  
86 removing the reference to a connection to the mains.

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

90 1) Maximum Reported Luminance: The On Mode preset setting in which the display is brightest, as  
91 specified by the manufacturer, for example, in the user manual.

92 2) Maximum Measured Luminance: The On Mode setting in which the display controls, such as  
93 brightness and contrast level, are set to a maximum level.

94 3) As-shipped Luminance: The factory default preset setting which is selected by the manufacturer  
95 for normal home or applicable market use.

96 E) Illuminance: The areal density of the luminous flux incident at a point on a surface. Illuminance refers  
97 to the ambient light conditions in the environment in which the display is located.

98 **Note:** For clarity and consistency with other standards, EPA proposes to include a definition for  
99 illuminance that harmonizes with the proposed definition from the Canadian Standards Association  
100 (CSA). EPA welcomes stakeholder feedback on the definition.

101 F) Screen Area: The viewable screen width multiplied by the viewable screen height, expressed in  
102 square inches ( $\text{in}^2$ ).

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

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

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

111 **Note:** To ensure accuracy of the product family composition, EPA proposes a revised definition for a  
112 product family of displays, indicating select criteria evident in displays within a family.

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

## 2 SCOPE

### 2.1 Included Products

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

- i. Computer Monitors;
- ii. Digital Picture Frames;
- iii. Signage Displays; and,
- iv. Additional products including monitors with keyboard, video and mouse (KVM) switch functionality, and other industry-specific displays that meet the Display definition and efficiency criteria.

### 2.2 Excluded Products

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

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

- i. Products with a viewable diagonal screen size greater than 61 inches;
- ii. Products with an integrated television tuner;
- iii. Products that are marketed and sold as televisions, including products with a computer input port (e.g., VGA) that are marketed and sold primarily as televisions;
- iv. Products that are component televisions. A component television is a product that is composed of two or more separate components (e.g., display device and tuner) that are marketed and sold as a television under a single model or system designation. A component television may have more than one power cord;
- v. Dual-function televisions / computer monitors that are marketed and sold as such;
- vi. Tablet computers (e.g., electronic readers, smartphones);
- vii. Products that must meet FDA specifications for medical devices that prohibit power management capabilities and/or do not have a power state meeting the definition of Sleep Mode; and
- viii. Thin Clients and Ultra-Thin Clients / Zero Clients.

**Note:** EPA received mixed feedback from stakeholders on whether to raise the size limit for the scope of the specification and received data from only one manufacturer for the power consumption of products larger than 60". As a result, EPA does not have enough data to propose power consumption levels for products larger than 60". EPA, does however, propose one modest extension of the current size limit. EPA received data for some displays with a viewable diagonal screen size of 60.49 inches and does not wish to prevent them from qualifying. Thus, EPA proposes that products less than or equal to 61 inches be eligible for ENERGY STAR qualification. EPA plans to consider expanding this limit in a future revision.

154 Following discussions with industry about Zero Clients (sometimes referred to as Ultra-Thin Clients) and  
155 Virtual Clients, EPA intends for these products specifically to be covered under the ENERGY STAR  
156 Computers specification. Additional capabilities such as compression/decompression and their associated  
157 power consumption, as well as compatibility with the Computers test procedure indicate that these  
158 products are similar to Thin Clients, some of which also attribute more power consumption to their  
159 integrated display rather than their computational operations.

### 160 3 QUALIFICATION CRITERIA

#### 161 3.1 Significant Digits and Rounding

162 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

163 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using directly  
164 measured or calculated values without any benefit from rounding.

165 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR  
166 website shall be rounded to the nearest significant digit as expressed in the corresponding  
167 specification limit.

#### 168 3.2 General Requirements

169 3.2.1 External Power Supply: If the product is shipped with an EPS, the EPS shall meet the level V  
170 performance requirements under the International Efficiency Marking Protocol and include the  
171 level V marking. Additional information on the Marking Protocol is available  
172 at [www.energystar.gov/powersupplies](http://www.energystar.gov/powersupplies).

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

176 3.2.2 Power Management:

- 177 i. Products shall offer at least one power management feature that is enabled by default, and  
178 that can be used to automatically transition from On Mode to Sleep Mode (e.g., support for  
179 VESA Display Power Management Signaling (DPMS), enabled by default).
- 180 ii. Products that generate content for display from one or more internal sources shall have a  
181 sensor or timer enabled by default to automatically engage Sleep or Off Mode.
- 182 iii. The default delay time, after which the product transitions from On Mode to Sleep Mode or  
183 Off Mode, shall be reported.

