



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 (AV) products. 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 AV products 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 AV 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 AV products.
 - 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 all 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;
 - 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
 - 3) On product packaging/boxes for products sold at retail.
 - 5.1.2. 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;
6. Work with Value Added Resellers (VARs) of Partner's products to help ensure that AV products remain in compliance with ENERGY STAR requirements.
 - 6.1. Any party within the distribution channel of an ENERGY STAR qualified AV product that alters the power profile of a product after its date of manufacture through hardware or software modifications must ensure that the product continues to meet the ENERGY STAR requirements

before delivering this product to the end customer. If the product no longer meets the requirements, it may not bear the ENERGY STAR mark;

- 6.2. If a VAR makes any modifications to an AV product that was previously qualified as ENERGY STAR, re-brands the product, and promotes it as ENERGY STAR, the VAR must become an ENERGY STAR Partner and follow the requirements outlined in this document.

Verifying Ongoing Product Qualification

7. Participate in third-party verification testing through a Certification Body recognized by EPA for AV products.
8. 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

9. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
 - 9.1. Partner must submit the total number of ENERGY STAR qualified AV products 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).
 - 9.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.
 - 9.3. 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;
10. Report to EPA any attempts by laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
11. 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 Audio/Video

Eligibility Criteria Draft Version 2.1

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

3 **1 DEFINITIONS**

4 A) Product Types:

5 1) AV Product: A mains-connected product that offers audio amplification and/or optical disc
6 drive functions. This definition does not include Dedicated Audio DSP Devices.

7 2) Dedicated Audio DSP Device: A device that meets all of the following criteria:

8 a) Provides audio digital signal processing as its primary function.

9 b) Provides support for RS-232, Ethernet, WiFi, IEEE-1394 FireWire or similar protocol for
10 hard-wired or wireless remote control.

11 c) Does not provide audio amplification.

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

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

21 C) Loss of Signal (LOS):

22 1) For audio signals, LOS is defined as:

23 a) Analog inputs: Less than 1 dB above the measured noise floor for 60 seconds.

24 b) HDMI: Receive <Inactive Source> or <Standby> signal over the CEC channel, or [Power
25 Status] of an upstream device goes to "Standby" or "In Transition to Standby" over the
26 CEC channel.

27 c) Other Digital Inputs (e.g., Ethernet): No audio information in the data stream.

28 d) Detectable cable disconnects.

29 2) For video signals, LOS is defined as:

30 a) Analog Inputs: Loss of either the horizontal or vertical sync signal.

31 b) HDMI: Receive <Inactive Source> or <Standby> signal over the Consumer Electronics
32 Control (CEC) channel, or [Power Status] of an upstream device goes to "Standby" or "In
33 Transition to Standby" over the CEC channel; or detection of a disabled TMDS link, a
34 TMDS clock line signal below 22.5 MHz for more than one second, or a TMDS link
35 operating outside of the valid frequency range.

