ENERGY STAR® Program Requirements for Televisions

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for televisions. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. Obtain certification of ENERGY STAR qualification from a Certification Body recognized by EPA for televisions prior to associating the ENERGY STAR name or mark with any product. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform television product testing.

Using the ENERGY STAR Name and Marks

3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale.
5. Provide clear and consistent labeling of ENERGY STAR qualified televisions.

    5.1. Partner shall adhere to the following product-specific commitments regarding use of the ENERGY STAR certification mark on qualified products:

        5.1.1. Partner must use the ENERGY STAR mark in one of the following ways:

            1) Via permanent or temporary label on top or front of the product. All temporary labeling must be affixed to the product with an adhesive or cling-type application; or

            2) Via electronic labeling, such that the ENERGY STAR mark appears on the television menu screen where pre-set picture settings are selected.

        5.1.2. Partner must also use the ENERGY STAR mark in all of the following ways:

            1) In product literature (e.g., user manuals, specification sheets, etc.); and

            2) On product packaging/boxes for products sold at retail.

        5.1.3. If additional information about the ENERGY STAR program or other products is provided by the Partner on its website, Partner must comply with the ENERGY STAR Web Linking Policy, which can be found at www.energystar.gov/partners;

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for televisions.

7. Comply with tests that EPA/DOE may conduct at its discretion on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

Providing Information to EPA

8. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:

    8.1. Partner must submit the total number of ENERGY STAR qualified televisions shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).

    8.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

    8.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

    Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

9. Report to EPA any attempts by laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.

10. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, communicate, and/or promote Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as

providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.

- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions. Through participation, companies create a credible record of their accomplishments and receive EPA recognition as corporate environmental leaders. For more information on Climate Leaders, visit www.epa.gov/climateleaders.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.

ENERGY STAR® Program Requirements
Product Specification for Televisions

Eligibility Criteria
Draft Version 4.2

Following is the Version 4.2 ENERGY STAR Product Specification for Televisions. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

Note: In response to questions received during the implementation of the Version 4.0 specification, EPA has made several minor changes to the Version 4.2 specification for additional clarity. Clarifications and additions are annotated throughout this document with note boxes. Version 4.2 and Version 5 have been placed in separate documents to minimize confusion about specification effective dates. The changes included in Version 4.2 will also be included in the Version 5 specification.

1 DEFINITIONS

A) Product Types:

1) Television (TV): A commercially available electronic product designed primarily for the reception and display of audiovisual signals received from terrestrial, cable, satellite, Internet Protocol TV (IPTV), or other digital or analog sources. A TV consists of a tuner/receiver and a display encased in a single enclosure. Cathode-ray tube (CRT), liquid crystal display (LCD), and plasma display panel (PDP) are examples of common display technologies.

2) Rear-projection TV: A television product in which the display device is a projector that focuses images onto a screen located inside the TV enclosure.

3) Direct-view TV: A television product in which the display device emits light either directly from the screen surface or transmits light from a source mounted directly behind the screen.

4) TV Combination Unit: A television product in which the TV and one or more additional devices (e.g., DVD player, Blu-ray Disc player, Hard Disk Drive) are combined into a single enclosure, and which meets all of the following criteria:

   a) it is not possible to measure the power of the individual components without removing the product housing; and

   b) the product connects to a wall outlet via a single power cord.

5) Component Television: A television product composed of two or more separate components (e.g., display device and tuner) that is marketed and sold as a television under a single model or system designation. A component television may have more than one power cord.

6) Hospitality Television: A television product which includes the following features:

   a) a control port for bi-directional communication (DB-9, RJ11, RJ12, RJ45, coaxial cable, or HDMI-CEC);

   b) activated hospitality protocol software (e.g., SmartPort, MPI, MTI, Serial Protocol) to provide direct access to Video-On-Demand (VOD) systems or a digital media player designed for hospitality-specific applications; and

c) a power state that meets the definition of Download Acquisition Mode.

7) Analog Television: A television product which has an NTSC, PAL, or SECAM tuner, and may have analog video inputs (e.g., composite video, component video, S-video, RGB).

8) Digital Television: A television product which has at least one digital tuner or at least one digital video input (e.g., HDMI). Products with an analog tuner and both analog and digital inputs are considered digital products under this specification.

B) Native Vertical Resolution: The physical pixel count for the vertical axis of the television (e.g, a television with a screen resolution of 1920 x 1080 (horizontal x vertical) would have a native vertical resolution of 1080).

C) Electronic Program Guide (EPG): An interactive on-screen menu of TV program information downloaded from an external source (e.g., program time, date, descriptions).

