ENERGY STAR® Program Requirements
Product Specification for Displays

Eligibility Criteria
Draft 1 Version 6.0

Following is the Version 6.0 ENERGY STAR Specification for Display Products. 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 commercially-available product with a display screen and associated electronics, often encased in a single housing, that as its primary function displays visual information from (1) a computer, workstation or server via one or more inputs (e.g., VGA, DVI, HDMI, Display Port, IEEE 1394), (2) a USB flash drive, (3) a memory card, or (4) a network connection.

a) Computer Monitor: A device that displays the computer's user interface and open programs, allowing the user to interact with the computer, typically using the keyboard and mouse.

b) Display with KVM functionality: A device that allows a user to control multiple computer hardware devices from a single keyboard, electronic display and mouse.

c) Digital Picture Frames: An electronic device whose primary function is to display digital images, but it may contain additional functionality such as a programmable timer, occupancy sensor, audio, video, bluetooth, wireless capability, etc.

d) Signage Displays: An electronic device with a display screen that is marketed as signage for typical use in locations such as retail and department stores, fast food restaurants, museums, hotels, outdoor venues, airports, conference rooms and education markets.

Note: It is EPA's intent to cover a wide range of display products currently available in the market. As such, EPA welcomes stakeholder feedback on other display product types that can be addressed in this specification, their power consumption, typical functionality, and applicable market usage.

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 is connected to a mains power source, 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 in Off Mode.

2) Sleep Mode: The power mode in which the product is connected to a mains power source, is not providing a principal function, and offers one or more of the following user oriented or protective functions, which may persist for an indefinite time:

a) to facilitate the activation of other modes (including activation or deactivation of On Mode) occupancy sensor or internal timer.

b) continuous function: information or status displays including clocks.

c) continuous function: sensor-based functions.

Sleep Mode is defined as the time when the product is connected to a power source, produces neither sound nor picture, neither transmits nor receives program information and/or data (excluding data transmitted to change the unit's condition from Sleep Mode to On Mode), and is waiting to be switched to On Mode by a direct or indirect signal from the consumer (e.g., with the remote control).

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

Note: In an effort to harmonize the definitions for displays and televisions to the best extent possible, the definitions for On Mode, Sleep Mode and Off Mode for display products have been adopted from the ENERGY STAR Television Specification. EPA welcomes stakeholder feedback of the adoption of these definitions and any needed clarification.

D) Luminance: The photometric measure of the luminous intensity per unit area of light travelling in a given direction, expressed in units of candelas per square meter (cd/m2).

1) Maximum Luminance: the preset picture setting in which the display is displaying the brightest on mode conditions.

2) As-shipped Luminance: the picture setting which is recommended and selected by the manufacturer for normal home or applicable market use.

Note: For clarification, EPA has included additional definitions for different luminance settings which will be relevant for testing and qualifying displays. EPA references "as-shipped" luminance as equivalent to 'recommended by the manufacturer for home use' cited in IEC 62087. EPA welcomes stakeholder feedback on whether the proposed as-shipped definition is appropriate for displays or if a different way to characterize "as-shipped" luminance for displays would be more accurate.

E) Screen Area: The viewable screen area of a product, calculated by multiplying the viewable image width by the viewable image height.

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

G) Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR qualification criteria, and (3) of a common basic design. Product models within a family differ from each other according to one or more characteristics or features that either (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2) are specified herein as acceptable variations within a product family. For Displays, acceptable variations within a product family include:

1) Color,

2) Housing

Note: EPA has heard from stakeholders seeking clarity on how to qualify a family of displays where some family members have additional features. EPA is interested in ensuring that consumers receive high quality and accurate information on which products qualify as ENERGY STAR, however, EPA also seeks to avoid duplicative testing of models. EPA welcomes stakeholder feedback on how the definition of product family can be further clarified, especially given that in Section 4.2.1, EPA requires that the highest energy using configuration within the family shall be considered the Representative Model for testing purposes.

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. Display with KVM functionality

iii. Digital Picture Frames

iv. Signage Displays

Note: EPA proposes to add Displays with KVM functionality to this specification.

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.

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

i. Products with a viewable diagonal screen size greater than 60”,

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 dual-function televisions / computer monitors,

vi. Tablet computers (i.e. electronic readers, smartphones), and

vii. Products used in diagnostic medical applications that do not have a power state meeting the definition of Sleep Mode (e.g. FDA’s specifications for medical devices that require luminance to be maintained over the lifetime of the displays among other requirements that prevent such displays from implementing power management capabilities).

Note:

Recognizing that screen sizes are growing, EPA is interested in stakeholder feedback on the value of expanding coverage in this specification to displays larger than 60” in diagonal screen size. EPA seeks more information on the prevalence of displays larger than 60” in the marketplace and their intended uses.

