



ENERGY STAR® Program Requirements for Audio/Video

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 Audio/Video equipment. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by EPA for Audio/Video equipment. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform Audio/Video equipment testing. A list of EPA-recognized laboratories and certification bodies can be found at www.energystar.gov/testingandverification.

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 in the U.S and/or ENERGY STAR partner countries.
5. Provide clear and consistent labeling of ENERGY STAR qualified Audio/Video equipment.
 - 5.1. Partner must use the ENERGY STAR mark in all of the following ways:
 - 5.1.1. Via permanent or temporary label on the product. All temporary labeling must be affixed to the top/front of the product with an adhesive or cling-type application. Partner must comply with guidance for certification marks provided in the ENERGY STAR Identity Guidelines, which can be found at www.energystar.gov/marks;
 - 5.1.2. Either in product literature (e.g., user manuals, specification sheets, etc.) or in a separate box insert that provides educational language about the Product's ENERGY STAR settings; and
 - 5.1.3. On product packaging/boxes for products sold at retail.
 - 5.2. If additional information about the ENERGY STAR program(s) or other products provided by the Partner on its Web site, 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 Audio/Video equipment, providing full cooperation and timely responses. EPA/DOE may also, at its discretion, conduct tests 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

7. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
 - 7.1. Partner must submit the total number of ENERGY STAR qualified Audio/Video equipment 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).
 - 7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.
 - 7.3. 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. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. 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, and communicate 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 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 Audio/Video

Eligibility Criteria Version 2.1

Following is the Version 2.1 ENERGY STAR Product Specification for Audio/Video. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

A) Product Types:

- 1) AV Product: A mains-connected product that offers audio amplification and/or optical disc drive functions. This definition does not include Dedicated Audio DSP Devices.
- 2) Dedicated Audio DSP Device: A device that meets all of the following criteria:
 - a) Provides audio digital signal processing as its primary function.
 - b) Provides support for RS-232, Ethernet, WiFi, IEEE-1394 FireWire or similar protocol for hard-wired or wireless remote control.
 - c) Does not provide audio amplification.

- B) APD (Auto Power Down): The capability to automatically switch a device from On Mode to Sleep Mode after a predetermined period of time (APD timing) has elapsed. APD timing begins when the following criteria have been met: (1) the device has ceased performance of all primary functions, or (2) the last user input has been received (e.g., remote control signal, volume adjustment). The intent of APD is that products will automatically power down into Sleep Mode when not in active use.

EXAMPLE: A DVD player is by definition performing a primary function during active video playback from the disc; and thus is not required to APD for the duration of active video playback. The same DVD player is expected to power down to Sleep Mode when video content playback concludes, such that the product does not indefinitely remain in On Mode while sitting in a disc menu screen.

C) Loss of Signal (LOS):

- 1) For audio signals, LOS is defined as:
 - a) Analog inputs: Less than 1 dB above the measured noise floor for 60 seconds.
 - b) HDMI: Receive <Inactive Source> or <Standby> signal over the CEC channel, or [Power Status] of an upstream device goes to "Standby" or "In Transition to Standby" over the CEC channel.
 - c) Other Digital Inputs (e.g., Ethernet): No audio information in the data stream.
 - d) Detectable cable disconnects.
- 2) For video signals, LOS is defined as:
 - a) Analog Inputs: Loss of either the horizontal or vertical sync signal.
 - b) HDMI: Receive <Inactive Source> or <Standby> signal over the Consumer Electronics Control (CEC) channel, or [Power Status] of an upstream device goes to "Standby" or "In Transition to Standby" over the CEC channel; or detection of a disabled TMDS link, a TMDS clock line signal below 22.5 MHz for more than one second, or a TMDS link operating outside of the valid frequency range.