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

E) Point of Deployment (POD) Module: A conditional access module for digital cable signal reception.

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

G) 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 Download Acquisition Mode.

a) Power Overhang State: A power state within On Mode that is intended to facilitate a rapid return to full functionality in the event a product is accidentally switched off. This feature is present in some products that are designed to remain in a highly-functional “ready” state for a limited amount of time after being switched off by the user.

Note: A definition for Power Overhang has been added to this document in response to stakeholder questions about whether time spent in a high power operating state after the user has turned off the television should be classified as part of Download Acquisition Mode. It is EPA’s belief that these limited-duration events have a negligible impact on total TV energy consumption, and should be allowed as an extension of On Mode provided that power does not exceed On Mode limits and duration is limited to 3 minutes per occurrence. Requirements for Power Overhang are established in Section 3 of this document.

2) Sleep Mode: The power mode, sometimes referred to as “Standby,” 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) by remote switch (including remote control), internal sensor, 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. An indicator that only shows the user that the product is in the off position is included within the classification of an Off Mode.

4) Download Acquisition Mode (DAM): The power mode in which the product is connected to a mains power source, produces neither sound nor picture, and is actively downloading data. Data downloads may include channel listing information for use by an electronic programming guide, TV setup data, channel map updates, firmware updates, monitoring for emergency messaging / communications or other network communications. The power in DAM is typically greater than the power in Sleep Mode and is typically less than the power in On Mode.

Note: EPA has adopted the definition of Download Acquisition Mode that was proposed in the CEA DAM test procedure, with minor edits for consistency with ENERGY STAR specification language.

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

I) 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 Televisions, acceptable variations within a product family include:

1) Color, and

2) Housing.

2 SCOPE

2.1 Included Products

2.1.1 Products that are (1) marketed to the consumer as a television (e.g., television is the primary function), (2) capable of being powered from either a wall outlet or a battery unit that is sold with an external power supply, and (3) meet one of the following product type definitions, are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2:

i. Televisions
ii. Television Combination Units
iii. Component Televisions
iv. Hospitality Televisions

v. Products with a computer input port (e.g., VGA) that are marketed and sold primarily as televisions.

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 Products that satisfy one or more of the following conditions are not eligible for ENERGY STAR qualification under this specification:

i. Products with a computer input port (e.g., VGA) that are marketed and sold primarily as computer monitors,
ii. Products that are marketed and sold as dual-function televisions / computer monitors, and
iii. Products that do not have a power state meeting the definition of Sleep Mode (e.g., Public Alert CEA2009A certified models which offer 24/7/365 active public alert features), with the exception of Hospitality Televisions that meet the requirements specified in Section 3.7.

3 QUALIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be carried out with actual measured or observed values. Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from further rounding.

3.2 General Requirements

3.2.1 External Power Supply (EPS): 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.

3.2.2 User Information: The product shall ship with consumer informational materials located in either (1) the hard copy or electronic user manual, or (2) a package or box insert. These materials shall include:

i. Information about the ENERGY STAR program,
ii. Information on the energy consumption implications of changes to default as-shipped television configuration and settings, and
iii. Notification that enabling certain optional features and functionalities (e.g., instant-on), may increase energy consumption beyond the limits required for ENERGY STAR qualification, as applicable.

3.2.3 Forced Menu: Any product that includes a forced menu upon initial start-up shall:

i. Provide users with a choice of “home” picture mode or “retail” picture mode. Partners may use alternative terminology if approved by EPA.

ii. Upon selection of "retail" picture mode at initial start-up, either (1) display a second prompt requiring the user to confirm the choice of "retail" picture mode, or (2) display information on the start-up menu that the "home" picture mode is the mode in which the product qualifies for ENERGY STAR. If option (2) is selected, additional detail about ENERGY STAR qualification and energy consumption expectations shall be included in printed product literature and on the product information page on the Partner's website.

3.2.4 Component Televisions: For component television products, the total power of all components shall be considered for evaluation against any power requirement in this specification.

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

$$P_{ON} = (0.55 \times P_{0\_BROADCAST}) + (0.45 \times P_{ABC\_BROADCAST})$$

Where:

- P_{ON} *is the calculated On Mode power,*
- $P_{0\_BROADCAST}$ *is the measured On Mode power when tested with a minimum ambient light level of 0 lux,*
- $P_{ABC\_BROADCAST}$ *is the measured On Mode power when tested with an ambient light level of 300 lux.*

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 Equation 2, shall be less than or equal to the Maximum On Mode Power Requirement (P_{ON_MAX}), as calculated per Table 1.