- 36 c) DVI: Detection of a disabled TMDS link, a TMDS clock line signal below 22.5 MHz for
37 more than one second, or a TMDS link operating outside of the valid frequency range.
- 38 d) Other Digital Inputs (e.g., Ethernet): No video information in the data stream.
- 39 e) Detectable cable disconnects.
- 40 D) Primary Function: Any discrete, dynamic device function that can be perceived by an end user,
41 including the delivery or processing of audio/video content, and excluding the following:
- 42 1) Continuous device functions (e.g. clocks, status displays, indicator lamps) ,
- 43 2) Static device functions, such as:
- 44 a) No active audio or video processing or output;
- 45 b) Playback paused or stopped;
- 46 c) No optical disc media in disc drive; or
- 47 d) Waiting in disc menu or other menu for user input.
- 48 E) Operational Modes:
- 49 1) On Mode: Where the product is connected to a mains power source, has been activated and
50 is capable of providing one or more primary functions. The common terms “active”, “in-use”
51 and “normal operation” also describe this mode.
- 52 a) Active State: A state within On Mode in which a product is performing a primary function.
- 53 b) Idle State: A state within On Mode in which a product is not performing a primary function
54 and no content is actively being delivered to the end-user.
- 55 2) Sleep Mode: The common term “standby” may also describe this mode, where the product is
56 connected to a mains power source, is incapable of providing a primary function, and offers
57 one or more of the following user oriented or protective functions which may persist for an
58 indefinite time.
- 59 a) To facilitate the activation of other modes (including activation of On Mode) by remote
60 switch (including remote control), internal sensor, timer;
- 61 b) Continuous function: information or status displays including clocks;
- 62 c) Continuous function: sensor-based functions.
- 63 For purposes of this specification, Sleep Mode is defined as the time when the product is
64 connected to a power source, produces neither sound nor picture, neither transmits nor
65 receives program information and/or data (excluding data transmitted to change the unit’s
66 condition from Sleep Mode to On Mode), and is waiting to be switched to On Mode by a
67 direct or indirect signal from the consumer (e.g., with the remote control).
- 68 3) Off Mode: Where the product is connected to a mains power source, is not providing any On
69 Mode or Sleep Mode functions, and cannot be switched into any other mode except by user
70 actuation of a manual power switch. An indicator that only shows the user that the product is
71 in the off position is included within the classification of an Off Mode.
- 72 F) EPS (External Power Supply): Also referred to as External Power Adapter. A component contained
73 in a separate physical enclosure external to the AV product, designed to convert line voltage AC input
74 from the mains to lesser DC voltage(s) in order to provide power to the AV product. An EPS connects
75 to the AV product via a removable or hard-wired male/female electrical connection, cable, cord or
76 other wiring.
- 77 G) HDMI (High-Definition Multimedia Interface): A compact audio/video interface for transmitting
78 uncompressed digital data.

- 79 1) CEC (Consumer Electronics Control) Protocol: A single-conductor wire or bus technology that
80 is an optional feature in the HDMI specification. CEC is meant to carry IR/remote and/or
81 control commands between HDMI devices that are interconnected.
- 82 H) High Definition Resolution: Video output with resolution greater than 480 lines (480 i/p).
- 83 I) Multi-component System: A product consisting of several components with separate enclosures that
84 are sold as and intended for use as a single system. A "Home Theater in a Box" is an example of a
85 Multi-component System.
- 86 J) Audio Amplifier Type Classifications:
- 87 1) Full-spectrum Amplifier: An amplifier capable of full audible frequency range (20 Hz to 20
88 kHz) output on all channels.
- 89 2) Limited-bandwidth Amplifier: An amplifier limited to less than full audible frequency range (20
90 Hz to 20 kHz) output on one or more channels.
- 91 K) Product Functions:
- 92 1) Audio Amplification: A function by which a device increases the amplitude of an audio signal
93 for purposes of sending the signal to a transducer for playback.
- 94 2) Audio Signal Processing: A function by which a device modifies an audio signal for a purpose
95 other than amplification.
- 96 3) High Resolution Display: A function by which a device converts a video signal into a visual
97 output (e.g., LCD panel, Plasma display panel). This definition does not include Status
98 Displays.
- 99 4) Status Display: A function by which a product provides a visual display of less than 480x234
100 pixel resolution or 5 inches diagonal screen size, including a back-lit alphanumeric clock or
101 channel indicator. This definition does not include single indicator lamps.¹
- 102 5) IP Video Tuner: A function by which a device can play back streaming digital video content
103 packetized or downloaded over an IP network.
- 104 6) Networking / Control Protocol: A function by which a device can connect to a network for
105 transmission and receipt of data. The connection may be wired or wireless (e.g., Wi-Fi,
106 Ethernet, Bluetooth, RS-232, USB).
- 107 7) Optical Disc Player / Recorder: A function by which a device can read and/or write data to
108 removable disk media (e.g., CD, DVD, Blu-ray Disc).
- 109 L) THD (Total Harmonic Distortion): The ratio of the sum of the powers of all harmonic components to
110 the power of the fundamental frequency of a signal.
- 111 M) MUP (Maximum Undistorted Power): The amplifier output power at which the THD of any output
112 channel is 1.0% or greater for a given input.
- 113 N) Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject
114 to the same ENERGY STAR qualification criteria, and (3) of a common basic design. Product models
115 within a family differ from each other according to one or more characteristics or features that either
116 (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2)
117 are specified herein as acceptable variations within a product family. For Audio/Video, acceptable
118 variations within a product family include:
- 119 1) Color, and
- 120 2) Housing

