



ENERGY STAR® Program Requirements Product Specification for Displays

Eligibility Criteria Draft 1 Version 7.0

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

3 1 DEFINITIONS

4 A) Product Types:

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

10 a) Monitor: An Electronic Display with pixel density greater than 5,000 pixels per square
11 inch (pixels/in²).

12 Note: Monitors are typically intended for one person to view in a desk based
13 environment.

14 b) Signage Display: An Electronic Display with pixel density less than or equal to 5,000
15 pixels per square inch (pixels/in²).

16 Note: Signage Displays are typically intended for multiple people to view in non-desk
17 based environments, such as retail or department stores, restaurants, museums,
18 hotels, outdoor venues, airports, conference rooms or classrooms.

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

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

Product Type	Monitor	Signage Display
Pixel Density <i>quantitative metric requirement</i>	>5,000 pixels/in ²	≤5,000 pixels/in ²
Viewing Environment <i>intended to describe the typical product but may not necessarily apply to all products</i>	desk-based environment, to be viewed primarily by one person	non-desk-based environment to be viewed primarily by multiple people

24
25
26 EPA seeks feedback on the appropriateness of continuing to specify pixel density for these products and
27 whether EPA has characterized the products’ intended viewing environments correctly.

28 EPA is proposing to maintain separate criteria for enhanced performance displays, acknowledging that
29 such displays have added features that require additional energy. Therefore, EPA proposes to account
30 for enhanced performance displays with an allowance in the On Mode Power Requirements section
31 rather than characterizing them as a separate product category in the Definitions section.

32 B) Operational Modes:

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

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

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

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

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

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

48 C) Visual Characteristics:

49 1) Luminance: The photometric measure of the luminous intensity per unit area of light
50 travelling in a given direction, expressed in candelas per square meter (cd/m^2).

51 a) Maximum Reported Luminance: The maximum Luminance the Display may attain at
52 an On Mode preset setting, and as specified by the manufacturer, for example, in the
53 user manual.

54 b) Maximum Measured Luminance: The maximum measured Luminance the Display
55 may attain by manually configuring its controls, such as brightness and contrast.

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

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

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

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

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

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

69 5) Native Vertical Resolution: The number of visible physical lines along the vertical axis of the
70 Display.

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

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

77 D) Additional Functions and Features:

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

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

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

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

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

91 **Note:** EPA is proposing to replace the definition of Network Capability with Full Network Connectivity
92 harmonizing with the Draft 2 Version 7.0 Televisions Specification, the Version 6.0 Computers
93 Specification, and the Version 3.0 Telephony Specification. The definition is accompanied by a proposed
94 test procedure in the Draft 2 ENERGY STAR Displays Test Method Section 6.7. The test confirms that
95 the display can maintain and respond to a network presence over Internet Protocol in order to receive the
96 proposed Sleep Mode power allowance. EPA welcomes feedback on the above definition and whether it
97 accurately captures the network functions that may be present in displays on the market today or in
98 development.

99 3) Occupancy Sensor: A device used to detect human presence in front of or in the area
100 surrounding a display.

101 Note: An Occupancy Sensor is typically used to switch a Display between On Mode and
102 Sleep Mode.

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

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

108 EPA encourages stakeholder feedback on the prevalence, capability (multi or single point touch), and
109 power use of the following Touch Technologies in Monitors and Signage Displays.

- 110 - *Resistive*
- 111 - *Capacitive*
- 112 - *Optical and Infrared*
- 113 - *Dispersive Signal*
- 114 - *Surface Acoustic Wave*

115
116 EPA would also like to understand whether Touch Technology is typically enabled by default for Sleep
117 and On Mode. What processing capability or connections (i.e., USB to host) are necessary for Touch
118 Technology to operate? What accessories are required?

119 5) Internal Processor: An internal device that provides one or more of the specific functions
120 without the explicit purpose of providing general computing function:

- 121 a) Display images, mirror remote content streamed to it or otherwise render content on
122 the screen from local or remote sources; or
- 123 b) Process touch signals.