184 **Note:** In an effort to decrease energy consumption while displays, especially computer monitors, are left  
185 on, EPA is interested in establishing a default delay time to sleep requirement. Based on stakeholder  
186 feedback noting that prescribing a default delay time to sleep may not be applicable to some products,  
187 like signage displays, EPA proposes to require that manufacturers report the default delay time to sleep  
188 for the product. EPA believes this information will be helpful to consumers. EPA welcomes stakeholder  
189 feedback on typical delay times prevalent in industry.

190  
191 Although some stakeholders submitted comments on occupancy sensors and timers, EPA did not receive  
192 extensive information on these or other emerging power management technologies. Therefore, EPA is  
193 not including requirements in this Version 6.0 specification. EPA will continue to research their use to  
194 gauge potential energy savings for possible future integration with the specification.

195 **3.3 On Mode Requirements**

196 3.3.1 On Mode power ( $P_{ON}$ ), as measured per the ENERGY STAR test method, referenced in Table 6,  
 197 shall be less than or equal to the Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ), as  
 198 calculated and rounded per Table 1, below.

- 199 i. If the product screen resolution ( $r$ ) is more than 4.096 MP, then the screen resolution ( $r$ )  
 200 used for the Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ) calculation shall be 4.096  
 201 MP.

202 **Table 1: Calculation of Maximum On Mode Power Requirements ( $P_{ON\_MAX}$ )**

Product Type and Diagonal Screen Size, $d$ (inches)	$P_{ON\_MAX}$ (watts)  <i>Where:</i> <ul style="list-style-type: none"> <li>▪ <math>r</math> = Screen resolution in megapixels</li> <li>▪ <math>A</math> = Viewable screen area</li> <li>▪ The result shall be rounded to the nearest tenth of a watt</li> </ul>
$d < 12.0$	$(6.0 \times r) + (0.05 \times A) + 3.0$
$12.0 \leq d < 18.0$	$(6.0 \times r) + 6.0$
$18.0 \leq d < 22.0$	$(6.0 \times r) + (0.015 \times A) + 3.9$
$22.0 \leq d < 25.0$	$(6.0 \times r) + (0.045 \times A) - 2.2$
$25.0 \leq d$	$(6.0 \times r) + (0.14 \times A) - 27.0$
$30.0 \leq d \leq 61.0$ <i>(for products meeting the definition of a signage display only)</i>	$(0.27 \times A) + 8.0$

203  
 204 3.3.2 For products meeting the definition of an enhanced-performance display, a power allowance  
 205 ( $P_{EP}$ ), as calculated per Equation 1, shall be added to the Maximum On Mode Power  
 206 Requirement ( $P_{ON\_MAX}$ ), as calculated per Table 1. On Mode power ( $P_{ON}$ ), as measured per the  
 207 ENERGY STAR test method, referenced in Table 6, shall be less than or equal to the Maximum  
 208 On Mode Power Requirement ( $P_{ON\_MAX}$ ).

209 **Equation 1: Calculation of On Mode Power Allowance for Enhanced-Performance Displays**

$$P_{EP} = 20\% \times P_{ON\_MAX}$$

210  
 211 *Where:*

- 212 ▪  $P_{EP}$  is the On Mode power allowance for enhanced-performance displays, in  
 213 watts, and
- 214 ▪  $P_{ON\_MAX}$  is the maximum On Mode power requirement, in watts.

215  
 216  
 217 **Note:**

218 **On Mode power levels for Computer Monitors:** Based on analysis of approximately 2,000 products,  
 219 including all ENERGY STAR qualified and other non-qualified products submitted by ENERGY STAR  
 220 Partners, and in response to stakeholder feedback, power limits at certain diagonal sizes, namely those  
 221 24 inches and greater have been further revised. The data supports further binning of products to ensure  
 222 adequate selection, especially in top selling product sizes. At the proposed levels, a review of the current  
 223 dataset shows a broad selection of competitively priced products from a variety of manufacturers in each  
 224 of the popular size bins for computer monitors.  
 225