- c) **DVI:** Detection of a disabled TMDS link, a TMDS clock line signal below 22.5 MHz for more than one second, or a TMDS link operating outside of the valid frequency range.
 - d) **Other Digital Inputs (e.g., Ethernet):** No video information in the data stream.
 - e) **Detectable cable disconnects.**
- D) **Primary Function:** Any discrete, dynamic device function that can be perceived by an end user, including the delivery or processing of audio/video content, and excluding the following:
- 1) Continuous device functions (e.g. clocks, status displays, indicator lamps) ,
 - 2) Static device functions, such as:
 - a) No active audio or video processing or output;
 - b) Playback paused or stopped;
 - c) No optical disc media in disc drive; or
 - d) Waiting in disc menu or other menu for user input.
- E) **Operational Modes:**
- 1) **On Mode:** Where the product is connected to a mains power source, has been activated and is capable of providing one or more primary functions. The common terms “active”, “in-use” and “normal operation” also describe this mode.
 - a) **Active State:** A state within On Mode in which a product is performing a primary function.
 - b) **Idle State:** A state within On Mode in which a product is not performing a primary function and no content is actively being delivered to the end-user.
 - 2) **Sleep Mode:** The common term “standby” may also describe this mode, where the product is connected to a mains power source, is incapable of providing a primary 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 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.

For purposes of this specification, 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:** Where the product is connected to a mains power source, is not providing any On Mode or Sleep Mode functions, and cannot be switched into any other mode except by user actuation of a manual power switch. An indicator that only shows the user that the product is in the off position is included within the classification of an Off Mode.
- F) **EPS (External Power Supply):** Also referred to as External Power Adapter. A component contained in a separate physical enclosure external to the AV product, designed to convert line voltage AC input from the mains to lesser DC voltage(s) in order to provide power to the AV product. An EPS connects to the AV product via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.
- G) **HDMI (High-Definition Multimedia Interface):** A compact audio/video interface for transmitting uncompressed digital data.

- 1) CEC (Consumer Electronics Control) Protocol: A single-conductor wire or bus technology that is an optional feature in the HDMI specification. CEC is meant to carry IR/remote and/or control commands between HDMI devices that are interconnected.
- H) High Definition Resolution: Video output with resolution greater than 480 lines (480 i/p).
- I) Multi-component System: A product consisting of several components with separate enclosures that are sold as and intended for use as a single system. A "Home Theater in a Box" is an example of a Multi-component System.
- J) Audio Amplifier Type Classifications:
- 1) Full-spectrum Amplifier: An amplifier capable of full audible frequency range (20 Hz to 20 kHz) output on all channels.
 - 2) Limited-bandwidth Amplifier: An amplifier limited to less than full audible frequency range (20 Hz to 20 kHz) output on one or more channels.
- K) Product Functions:
- 1) Audio Amplification: A function by which a device increases the amplitude of an audio signal for purposes of sending the signal to a transducer for playback.
 - 2) Audio Signal Processing: A function by which a device modifies an audio signal for a purpose other than amplification.
 - 3) High Resolution Display: A function by which a device converts a video signal into a visual output (e.g., LCD panel, Plasma display panel). This definition does not include Status Displays.
 - 4) Status Display: A function by which a product provides a visual display of less than 480x234 pixel resolution or 5 inches diagonal screen size, including a back-lit alphanumeric clock or channel indicator. This definition does not include single indicator lamps.¹
 - 5) IP Video Tuner: A function by which a device can play back streaming digital video content packetized or downloaded over an IP network.
 - 6) Networking / Control Protocol: A function by which a device can connect to a network for transmission and receipt of data. The connection may be wired or wireless (e.g., Wi-Fi, Ethernet, Bluetooth, RS-232, USB).
 - 7) Optical Disc Player / Recorder: A function by which a device can read and/or write data to removable disk media (e.g., CD, DVD, Blu-ray Disc).
- L) THD (Total Harmonic Distortion): The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency of a signal.
- M) MUP (Maximum Undistorted Power): The amplifier output power at which the THD of any output channel is 1.0% or greater for a given input.
- N) 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 Audio/Video, acceptable variations within a product family include:
- 1) Color, and
 - 2) Housing.

¹ Note that single indicator lamps are not provided power allowances under this specification.

2 SCOPE

2.1 Included Products

- 2.1.1 Products that meet the definition of an AV Product or Dedicated Audio DSP Device as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2.

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 excluded from qualification under this specification.
- i. Products whose primary video playback capability is via IP Video Tuner and which are sold or provided outside of a dedicated service contract,
 - ii. Primarily battery-powered products (e.g., MP3 players, portable DVD players, portable gaming systems),
 - iii. Products for use in automotive applications,
 - iv. Video projectors,
 - v. Home and building automation & control products,
 - vi. Whole-house and whole-building audio and/or video systems,
 - vii. Videoconferencing systems,
 - viii. Wireless microphone systems,
 - ix. A/B selector switches,
 - x. Media servers.