Equation 2: Calculation of On Mode Power for Products without ABC Enabled by Default

$$P_{ON} = P_{0\_BROADCAST}$$

Where:

- P_{ON} *is the calculated On Mode power,*
- $P_{0\_BROADCAST}$ *is the measured On Mode power when tested with a minimum ambient light level of 0 lux.*

Table 1: Calculation of Maximum On Mode Power

Viewable Screen Area, *A* (square inches)	P_{ON_MAX} (watts)
A < 275.0	$(0.190 \times A) + 5.0$
A ≥ 275.0	$(0.120 \times A) + 25.0$

*EXAMPLE: The maximum On Mode power requirement for a TV with a width of 36.6 inches and a height of 20.6 inches (screen area of 754 in^2) would be: (0.120 * 754) + 25 = 115.4 watts, or 115 watts when rounded to the nearest whole number.*

3.3.3 Power Overhang:

i. Any Power Overhang state that occurs after the user has sent a command to switch the product into Sleep Mode, and immediately preceding entry into Sleep Mode, shall be less than 3 minutes in duration.
ii. Measured Power during the Power Overhang state shall be less than or equal to the Maximum On Mode Power Requirement (P_{ON_MAX}) specified in section 3.3.1.

Note: Stakeholders have advised EPA that many products on the market today make use of a "power overhang" state of no more than 3 minutes duration to provide for a quick re-start if the television is inadvertently turned off, and inquired as to whether this state should be classified as part of Download Acquisition Mode.

EPA believes that an additional few minutes of power at the end of each On Mode power cycle will have minimal impact on total energy consumption, and should not be considered part of DAM, but invites additional comments related to this proposal.

The "minimal impact" rationale is as follows: Assume 3 power cycles per day x 3 minutes of On Mode power = 9 additional minutes of On Mode. TEC assumes 5 hours (300 minutes) of On mode per day, so the net effect of power overhang on TEC is 9 / 300 minutes, or 3%. For the most consumptive TV on the current ENERGY STAR qualified products list (~ 400 kWh per year TEC) power overhang would result in no more than an additional 12 kWh per year. For the average TV on the qualified products list, the net impact on TEC would be no more than 5 kWh per year.

3.4 Sleep Mode Requirements

3.4.1 Measured Sleep Mode power (P_{SLEEP}) shall be less than or equal to 1.0 W.

3.4.2 If a product offers multiple Sleep Modes, the Sleep Mode with the lowest power shall be enabled by default.

3.5 Luminance Requirements

3.5.1 Measured peak luminance in the "home" (or default, as-shipped) picture mode (L_{HOME}) shall be greater than or equal to 65% of measured peak luminance in the "retail" (or brightest-selectable) preset picture mode (L_{RETAIL}).

3.6 Download Acquisition Mode (DAM) Requirements

3.6.1 A product may automatically exit Sleep Mode and enter Download Acquisition Mode according to a predefined schedule, in order to:

i. Download channel listing information for use by an electronic programming guide,
ii. Monitor for emergency messaging/communications, or
iii. Communicate via a network protocol.

3.6.2 Measured energy consumption for all DAM states (E_{DAM}) shall be less than or equal to 0.08 kWh per day (80 W-h per day).

3.7 Hospitality Television Requirements

3.7.1 Hospitality Television TEC (TEC_{HOSP}), as calculated per Equation 2, shall be less than or equal to the Maximum Hospitality Television TEC Requirement (TEC_{HOSP_MAX}), as determined per Table 2.

3.7.2 For Hospitality Televisions that feature an always-on DAM, measured DAM power (P_{DAM}) shall be less than or equal to 1.0 W when tested per the Sleep Mode test procedures in the ENERGY STAR Test Method for Televisions.

Note: EPA has proposed an exception to the qualifying products section to allow hospitality TVs with an always-on DAM (but no traditional Sleep Mode, due to active networking) to qualify for ENERGY STAR, provided that DAM power does not exceed the Sleep Mode power limit of 1.0 watt, and that the calculated TEC does not exceed the TEC limit for Hospitality Televisions.

Equation 3: Calculation of TEC for Hospitality Televisions (TEC_{HOSP})

$$TEC_{HOSP} = (P_{ON} \times 5) + (P_{SLEEP} \times 19) + E_{DAM}$$

Where:

- *TEC_{HOSP} is the calculated Hospitality Television TEC*
- *P_{ON} is the measured On Mode power*
- *P_{SLEEP} is the measured Sleep Mode power*
- *E_{DAM} is the measured DAM energy over a 24 hour period*

Table 2: Calculation of Maximum TEC Requirement for Hospitality Televisions (TEC_{HOSP_MAX})

Screen Area, *A* (square inches)	TEC_{HOSP_MAX} (watt-hours)
$A < 275.0$	$(0.95 \times A) + 104.0$
$A \geq 275.0$	$(0.60 \times A) + 224.0$

4 TESTING

4.1 Test Methods

4.1.1 When testing Television products, the test methods identified in Table 3 shall be used to determine ENERGY STAR qualification.

