



# ENERGY STAR® Program Requirements Product Specification for Audio/Video

## Eligibility Criteria Draft 1 Version 3.0

1 Following is the Version 3.0 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**

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5 A) AV Product: A mains-connected product that offers audio amplification and/or optical disc drive  
6 functions.

7 **Note**: References to “Dedicated Audio DSP” have been removed from this specification. There does not  
8 appear to be an active market for the ENERGY STAR label for DSPs, since no DSP devices have been  
9 submitted for ENERGY STAR qualification since the release of the Version 2.0 specification.

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

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

19 C) Loss of Signal (LOS):

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

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

22 b) HDMI: Receive <Inactive Source> or <Standby> signal over the CEC channel, or [Power  
23 Status] of an upstream device goes to “Standby” or “In Transition to Standby” over the  
24 CEC channel;

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

26 d) Detectable cable disconnects.

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

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

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

- 34 c) DVI: Detection of a disabled TMDS link, a TMDS clock line signal below 22.5 MHz for  
35 more than one second, or a TMDS link operating outside of the valid frequency range;
- 36 d) Other Digital Inputs (e.g., Ethernet): No video information in the data stream; or
- 37 e) Detectable cable disconnects.

38 D) Primary Function: Any discrete, dynamic device function that can be perceived by an end user,  
39 including the delivery or processing of audio/video content, and excluding the following:

- 40 1) Continuous device functions (e.g. clocks, status displays, indicator lamps),
- 41 2) Static device functions, such as:
- 42 a) No active audio or video processing or output;
- 43 b) Playback paused or stopped;
- 44 c) No optical disc media in disc drive; or
- 45 d) Waiting in disc menu or other menu for user input.

46 E) Operational Modes:

47 1) On Mode: Where the product is connected to a mains power source, has been activated and  
48 is capable of providing one or more primary functions. The common terms “active”, “in-use”  
49 and “normal operation” also describe this mode.

50 a) Active State: A state within On Mode in which a product is performing a primary function.

51 b) Idle State: A state within On Mode in which a product is not performing a primary function  
52 and no content is actively being delivered to the end-user.

53 2) Sleep Mode: Where the product is connected to a mains power source, is incapable of  
54 providing a primary function, and offers one or more of the following user oriented or  
55 protective functions which may persist for an indefinite time. The common term “standby”  
56 may also describe this mode.

57 a) To facilitate the activation of other modes (including activation of On Mode) by remote  
58 switch (including remote control), internal sensor, or timer;

59 b) Continuous function: information or status displays including clocks;

60 c) Continuous function: sensor-based functions.

61 For purposes of this specification, Sleep Mode is defined as the condition where the product  
62 is connected to a power source, produces neither sound nor picture, neither transmits nor  
63 receives program information and/or data (excluding data transmitted to change the unit’s  
64 condition from Sleep Mode to On Mode), and is waiting to be switched to On Mode by a  
65 direct or indirect signal from the consumer (e.g., with the remote control).

66 3) Off Mode: Where the product is connected to a mains power source, is not providing any On  
67 Mode or Sleep Mode functions, and cannot be switched into any other mode except by user  
68 actuation of a manual power switch. An indicator that only shows the user that the product is  
69 in the off position is included within the classification of an Off Mode.

70 **Note:** EPA supports the current draft of IEC 62542, that defines modes of operation for global use,  
71 and intends to adopt the changes therein once that standard has been finalized.

72 F) EPS (External Power Supply): Also referred to as External Power Adapter. A component contained in  
73 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.<sup>1</sup>
- 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

<sup>1</sup> Note that single indicator lamps are not provided power allowances under this specification.

120 2) Housing.

## 121 2 SCOPE

### 122 2.1 Included Products

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

125 **Note:** EPA welcomes stakeholder feedback on whether any new products, or other types of products that  
126 are not already excluded, should be considered under the scope of included products.

### 127 2.2 Excluded Products

128 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for  
129 qualification under this specification. The list of specifications currently in effect can be found at  
130 [www.energystar.gov/specifications](http://www.energystar.gov/specifications).

131 2.2.2 The following products are excluded from qualification under this specification.

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

## 144 3 QUALIFICATION CRITERIA

### 145 3.1 Significant Digits and Rounding

146 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

147 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using directly  
148 measured or calculated values without any benefit from rounding.

149 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR  
150 website shall be rounded to the nearest significant digit as expressed in the corresponding  
151 specification limit.

152 **3.2 General Qualification Criteria**

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

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

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

163 **Note:** EPA is considering requiring CEC implementation for all devices supporting HDMI.  
164 ENERGY STAR would like stakeholders to submit feedback on this proposal.

165 **3.3 Auto Power Down (APD) Requirements**

166 3.3.1 APD functionality shall be available on all products except those that are subject to 3rd-party  
167 performance standards that prohibit APD, including those used for Mass Notification and  
168 Emergency Communications Systems and those subject to ANSI/UL 2572.

