



ENERGY STAR® Program Requirements for Audio/Video

FINAL DRAFT Version 2.0

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ENERGY STAR® Program Requirements for Audio/Video

FINAL DRAFT Version 2.0 Partner Commitments

1 **Commitment**

2 The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the
3 manufacturing of ENERGY STAR qualified Audio/Video (AV) products. The ENERGY STAR Partner
4 must adhere to the following program requirements:

- 5 • comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must
6 be met for use of the ENERGY STAR certification mark on Audio/Video products and specifying
7 the testing criteria for AV products. EPA may, at its discretion, conduct tests on products that are
8 referred to as ENERGY STAR qualified. These products may be obtained on the open market, or
9 voluntarily supplied by Partner at EPA's request;
- 10 • comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR
11 marks and name may be used. Partner is responsible for adhering to these guidelines and for
12 ensuring that its authorized representatives, such as advertising agencies, dealers, and
13 distributors, are also in compliance;
- 14 • qualify at least one ENERGY STAR Audio/Video product within six months of activating a
15 Partnership agreement. When Partner qualifies a product, it must meet the specification in effect
16 at that time;
- 17 • provide clear and consistent labeling of ENERGY STAR qualified AV products. Partner must use
18 the ENERGY STAR mark in all of the following ways:
 - 19 ○ Via permanent or temporary label on the product. All temporary labeling must be affixed
20 to the top/front of product with an adhesive or cling-type application. Partner must
21 comply with guidance for certification marks provided in the ENERGY STAR Identity
22 Guidelines, which can be found at www.energystar.gov/marks.
 - 23 ○ Either in product literature (e.g., user manuals, specification sheets, etc.) or in a separate
24 box insert that provides educational language about the product's ENERGY STAR
25 settings; and
 - 26 ○ On product packaging/boxes for products sold at retail.
 - 27 ○ If additional information about the ENERGY STAR program(s) or other products is
28 provided by the Partner on its Web site, Partner must comply with the ENERGY STAR
29 Web Linking Policy, which can be found at www.energystar.gov/partners.
- 30 • work with Value Added Resellers (VARs) of Partner's products to help ensure that AV products
31 remain in compliance with ENERGY STAR requirements. Any party within the distribution
32 channel of an ENERGY STAR qualified AV product that alters the power profile of a product after
33 its date of manufacture through hardware or software modifications must ensure that the product
34 continues to meet the ENERGY STAR requirements before delivering this product to the end
35 customer. If the product no longer meets the requirements, it may not bear the ENERGY STAR
36 mark.
- 37 • if a VAR makes any modifications to an AV product that was previously qualified under this
38 Version 2.0 specification, re-brands the product, and promotes it as ENERGY STAR, it must
39 become an ENERGY STAR Partner and follow the requirements outlined in this Version 2.0
40 specification.

- provide to EPA, on an annual basis, an updated list of ENERGY STAR qualifying AV products. Once the Partner submits its first list of ENERGY STAR qualified products, the Partner will be listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the list of participating product manufacturers;
- provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total number of ENERGY STAR qualified AV products shipped (in units, by model) or an equivalent measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g., capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year should be submitted to EPA, preferably in electronic format, no later than the following March and may be provided directly from the Partner or through a third party. The 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;
- notify EPA of a change in the designated responsible party or contacts for AV products within 30 days.

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:

- consider energy efficiency improvements in company facilities and pursue the ENERGY STAR mark for buildings;
- 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;
- ensure the power management feature is enabled on all ENERGY STAR qualified monitors 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 product models;
- feature the ENERGY STAR mark(s) on Partner Web site and in other promotional materials. If information concerning ENERGY STAR is provided on the Partner Web site as specified by the ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources section on the ENERGY STAR Web site at www.energystar.gov), EPA may provide links where appropriate to the Partner Web site;
- 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 Web pages, etc. The plan may be as simple as providing a list of planned activities or planned milestones of which the Partner would like EPA to be aware. For example, activities may include: (1) increase the availability of ENERGY STAR labeled products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrate the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) provide information to users (via the Web site and user's manual) about energy-saving features and operating characteristics of

ENERGY STAR qualified products, and (4) build awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event;

- 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.
- join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. SmartWay Transport 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, visit www.epa.gov/grnpower.