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

128 EPA requests stakeholder feedback on this definition and the presence of Internal Processors in Signage
129 Displays as follows:

- 130 - Are Internal Processors shipped with the Display in its default condition?
- 131 - Are Internal Processors typically modular?
- 132 - What is the typical range of processing capability?
- 133 - Can touch screens and other functions operate without a modular processor installed?

134

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

- 140 1) Color,
- 141 2) Housing;
- 142 3) Number and types of interfaces;
- 143 4) Number and types of data, network, or peripheral ports; and
- 144 5) Processing and memory capability.

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

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

152 G) Power Source

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

156 **Note:** EPA has updated the definition of External Power Supply to harmonize with the U.S. Department of
157 Energy10 Code of Federal Regulations 430.2.

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

160 Note: Common examples are USB and Power-over-Ethernet. Usually Standard dc includes
161 both power and communications over the same cable, but as with the
162 380 V dc standard, that is not required.

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

165 2 SCOPE

166 2.1 Included Products

167 2.1.1 Products that meet the definition of a Display as specified herein and are powered directly from
168 ac mains or Standard dc are eligible for ENERGY STAR certification, with the exception of
169 products listed in Section 2.2. Typical products that would be eligible for certification under this
170 specification include:

- 171 i. Monitors;
- 172 ii. Monitors with keyboard, video, and mouse (KVM) switch functionality;
- 173 iii. Signage Displays; and
- 174 iv. Signage Displays and Monitors with Internal Processors.

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

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

185 2.2 Excluded Products

186 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for
187 certification under this specification including Televisions and Computers (Thin Clients,
188 Slates/Tablets). The list of specifications currently in effect can be found at
189 www.energystar.gov/products.

190 **Note:** EPA has included specific examples of products covered under ENERGY STAR specifications that
191 are excluded from this specification. In particular, please refer to the ENERGY STAR Version 6.0/6.1
192 Computers Specification for definitions of Thin Clients and Slates/Tablets. EPA welcomes stakeholder
193 feedback on whether or not these exclusions are unclear or if there is any overlap between the product
194 types.

195 2.2.2 The following products are not eligible for certification under this specification:

- 196 i. Products with an integrated television tuner;
- 197 ii. Displays designed to operate primarily with integrated or replaceable batteries without the
198 support of ac mains or external dc power (e.g., electronic readers, battery-powered digital
199 picture frames); and
- 200 iii. Products that must meet Food and Drug Administration specifications for medical devices
201 that prohibit power management capabilities and/or do not have a power state meeting the
202 definition of Sleep Mode.

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

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

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

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

217 **3 CERTIFICATION CRITERIA**

218 **3.1 Significant Digits and Rounding**

219 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

220 3.1.2 Unless otherwise specified, compliance with specification requirements shall be evaluated using
221 directly measured or calculated values without any benefit from rounding.

222 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
223 website shall be rounded to the nearest significant digit as expressed in the corresponding
224 specification requirements.

225 **3.2 General Requirements**

226 3.2.1 External Power Supplies (EPSs): Single- and Multiple-voltage EPSs shall meet the Level VI or
 227 higher performance requirements under the International Efficiency Marking Protocol when tested
 228 according to the Uniform Test Method for Measuring the Energy Consumption of External Power
 229 Supplies, Appendix Z to 10 CFR Part 430.

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

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

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

237 3.2.2 Power Management:

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

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

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

246 iv. Monitors shall automatically enter Sleep Mode or Off Mode within 15 minutes of being
 247 disconnected from a host computer.

248 **3.3 On Mode Requirements**

249 3.3.1 The Maximum On Mode Power (P_{ON_MAX}) in watts shall be calculated per Table 1.