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 Qualification Criteria

- 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 **Multi-component Systems:** On Mode and Sleep Mode power limits for each power-consuming component in a Multi-component System shall be assessed independently. To qualify for ENERGY STAR, each component shall meet applicable ENERGY STAR criteria.
- 3.2.3 **Networking / Control Protocols:** To qualify for ENERGY STAR, AV products that offer one or more Networking / Control Protocol options shall meet all applicable ENERGY STAR criteria in all possible control protocol configurations.

3.3 Auto Power Down (APD) Requirements

- 3.3.1 APD functionality shall be available on all products except those that are subject to 3rd-party performance standards that prohibit APD, including those used for Mass Notification and Emergency Communications Systems and those subject to proposed ANSI/UL 2572
- 3.3.2 APD functionality shall be enabled by default, with APD timing less than or equal to 2 hours, subject to the following exceptions:
- i. Products may offer users the option (e.g., via system menu or physical switch) to modify APD timing in 10 minute intervals, or to disable APD entirely.
 - ii. Products may initiate APD immediately upon receipt of authoritative control instruction via an active Networking / Control Protocol.
- 3.3.3 APD Timing Default Settings shall be as follows:
- i. **APD Timing \leq 30 minutes:** This timing option is acceptable for use as a default setting. If APD timing is set by default to no more than 30 minutes and APD cannot be disabled or increased to greater than 30 minutes, products do not have to meet Idle state power requirements.
 - ii. **30 minutes $<$ APD Timing \leq 2 hours:** This timing option is acceptable for use as a default setting. If APD can be disabled, or if APD timing can be increased to no more than 2 hours, products shall meet Idle state power requirements.
 - iii. **APD Timing $>$ 2 hours:** This timing option may only be enabled by the end user and is not acceptable for use as a default setting. If APD can be disabled, or if APD timing can be set to greater than 2 hours, products shall meet Idle state power requirements.

3.4 Sleep Mode Requirements

- 3.4.1 Measured Sleep Mode power (P_{SLEEP}) shall be less than or equal to the Maximum Sleep Mode Power Requirement (P_{SLEEP_MAX}), as calculated per Equation 1.

Equation 1: Calculation of Maximum Sleep Mode Power Requirement

$$P_{SLEEP_MAX} = P_{SLEEP_BASE} + \sum_{i=1}^n P_{WAKE_i}$$

Where:

- P_{SLEEP_MAX} is the Maximum Sleep Mode Power Requirement;
- P_{SLEEP_BASE} is the base Sleep Mode power allowance for all products, as specified in Table 1;
- P_{WAKE_i} is the Sleep Mode power allowance for each active, in-use networking/control protocol that provides remote hosts with the capability to wake the product from Sleep Mode, as specified in Table 1, for a total of n such allowances.

Table 1: Sleep Mode Power Allowances

Product Function	Tier 2 Sleep Mode Power Allowance (watts)	Tier 3 Sleep Mode Power Allowance (watts)
Base Allowance for All Products ($P_{SLEEP\ BASE}$)	1.0	1.0
In-use Networking / Control Protocol with Wake Capability ($P_{WAKE\ i}$)	2.0	1.0

3.5 On Mode Requirements

- 3.5.1 Measured On Mode power (P_{ON}), shall be less than or equal to the Maximum On Mode Power requirement (P_{ON_MAX}), as calculated per Equation 2, subject to the following requirements:
- Where multiple On Mode tests can be performed on a single product (e.g., both playback and recording tests can be performed on a DVD Player/Recorder), the product shall meet the On Mode requirements, as calculated per Equation 2, for each test that is performed.
 - Measured On Mode power for optical disc players capable of processing both SD and HD video content shall be the average of the On Mode power when processing SD content and the On Mode power when processing HD content, as measured per the test procedure.
 - On Mode power allowances specified in Table 2 shall be applied for each instance of an applicable product function, with the exception of the optical disc player. Only one optical disc player allowance may be applied per product.
 - The Networking / Control Protocol On Mode power allowance shall be applied only to active, in-use networking / control protocols.
 - Dedicated Audio DSP Devices are exempt from On Mode power requirements.² Measured On Mode power must be reported for each product submission.