ENERGY STAR® Program Requirements for Audio/Video

FINAL DRAFT Version 2.0 Program Requirements

Below is the Version 2.0 product specification for ENERGY STAR qualified audio/video products. A product must meet all of the identified criteria if it is to earn the ENERGY STAR.

1. Definitions

- a) APD (Auto-Power Down): The capability to automatically switch a device from On mode to Sleep mode when all of the following criteria have been met: (1) the device has ceased performance of all primary functions, (2) the last user input has been received (e.g. remote control signal, volume adjustment), and (3) a predetermined period of time (APD timing) has elapsed.

Note: EPA has modified the definition of APD for clarity.

- b) Loss of Signal (LOS):

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

- i) RCA audio inputs: 1 dB or less above the measured noise floor for 60 seconds.
- ii) 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.

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

- i) Composite inputs: 1 dB or less above the measured noise floor for 60 seconds.
- ii) Analog VGA inputs: Loss of either the horizontal or vertical sync signal.
- iii) 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.
- iv) 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

Note: EPA has specified audio and video LOS based on stakeholder feedback. Additional suggestions for further refinement of audio or video LOS definitions are welcome before the specification is finalized. Specifically, is the proposed 1dB above the noise floor / 60 second requirement appropriate to capture the majority of actual LOS situations without negatively affecting the end-user experience?

- c) Primary Function: A primary function is any discrete, dynamic device function that can be perceived by an end user. The delivery of active audio/video content to an end user is considered a primary function.

- 1) Continuous device functions (e.g. clocks, status displays, indicator lamps) are not primary functions.
- 2) Static device functions are not considered to be primary functions. Static functions include, but are not limited to:
 - i) No active audio or video processing or output
 - ii) Playback paused or stopped

- iii) No optical disc media in disc drive
- iv) System waiting in disc menu or other menu for user input

Note: Per stakeholder suggestions, the list of static device functions has been expanded to specify additional device operations which do not constitute primary functions. A product which is performing a static function would be expected to APD per the requirements specified in this document.

d) Operational Modes:¹

- 1) On Mode: Where the product is connected to a mains power source, has been activated and is providing one or more primary functions. The common terms “active”, “in-use” and “normal operation” also describe this mode.
 - i) Active State: A state within On mode in which a product is performing a primary function.
 - ii) 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 not providing a primary function, and offers one or more of the following user oriented or protective functions which may persist for an indefinite time.
 - i) To facilitate the activation of other modes (including activation or deactivation of On mode) by remote switch (including remote control), internal sensor, timer;
 - ii) Continuous function: information or status displays including clocks;
 - iii) 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) Standby Mode: The mode in which the product is connected to the power source, is possibly producing status information or time readout, is waiting to be switched to the active mode, and produces/records no video or audio signal (either directly audible, or audible as reproduced by headphones, loudspeakers, or other transducers). The product may exit the standby mode through an automatic timer activation, direct activation by the user, or a remote control command from the user. In standby mode, the product is substantially shut down but may continue to perform some functions (e.g., remote control sensing and clock).

Note: The Standby mode definition is included for purposes of allowing Consumer AV Products additional time to meet the new Version 2.0 “Tier 2” requirements. This definition is taken directly from the Version 1.0 Audio/DVD specification.

- 4) Off Mode: Where the product is connected to a mains power source and is not providing any On mode or Sleep mode functions, and where the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the classification of an off mode.

Note: EPA has expanded Operational Mode definitions to include additional detail about Power states within On Mode, and to align the Sleep Mode definition with the ENERGY STAR Televisions specification. These definitions are referenced in subsequent product requirements.

¹ Operational mode definitions are derived from IEC 62301

- e) 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 lower DC voltage(s) in order to provide power to the AV product. An EPS must connect to the AV product via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.
- f) 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. CEC is not currently required for HDMI compliance.