Table 3: Test Methods for ENERGY STAR Qualification

Operational Mode	Test Method
All	ENERGY STAR Test Method for Televisions, Rev. Aug-2010

Operational Mode	Test Method
On Mode	IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment CEA-2037: Determination of Television Average Power Consumption (December 2009)
Sleep Mode	IEC 62301, Ed 1.0: Household Electrical Appliances – Measurement of Standby Power.
Download Acquisition Mode	CEA: Procedure for DAM Testing

Note: The final CEA Procedure for DAM Testing has been posted on the ENERGY STAR Web site and is available for use with this Version 4.2 specification. The final CEA procedure has been edited from its draft form to include comments and suggestions proposed by EPA as well as any stakeholder feedback on EPAs proposed modifications.

4.2 Number of Units Required for Testing

4.2.1 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, any product configuration within the family may be considered the Representative Model.

4.2.2 A single unit of each Representative Model shall be selected for testing. If test results for any operational mode power measurement are within 10% of ENERGY STAR requirements, two additional units of the same Representative Model with an identical configuration shall be tested.

4.2.3 All tested units shall meet ENERGY STAR qualification requirements.

4.3 International Market Qualification

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

5 DATA AVAILABILITY

5.1.1 EPA will make On Mode, Sleep Mode, luminance, and DAM data available on the ENERGY STAR Web site for interested consumers. On Mode power and luminance data in both home and retail modes will be published on the ENERGY STAR website.

5.1.2 EPA will publish an estimate of annual energy consumption (in kWh/year) on the ENERGY STAR qualified product list. This estimate will be based on a typical energy consumption (TEC) model that assumes a daily duty cycle of 5 hours in On Mode and 19 hours in Sleep Mode, plus estimated annual energy consumption in Download Acquisition Mode.

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.

7 EFFECTIVE DATE

7.1.1 Effective Date: The Version 4.2 ENERGY STAR Televisions specification shall take effect on the date specified in Table 4. 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 4: Specification Effective Dates

Effective Date
April 30, 2010

APPENDIX A:
Sample Calculations

Viewable Diagonal Screen Size (inches)	Aspect Ratio	Viewable Screen Size, *w x l* (Inches)	Screen Area, *A* (sq-inches)	P_{ON_MAX} (watts)
20	16:9	17.4 x 9.8	170.5	37.0
32	16:9	27.9 x 15.7	438.0	78.0
42	16:9	36.6 x 20.6	754.0	115.0
50	16:9	43.6 x 24.5	1068.2	153.0
60	16:9	52.3 x 29.4	1537.6	210.0

ENERGY STAR® Program Requirements Product Specification for Televisions

Test Method

1 OVERVIEW

The following test method shall be used for determining product compliance with requirements in the ENERGY STAR Eligibility Criteria for Televisions.

2 APPLICABILITY

ENERGY STAR test requirements are dependent upon the feature set of the product under evaluation. The following guidelines shall be used to determine the applicability of each section of this document:

1) Test procedures in section 6 shall be performed on all products;

2) Test procedures in section 6.3 shall be performed on products without automatic brightness control (ABC) enabled by default;

3) Test procedures in section 6.4 shall be performed on products with ABC enabled by default;

4) Test procedures in section 6.5 shall be performed on products with download acquisition mode (DAM).

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Televisions.

4 TEST SETUP

A) Test Setup and Instrumentation: Test setup and instrumentation for all portions of this procedure shall be in accordance with the requirements of IEC 62301, Ed. 1.0, "Measurement of Household Appliance Standby Power", Section 4, "General Conditions for Measurements", unless otherwise noted in this document. In the event of conflicting requirements, the ENERGY STAR test method shall take precedence.

B) Input Power: Input power shall be as specified in Table 1.

Table 1: Input Power Requirements

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 Vac	+/- 1.0 %	2.0 %	60 Hz	+/- 1.0 %
Europe, Australia, New Zealand	230 Vac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
China	220 Vac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
Japan	100 Vac	+/- 1.0 %	2.0 %	50 Hz and 60 Hz	+/- 1.0 %

C) Ambient Temperature: Ambient temperature shall be from 18 ^{o}C to 28 ^{o}C.