Equation 2: Calculation of Maximum On Mode Power Requirement

$$P_{ON_MAX} = \sum_{i=1}^n P_{ON_i}$$

Where:

- P_{ON_MAX} is the Maximum On Mode Power Requirement, in watts
- P_{ON_i} is the On Mode power allowance for each applicable product function listed in Table 2, rounded to the nearest 0.1 watts, for a total of n such allowances.

² Manufacturers shall test and report On Mode power for all qualifying products. EPA may consider this On Mode power data in future evaluations of Audio/Video ENERGY STAR requirements

Table 2: On Mode Power Allowances

Product Function	Tier 2 On Mode Power Allowance, P_{ON_i} (watts)	Tier 3 On Mode Power Allowance, P_{ON_i} (watts)
High Resolution Display	$P_{ON} = (6.0 \times R) + (0.55 \times A) + 3.0$ Where: <ul style="list-style-type: none"> ▪ R is the display resolution ($x * y$) in megapixels ▪ A is the viewable screen area in square inches 	
In-use Networking / Control Protocol	2.0	1.0
SD or Audio Source Optical Disc Player: Playback Test	6.0	TBD
SD or Audio Source Optical Disc Player: Record Test	16.0	TBD
SD Source to HD Output "Upconversion" Optical Disc Player: Playback Test	10.0	TBD
HD Source Optical Disc Player: Playback Test	15.0	TBD
HD Source Optical Disc Player: Record Test	25.0	TBD

EXAMPLE: The Tier 2 Maximum On Mode power requirement for an AV product with an integrated display, HD Blu-ray Disc player, and an active Ethernet network connection would be calculated as follows: (1) A display with 480 x 234 pixel resolution (0.112320 MP) and a 7 inch diagonal screen (viewable area of 20.9 square inches), would receive $[(6 \times 0.112320) + (0.55 \times 20.9)] + 3.0 = 4.7$ watts; (2) the HD optical disc player would receive 15.0 watts during playback; and (3) the Ethernet connection would receive 2.0 watts. The On Mode power limit during playback of video content from the disc would be $4.7\text{ W} + 15.0\text{ W} + 2.0\text{ W} = 22.0$ watts.

3.6 Idle State Requirements

- 3.6.1 Measured Idle State power (P_{IDLE}), shall be less than or equal to the Maximum Idle State Power requirement (P_{IDLE_MAX}), as calculated per Equation 3, subject to the following requirements:
- 3.6.2 Products with a default APD timing less than or equal to 30 minutes and that cannot be disabled or increased to greater than 30 minutes shall be excluded from the requirement.

Equation 3: Calculation of Maximum Idle State Power Requirement

$$P_{IDLE_MAX} = \sum_{i=1}^n P_{IDLE_i}$$

Where:

- P_{IDLE_MAX} is the Maximum Idle State Power Requirement, in watts
- P_{IDLE_i} is the Idle State power allowance for each applicable product function listed in Table 3, for a total of n such allowances.

Table 3: Idle State Power Allowances

Product Function		Tier 2 Idle State Power Allowance, P_{IDLE_i} (watts)	Tier 3 Idle State Power Allowance, P_{IDLE_i} (watts)
Base (All Products)		5.0	5.0
Audio Amplification <i>Where: P_{OUT} is the output power at 1/8 MUP with 1kHz sinusoidal input</i>	$P_{OUT} \leq 50.0$ watts	5.0	5.0
	$P_{OUT} > 50.0$ watts	$(0.10 \times P_{OUT})$	$(0.10 \times P_{OUT})$

3.7 Amplifier Efficiency Requirements

3.7.1 If no AV inputs are available and the optical disc player is used for audio signal input (per ENERGY STAR test method Section 5.E), the power consumption from the optical disc player, as measured in Section 8.3 of the test procedure, may be subtracted from the total measured power consumption of the device for all audio amplifier efficiency calculations.