Note: In future specification revisions, EPA intends to require devices to have the ability to; (1) expose power state across inter-device connections, (2) issue and receive power control commands across inter-device connections, and (3) make power state changes based on available information. This requirement would extend to other ENERGY STAR labeled products that connect to AV products (e.g. TV's, set top boxes, etc). HDMI CEC is one of several technology options that will be evaluated. EPA intends to work with industry to develop specific guidelines for implementation.

- g) High Definition Resolution: Video output with resolution greater than 480i/p.
- h) 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.
- i) Audio Amplifier Type Classifications:
- 1) Full-spectrum Amplifier: An amplifier capable of full (20 Hz to 20 kHz) audible frequency range output on all channels.
- 2) Limited-bandwidth Amplifier: An amplifier limited to less than full (20Hz to 20 kHz) audible frequency range output on one or more channels.
- j) Audio Amplifier Size Classifications:
- 1) Large Amplifier: Where $P_{IN} > 100 \text{ W}$ (P_{IN} = Input Power @ 1/8 MUP 1kHz Sine Wave)
- 2) Medium Amplifier: Where $20 \text{ W} \leq P_{IN} < 100 \text{ W}$ (P_{IN} = Input Power @ 1/8 MUP 1kHz Sine Wave)
- 3) Small Amplifier: Where $P_{IN} < 20 \text{ W}$ (P_{IN} = Input Power @ 1/8 MUP 1kHz Sine Wave)
- k) Product Classifications:
- 1) AV Product: For purposes of this specification, all products that offer audio amplification and/or optical disc drive functions and do not meet the definition of a Dedicated Audio DSP Device shall be classified as AV Products and subject to the requirements specified in this document.
- 2) Consumer AV Product: Consumer AV Products are intended for sale to individual consumers and include the following: cassette decks, CD players/changers, CD recorders/burners, clock radios, DVD & Blu-ray Disc products, equalizers, laserdisc players, mini- and midi-systems, minidisc players, powered speakers, rack systems, stereo amplifiers/pre-amplifiers, stereo receivers, table radios, and tuners.
- 3) Dedicated Audio DSP Device: A device may be classified as a "Dedicated Audio DSP Device" if it meets all of the following criteria:
- i) Provides audio digital signal processing as its primary function.
- ii) Provides support for RS232 or similar protocol for hard-wired remote control.
- iii) Does not provide audio amplification

Note: The “Consumer AV Product” definition is derived from the Version 1.0 Audio/DVD specification, and is included in this document to allow additional time for products qualified to the Version 1.0 specification to meet Tier 2 Version 2.0 requirements.

Note: Product Classifications have been updated to define product categories that will be subject to unique requirements under this specification. The first definition, for “AV Product” is intended to be the general purpose definition for the majority of products on the market today. A specific exception is noted for Dedicated Audio DSP Devices, since these will be subject to unique requirements under this specification.

l) 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).
- 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. A typical status display would be a back-lit alphanumeric clock or channel indicator. Note that single indicator lamps are not included under the definition of status displays and are not provided power allowances under this specification.

Note: EPA has revised the lower limit for high-resolution displays and added a definition for Status Display per suggestions received from stakeholders.

- 5) IP Networking: A function by which a device can connect to an IP-based network for transmission and receipt of data. The connection may be wired or wireless (e.g. WiFi, Ethernet, Bluetooth).
- 6) 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, and derivatives).
- m) 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.
- n) MUP (Maximum Undistorted Power): A measure of amplifier output power at the point at which the THD of the amplifier is 1% or greater.
- o) UUT (Unit Under Test): The device being tested.

2. Qualifying Products

2.1. Included Products:

A product must meet the definitions provided in Section 1 of this document to be eligible for ENERGY STAR qualification under this specification, with the exception of products identified in Section 2.2.

Note: Note that the term “Consumer AV” refers to those products primarily intended for use in a residential environment, while “Commercial AV” refers to those products primarily intended for commercial or professional applications. The distinction is included for purposes of expanding the breadth of the ENERGY STAR Audio/Video product category in order to (1) allow commercial products that were previously excluded from qualification to immediately qualify for ENERGY STAR, and (2) allow consumer products currently covered under Version 1.0 Audio/DVD ample time to transition to the new efficiency requirements.