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

121 **2 SCOPE**

122 **2.1 Included Products**

123 2.1.1 Products that meet the definition of an AV Product or Dedicated Audio DSP Device as specified
124 herein are eligible for ENERGY STAR qualification, with the exception of products listed in
125 Section 2.2.

126 **2.2 Excluded Products**

127 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for
128 qualification under this specification. The list of specifications currently in effect can be found at
129 www.energystar.gov/products.

130 2.2.2 The following products are excluded from qualification under this specification.

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

143 **3 QUALIFICATION CRITERIA**

144 **3.1 Significant Digits and Rounding**

145 3.1.1 All calculations shall be carried out with actual measured or observed values. Only the final result
146 of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant
147 digit as expressed in the corresponding specification limit.

148 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact
149 values without any benefit from further rounding.

150 **3.2 General Qualification Criteria**

151 3.2.1 External Power Supply: If the product is shipped with an EPS, the EPS shall meet the level V
152 performance requirements under the International Efficiency Marking Protocol and include the
153 level V marking. Additional information on the Marking Protocol is available at
154 www.energystar.gov/powersupplies.

155 3.2.2 Multi-component Systems: On Mode and Sleep Mode power limits for each power-consuming
156 component in a Multi-component System shall be assessed independently. To qualify for
157 ENERGY STAR, each component shall meet applicable ENERGY STAR criteria.

158 3.2.3 Networking / Control Protocols: To qualify for ENERGY STAR, AV products that offer one or more
159 Networking / Control Protocol options shall meet all applicable ENERGY STAR criteria in all
160 possible control protocol configurations.

161 3.3 Auto Power Down (APD) Requirements

162 3.3.1 APD functionality shall be available on all products except those that are subject to 3rd-party
163 performance standards that prohibit APD, including those used for Mass Notification and
164 Emergency Communications Systems and those subject to proposed ANSI/UL 2572

165 3.3.2 APD functionality shall be enabled by default, with APD timing less than or equal to 2 hours,
166 subject to the following exceptions:

167 i. Products may offer users the option (e.g., via system menu or physical switch) to modify APD
168 timing in 10 minute intervals, or to disable APD entirely.

169 ii. Products may initiate APD immediately upon receipt of authoritative control instruction via an
170 active Networking / Control Protocol.

171 3.3.3 APD Timing Default Settings shall be as follows:

172 i. APD Timing ≤ 30 minutes: This timing option is acceptable for use as a default setting. If
173 APD timing is set by default to no more than 30 minutes and APD cannot be disabled or
174 increased to greater than 30 minutes, products do not have to meet Idle state power
175 requirements.

176 ii. 30 minutes < APD Timing ≤ 2 hours: This timing option is acceptable for use as a default
177 setting. If APD can be disabled, or if APD timing can be increased to no more than 2 hours,
178 products shall meet Idle state power requirements.

179 iii. APD Timing > 2 hours: This timing option may only be enabled by the end user and is not
180 acceptable for use as a default setting. If APD can be disabled, or if APD timing can be set to
181 greater than 2 hours, products shall meet Idle state power requirements.

182 3.4 Sleep Mode Requirements

183 3.4.1 Measured Sleep Mode power (P_{SLEEP}) shall be less than or equal to the Maximum Sleep Mode
184 Power Requirement (P_{SLEEP_MAX}), as calculated per Equation 1.