169 3.3.2 APD functionality shall be enabled by default, with APD timing less than or equal to 2 hours,  
170 subject to the following exceptions:

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

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

175 3.3.3 APD Timing Default Settings shall be as follows:

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

179 ii. 30 minutes < APD Timing ≤ 2 hours: This timing option is acceptable for use as a default  
180 setting. If APD can be disabled, or if APD timing can be set to greater than 30 minutes,  
181 products shall meet Idle state power requirements.

182 iii. APD Timing > 2 hours: This timing option may only be enabled by the end user and is not  
183 acceptable for use as a default setting. If APD can be disabled, or if APD timing can be set to  
184 greater than 30 minutes, products shall meet Idle state power requirements.

185 **3.4 Sleep Mode Requirements**

186 3.4.1 Measured Sleep Mode power ( $P_{SLEEP}$ ) shall be less than or equal to the Maximum Sleep Mode  
187 Power Requirement ( $P_{SLEEP\_MAX}$ ), as calculated per Equation 1.

188 **Equation 1: Calculation of Maximum Sleep Mode Power Requirement**

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$$P_{SLEEP\_MAX} = P_{SLEEP\_BASE} + \sum_{i=1}^n P_{WAKE\_i}$$

190 *Where:*

- 191 ▪  $P_{SLEEP\_MAX}$  is the Maximum Sleep Mode Power Requirement;
- 192 ▪  $P_{SLEEP\_BASE}$  is the base Sleep Mode power allowance for all  
193 products, as specified in Table 1;

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- $P_{WAKE\_i}$  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.

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**Table 1: Sleep Mode Power Allowances**

Product Function	Sleep Mode Power Allowance (watts)
Base Allowance for All Products ( $P_{SLEEP\_BASE}$ )	1.0
In-use Networking / Control Protocol with Wake Capability ( $P_{WAKE\_i}$ )	1.0

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**Note:** If a product's Idle state meets the Sleep mode power requirements, a distinct and separate sleep mode is not required to be implemented.

201 **3.5 On Mode Requirements**

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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:

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i. 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.

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ii. 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.

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iii. 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.

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iv. The Networking / Control Protocol On Mode power allowance shall be applied only to active, in-use networking / control protocols.

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**Equation 2: Calculation of Maximum On Mode Power Requirement**

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$$P_{ON\_MAX} = P_{ON} + \sum_{i=1}^n P_{ADD\_i}$$

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Where:

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- $P_{ON\_MAX}$  is the Maximum On Mode Power Requirement, in watts
- $P_{ON}$  is the On Mode power base allowance for each applicable product function listed in Table 2, Note: only one  $P_{ON}$  is applicable for each tested function of a product.
- $P_{ADD\_j}$  is the On Mode Power Function Adder for each applicable product function listed in Table 3, rounded to the nearest 0.1 watts, for a total of  $n$  such allowances.

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**Table 2: On Mode Power Base Allowances**

Product Function	On Mode Power Allowance, P <sub>ON</sub> (watts)
SD or Audio Source Optical Disc Player: Playback Test	6.0
SD Source to HD Output "Upconversion" Optical Disk Player: Playback Test	10.0
HD Source Optical Disc Player: Playback Test	10.5

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**Note:** EPA has proposed Version 3.0 On Mode power requirements based on data from the ENERGY STAR qualified product list. EPA is proposing a reduction in the On Mode power allowance for Blu-Ray DVD players from the current limit of 15.0 watts to 10.5 watts. An analysis of EPA's current data set supports a good selection of products from a range of manufacturers that would be available and cost effective at this level. Given the comparatively low market share of ENERGY STAR qualified standard DVD players and their overall decline in the market, EPA is proposing to retain existing requirements for these products at 6.0 watts and 10.0 watts respectively. EPA welcomes feedback on these proposed On Mode power requirements as well as any additional data that stakeholders would like to share.

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EPA has removed the requirements for recording to optical discs. This function is not represented in our dataset nor does EPA feel that the market for this type of function is significant. EPA welcomes feedback on this proposal.

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**Table 3. On Mode Power Function Adders**

Product Function	On Mode Power Allowance, P <sub>ADD_i</sub> (watts)
High Resolution Display	$P_{ON} = (6.0 \times R) + (0.05 \times A) + 3.0$ <i>Where: R is the display resolution (x * y) in megapixels A is the viewable screen area in square inches</i>
In-use Networking / Control Protocol	1.0

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*EXAMPLE: The 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  $[(6 \times 0.112320) + (0.05 \times 20.9) + 3.0] = 4.7$  watts; (2) the HD optical disc player would receive 10.5 watts during playback; and (3) the Ethernet connection would receive 1.0 watts. The On Mode power limit during playback of video content from the disc would be  $4.7 W + 10.5 W + 1.0 W = 16.2$  watts.*

**250 3.6 Idle State Requirements**

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3.6.1 Measured Idle State power (P<sub>IDLE</sub>), shall be less than or equal to the Maximum Idle State Power requirement (P<sub>IDLE\_MAX</sub>), as calculated per Equation 3, subject to the following requirements:

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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.

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

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$$P_{IDLE\_MAX} = \sum_{i=1}^n P_{IDLE\_i}$$

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Where:

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- $P_{IDLE\_MAX}$  is the Maximum Idle State Power Requirement, in watts

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- $P_{IDLE\_i}$  is the Idle State power allowance for each applicable

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product function listed in Table 4, for a total of n such

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allowances.