226  
227 With this Draft 3, EPA is proposing a slight modification to the binning of monitors and signage. Given that  
228 the difference in power allowance between products under 30 inches in diagonal screen size and those  
229 30 inches and greater is substantial, EPA seeks to guard against the possibility that computer monitors  
230 over 30 inches could be granted up to a threefold increase in power allowance in comparison to products  
231 just under 30 inches. EPA examined the extent to which computer monitors over 30 inches are prevalent  
232 in the marketplace and, although they currently represent a small share of the market, it is possible that  
233 they may become more popular in the near future. As such, EPA is proposing that the On Mode power  
234 equation be extended to computer monitors over 25 inches in diagonal screen size. As noted in previous  
235 drafts, EPA does not intend to modify the On Mode power allowance for displays with diagonal sizes 30  
236 inches to 61 inches, however, in this Draft 3, EPA proposes that those limits pertain only to products that  
237 meet the proposed signage display definition, and not to computer monitors.

238  
239 **Resolution:** EPA has proposed a 6 watt per megapixel adder for Displays. With this Draft 3 and in  
240 consideration of EPA's dataset, the agency proposes that a total of 24.6 watts be available to display  
241 products with a resolution greater than 4.096 megapixels. This proposed structure enables products of  
242 any resolution to be eligible for ENERGY STAR qualification but acknowledges that EPA's dataset  
243 includes only displays with 4.096 or fewer megapixels and thus EPA can only confirm the appropriateness  
244 of the current adder structure for up to 4.096 megapixels. EPA welcomes stakeholder feedback on this  
245 approach.

246  
247 **Rounding:** Some stakeholders noted that the rounding guidance in Section 3.1, which states that  
248 calculated values shall be rounded to the nearest significant digit as expressed in the corresponding  
249 specification limit, cannot be applied to the Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ) since  
250  $P_{ON\_MAX}$  is a calculated value itself. EPA has therefore included a clarification on rounding for  $P_{ON\_MAX}$ ,  
251 stating that calculated values pertaining to  $P_{ON\_MAX}$  shall be rounded to the nearest tenth of a watt.

252  
253 **Proposed approach for calculating On Mode power for enhanced-performance displays:**

254 In December 2011, EPA assembled and analyzed data to further understand the energy use associated  
255 with products that meet the enhanced-performance or high performance display definition. Based on this  
256 analysis and in recognition of identified power consumption associated with enhanced performance as  
257 defined in this Draft specification, EPA proposes an adder to the On Mode power levels for enhanced-  
258 performance or high performance displays. As proposed, this adder  $P_{EP}$  would be added to the maximum  
259 On Mode power equation in Table 1 for relevant size classes.

260  
261 EPA seeks stakeholder feedback on the associated On Mode power allowances, especially in light of  
262 models that are currently available on the market and those that are to be released in 2013 when the  
263 specification is expected to take effect.

264 3.3.3 For products with Automatic Brightness Control (ABC) enabled by default, a power allowance  
265 ( $P_{ABC}$ ), as calculated per Equation 3, shall be added to the Maximum On Mode Power  
266 Requirement ( $P_{ON\_MAX}$ ), as calculated per Table 1, if the On Mode power reduction ( $R_{ABC}$ ), as  
267 calculated per Equation 2, is greater than or equal to 20%.

- 268 i. If the On Mode power reduction ( $R_{ABC}$ ) is less than 20%, power allowance ( $P_{ABC}$ ) shall not  
269 be added to the Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ).
- 270 ii. On Mode power ( $P_{ON}$ ), as measured with ABC disabled per the ENERGY STAR test  
271 method, referenced in in Table 6 below, shall be less than or equal to the Maximum On  
272 Mode Power Requirement ( $P_{ON\_MAX}$ ).

273 **Equation 2: Calculation of On Mode Power Reduction for Products with ABC Enabled by Default**

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

274 Where:

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

280 **Equation 3: Calculation of On Mode Power Allowance for Products with ABC Enabled by Default**

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

281 Where:

- 282 ▪  $P_{ABC}$  is the On Mode power allowance, in watts, and
- 283 ▪  $P_{ON\_MAX}$  is the maximum On Mode power requirement, in watts.

285 **Note:**

286 **Products with ABC enabled as-shipped:** For display products where ABC is enabled by default, EPA is  
287 proposing a change to the Version 5.1 requirement that Displays be tested at 0 lux and 300 lux, where the  
288 power measurement at 0 lux was given a 20 percent weighting and the power measurement at 300 lux  
289 was given a 80 percent weighting. After receiving extensive stakeholder feedback that 0 lux was not  
290 representative of room lighting conditions where displays are used, EPA proposes to improve the  
291 approach to ABC testing to increase its energy savings and better reflect real-world use.