D) Relative Humidity: Relative humidity shall be from 10% to 80%.

Note: EPA has revised all references to IEC 62301 to refer to Edition 1.0. References to Edition 2.0 were included in previous versions of this specification, but as of this writing Edition 2.0 remains in draft status with IEC and has recently undergone substantial changes. EPA will revisit the use of references to IEC 62301 Ed. 2.0 in future versions of this specification.

E) Power Meter: Power meters shall possess the following attributes:

1) Crest Factor: Capability to measure the current waveform without clipping.

i) The peak of the current waveform measured during Sleep Mode and On Mode shall determine the crest factor rating requirement and the appropriate current range setting.

ii) The full-scale value of the selected current range multiplied by the crest factor for that range shall be at least 15% greater than the peak current.

2) Bandwidth: Minimum bandwidth as determined by an analysis of current and voltage to determine the highest frequency component (harmonic) with a magnitude greater than 1% of the fundamental frequency under the test conditions.

3) Minimum Frequency Response: 3.0 kHz

4) Minimum Sampling Frequency: 60 Hz

5) Minimum Resolution:

i) 0.01 W for measurement values less than 10 W;

ii) 0.1 W for measurement values from 10 W to 100 W; and

iii) 1.0 W for measurement values greater than 100 W.

F) Measurement Accuracy:

1) Power measurements with a value greater than or equal to 0.5 W shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level.

2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W at the 95% confidence level.

3) All power measurements shall be reported in watts and rounded to the second decimal place. For measurements greater than or equal to 10 W, three significant figures shall be reported.

5 TEST CONDUCT

5.1 Guidance for Implementation of IEC 62301

A) Testing at Factory Default Settings: Power measurements shall be performed with the product in its as-shipped condition for the duration of Sleep Mode testing, with all user-configurable options set to factory defaults, except as otherwise specified by the test procedure.

B) POD Modules: Optional POD modules shall not be installed.

C) Network Connection: Products that offer networking capability (e.g., Ethernet, WiFi) shall be configured with networking features deactivated.

D) Multiple Sleep Modes: If the product offers multiple Sleep Modes, the power during all Sleep Modes shall be measured and recorded.

5.2 Guidance for Implementation of IEC 62087 and CEA-2037

A) Testing at Factory Default Settings:

1) Power measurements shall be performed with the product in its as-shipped condition for the duration of On Mode testing, with all user-configurable options set to factory defaults, except as otherwise specified by the test procedure.

2) Picture level adjustments shall be performed per the instructions in IEC 62087, Ed. 2.0, Section 11.4.8.

3) Products that include a “forced menu” upon initial start-up shall be tested in “standard” or “home” picture mode. Products that do not include a forced menu shall be tested in the default picture mode. In the case that no “standard” mode or equivalent exists, the first mode listed in the on-screen menus shall be used for testing and noted in the test report.

B) Input Signal Accuracy: Follow guidance provided in Section 4.3 of CEA-2037.

C) Broadcast Test Materials: Follow guidance provided in Section 4.1 of CEA-2037.

D) True Power Factor: Measure and record the average true power factor over the duration of all On Mode tests.

E) Signal Input: If the UUT has an HDMI input, the HDMI input shall be used for display of test signals during testing. If HDMI is not available, then the component interface shall be used. The VGA interface shall not be used.

Note: EPA has added additional detail about the use of various signal inputs for testing.

F) Automatic Brightness Control: Follow guidance provided in Section 4.4.3.2 of CEA-2037.

G) Network Connection: Products that offer networking capability (e.g., Ethernet, WiFi) shall be configured with networking features deactivated.

5.3 Guidance for Implementation of CEA "Procedure for DAM Testing"

A) The "Ideal" CEA test protocol is the preferred protocol for ENERGY STAR DAM testing, though the "Practical" protocol may also be used.

B) Energy consumption for all DAM functionalities, both frequent and infrequent, shall be declared on the data collection sheet.

C) Energy consumption from DAM functionalities meeting the definition of "infrequent" may be excluded from the calculation of total DAM energy consumption.

Note: EPA has revised the requirements for DAM testing to include a reference to the CEA "Procedure for DAM Testing" and guidance for proper implementation.

6 TEST PROCEDURES FOR ALL PRODUCTS

6.1 Sleep Mode Testing

A) Sleep Mode power (P_{SLEEP}) shall be measured according to IEC 62301, Ed 1.0: Household Electrical Appliances – Measurement of Standby Power, with the additional guidance in section 5.

6.2 Luminance Testing

A) Luminance testing shall be performed in dark room conditions. Display screen illuminance (E) as measured with the UUT in Off Mode shall be less than or equal to 1.0 lux.