250 **Table 1: Calculation of Maximum On Mode Power (P_{ON_MAX}) in Watts**

251

Product Type	P_{ON_MAX} (watts)
	Where: A = Screen Area in in^2 ; r = Total screen resolution in megapixels; and I = Total luminance of display in megacandelas calculated as As-Shipped Luminance multiplied by Area.
Monitors	$(2.0 \times r) + 17.1 \times \tanh(0.0040 \times (A - 63.0) + 0.22) + 0.3$
Signage Displays	$(75.0 \times I) + 82.0 \times \tanh(0.0010 \times (A - 200.0) + 0.1) + 6.0$

252 **Note: Monitors:** Since the introduction of Version 6.0 in fall 2012, the number of ENERGY STAR certified
253 models of Monitors has grown to represent the majority of the total available models on the market.
254 Market share has grown to approximately 80–90 percent in 2014. This represents an opportunity for the
255 ENERGY STAR program to further differentiate among the highly efficient Monitors on the market,
256 helping to ensure that the ENERGY STAR label remains an effective tool for consumers. With this Draft 1,
257 EPA used as its dataset 962 unique models, and is proposing power requirements that capture, on
258 average, the top 20 percent of available Monitors in the market today. The proposed criteria would
259 recognize a good selection of models across all common sizes from 15 major Monitor manufacturers.
260 Recognizing similarities among Monitors and televisions, EPA proposes an approach to capture the top
261 performing Monitors that allows for products of all sizes to meet the requirements but where larger, more
262 consumptive units must meet more stringent requirements As seen with televisions, as products have
263 increased in size while maintaining resolution, they have also demonstrated the ability to achieve
264 proportionally greater power consumption reductions and maintain product performance. As
265 manufacturers continue to offer Monitors in larger sizes today than ones offered in the past, EPA seeks to
266 reward and further incentivize improvements in efficiency among larger sizes.

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

273

274 **Note: Signage:** EPA's proposal captures the top performing Signage Display products in the market
275 today that are less than or equal to 60 inches in diagonal screen size and that all have as-shipped screen
276 luminances that are typically 500-700 cd/m² or less. EPA used as its dataset products currently certified
277 to the ENERGY STAR. In researching the market, it appears that certified models represent the majority
278 of market for products within the scope of the current specification, namely products less than or equal to
279 60 inches in screen size, which all appear to be intended primarily for indoor uses, based on their as-
280 shipped screen luminances. EPA understands that the market for Signage includes products larger than
281 60 inches in diagonal screen size, products with TVs tuners which therefore qualify under the Televisions
282 specification, and niche products that may be sold in separate components for customizable installation.
283 EPA is interested in expanding the scope to capture more Signage Displays of interest to buyers. To this
284 end, under the Version 7.0 Displays specification, EPA proposes expanding the scope to include products
285 greater than 60 inches in screen size and anticipates that the number of certified products will increase
286 once these larger screen sizes become eligible for inclusion.

287 As with its proposed approach for Monitors, EPA proposes an approach to capture the top performing
288 Signage Displays such that larger screens must deliver performance with a similar power budget as
289 smaller displays. As screens grow in size, EPA seeks to recognize products that have optimized
290 efficiencies and therefore limit increased energy consumption. Such an approach builds on the energy
291 savings demonstrated by TV products. In recent years TVs in very large sizes have demonstrated the
292 ability to achieve proportionally greater power consumption reductions and maintain product performance
293 as size has increased, notwithstanding increases in resolution. With this proposal, EPA seeks to reward
294 and further incentivize the development of such products among Signage, given technological similarities
295 between TVs and Signage Displays. EPA seeks data from manufacturers, using the Displays Test
296 Method, for Signage Displays greater than 60 inches and seeks feedback from all stakeholders on its
297 approach.