292 The new approach consists of measuring the display On Mode power at 10 lux and 300 lux. If the two  
293 measurements demonstrate a minimum 20 percent difference in power consumption, EPA proposes that  
294 the display receive an adder of 10 percent of the maximum On Mode power requirement ( $P_{ON\_MAX}$ ).

295 EPA proposes this approach based on analysis of displays that are currently qualified with ABC enabled  
296 as-shipped, many of which reduce power consumption by more than 20 percent from 300 lux to 0 lux.  
297 EPA believes the proposed power reduction and adder values will incentivize greater implementation of  
298 ABC in products.

299 The proposed approach is intended to give manufacturers the flexibility to implement ABC across various  
300 lighting conditions. After Version 6.0 is finalized, EPA will continue to gather information on room lighting  
301 conditions for displays, namely for computer monitors and applications for signage, to determine if, in a  
302 future specification revision, a different approach with specific room illuminance measures and  
303 corresponding weightings would be more appropriate.

304 **Ambient room illuminance levels:** EPA is proposing 10 lux as a room illuminance measurement  
305 because stakeholders agree that 0 lux does not accurately represent how display products are ever used.  
306 Studies conducted by the Consumer Electronics Association (CEA) and the Collaborative Labeling &  
307 Appliance Standards Program (CLASP) in 2011 indicate that for Televisions, 10 lux is a more accurate  
308 illuminance at which these products are viewed. Therefore, to harmonize with how similar products are  
309 tested, EPA proposes maintaining 10 lux for the Displays Version 6.0 specification, with the  
310 understanding that display products are used differently and in different settings as compared to  
311 Televisions. At this time, EPA does not have enough data or information on the varied lighting conditions  
312 where displays are typically used, such as office environments, commercial, retail or other public spaces,  
313 and therefore proposes an approach that seeks to reward and incentivize the prevalence of ABC with an  
314 adder once the product demonstrates a difference in power consumption in a bright settings versus a dim  
315 setting.



316 EPA proposes that the display be tested additionally at 100 lux and 500 lux, not for qualification purposes  
317 at this time, but rather to expand available information on how display products, especially signage  
318 products intended for commercial use, perform in brighter settings. Such data will provide EPA and  
319 purchasers with useful information on how displays perform in different light levels.

320 **DOE NOPR for Televisions:** Should display products with diagonal screen sizes of 30"-61" fall under the  
321 proposed scope of consumer-oriented products in DOE's Notice of Proposed Rulemaking (NOPR) for  
322 Televisions, such products shall be further tested at the designated illuminance points in the NOPR. As  
323 EPA seeks to finalize the Displays specification in April 2012, EPA will address any necessary revisions  
324 to the Version 6.0 Displays test method after DOE publishes its final test method for Televisions.

325 EPA welcomes stakeholder feedback on the proposed approach to ABC testing, reporting, and  
326 qualification requirements.

327 3.3.4 For products powered with a low-voltage dc source, On Mode power ( $P_{ON}$ ), as calculated per  
328 Equation 4, shall be less than or equal to the Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ),  
329 as calculated per Table 1.

330 **Equation 4: Calculation of On Mode Power for Products Powered by a Low-voltage Dc Source**

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

331  
332 *Where:*

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

337 **3.4 Sleep Mode Requirements**

338 3.4.1 Measured Sleep Mode power ( $P_{SLEEP}$ ) for products without data or networking connection  
339 capabilities shall be less than or equal to the Maximum Sleep Mode Power Requirement  
340 ( $P_{SLEEP\_MAX}$ ), as specified in Table 2.

341 **Table 2: Maximum Sleep Mode Power Requirement ( $P_{SLEEP\_MAX}$ )**

$P_{SLEEP\_MAX}$ (watts)
0.5

342  
343 3.4.2 For products with capabilities that require additional power in Sleep Mode, such as data or  
344 networking connections, measured Sleep Mode power ( $P_{SLEEP}$ ) shall be less than or equal to the  
345 Maximum Data/Networking Sleep Mode Power Requirement ( $P_{SLEEP\_AP}$ ), as calculated per  
346 Equation 5.