B) Luminance shall be measured perpendicular to the center of the display screen using a Light Measuring Device (LMD). A 500 mm measurement distance is recommended for LMDs that cannot be operated in close proximity to the screen.

C) The position of the LMD relative to the display screen shall remain fixed throughout the duration of testing.

D) For products with Automatic Brightness Control, luminance measurements shall be performed with ABC disabled. If ABC cannot be disabled, luminance measurements shall be performed with light entering directly into the television's ambient light sensor at greater than or equal to 300 lux.

E) Luminance measurements shall be performed per the following procedure:

1) Verify that the product is in the “home” picture mode, or the default as-shipped picture mode.

2) Immediately following the conclusion of On Mode power testing, begin to display the three-bar video signal specified in IEC 62087 Ed. 2.0, Section 11.5.5 (three bars of white (100%) over a black (0%) background).

3) Display the three-bar video signal for not less than 10 minutes to allow the display luminance to stabilize. This 10-minute stabilization period may be reduced if luminance measurements are stable to within 2% over a period of not less than 60 seconds.

4) Measure and record luminance in the home, or default as-shipped picture mode (L_{HOME}). For products that are known to stabilize within 10 minutes, the three-bar signal display duration may be reduced if the luminance measurement can be shown to be within 2% of the result that would be achieved with the full duration.

5) Within 1 minute of performing the measurement, set the television to “retail” picture mode, or the brightest-selectable preset picture mode.

6) Display the three-bar video signal for not less than 10 minutes to allow the display luminance to stabilize. This 10-minute stabilization period may be reduced if luminance measurements are stable to within 2% over a period of not less than 60 seconds.

7) Measure and record luminance in the retail, or brightest-selectable, preset picture mode (L_{RETAIL}).

6.3 On Mode Testing for Products without ABC Enabled by Default

A) On mode power *(P_{ON})* shall be measured according to IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment, with the additional guidance in section 5.

6.4 On Mode Testing for Products with ABC Enabled by Default

A) On mode power in various lighting conditions for TVs with ABC enabled ($P_{o\_BROADCAST}$ and $P_{ABC\_BROADCAST}$) shall be measured according to IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment, with the additional guidance in section 5.

6.5 Download Acquisition Mode Testing

A) Energy consumption in Download Acquisition Mode (E_{DAM}) shall be measured per the CEA “Procedure for DAM Testing,” with the additional guidance in Section 5.

NOTE: This final version of the **CEA Procedure for DAM Testing** is included with the Draft Version 4.2 ENERGY STAR Televisions Test Method for the convenience of stakeholders

1 SCOPE

This is the CEA Test Method for the determination of Download Acquisition Mode (DAM) energy consumption (E_DAM), as applicable to the ENERGY STAR Program Requirements for Televisions. The test procedure herein is applicable to any television using a DAM as defined in the ENERGY STAR Program Requirements document.

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3 REFERENCE DOCUMENTS

1. Energy Star TV Program Requirements – Procedure for DAM Testing
2. ENERGY STAR® Program Requirements for Televisions Eligibility Criteria Versions 4.1 and 5.1

4 Definition of DAM mode

In Energy Star 4.1, the EPA defines the following:

Download Acquisition Mode (DAM): Where the product is connected to a mains power source, is not producing a sound or a picture, and is actively downloading data, to include but not limited to, channel listing information according to a defined schedule for use by the electronic programming guide, TV setup data, channel map updates, TV firmware updates, monitoring for emergency messaging/communications and/or otherwise communicating through a network protocol. The power use in this mode is typically greater than the power requirement in Sleep and less than that in On Mode.

This test procedure introduces the following definitions:

Infrequent Download: Any DAM download that occurs no more than four times per year and has a duration of less than six hours per instance (i.e., total of less than 24 hours/year or 0.27%). Some examples of infrequent downloads are TV firmware updates, TV setup data downloads, and the Rovi EPG Setup State.

Frequent Download: Any DAM download that does not meet the definition of an Infrequent Download.

5 Qualifications to the DAM mode power usage

5.1 All frequent downloads must be included in the DAM mode power measurement. Note: All DAM functionalities, both frequent and infrequent must be declared, but those meeting the definition of infrequent can be excluded from the measurement procedure. (This declaration is so that the EPA is made aware of, and thereby has the option to evaluate the validity of, and test for the occurrences of, those downloads defined as infrequent.)

5.1.1. Downloads that happen at a frequency of less than once per day, but do not meet the definition of infrequent , must be averaged to come up with an equivalent daily value for the DAM measurement.