EPA is proposing that products that are explicitly marketed and sold as dual-function televisions / computer monitors meet the Television requirements in order earn the ENERGY STAR and thus has proposed excluding them from this specification. EPA appreciates stakeholder comments on this matter and will also seek comment in the Televisions specification process.

During the previous specification revision process, EPA evaluated the inclusion of displays used in medical applications but since these products are not able to meet the ENERGY STAR power management capability due to FDA requirements, EPA proposes not to address them as part of this category but will potentially take them up separately at a later date. More information on FDA requirements is available at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm107549.htm.

EPA appreciates any additional stakeholder comments about medical display products meeting the qualification criteria.

3 QUALIFICATION 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 limits 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 limit.

3.2 General Requirements

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

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

3.2.2 Networking Capabilities:

Note: Currently, there are displays sold in the market that have networking capability (e.g. Ethernet, Wi-Fi) and may serve as the main connector to common peripherals and mobile devices. Due to these additional functionalities, the power consumption associated with these Displays may increase in the On, Off and Sleep mode. EPA welcomes stakeholder feedback regarding the prevalence of these products in the market and their associated power consumption.

3.2.3 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 (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.

Note: EPA commends the advances in power management that displays manufacturers have implemented. EPA understands that manufacturers continue to develop and implement innovative power management functions involving new technologies such as occupancy sensors, proximity sensors or timer functions. EPA would like to understand better these technologies, their prevalence in the market, and energy savings they offer consumers and, as appropriate, encourage their broader application.

3.3 On Mode Requirements

3.3.1 For products with Automatic Brightness Control (ABC) enabled by default, On Mode power (P_{ON}), as calculated per Equation 1, shall be less than or equal to the Maximum On Mode Power Requirement (P_{ON_MAX}), as calculated per Table 1.

Equation 1: Calculation of On Mode Power for Products with ABC Enabled by Default

$$P_{ON} = (0.25 \times P_{broadcast\_10lux}) + (0.25 \times P_{broadcast\_100lux}) + (0.25 \times P_{broadcast\_150lux}) + (0.25 \times P_{broadcast\_300lux})$$

Where:

- *P_{ON} is the calculated On Mode power,*
- *$P_{broadcast\_10lux}$ is the measured On Mode power when tested with a minimum ambient light level of 10 lux.*
- *$P_{broadcast\_100lux}$ is the measured On Mode power when tested with a minimum ambient light level of 100 lux.*
- *$P_{broadcast\_150lux}$ is the measured On Mode power when tested with a minimum ambient light level of 150 lux.*
- *$P_{broadcast\_300lux}$ is the measured On Mode power when tested with a minimum ambient light level of 300 lux.*

Note: EPA and the U.S. Department of Energy (DOE) are interested in improving the measurement associated with ABC enabled by default. Both EPA and DOE believe that the test conditions for room illuminance should be representative of consumer use. EPA is proposing adopting the proposed DOE Television testing conditions for ABC enabled by default. EPA intends to adopt the DOE test procedure once it is finalized. EPA is referencing the DOE recommendations for testing televisions to harmonize with the Version 6.0 draft specification for Televisions.

While assigning different weights according to usage patterns would yield the most representative results, little information exists in this area. An average approach may be preferable because it will assume equal usage in each mode. EPA welcomes feedback on the assigned weights to each of the values and also testing ABC at three room illuminance levels instead of four. EPA also welcomes feedback on whether the proposed room illuminance levels are appropriate for displays which are intended for use in non-household applications, such as signage, and that are 30"-60" in diagonal screen size.

3.3.2 For products that do not offer ABC, or for which ABC is not enabled by default, On Mode power (P_{ON}), as calculated per the ENERGY STAR test method, shall be less than or equal to the Maximum On Mode Power Requirement (P_{ON_MAX}), as calculated per Table 1.

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

Product Type Diagonal Screen Size, *d* (inches)	**$P_{ON\ MAX}$ (watts)** *Where:* ▪ *r= Screen resolution in megapixels* ▪ *A = Viewable screen area, rounded to the nearest 0.1 square inches.*
All sizes	TBD

Note: EPA is inviting comments on this Draft 1. Due to the proposed adoption of the IEC 62087 standard for testing displays less than 30" in diagonal screen size, EPA is dividing the comment period into two phases.

Phase 1: Request clarification or guidance on applying IEC 62087 to test all display products (through June 14, 2011): EPA will redistribute an updated test method incorporating any clarifications with an accompanying data assembly form soon after the June 14 deadline.