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**Table 4: Idle State Power Allowances**

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

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**3.7 Amplifier Efficiency Requirements**

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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.

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i. Measured amplifier efficiency ( $\eta$ ) 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 5.

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ii. If the amplifier is tested with an AV input, then  $P_{DISC} = 0$

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**Equation 4: Calculation of Amplifier Efficiency**

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

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Where:

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- $\eta$  is the amplifier efficiency

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- $P_{OUT}$  is the output power at 1/8 MUP with 1 kHz sinusoidal input, in watts

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- $P_{IN}$  is the input power at 1/8 MUP with 1 kHz sinusoidal input, in watts

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- $P_{DISC}$  is the power measured during the audio playback test in the test method for products without AV inputs that must rely on an optical disc player for audio signal input.

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**Table 5: Amplifier Efficiency Requirements**

Amplifier Input Power at 1/8 MUP with 1 kHz Sinusoidal Input, $P_{IN}$ (W)	Version 3.0 Minimum Amplifier Efficiency, $\eta$
$P_{IN} < 20$	TBD
$20 \leq P_{IN} < 100$	TBD
$P_{IN} \geq 100$	TBD

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**Note:** Prior to proposing Amplifier Efficiency requirements in Draft 2, EPA seeks to enhance its dataset for these products such that it is more representative of the market. As such, EPA is assembling non-ENERGY STAR qualified product data. EPA welcomes any new data as well as proposals on how to address the energy use of small amplifiers.

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### 3.8 Toxicity and Recyclability/Recycled Content Requirements

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3.8.1 Audio/Video products shall not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

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**Note:** Consistent with the ENERGY STAR commitment to delivering energy efficiency along with the product features and functions that consumers value, EPA would like to ensure that the ENERGY STAR label is associated only with those products that meet minimum expectations for materials toxicity, recyclability and recycled content where existing standards can be referenced. Adding this type of requirement extends a longstanding ENERGY STAR practice of addressing issues such as mercury in CFLs where existing standards can be leveraged. EPA anticipates that a manufacturer declaration would be required to demonstrate compliance with this requirement along with the maintenance of relevant quality assurance documentation.

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The proposed toxicity requirement and compliance approach are consistent with the European Union RoHS Directive, which also applies to Audio/Video products. The RoHS Directive, formally known as Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment, was amended by 2005/618/EC and went into effect in 2006. Accordingly, products that currently meet the EU RoHS Directive would satisfy this toxicity requirement.

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EPA has not identified any standards that address recyclability and/or including recycled content for this product category and, therefore, seeks additional feedback from stakeholders on whether any existing standards that address recycled content in and/or design for recyclability of products could apply to Audio/Video products.

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## 4 TESTING

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### 4.1 Test Methods

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4.1.1 When testing Audio/Video products, the test methods identified in Table 6 shall be used to determine ENERGY STAR qualification.

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**Table 6. Test Methods for ENERGY STAR Qualification**

Product Type	Test Method
All	ENERGY STAR Test Method for Audio/Video, Rev. Jun-2011
External Power Supply	<i>Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies</i> , Aug. 11, 2004.  (Available for download from <a href="http://www.efficientpowersupplies.org">www.efficientpowersupplies.org</a> ).

317 **4.2 Number of Units Required for Testing**

318 4.2.1 Representative Models shall be selected for testing per the following requirements:

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

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

324 4.2.2 A single unit of each Representative Model shall be selected for testing. If test results for any  
325 operational mode power measurement are within 10% of ENERGY STAR requirements, two  
326 additional units of the same Representative Model with an identical configuration shall be tested.

327 4.2.3 All tested units shall meet ENERGY STAR qualification requirements.

328 **4.3 International Market Qualification**

329 4.3.1 Products shall be tested for qualification at the relevant input voltage/frequency combination for  
330 each market in which they will be sold and promoted as ENERGY STAR.

331 **5 USER INTERFACE**

332 5.1.1 Partners are encouraged to design products in accordance with the user interface standard IEEE  
333 P1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in  
334 Office/Consumer Environments. For details, see <http://eetd.LBL.gov/Controls>.

335 **6 EFFECTIVE DATE**

336 6.1.1 Effective Date: The Version 3.0 ENERGY STAR Audio/Video specification shall take effect on the  
337 dates specified in Table 7.

338 6.1.2 To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in  
339 effect on its date of manufacture. The date of manufacture is specific to each unit and is the date  
340 (e.g., month and year) on which a unit is considered to be completely assembled.

**Table 7. Specification Effective Dates**

<b>Version 3.0</b>
TBD

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343 6.1.3 Future Specification Revisions: EPA reserves the right to change this specification should  
344 technological and/or market changes affect its usefulness to consumers, industry, or the  
345 environment. In keeping with current policy, revisions to the specification are arrived at through  
346 stakeholder discussions. In the event of a specification revision, please note that the ENERGY  
347 STAR qualification is not automatically granted for the life of a product model.