- i. Measured amplifier efficiency (η) of products that offer Audio Amplification, as calculated per Equation 4, shall be greater than or equal to the On Mode amplifier efficiency requirements specified in Table 4.
- ii. If the amplifier is tested with an AV input, then $P_{DISC} = 0$

Equation 4: Calculation of Amplifier Efficiency

$$\eta = \frac{P_{OUT}}{P_{IN} - P_{DISC}}$$

Where:

- η is the amplifier efficiency
- P_{OUT} is the output power at 1/8 MUP with 1 kHz sinusoidal input, in watts
- P_{IN} is the input power at 1/8 MUP with 1 kHz sinusoidal input, in watts
- P_{DISC} is the measured power during audio playback for products without AV inputs that must rely on an optical disc player for audio signal input.

Table 4: Amplifier Efficiency Requirements

Amplifier Input Power at 1/8 MUP with 1 kHz Sinusoidal Input, P_{IN} (W)	Tier 2 Minimum Amplifier Efficiency, η	Tier 3 Minimum Amplifier Efficiency, η
$P_{IN} < 20$	n/a	n/a
$20 \leq P_{IN} < 100$	0.44	TBD
$P_{IN} \geq 100$	0.55	TBD

4 TESTING

4.1 Test Methods

- 4.1.1 When testing Audio/Video products, the test methods identified in Table 5 shall be used to determine ENERGY STAR qualification.

Table 5: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
All	ENERGY STAR Test Method for Audio/Video, Rev. Aug-2010

4.2 Number of Units Required for Testing

- 4.2.1 Representative Models shall be selected for testing per the following requirements:
- 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;
 - For qualification of a product family, any product configuration within the family may be considered the Representative Model.

4.3 International Market Qualification

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

5 USER INTERFACE

- 5.1.1 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>.

6 EFFECTIVE DATE

- 6.1.1 Effective Date: The Version 2.1 ENERGY STAR Audio/Video 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.

Table 6: Specification Effective Dates

Tier 2	Tier 3
July 30, 2010	March 30, 2012

- 6.1.2 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.



ENERGY STAR® Program Requirements Product Specification for Audio/Video

Test Method

1 OVERVIEW

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

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:

- Power mode tests (Section 7) shall be performed on every product;
- Optical media player tests (Section 8) shall be performed on any product capable of playback or recording of audio and/or video stored on optical media (e.g., CD, SA-CD, DVD, Blu-ray Disc); and
- Audio amplification tests (Section 9) shall be performed on any product that offers audio amplification.
- Tests of the auto-power down (APD) function (Section 7.1) shall not be applicable to products subject to 3rd-party performance standards that prohibit APD.

Example: A typical Home Theater in a Box (HTIB) system with an integrated DVD player/recorder and audio amplifiers would be subject to the power mode tests in Section 7, several of the optical disc player tests in Section 6, and the full-spectrum audio amplifier tests in Section 8. In contrast, a stand-alone rack-mount audio amplifier would likely only be subject to the power mode tests in Section 5 and the full-spectrum audio amplifier tests in Section 9.

3 DEFINITIONS

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

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". 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 and Table 2.

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Table 1: Input Power Requirements for Products with Nameplate Rated Power less than or equal to 1500 W

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 %
Japan	100 Vac	+/- 1.0 %	2.0 %	50 Hz/60Hz	+/- 1.0 %

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Table 2: Input Power Requirements for Products with Nameplate Rated Power greater than 1500 W

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 Vac	+/- 4.0 %	5.0 %	60 Hz	+/- 1.0 %
Europe, Australia, New Zealand	230 Vac	+/- 4.0 %	5.0 %	50 Hz	+/- 1.0 %
Japan	100 Vac	+/- 4.0 %	5.0 %	50 Hz/60Hz	+/- 1.0 %

33 C) Ambient Temperature: Ambient temperature shall be from 18 °C to 28 °C.

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

35 **5 TEST CONDUCT**

36 A) As-shipped Condition: Products must be tested in their “as-shipped” configuration. For products that
37 offer a choice of user-configurable options, all options shall be set to their default condition.

38 B) Unit Under Test (UUT) Control: The UUT shall be controlled with the factory-supplied remote control
39 (I/R or RF) to the extent possible. For units that do not ship with a remote control, or for functions that
40 cannot be exercised with the supplied remote control, control interfaces on the face or body of the
41 UUT may be used.