Phase 2: Submit all test data and comments on the proposed draft specification (through July 18, 2011): EPA will consider all test data and comments on the proposed edits in Draft 1 specification in its analysis for Draft 2. EPA will also propose performance levels for all product types/sizes in the Draft 2 specification.

Adopting the International Electrical Commission (IEC) standard IEC62087[1], Ed. 2.0: Test Methods for displays less than 30" in diagonal screen size. In Version 5.0 of the specification, EPA indicated that it will explore testing all displays for On Mode power using the IEC 62087 test procedure to harmonize the test procedures for the ENERGY STAR Displays Product specification with the ENERGY STAR TV specification and other national and international standards. Therefore, EPA is proposing testing and measuring On Mode power for displays less than 30" using the IEC 62087, Ed.2.0 test method which is currently used to determine ENERGY STAR eligibility for display products 30"- 60" and for Televisions of all sizes. EPA asks that stakeholders share requests for clarification or guidance regarding application of this test method to displays less than 30" in diagonal screen size. In addition, EPA acknowledges that the IEC 62087 Ed. 2.0 test method may provide different On Mode power test results than the VESA Flat Panel Display Measurements (FPDM) Standard, Version 2.0, currently being used to test displays less than 30" in diagonal screen size. **As such, EPA encourages stakeholders to test displays less than 30" using the IEC 62087, Ed.2.0 test method and to share the performance data for EPA consideration. EPA appreciates receiving data on currently qualified models, new models that have not yet been ENERGY STAR qualified, as well as non-qualified models. Also, having data associated with a range of screen sizes and manufacturers best informs EPA's proposed eligibility criteria.** EPA will include in its review for specification development purposes, all data received by July 18, 2011.

Understanding On Mode power levels for displays greater than 30" in diagonal screen size. EPA currently has limited data from its qualified product list for displays in this size category and therefore seeks performance data of non-qualified products.

Exploring display resolution. In preparation for this specification revision, EPA analyzed the ENERGY STAR qualified displays to determine the extent to which resolution has an impact in determining. EPA is interested in getting additional new data to further understand under what circumstances resolution impacts power consumption in order to determine if it should propose removing resolution from the equation that determines On Mode power consumption. **EPA invites stakeholders to provide any feedback or additional data that demonstrates how and why resolution impacts power consumption for display products and for which products it demonstrates an impact. Specifically, EPA seeks feedback on the following questions:**

1) How is the amount of light transmitted through a display panel affected by the pixel size and its relative resolution? EPA would also like to better understand the power consumption associated with the resolution of the test image sent to the display, and if it is different from the native resolution of the display.
2) What is the estimated number of display products that are not ENERGY STAR qualified that currently exist in the US market and what are the screen sizes and resolutions of those products?
3) During the display design process, what is the determining factor in selecting a certain resolution for a particular screen size or screen size range? Does industry project a growing variance in resolutions for a particular screen size or for certain product applications?

Developing a better understanding of how displays 30"-32" in diagonal screen size are used in the marketplace. At the time Version 5.0 was developed, EPA and stakeholders flagged 30" in diagonal screen size as the dividing line between monitors and signage. Market research and ENERGY STAR's qualified product list indicate that the dividing line may have shifted up. EPA seeks feedback on the size at which displays are most frequently used for signage rather than desktop displays.

[1] The IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment is currently under revision. EPA will reference the proper IEC 62087 edition upon its publication.

3.4 Luminance Requirements

3.4.1 Luminance shall be tested at the as-shipped value, which is greater than or equal to 65% of the maximum luminance.

Table 2: Luminance Requirements

Requirement	Luminance Value
Reporting and Testing	Greater than or equal to 65% of the maximum luminance.

Note: EPA data analysis demonstrates that luminance plays an important role in the energy consumption of displays.

EPA proposes that Partner test and ship products at a luminance value greater than or equal to 65% of the maximum luminance to qualify ENERGY STAR products. EPA proposes that for purposes of qualification partners report both the "as shipped" and maximum luminance values that reflect a ratio of at least 65% to EPA.

Based on EPA discussions with stakeholders and analyzing the differences in maximum luminance capabilities for different models with screen sizes less than 30" in diagonal screen size, EPA is evaluating whether the default testing luminance requirements initially outlined in the VESA based test procedure found in Version 5.1 (175 cd/m2 for displays with resolutions less than 1.1. MP and 200 cd/m2 for resolutions greater than or equal to 1.1 MP) is truly representative of how the displays are used by the end user. Data demonstrated that the maximum luminance levels for displays less than 30" can range from 230 cd/m2 to over 370 cd/m2.