5.2 There are also various triggers for the initiation of a DAM sequence. It may be a daily trigger at a certain time of day (as an EPG download), or a TV power state trigger (as a clock update that is performed each time the TV “turned off” before it actually enters Sleep mode.) There are also other asynchronous external triggers possible. Daily triggers need no further discussion, a TV power state trigger will be

assumed to happen five times per day. Asynchronous triggers must be estimated in good faith, conservatively towards the high side of expected occurrence. (Significant underestimation is clearly grounds for de-listing.)

6 DAM power measurement

To test for the power consumed in DAM, the Ideal or the Practical test method may be used.

6.1 Ideal

6.1.1 To ideally measure the DAM mode power consumption, the TV should be connected to power meter that measures the total energy consumed (E_TOTAL) and a signal source that can provide a signal containing the same type and amount or duration of data that the TV will acquire in its actual application DAM use. The following procedure should be followed:

1. UUT shall be connected to a power meter that will measure the total energy consumed over duration of the test.
2. A signal source shall be prepared that can provide a signal containing the same type and amount or duration of data that the TV will acquire over the course of an average 24 hour period. This signal shall include representative segments from all Frequent Downloads.
3. The energy consumption of the UUT shall be measured over a 24 hour period (E_TOTAL), during which the TV is turned on for 1 hour then turned off for 1.5 hours 4 times then turned on for 1 hour and off for 13 hours.
4. The following equation shall be used to derive the energy used in DAM (E_DAM):

E_DAM = E_TOTAL – (P_ON * 5 Hours) – (P_SLEEP * 19 Hours)

Where:

E_TOTAL – Total energy used by the UUT over a 24 hour period
P_ON – On mode power consumption
P_SLEEP – Sleep mode power consumption
Time_DAM – Average time spent in DAM per day

6.2 Practical

6.2.1 For practical measurement of DAM mode power consumption, it can be verified that the E_DAM can be calculated by simply multiplying the

instantaneous (P_DAM - P_SLEEP) by the time in DAM mode. The following steps should be followed:

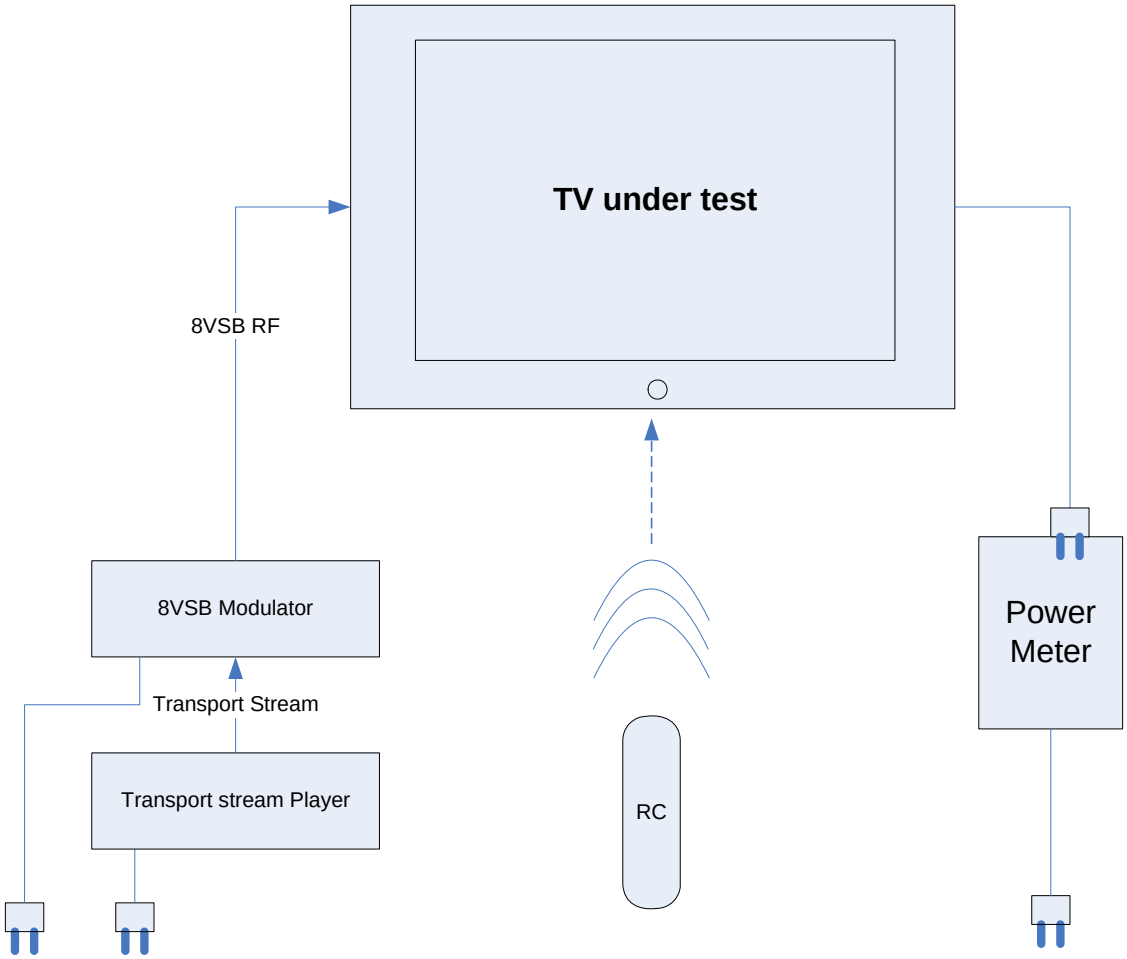
1. The TV shall be connected to a power meter and power source.
2. The TV shall be connected to an appropriate signal source for communicating with the DAM function being tested.
3. The signal which causes the TV to activate the DAM function should be applied.
4. Confirm that the TV has activated the DAM function and is communicating with the DAM signal source as appropriate for the DAM function being tested.
5. Record “P_DAM" (watts) power consumption in DAM using the power meter.
6. Confirm "Time_DAM" (hours) time of DAM per day, and calculate "E_DAM" by
   the following equation:
   E_DAM = (P_DAM - P_SLEEP) x Time_DAM
7. If there are different DAM functions for the same TV, repeat steps 1 through 6 for each DAM function. In this case, the total E_DAM is calculated:
   E_DAM = SUM((P_DAM – P_SLEEP) x Time_DAM)