298 In addition, EPA proposes its On Mode Power limit for Signage Displays based on As-Shipped
299 Luminance, as well as Area, after finding a wide range of as-shipped luminances among Signage
300 Displays. Signage Displays of the same size may have different as-shipped luminances—some brighter,
301 some less bright—depending on their intended use (i.e., indoor vs. outdoor), which also impacts the
302 power consumption of the product. Within the EPA dataset containing a variety of manufacturers’
303 products, the proposed criteria capture the top-performing Signage Displays evenly across sizes ranging
304 from 30 inches to 60 inches and as-shipped luminance ranging from 50 to 800 cd/m². Under EPA’s
305 proposed approach, products would be granted a scalable allowance based on the screen total
306 luminance in megacandelas. EPA seeks feedback on this proposed approach that accounts for products
307 with significant variations in as-shipped luminances. EPA is considering a cap for the luminance
308 allowance to incentivize gains in efficiency and to set an overall limit in total energy consumption for
309 Signage Displays that ship at significantly higher screen luminances (i.e., >2000 cd/m²). In addition, EPA
310 seeks to determine how to best account for variations in any other physical characteristics and intended
311 uses for Signage. Specifically, EPA requests the following information from stakeholders:

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

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

315 3.3.2 For all Displays, Measured On Mode Power (P_{ON}) in watts shall be less than or equal the
316 calculation of Maximum On Mode Power (P_{ON_MAX}) with the applicable allowances and
317 adjustments per Equation 1.

318 **Equation 1: On Mode Power Requirement for All Displays**

$$P_{ON} \leq (P_{ON_MAX} + P_{EP} + P_{ABC}) \times eff_{AC_DC_ON}$$

319 Where:

- 320 ▪ P_{ON} is Measured On Mode Power in watts;
- 321 ▪ P_{ON_MAX} is the Maximum On Mode Power in watts;
- 322 ▪ P_{EP} is the On Mode Power allowance in watts for an enhanced performance display;
- 323 ▪ P_{ABC} is the On Mode power allowance for ABC in watt; and
- 324 ▪ $eff_{AC_DC_ON}$ is the standard adjustment for ac-dc power conversion losses that occur at the device
325 powering the Display in On Mode, and is 1.0 for Ac-powered Displays and 0.85 for displays tested
326 with Standard dc.
- 327 ▪ The result shall be rounded to the nearest tenth of a watt for reporting.
- 328

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

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

337 EPA calculated the typical power supply loads when the Display would be in On Mode (equivalent to
338 Short Idle in the Computers specification) as approximately 30% of rated output power. EPA then
339 reviewed efficiency data at the 20% and 50% loading points (for internal power supplies) and the average
340 at the 25%, 50%, 75%, and 100% loading points (for external power supplies). The conversion
341 efficiencies based on this analysis suggests displays with Standard dc will see conversion efficiencies
342 ranging from 85% to 91% in On Mode. EPA chose an efficiency factor at the low end of this range to be
343 conservative. EPA welcomes stakeholder comment on these assumptions.

344 3.3.3 For Displays meeting the following enhanced performance criteria, a power allowance (P_{EP}), as
345 calculated per Equation 2, shall be added to P_{ON_MAX} , as calculated per Equation 1:

- 346 i. A contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85°, with
347 or without a screen cover glass;
- 348 ii. A native resolution greater than or equal to 2.3 megapixels (MP); and,
- 349 iii. A color gamut size of at least sRGB as defined by IEC 61966-2-1. Alternate color spaces
350 are allowable as long as 99% or more of defined sRGB colors are supported.

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

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

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

357
$$P_{EP} = 0.30 \times P_{ON_MAX}$$

358 Where:

- 359
 - 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

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

372 3.3.4 For Monitors with ABC enabled by default, a power allowance (P_{ABC}), as calculated per Equation
373 4, shall be added to P_{ON_MAX} , as calculated per Equation 1, if the On Mode power reduction
374 (R_{ABC}), as calculated per Equation 3, is greater than or equal to 20%.

375 **Equation 3: Calculation of On Mode Power Reduction for Monitors with ABC Enabled by Default**

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

376 Where:

- 377
 - 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.