347 **Equation 5: Calculation of Maximum Data/Networking Sleep Mode**

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

Where:

- $P_{SLEEP\_AP}$  is the Maximum Sleep Mode Power Requirement, in watts, for products with capabilities that require additional power in Sleep Mode,
- $P_{SLEEP\_MAX}$  is the Maximum Sleep Mode Power Requirement, in watts, as specified in Table 2,
- $P_{DN}$  is the power allowance, in watts, as specified in Table 3 for data or networking capability present in the product and connected during Sleep Mode testing, and
- $P_{ADD}$  is the power allowance, in watts, as specified in for Table 4 for additional capabilities present in the product and active during Sleep Mode testing.

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

Capability	Included Types	$P_{DN}$ (watts)
<b>Wired</b>	Fast Ethernet, USB 1.x	0.1
	Gigabit Ethernet, USB 2.x	0.5
	DisplayPort, Thunderbolt, USB 3.x	0.7
<b>Wireless</b>	Wi-Fi	2.0

**Table 4: Power Allowances in Sleep Mode for Additional Capabilities**

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

**Note:** EPA thanks stakeholders for providing suggested and measured values associated with increased power consumption in Sleep Mode due to data/networking capabilities and occupancy sensors. Based on the information provided and from experience in developing other ENERGY STAR specifications, EPA proposes designated adders for Sleep Mode power according to the particular data or network connection used during testing. In addition, EPA is interested in incentivizing IEEE 802.3az, Energy Efficient Ethernet (EEE), and intends to require its use in the next specification revision. EPA welcomes stakeholder feedback on this proposal.

3.4.3 For products that offer more than one Sleep Mode (e.g., “Sleep” and “Deep Sleep”), measured Sleep Mode power ( $P_{SLEEP}$ ) in any Sleep Mode shall not exceed the Maximum Sleep Mode power Requirement.

### 3.5 Off Mode Requirements

3.5.1 Measured Off Mode power ( $P_{OFF}$ ) shall be less than or equal to the Maximum Off Mode Power Requirement ( $P_{OFF\_MAX}$ ) specified in Table 5.

**Table 5: Maximum Off Mode Power Requirement ( $P_{OFF\_MAX}$ )**

$P_{OFF\_MAX}$
(watts)
0.5

376 **3.6 Luminance Reporting Requirements**

377 3.6.1 The as-shipped luminance and the maximum luminance shall be reported.

378 **3.7 Toxicity and Recyclability Requirements**

379 3.7.1 Display products shall contain restricted levels of the following materials, where the maximum  
380 concentration values tolerated by weight in homogeneous materials are: lead (0.1%), mercury  
381 (0.1%), cadmium (0.01%), hexavalent chromium (0.1%), polybrominated biphenyls (PBB) (0.1%),  
382 or polybrominated diphenyl ethers (PBDE) (0.1%). Batteries are exempt. The following  
383 exemptions are granted for components in Displays:

- 384 i. Lead in glass of fluorescent tubes not exceeding 0.2% by weight.
- 385 ii. Copper alloy containing up to 4% lead by weight.
- 386 iii. Electrical or electronic components containing lead in a glass or ceramic other than  
387 dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic  
388 matrix.
- 389 iv. Lead in dielectric ceramic in capacitors for a rated voltage of 125 Vac or 250 Vdc or higher.

390 3.7.2 Display products shall be designed for ease of disassembly and recyclability where external  
391 enclosures, sub-enclosures, chassis and electronic subassemblies are easily removable with  
392 commonly available tools, by hand, or by a recycler's automated processes. Products shall  
393 identify and provide ease of access to, and removal of, materials with special handling needs.

394 3.7.3 For purposes of third-party certification, toxicity and recyclability requirements shall not be  
395 reviewed when products are initially qualified or during subsequent verification testing. Instead,  
396 consistent with the RoHS Directive (for toxicity) and IEEE 1680 standard (for design for  
397 recyclability), manufacturers shall maintain documentation on file that products meet these  
398 requirements. EPA reserves the right to request this documentation at any time.

399 3.7.4 To the extent product models are sold in countries other than the U.S., they are not subject to  
400 requirements in 3.7.1, 3.7.2, and 3.7.3.