42 C) Measurement Location: All power measurements shall be taken at a point between the ac power
43 source and the UUT.

44 D) Multi-component Systems: For products composed of multiple components in separate housings, all
45 components shall be connected together in a typical end-use configuration. Power shall be measured
46 at each unique plug connection to the power source.

47 E) Signal Input Location: If the UUT does not have accessible signal input terminals, test signal input
48 may be through the device antenna, optical disc player, or other accessible means typical of customer
49 use.

- 50 F) Audio Sources: A 1 kHz sine wave input signal shall be used as the audio source for all amplifier tests
51 in Section 9. For stereo testing, sine wave signals shall be in-phase, with identical frequency.
- 52 G) Video Sources: SD and HD “dynamic broadcast” video content from IEC-62087 Ed. 2.0 shall be used
53 as the video source for optical disc player tests in Section 6.
- 54 H) Option to Test with Only HD Video Sources: If the UUT is found to have negligible differences in
55 power when processing SD and HD video sources, tests with SD video sources may be eliminated,
56 and all testing performed only with HD video sources.
- 57 I) Output Volume: UUT output volume shall be set to minimum for the duration of all tests except as
58 noted in the audio amplifier test procedures in Section 9.
- 59 J) Battery Powered Devices: If the UUT contains rechargeable batteries, or can be integrated with
60 another device that contains rechargeable batteries, all batteries shall be fully charged prior to the
61 start of testing shall remain in place for the duration of testing.
- 62 K) Amplifiers:
- 63 1) For devices with multiple independent audio amplifiers, all amplifiers shall be connected and
64 tested simultaneously.
- 65 2) Products that offer surround sound processing shall be tested in the default surround sound
66 mode.
- 67 L) Speaker Outputs:
- 68 1) If the UUT includes speaker outputs, connect a resistive load across each pair of output terminals
69 equivalent to the minimum nominal rated load impedance (e.g., 6 ohm if rated 6–8 ohm). The
70 same resistive load shall be used for all amplifier tests.
- 71 2) For self-powered or internal speakers with no accessible output terminals, output power must be
72 measured across the speaker input leads, using the attached speaker as the load.
- 73 M) AV Signal Interconnections: If the UUT offers several audio and video interconnection options, select
74 and configure the system with one of the following interconnections, in order of preference: HDMI,
75 component, S-video, and composite.
- 76 N) Networking / Control Protocols: If the UUT offers several networking / control protocol options, each
77 must be active and tested through all phases of the test procedure. Protocols may be either:
- 78 1) configured independently, with testing repeated for each available option; or
- 79 2) configured simultaneously, in order to expedite testing.

80 **6 PRE-TEST UUT INITIALIZATION**

- 81 A) Prior to the start of testing, the UUT shall be initialized as follows:
- 82 1) Set up the UUT per the instructions in the supplied operating manual.
- 83 2) If the UUT includes rechargeable batteries, ensure that all batteries are in a fully-charged state.
- 84 3) Connect the UUT to the power source.

- 85 4) Power on the UUT and perform initial system configuration, as applicable.
- 86 5) Ensure that all audio tone controls are set to mid-level.
- 87 6) Ensure that UUT settings (display brightness, etc.) are in their as-shipped configuration.
- 88 7) Connect the UUT to the signal source and test equipment. The input signal shall comply with the
89 requirements in Section 4.3, above.
- 90 8) Wait for 15 minutes, or until the unit has completed initialization and is ready for use.
- 91 9) Measure and record the ac input voltage and frequency.
- 92 10) Measure and record the test room ambient temperature.

93 **7 TEST PROCEDURES FOR ALL PRODUCTS**

94 The following tests shall be performed on all products.

95 **7.1 Auto Power Down (APD) Function**

- 96 1) Configure the UUT in a typical On Mode, Active State, with APD timing set to the default value.
- 97 2) Stop the UUT from performing any primary functions and turn off any input signal applied to active
98 AV inputs to cause the UUT to APD.
- 99 3) Begin measuring the elapsed time to APD after the product ceases performance of all primary
100 functions due to disconnection of signal.
- 101 4) Measure and record the average power before APD over a 2 minute period.
- 102 5) Allow the UUT to automatically power-down.
- 103 6) Verify that the device is in the expected APD low-power state and record the time to APD.
- 104 7) Measure and record the average power after APD over a 2 minute period.