381 **Equation 4: Calculation of On Mode Power Allowance for Monitors with ABC Enabled by Default**

$$P_{ABC} = 0.05 \times P_{ON_MAX}$$

382 Where:

- 383
 - 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.

385
386 3.3.5 For Signage Displays with ABC enabled by default: **TBD**

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

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

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

412 3.4 Sleep Mode Requirements

413 3.4.1 For all Displays, Measured Sleep Mode Power (P_{SLEEP}) in watts shall be less than or equal the
414 calculation of Maximum Sleep Mode Power Requirement (P_{ON_MAX}) with the applicable
415 allowances and adjustments per Equation 5.

416 Equation 5: Sleep Mode Power Requirement for All Displays

$$417 P_{SLEEP} \leq (P_{SLEEP_MAX} + P_N + P_T + P_{OS}) \times eff_{AC_DC_SLEEP}$$

418 Where:

- 419 ▪ P_{SLEEP} is Measured Sleep Mode Power in watts;
- 420 ▪ P_{SLEEP_MAX} is the Maximum Sleep Mode Power requirement in watts specified in Table 2;
- 421 ▪ P_N is the Full Network Connectivity allowance in watts specified in Table 3;
- 422 ▪ P_T is the Touch Technology allowance in watts specified in Table 4;
- 423 ▪ P_{OS} is the Occupancy Sensor allowance in watts specified in Table 4; and
- 424 ▪ $eff_{AC_DC_SLEEP}$ is the standard adjustment for ac-dc power conversion losses that occur at the device
425 powering the Display in Sleep Mode, and is 1.0 for Ac-powered Displays and 0.81 for displays tested
426 with Standard dc.
- 427 ▪ The result shall be rounded to the nearest tenth of a watt for reporting.
- 428

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

434 The resulting load was approximately 6% of rated power supply output power, so EPA reviewed efficiency
 435 data at the 10% loading point (the closest data point available). The efficiencies at this loading point
 436 ranged from 81% to 86%. EPA chose an efficiency factor at the low end of this range to be conservative.
 437 EPA welcomes stakeholder comment on these assumptions.

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

$P_{\text{SLEEP MAX}}$ (watts)
0.5

439
 440 3.4.2 Products with Full Network Connectivity confirmed in Section 6.7 of the ENERGY STAR Test
 441 Method shall apply the allowance specified in Table 3.

442 **Table 3: Full Network Connectivity Allowance**

P_N (watts)
0.5

443
 444 3.4.3 Products tested with an Occupancy Sensor or Touch Technology active shall apply the
 445 allowances specified in Table 4.

446 **Table 4: Additional Functions Sleep Mode Power Allowances**

Type	Allowance (watts)
Touch Technology P_T	0.3
Occupancy Sensor P_{OS}	0.3

447
 448 **Note:** EPA is proposing the following Sleep Mode allowance revisions:

Allowance Category	Type	Allowance (watts)
Bridging	USB 1.x	0.1
	USB 2.x	0.5
	USB 3.x, DisplayPort (non-video-connection), Thunderbolt	0.7
Network	Wi-Fi	2 0.5
	Fast Ethernet	0.2 0.5
	Gigabit Ethernet	1.0 0.5
Sensor	Occupancy Sensor	0.5 0.3
Memory	Flash memory card/smart card readers, camera interfaces, PictBridge	0.2

449

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

459

460 3.4.4 For products that offer more than one Sleep Mode (e.g., “Sleep” and “Deep Sleep”), measured
 461 Sleep Mode power (P_{SLEEP}) in any Sleep Mode shall not exceed the requirements as stated in
 462 Equation 5 with the applicable allowances. If the product has a variety of Sleep Modes that may be
 463 manually selected, or if the product can enter Sleep Mode via different methods (e.g., remote
 464 control or putting the host PC to sleep), the measured Sleep Mode power (P_{SLEEP}) of the Sleep
 465 Mode with the highest P_{SLEEP} , as measured per Section 6.5 of the Test Method, shall be the P_{SLEEP}
 466 reported for certification. If the product automatically transitions through its various Sleep Modes,
 467 the average P_{SLEEP} of all Sleep Modes as measured in Section 6.5 of the Test Method shall be the
 468 P_{SLEEP} reported for certification

469

470 **3.5 Off Mode Requirements**

471 3.5.1 A product need not have an Off Mode to be eligible for certification. For products that do offer Off
 472 Mode, measured Off Mode power (P_{OFF}) shall be less than or equal to the Maximum Off Mode
 473 Power Requirement (P_{OFF_MAX}) in Table 5.