Under Tier 1, Consumer AV products will continue to be subject to Version 1.0 Standby mode requirements. Thus, these requirements as well as the testing protocol have been added to this specification.

Excluded Products:

Products that are covered under existing ENERGY STAR product specifications are not eligible for qualification under the Audio/Video specification. The list of specifications currently in effect can be found at www.energystar.gov/products. For example, displays, monitors, lighting, computers, and game consoles cannot qualify as Audio/Video products, since each is subject to qualification criteria under another ENERGY STAR specification.

The following products are excluded from qualification under this specification.

- a) Products which meet the definition of a Display, Television, Set-Top Box (STB), Computer, or Game Console per the definitions in ENERGY STAR requirements for those product categories. Also excluded are products that include an IP video tuner and are sold or provided outside of a dedicated service contract.
- b) Primarily battery-powered products (i.e. MP3 players, portable DVD players, portable gaming systems, etc.)
- c) Products for use in automotive applications
- d) Video projectors
- e) Home and building automation & control products
- f) Whole-house and whole-building audio and/or video systems
- g) Videoconferencing systems
- h) Wireless microphone systems
- i) A/B Selector Switching
- j) Media Server

Note: The ENERGY STAR label is intended for stand-alone products, not customized system installations. There is provision to qualify “products” that are made up of several sub-components in separate enclosures with independent power supplies (i.e. Home Theater in a Box). Products that include an IP video tuner and are sold or provided outside of a dedicated service contract will be considered for inclusion in the next revision of the ENERGY STAR Set-top Box specification.

3. Energy Efficiency Criteria

Products must meet all of the requirements specified below to be eligible for ENERGY STAR qualification under this specification. A summary of these requirements is in Table 1. Products previously eligible for qualification under the Version 1.0 ENERGY STAR Audio/DVD specification are not subject to new qualification requirements until Tier 2 takes effect.

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Table 1: Summary of Energy Efficiency Requirements

<i>Product</i>	<i>Requirements</i>		
	<i>Tier 1 Nov 2009</i>	<i>Tier 2 July 2010</i>	<i>Tier 3 March 2012</i>
Consumer AV Products	<ul style="list-style-type: none"> Standby power consumption limit = 1W 	<ul style="list-style-type: none"> Sleep mode power consumption limits (base, IP networking) Auto Power Down requirements Product function power consumption limits (display, IP networking, optical disc player) Amplifier efficiency requirement (small, medium, and large) Idle power limits for all products if option to disable APD 	<ul style="list-style-type: none"> Sleep mode power consumption limits (base, IP networking) Auto Power Down requirements More stringent product function power consumption limits (display, IP networking, optical disc player) More stringent amplifier efficiency requirement (small, medium, and large) Idle power limits for all products if option to disable APD
Professional and Commercial AV Products	<ul style="list-style-type: none"> Sleep mode power consumption limits (base, IP networking) Auto Power Down requirements (for Digital Signal Processors, this is the only requirement) Product function power consumption limits (display, IP networking, optical disc player) Amplifier efficiency requirement (small, medium, and large) Idle power limits for all products if option to disable APD 		

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305 **3.1. General Qualification Criteria:**

306 a) Mandatory Auto-Power Down: To qualify for ENERGY STAR, all products must offer APD
 307 functionality that is enabled by default. APD timing begins after the last user input has been received
 308 (e.g. control signal, volume adjustment) and when the product ceases performance of all primary
 309 functions. For devices that process audio or video signals from external sources, the presence of a
 310 signal on any active AV input shall constitute performance of a primary function, and APD timing
 311 begins upon loss of signal (LOS) on all active AV inputs. APD must function on all available AV
 312 inputs. Manufacturers may offer users the option (via system menu, DIP-switch, or other means) to
 313 modify APD timing in 30 minute intervals or to disable APD entirely.

314 1) APD ≤ 30 minutes: This timing option is acceptable for use as a default setting. If APD timing is
 315 set to less than or equal to 30 minutes, products do not have to meet Idle state power
 316 consumption requirements.