401 **Note:** In response to stakeholder comments related to third party certification, EPA has clarified that  
402 these requirements are exempt from the ENERGY STAR third-party certification process. Further, also in  
403 response to stakeholder comment, EPA added language making clear that the non-energy requirements  
404 proposed here are not intended for international adoption.  
405

406 In developing these requirements, EPA seeks to avoid associating the ENERGY STAR label with poor  
407 quality or otherwise undesirable products. EPA drew from existing standards for toxicity and design for  
408 recyclability. EPA looked to the RoHS Directive for a toxicity limit because Displays manufacturers have  
409 extensive experience with designing products free from certain toxic materials in compliance with RoHS.  
410 Most global manufacturers have been in compliance with RoHS since 2006, when the directive first took  
411 effect. EPA drew from the IEEE 1680.1 standard for the recyclability requirement because many  
412 manufacturers have years of experience with design for recyclability for displays. Currently, over 700  
413 products offered by the majority of the ENERGY STAR Displays Partners meet the minimum criteria for  
414 design for recyclability under IEEE1680.1, which has been in place since 2006.  
415

416 EPA intends to harmonize with the RoHS Directive by adding language in Section 3.7 allowing the same  
417 exemptions as those outlined in the current RoHS Directive. EPA continues to seek stakeholder  
418 assistance in identifying all exemptions applicable to Displays. The exemptions proposed in this section  
419 are harmonized with exemptions 5(b), 6(c), 7(c)-I. and 7(c)-II in the revised RoHS Directive. Additionally,  
420 EPA is requesting feedback on whether the exemption in the revised RoHS Directive (#39) for "cadmium  
421 in colour converting II-VI LEDs (< 10 µg Cd per mm<sup>2</sup> of light-emitting area) for use in solid state  
422 illumination or display systems" (due to expire July 1, 2014) is applicable to Displays. EPA does not  
423 intend to require documentation of the need for exemption beyond what is needed by the Partner to  
424 demonstrate compliance with the RoHS Directive.  
425

426 EPA acknowledges an error in the Draft 2 for the proposed mercury level under 3.7.1, which has been  
427 corrected in this Draft 3 to harmonize with 0.1% allowance in the RoHS Directive.

## 428 **4 TEST REQUIREMENTS**

### 429 **4.1 Test Methods**

430 4.1.1 Test methods identified in Table 6 shall be used to determine qualification for ENERGY STAR.

431

**Table 6: Test Methods for ENERGY STAR Qualification**

Product Type	Test Method
All Product Types and Screen Sizes	ENERGY STAR Test Method for Displays Rev. Sep 2011
	IEC 62087, Ed 3.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment
	IEC 62301, Ed 2.0: Household Electrical Appliances- Measurement of Standby Power
	VESA Flat Panel Display Measurements (FPDM) Standard, Version 2.0 <sup>1</sup>

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**Note:** Based on testing of certain digital picture frames, not all displays are capable of using the IEC 62087 test material. EPA proposes testing these displays using the VESA Flat Panel Display Measurements (FPDM) Standard, Version 2.0. The difference in measured On Mode power between the VESA standard and an image rendering similar to the IEC 62087 test material was found to be less than 1 watt, demonstrating fair product comparability. EPA welcomes stakeholder feedback on this proposal.

438

**4.2 Number of Units Required for Testing**

439

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

440

441

442

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

443

**4.3 International Market Qualification**

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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.

446

**5 USER INTERFACE**

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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>. In the event that the manufacturer does not adopt *IEEE P1621*, the manufacturer shall provide EPA with its rationale for not doing so.

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**6 EFFECTIVE DATE**

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

<sup>1</sup> To be used only for displays that cannot be tested using IEC 62087

458 6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should  
459 technological and/or market changes affect its usefulness to consumers, industry, or the  
460 environment. In keeping with current policy, revisions to the specification are arrived at through  
461 stakeholder discussions. In the event of a specification revision, please note ENERGY STAR  
462 qualification is not automatically granted for the life of a model.

463 **Note:** At this time EPA anticipates finalizing Version 6.0 in April 2012, where the specification would then  
464 become effective in January 2013.

465  
466 As of January 1, 2013, only those models that have been certified by an EPA-recognized certification  
467 body will remain on the ENERGY STAR Qualified Product List. More information regarding product  
468 qualification will be provided along with the Final Draft specification. For information on third-party  
469 certification visit: [www.energystar.gov/3rdpartycert](http://www.energystar.gov/3rdpartycert).