The current ENERGY STAR qualified product list demonstrated that the majority of products tested under 30" in diagonal screen size utilized a luminance of at least 65% of the maximum luminance. This proposed approach also aligns with the luminance values typically used for shipping products 30"- 60" in diagonal screen size. The current ENERGY STAR qualified product list demonstrated that the majority of tested products between 30"-60" in diagonal screen size utilized a luminance of at least 65% of the maximum luminance. Finally, this approach harmonizes with the approach used in the current Version 5.3 and draft Version 6.0 Televisions specification.

EPA recognizes that not all display products are used in similar settings for identical purposes and therefore welcomes stakeholder feedback regarding:
1. The appropriateness of this proposal to the full range of products suggested; and
2. The typical process manufacturers use in determining the 'as-shipped' luminance value.

3.5 Sleep Mode Requirements

3.5.1 Measured Sleep Mode power (P_{SLEEP}) shall be less than or equal to the Maximum Sleep Mode Power Requirement (P_{SLEEP_MAX}), as specified in Table 3.

Table 3: Maximum Sleep Mode Power Requirements (P_{SLEEP_MAX})

P_{SLEEP_MAX} (watts)
0.5

3.5.2 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 (P_{SLEEP_MAX}).

Note: EPA recognizes that some display products have multiple Sleep Modes and welcomes stakeholder feedback on the commonality and characteristics of these multiple Sleep Modes and their associated power consumption. EPA also welcomes feedback on any additional features that could increase power consumption in Sleep Mode.

3.6 Off Mode Requirements

3.6.1 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 4.

Table 4: Maximum Off Mode Power Requirements (P_{OFF_MAX})

P_{OFF_MAX} (watts)
0.5

Note: EPA is proposing 0.5 watts for both Sleep and Off Mode power requirements to harmonize with the EU Ecodesign regulation (EC No. 1275/2008), which sets maximum allowed power consumption for Off Mode at 0.5 watts and for Standby Mode for most products also at 0.5 watts. These requirements are scheduled to take effect in January 2013. Over half of ENERGY STAR qualified products less than 30" in diagonal screen size would currently be able meet a requirement of maximum Sleep Mode power consumption at 0.5 watts. EPA welcomes stakeholder feedback to determine whether a maximum allowance of 0.5 watts for Sleep and Off Modes would be feasible for displays that are intended for commercial, rather than household, use (e.g. professional signage), and that are 30"- 60" in diagonal screen size. **EPA currently has limited data from its qualified product list for displays greater than 30"in diagonal screen size and therefore also seeks test data of non-qualified products for Sleep and Off Modes.**

4 TOXICITY AND RECYCLABILITY REQUIREMENTS

TBD

Note: Consistent with the ENERGY STAR commitment to delivering energy efficiency along with the product features and functions that consumers value, EPA expects to require that ENERGY STAR qualified Displays meet toxicity requirements and are recyclable by referencing existing regulations. Adding these types of requirements extends a longstanding ENERGY STAR practice of addressing issues like mercury in CFLs where existing standards can be leveraged. EPA requests information on existing standards that address these environmental issues and how conformity is demonstrated.

5 TEST REQUIREMENTS

5.1 Test Methods

5.1.1 When testing display products, the test methods identified in Table 5 shall be used to determine ENERGY STAR qualification.

Table 5: Test Methods for ENERGY STAR Qualification

Diagonal Screen Size, *d* (inches)	Test Method
All Screen Sizes	ENERGY STAR Test Method for Displays Rev. Oct 2011. IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment[2] IEC 62301, Ed 2.0 : Household Electrical Appliances-Measurement of Standby Power

5.2 Number of Units Required for Testing

5.2.1 Representative Models shall be selected for testing per the following requirements:

i. For qualification of an individual product model, a product configuration equivalent to that which is intended to be marketed and labeled as ENERGY STAR is considered the Representative Model;

ii. For qualification of a product family, the highest energy using configuration within the family shall be considered the Representative Model. When submitting product families, manufacturers continue to be held accountable for any efficiency claims made about their display products, including those not tested or for which data was not reported.

Note: EPA has clarified that for qualification purposes, the product configuration that represents the as shipped power consumption for each product category within the product family will be considered the Representative Model.

EPA seeks feedback from stakeholders on the proposed product family approach presented in this draft.

6 USER INTERFACE

6.1.1 Partners 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.

2 The IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment is currently under revision. EPA will reference the proper IEC 62087 edition upon its publication.

i. In the event that IEEE P1621 is not adopted, Partner shall provide EPA with rationale for avoidance.

7 EFFECTIVE DATE

7.1.1 Effective Date: The Version 6.0 ENERGY STAR Display Products specification shall take effect on the dates specified in Table 6. 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.

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

Table 6: Specification Effective Dates

Effective Date
TBD