   Where:
   P_SLEEP – Sleep mode power consumption
   P_DAM – DAM power consumption for each DAM function
   Time_DAM - Time spent in DAM for each DAM function

6.3 Verification

6.3.1 The average time per day spent in DAM mode is easily estimated and easily verified by connecting the TV into its intended application and monitoring the energy usage. It is self evident when the TV is in On mode. When the TV is off and drawing less than 1W it must be in Sleep mode, and when it is off and drawing more than 1W, it must be in DAM mode. The verification should be repeated for several days in case a less frequent download occurs on one day.

7 Connection Diagram



8 Templates

8.1 Data Declaration

8.1.1 As stated above, all DAM functions both frequent and infrequent must be declared. For each function all appropriate columns must be completed. The total E_DAM will be compared against the ENERGY STAR limit for DAM.

8.2 Blank DAM Declaration Template

DAM Declarations						P_DAM	P_DAM - P_Sleep	Time_DAM	E_DAM*	
	Function	Trigger	Duration(s)	Frequency	Estimate	Power (W)		Hrs:Min	(W-hrs)	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
					Total					

8.3 Example DAM Declaration Template

DAM Declarations						P_DAM	P_DAM - P_Sleep	Time_DAM	E_DAM*	
	Function	Trigger	Duration(s)	Frequency	Estimate	Power (W)		Hrs:Min	(W-hrs)	Notes
1	Firmware Update	availability detected by Check	1 hr 45 min	Infrequent	2x / year	26.5	26			only if required for feature update/fix
2	Download Setup data	new installation	5 min	Infrequent	Once	26.5	26			
3	Update Setup/Channel Map	availability detected by check	5 min	Infrequent	2x / year	26.5	26			if new channels added or room setup change required
4	Check for new version of 1,2, or 3	Turn off + 15 minutes	3 min	Frequent	5x / day	26.5	26	0:15	6.5	Check for new version - downloads only if new version available
5	Initialize EPG setup	new installation	3 hrs	Infrequent	Once	26.5	26			
6	Update EPG data	daily	15 min	Frequent	4x / day	26.5	26	2:22	62.4	
			2 hrs			26.5	26			
			5 min			26.5	26			
			2 min			26.5	26			
7	Weekly Download	weekly	1 hr	Frequent	1x / week	26.5	26	0:09	3.9	
8										
9										
10										
					Total			2:46	72.8	
										* E_DAM = (P_DAM - P_Sleep) x Time_DAM

9 REVISION HISTORY

Rev	Author	Section	Description	Date
0.1	Mark Laramie	All	Document Creation	2010-04-28
0.2	Mark Laramie	6.1 8	Corrected formula Corrected references and added columns for Average DAM Power and E_DAM	2010-04-30
0.3	Owen Sanford	All	Addressed comments	2010-09-08