474

Table 3: Maximum Off Mode Power Requirement (P_{OFF_MAX})

P_{OFF_MAX} (watts)
0.5

475 **Note:** EPA is proposing to maintain the existing Off Mode requirement. EPA requests feedback as to
476 whether Standard dc products have a mode that meets the definition of Off Mode. If so, EPA is proposing
477 to factor in the losses due to the computer power supply and dc-dc conversions in the connected
478 computer to permit a fair comparison with ac-powered Displays in Off Mode as in Sections 3.3.2 and
479 3.4.2.

480

481 **3.6 Luminance Reporting Requirements**

482 3.6.1 Maximum Reported and Maximum Measured Luminance shall be reported for all products; As-
483 Shipped Luminance shall be reported for all products except those with ABC enabled by default.

484

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

488 **4 TEST REQUIREMENTS**

489 **4.1 Test Methods**

490 4.1.1 Test methods identified in Table 6 shall be used to determine certification for ENERGY STAR.

491

Table 4: Test Methods for ENERGY STAR Certification

Product Type	Test Method
All Product Types and Screen Sizes	Draft 2 ENERGY STAR Test Method for Determining Displays Energy – Rev. Oct-2014

492 **4.2 Number of Units Required for Testing**

493 4.2.1 One unit of a Representative Model, as defined in Section 1, shall be selected for testing.

494 4.2.2 For certification of a Product Family, the product configuration that represents the worst-case
495 power consumption for each product category within the Product Family shall be considered the
496 Representative Model.

497 **4.3 International Market Qualification**

498 4.3.1 Products shall be tested for qualification at the relevant input voltage/frequency combination for
499 each market in which they will be sold and promoted as ENERGY STAR.

500 **5 USER INTERFACE**

501 5.1.1 Manufacturers are encouraged to design products in accordance with the user interface standard,
502 IEEE P1621: Standard for User Interface Elements in Power Control of Electronic Devices
503 Employed in Office/Consumer Environments. For details, see <http://eetd.LBL.gov/Controls>.

504 **Note:** EPA is reviewing the above User Interface requirements under this specification revision.
505 In order to better track these data, EPA is proposing that EPA-recognized certification bodies
506 report to EPA whether or not they comply with the standard. The reporting requirement would be
507 in the form of a “Yes/No.” EPA welcomes feedback both this proposed requirement and whether
508 the majority of products today comply with the standard.

509

510 **6 EFFECTIVE DATE**

511 6.1.1 Effective Date: The Version 6.0 ENERGY STAR Display specification shall take effect on **XX**,
512 **2015**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR
513 specification in effect on its date of manufacture. The date of manufacture is specific to each unit
514 and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

515 6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should
516 technological and/or market changes affect its usefulness to consumers, industry, or the
517 environment. In keeping with current policy, revisions to the specification are arrived at through
518 stakeholder discussions. In the event of a specification revision, please note ENERGY STAR
519 certification is not automatically granted for the life of a model

520 **7 CONSIDERATIONS FOR FUTURE REVISIONS**

521 7.1.1 On Mode DC Power Limit: EPA is interested in considering a separate On Mode Power
522 Maximum requirement for Standard dc products that does not necessitate an ac-dc conversion
523 calculation. EPA anticipates these products will become more popular on the market with the
524 latest USB standard and looks forward to receiving additional direct dc-tested data for these
525 products.

526