317 2) 30 minutes > APD < 2 hours: This timing option is acceptable for use as a default setting. If APD
 318 can be disabled, or if APD timing can be set to greater than 30 minutes, products must meet Idle
 319 state power consumption requirements.

320 3) APD ≥ 2 hours: This timing option may only be enabled by the end user and is not acceptable for
 321 use as a default setting. If APD can be disabled, or if APD timing can be set to greater than 2
 322 hours, products must meet Idle state power consumption requirements.

Exception to Mandatory APD Requirements: Products which are subject to 3rd party performance standards that prohibit APD, including those used for Mass Notification and Emergency Communications Systems and subject to proposed ANSI/UL 2572, are exempt from ENERGY STAR APD requirements.

Note: EPA has modified Section 3.1.a to clarify APD timing options and associated Idle power requirements. Note that APD must function on all available AV inputs, although only one input must be tested and verified for purposes of qualification for ENERGY STAR.

- b) Products Sold with an External Power Supply: To qualify for ENERGY STAR, AV products that are sold with an External Power Supply must use either; (1) an EPS that is ENERGY STAR qualified, or (2) an EPS that meets the applicable no-load active mode efficiency levels and power factor requirements provided in the latest version of the ENERGY STAR Program Requirements for Single Voltage External AC-AC and AC-DC Power Supplies. The EPS specification and qualified product list can be found at www.energystar.gov/powersupplies.
- c) Multi-component Systems: On and Sleep mode power consumption limits for each power-consuming component in a Multi-component System shall be assessed independently. To qualify for ENERGY STAR, each component must meet applicable ENERGY STAR criteria.

3.2. Modal Qualification Criteria:

- a) Standby Mode Power Consumption Requirements: The limits specified in Table 2 are the only limits applicable to Consumer AV Products under Tier 1 of this specification. To qualify for ENERGY STAR, the calculated Standby mode power consumption for a product must not exceed the limits in Table 2.

Table 2: Standby Mode Power Consumption Limits

Product	Standby Mode Power Consumption Limit (W) Tier 1 Consumer AV Products ONLY
Consumer AV Products	1.0

Note: Standby mode requirements for Consumer AV products will remain in place under Tier 1 of this specification. Products currently qualified to Version 1.0 ENERGY STAR Audio/DVD will maintain their qualification without action by partners. To qualify new Consumer AV products to ENERGY STAR under Tier 1, manufacturers must test and submit data for Standby power consumption per Section 5.4 of the test procedure in Appendix B.

- b) Sleep Mode Power Consumption Requirements: The limits specified in Table 3 are additive. To qualify for ENERGY STAR, the calculated Sleep mode power consumption for a product must not exceed the sum of the limits for each applicable product function listed in Table 3.

Table 3: Sleep Mode Power Consumption Limits

Product Function	Sleep Mode Power Consumption Limit (W)			
	Tier 1 Consumer AV Products	Tier 1 Commercial AV Products	Tier 2 All Products	Tier 3 All Products
Base Limit (All Products)	N/A	1.0	1.0	
IP Networking	N/A	1.0	1.0	

Note: Based on a recent stakeholder comment, EPA revisited the test data set to review whether an additional 1W Sleep mode power allowance was appropriate for Status Display functionality. The data set does not support an additional 1W, as most products in the data set provide Status Displays and are able to achieve Sleep mode power consumption of less than 1W.

- c) On Mode Power Consumption Requirements: The limits specified in Table 4 are additive, with the exception of the optical disc player limit. Only one optical disc player limit may be added to the On mode power consumption limit calculation for a product. To qualify for ENERGY STAR, power consumption in On mode must not exceed the sum of the limits for each applicable product function listed in Table 4. In the case where multiple On mode tests can be performed on a single product (e.g. both playback and record tests can be performed on a DVD Recorder), the product must meet the On mode requirements specified in Table 4 in each test that is performed. See the requirements flow chart in Appendix A to determine appropriate test and qualification requirements for a particular product.

Note: EPA has included additional guidance regarding how to meet On mode requirements for products that are subject to several On mode tests for a single function. For example, a DVD player will have to perform various playback and recording tests for optical disc players per Section 6 of this document – the device must meet the On mode power consumption requirements specified in Table 4 in each test that is performed.