185 Equation 1: Calculation of Maximum Sleep Mode Power Requirement

186
$$P_{SLEEP_MAX} = P_{SLEEP_BASE} + \sum_{i=1}^n P_{WAKE_i}$$

187 Where:

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

195

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
Each In-use Networking / Control Protocol with Wake Capability ($P_{WAKE\ i}$)	2.0	1.0

197 3.5 On Mode Requirements

- 198 3.5.1 Measured On Mode power (P_{ON}), shall be less than or equal to the Maximum On Mode Power
 199 requirement (P_{ON_MAX}), as calculated per Equation 2, subject to the following requirements:
- 200 i. Where multiple On Mode tests can be performed on a single product (e.g., both playback and
 201 recording tests can be performed on a DVD Player/Recorder), the product shall meet the On
 202 Mode requirements, as calculated per Equation 2, for each test that is performed.
 - 203 ii. Measured On Mode power for optical disc players capable of processing both SD and HD
 204 video content shall be the average of the On Mode power when processing SD content and
 205 the On Mode power when processing HD content, as measured per the test procedure.
 - 206 iii. On Mode power allowances specified in Table 2 shall be applied for each instance of an
 207 applicable product function, with the exception of the optical disc player. Only one optical disc
 208 player allowance may be applied per product.
 - 209 iv. The Networking / Control Protocol On Mode power allowance shall be applied only to active,
 210 in-use networking / control protocols.
 - 211 v. Dedicated Audio DSP Devices are exempt from On Mode power requirements.² Measured
 212 On Mode power must be reported for each product submission.

213 Equation 2: Calculation of Maximum On Mode Power Requirement

$$214 P_{ON_MAX} = \sum_{i=1}^n P_{ON_i}$$

215 Where:

- 216 ▪ P_{ON_MAX} is the Maximum On Mode Power Requirement, in watts
- 217 ▪ P_{ON_i} is the On Mode power allowance for each applicable
 218 product function listed in Table 2, rounded to the nearest
 219 0.1 watts, for a total of n such allowances.

220

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	$P_{ON} = (6.0 \times R) + (0.55 \times A) + 3.0$ <i>Where:</i> <ul style="list-style-type: none"> ▪ <i>R is the display resolution (x * y) in megapixels</i> ▪ <i>A is the viewable screen area in square inches</i> 	
In-use Networking / Control Protocol	2.0	1.0
SD or Audio Source Optical Disc Player: Playback	6.0	TBD
SD or Audio Source Optical Disc Player: Record	16.0	TBD
SD Source to HD Output "Upconversion" Optical Disk Player: Playback	10.0	TBD
HD Source Optical Disc Player: Playback	15.0	TBD
HD Source Optical Disc Player: Record	25.0	TBD

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

229 **3.6 Idle State Requirements**

230 3.6.1 Measured Idle State power (P_{IDLE}), shall be less than or equal to the Maximum Idle State Power
 231 requirement (P_{IDLE_MAX}), as calculated per Equation 3, subject to the following requirements:

232 3.6.2 Products with a default APD timing less than or equal to 30 minutes and that cannot be disabled
 233 or increased to greater than 30 minutes shall be excluded from the requirement.

234 **Equation 3: Calculation of Maximum Idle State Power Requirement**

235
$$P_{IDLE_MAX} = \sum_{i=1}^n P_{IDLE_i}$$

236 *Where:*

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

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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	$(0.10 \times P_{OUT})$	$(0.10 \times P_{OUT})$

243 **3.7 Amplifier Efficiency Requirements**

244 3.7.1 Measured amplifier efficiency (η) of products that offer Audio Amplification, as calculated per
 245 Equation 4, shall be greater than or equal to the On Mode amplifier efficiency requirements
 246 specified in Table 5.

Equation 4: Calculation of Amplifier Efficiency

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

249 *Where:*

- 250 ▪ η is the amplifier efficiency
- 251 ▪ P_{OUT} is the output power at 1/8 MUP with 1 kHz sinusoidal input, in watts
- 252 ▪ P_{IN} is the input power at 1/8 MUP with 1 kHz sinusoidal input, in watts
- 253 ▪ 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

259 **4 TESTING**

260 **4.1 Test Methods**

261 4.1.1 When testing Audio/Video products, the test methods identified in Table 5 shall be used to
 262 determine ENERGY STAR qualification.