105 **7.2 Idle State**

- 106 1) Configure the UUT in a typical Sleep Mode or Off Mode operational state.
- 107 2) Press the power button or otherwise switch the unit into an On Mode operational state, such that
108 no active content is playing.
- 109 3) Wait at least 60 seconds.
- 110 4) Measure and record the average power over a 2 minute period.

111 **7.3 Sleep Mode**

- 112 1) Configure the UUT in a typical On Mode operational state.

- 113 2) Switch the UUT into a Sleep Mode low-power operational state.
- 114 3) Measure and record the average power over a 2 minute period.

115 **8 TEST PROCEDURES FOR OPTICAL DISC PLAYERS**

116 The following tests shall be performed on any product capable of playback or recording of audio and/or
117 video on optical disc media (e.g., CD, DVD, Blu-ray Disc). Tests shall be performed with both SD and HD
118 video sources for devices capable of processing both SD and HD content.

119 **8.1 Video Playback Test**

- 120 1) Insert / install the removable media and begin playback of IEC-62087 SD video content.
- 121 2) Measure and record the average power over a 2 minute period.
- 122 3) If the UUT is capable of playing HD content, repeat the test with IEC-62087 HD video content and
123 record the average power over a 2 minute period.

124 **8.2 Video Recording Test**

- 125 1) Insert / install the removable media and begin recording of IEC-62087 SD video content.
- 126 2) Measure and record the average power over a 2 minute period.
- 127 3) If the UUT is capable of recording HD content, repeat the test with IEC-62087 HD video content
128 and record the average power over a 2 minute period.

129 **8.3 Audio Playback Test**

- 130 1) Insert / install the optical disc media with a 1 kHz sine wave signal per Section 5.E) and begin
131 playback.
- 132 2) Measure and record the average power (P_{DISC}) over a 2 minute period.

133 **8.4 Audio Recording Test**

- 134 1) Insert / install the optical disc media and begin recording of a 1 kHz sine wave signal per Section
135 5.E).
- 136 2) Measure and record the average power over a 2 minute period.

137 **9 TEST PROCEDURES FOR PRODUCTS WITH AUDIO** 138 **AMPLIFICATION**

- 139 1) Connect the UUT to the output of the signal generator.
- 140 2) Connect an input of the UUT to a generated 1 kHz sine wave input signal per Section 5.E).

- 141 i) For devices that accept only digital input signals, generate a representation of a 1 kHz sine
142 wave.
- 143 ii) For devices without AV inputs, play back an audio disc with a 1 kHz sine wave signal per
144 Section 8.3.
- 145 iii) If 1 kHz is outside the range of any bandwidth-limited channel in the UUT and the UUT has
146 AV inputs, sweep the input signal frequency between the upper and lower -3 dB points of
147 each channel. Record the input signal frequency when the UUT input power is at its maximum
148 and use this frequency for the bandwidth-limited channel for the remainder of the test.
- 149 3) Monitor each channel, one at a time, with a distortion analyzer and power meter.
- 150 4) Set the volume of the UUT to 100% and adjust the amplitude of the input signal until the THD of
151 any single channel is 1% or greater. For devices without AV inputs that are tested with an audio
152 disc, adjust the volume until the THD of any single channel is 1% or greater.
- 153 5) Identify the channel or channels with the greatest output power. These shall be considered the
154 reference channels and their output power shall be considered the maximum undistorted power
155 (MUP)¹.
- 156 6) Measure and record the input power.
- 157 7) Reduce the input signal amplitude until the output power of the reference channel(s) is at 1/8
158 MUP. For devices without AV inputs that are tested with an audio disc, adjust the volume until the
159 output power of the reference channel(s) is at 1/8 MUP
- 160 8) Measure and record the input power (P_{IN}).
- 161 9) With the reference channel(s) at 1/8 MUP, measure and record the output power for all channels,
162 averaged over a 2 minute period. Record the sum (P_{OUT}) of all output power measurements.

¹ If the UUT performs signal processing such that the amplifier output does not clip, maximum undistorted power shall be obtained by monitoring input signal amplitude and output power simultaneously to identify the point beyond which output power remains constant despite increases in input signal amplitude.