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Table 5: Test Methods for ENERGY STAR Qualification

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

265

4.2 Number of Units Required for Testing

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

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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;

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ii. For qualification of a product family, any product configuration within the family may be considered the Representative Model.

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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.

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4.2.3 All tested units shall meet ENERGY STAR qualification requirements.

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4.3 International Market Qualification

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

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5 USER INTERFACE

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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>.

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6 EFFECTIVE DATE

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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.

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Table 6: Specification Effective Dates

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

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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.

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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, SACD, 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 %
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 %

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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 %
China	220 Vac	+/- 4.0 %	5.0 %	50 Hz	+/- 1.0 %
Japan	100 Vac	+/- 4.0 %	5.0 %	50 Hz and 60 Hz	+/- 1.0 %

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

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

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

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

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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.

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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.

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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.

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3) Minimum Frequency Response: 3.0 kHz

- 44 4) Minimum Sampling Frequency: 60 Hz
- 45 5) Minimum Resolution:
- 46 i) 0.01 W for measurement values less than 10 W;
- 47 ii) 0.1 W for measurement values from 10 W to 100 W; and
- 48 iii) 1.0 W for measurement values greater than 100 W.
- 49 F) Measurement Accuracy:
- 50 1) Power measurements with a value greater than or equal to 0.5 W shall be made with an
- 51 uncertainty of less than or equal to 2% at the 95% confidence level.
- 52 2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than
- 53 or equal to 0.01 W at the 95% confidence level.

54 **5 TEST CONDUCT**

- 55 A) As-shipped Condition: Products must be tested in their “as-shipped” configuration. For products that
- 56 offer a choice of user-configurable options, all options shall be set to their default condition.
- 57 B) Unit Under Test (UUT) Control: The UUT shall be controlled with the factory-supplied remote control
- 58 (I/R or RF) to the extent possible. For units that do not ship with a remote control, or for functions that
- 59 cannot be exercised with the supplied remote control, control interfaces on the face or body of the
- 60 UUT may be used.
- 61 C) Measurement Location: All power measurements shall be taken at a point between the ac power
- 62 source and the UUT.
- 63 D) Multi-component Systems: For products composed of multiple components in separate housings, all
- 64 components shall be connected together in a typical end-use configuration. Power shall be measured
- 65 at each unique plug connection to the power source.
- 66 E) Signal Input Location: If the UUT does not have accessible signal input terminals, test signal input
- 67 may be through the device antenna, optical disc player, or other accessible means typical of customer
- 68 use.
- 69 F) Audio Sources: A 1 kHz sine wave input signal shall be used as the audio source for all amplifier tests
- 70 in Section 9. For stereo testing, sine wave signals shall be in-phase, with identical frequency.
- 71 G) Video Sources: SD and HD “dynamic broadcast” video content from IEC-62087 Ed. 2.0 shall be used
- 72 as the video source for optical disc player tests in Section 6.
- 73 H) Option to Test with Only HD Video Sources: If the UUT is found to have negligible differences in
- 74 power when processing SD and HD video sources, tests with SD video sources may be eliminated,
- 75 and all testing performed only with HD video sources.
- 76 I) Output Volume: UUT output volume shall be set to minimum for the duration of all tests except as
- 77 noted in the audio amplifier test procedures in Section 9.

78 J) Battery Powered Devices: If the UUT contains rechargeable batteries, or can be integrated with
79 another device that contains rechargeable batteries, all batteries shall be fully charged prior to the
80 start of testing shall remain in place for the duration of testing.

81 K) Amplifiers:

82 1) For devices with multiple independent audio amplifiers, all amplifiers shall be connected and
83 tested simultaneously.

84 2) Products that offer surround sound processing shall be tested in the default surround sound
85 mode.

86 L) Speaker Outputs:

87 1) If the UUT includes speaker outputs, connect a resistive load across each pair of output terminals
88 equivalent to the minimum nominal rated load impedance (e.g., 6 ohm if rated 6–8 ohm). The
89 same resistive load shall be used for all amplifier tests.

90 2) For self-powered or internal speakers with no accessible output terminals, output power must be
91 measured across the speaker input leads, using the attached speaker as the load.

92 M) AV Signal Interconnections: If the UUT offers several audio and video interconnection options, select
93 and configure the system with one of the following interconnections, in order of preference: HDMI,
94 component, S-video, and composite.

95 N) Networking / Control Protocols: If the UUT offers several networking / control protocol options, each
96 must be active and tested through all phases of the test procedure. Protocols may be either:

97 1) configured independently, with testing repeated for each available option; or

98 2) configured simultaneously, in order to expedite testing.

99 **6 PRE-TEST UUT INITIALIZATION**

100 A) Prior to the start of testing, the UUT shall be initialized as follows:

101 1) Set up the UUT per the instructions in the supplied operating manual.

102 2) If the UUT includes rechargeable batteries, ensure that all batteries are in a fully-charged state.

103 3) Connect the UUT to the power source.

104 4) Power on the UUT and perform initial system configuration, as applicable.

105 5) Ensure that all audio tone controls are set to mid-level.

106 6) Ensure that UUT settings (display brightness, etc.) are in their as-shipped configuration.

107 7) Connect the UUT to the signal source and test equipment. The input signal shall comply with the
108 requirements in Section 4.3, above.

109 8) Wait for 15 minutes, or until the unit has completed initialization and is ready for use.

110 9) Measure and record the ac input voltage and frequency.

111 10) Measure and record the test room ambient temperature.

112 **7 TEST PROCEDURES FOR ALL PRODUCTS**

113 The following tests shall be performed on all products.

114 **7.1 Auto Power Down (APD) Function**

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

124 **7.2 Idle State**

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

130 **7.3 Sleep Mode**

- 131 1) Configure the UUT in a typical On Mode operational state.
- 132 2) Switch the UUT into a Sleep Mode low-power operational state.
- 133 3) Measure and record the average power over a 2 minute period.

134 **8 TEST PROCEDURES FOR OPTICAL DISC PLAYERS**

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

138 **8.1 Video Playback Test**

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

143 **8.2 Video Recording Test**

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

148 **8.3 Audio Playback Test**

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

152 **8.4 Audio Recording Test**

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

156 **9 TEST PROCEDURES FOR PRODUCTS WITH AUDIO** 157 **AMPLIFICATION**

- 158 1) Connect the UUT to the output of the signal generator.
- 159 2) Connect an input of the UUT to a generated 1 kHz sine wave input signal per Section 5.E).
 - 160 i) For devices that accept only digital input signals, generate a representation of a 1 kHz sine
161 wave.
 - 162 ii) For devices without AV inputs, play back an audio disc with a 1 kHz sine wave signal per
163 Section 8.3.

- 164 iii) If 1 kHz is outside the range of any bandwidth-limited channel in the UUT and the UUT has
165 AV inputs, sweep the input signal frequency between the upper and lower -3 dB points of
166 each channel. Record the input signal frequency when the UUT input power is at its maximum
167 and use this frequency for the bandwidth-limited channel for the remainder of the test.
- 168 3) Monitor each channel, one at a time, with a distortion analyzer and power meter.
- 169 4) Set the volume of the UUT to 100% and adjust the amplitude of the input signal until the THD of
170 any single channel is 1% or greater. For devices without AV inputs that are tested with an audio
171 disc, adjust the volume until the THD of any single channel is 1% or greater.
- 172 5) Identify the channel or channels with the greatest output power. These shall be considered the
173 reference channels and their output power shall be considered the maximum undistorted power
174 (MUP)¹.
- 175 6) Measure and record the input power.
- 176 7) Reduce the input signal amplitude until the output power of the reference channel(s) is at 1/8
177 MUP. For devices without AV inputs that are tested with an audio disc, adjust the volume until the
178 output power of the reference channel(s) is at 1/8 MUP
- 179 8) Measure and record the input power (P_{IN}).
- 180 9) With the reference channel(s) at 1/8 MUP, measure and record the output power for all channels,
181 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.