Exception to On Mode Power Consumption Requirements: Dedicated Audio DSP Devices that meet the definition in Section 1 are exempt from ENERGY STAR On mode power consumption requirements. In order to qualify for ENERGY STAR, these products must meet the Sleep mode power consumption limits in Table 3, must have APD enabled by default, and must meet all other requirements specified in this document. Furthermore, manufacturers must test and report On mode power consumption for all qualifying products. EPA may consider this On mode power consumption data in future evaluations of Audio/Video ENERGY STAR requirements.

Table 4: On Mode Power Consumption Limits

Product Function	On Mode Power Consumption Limit (W)			
	Tier 1 Consumer AV Products	Tier 1 Commercial AV Products	Tier 2 All Products	Tier 3 All Products
High Resolution Display (> 480x234 resolution and 5 inches diagonal)	N/A	$P = 6*(R) + 0.05*(A) + 3$ Where: $R = \text{Display Resolution (x * y)}$ $A = \text{Screen Area}$		
IP Networking	N/A	1.5 W		TBD
Standard Definition (SD) Video and Audio Source Optical Disc Player/Recorder	N/A	6.0 W (Player Only) 16 W (Player/Recorder)		TBD
SD Source to HD Output "Upconversion" Optical Disc Player	N/A	10 W (Player Only) 20 W (Player/Recorder)		TBD
High Definition (HD) Video Source Optical Disc Player/Recorder	N/A	15 W (Player Only) 25 W (Player/Recorder)		TBD

Note: EPA has added a third category to Table 4 for “upconversion” disc players, which process a SD source for output to a HD device. The On mode limits for all optical disc players have also been relaxed from the previous draft based on stakeholder feedback. Because there was limited data on which to based Tier 1 levels, EPA plans to revisit Tier 2 levels to ensure appropriate levels are set.

d) On Mode Audio Amplifier Efficiency Requirements: To qualify for ENERGY STAR, all products that offer Audio Amplification must meet or exceed the On mode amplifier efficiency requirements specified in Table 5.

If no AV inputs are available and the optical disc player is used for audio signal input (per test procedure Section 4.3.a), the power consumption from the optical disc player, as measured in Section 6.3 of the test procedure, may be subtracted from the total measured power consumption of the device for all audio amplifier efficiency calculations.

Note: EPA has added additional clarification for devices that must meet On mode amplifier efficiency requirements but do not offer external signal input terminals for purposes of testing.

Table 5: On Mode Audio Amplifier Efficiency Requirements

Product Function	On Mode Amplifier Efficiency			
	Tier 1 Consumer AV Products	Tier 1 Commercial AV Products	Tier 2 All Products	Tier 3 All Products
Audio Amplification Small Amplifiers ($P_{IN} < 20$ W)	N/A	No Efficiency Requirement		No Efficiency Requirement
Audio Amplification Medium Amplifiers (20 W $\leq P_{IN} < 100$ W)	N/A	Efficiency > 55% Where: $Efficiency = P_{OUT} / (P_{IN} * 0.80)$		TBD
Audio Amplification Large Amplifiers ($P_{IN} \geq 100$ W)	N/A	Efficiency > 55% Where: $Efficiency = P_{OUT} / P_{IN}$		TBD

P_{IN} = Input Power @ 1/8 MUP 1kHz Sine Wave

P_{OUT} = Output Power @ 1/8 MUP 1kHz Sine Wave

Note: Because there is a wide range of usage patterns for products with an amplification function, EPA believes that there are significant benefits to be derived from both on-mode efficiency and APD requirements. The requirements above are the same as those presented in the audio amplification proposal.

e) Idle State Power Consumption Requirements: The limits specified in Table 6 are additive. To qualify for ENERGY STAR, power consumption in Idle state must not exceed the sum of the limits for each applicable product function listed in Table 6.

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Table 6: Idle State Power Consumption Limits

<i>Product Function</i>	<i>Idle State Power Consumption Limit (W)</i>			
	<i>Tier 1 Consumer AV Products</i>	<i>Tier 1 Commercial AV Products</i>	<i>Tier 2 All Products</i>	<i>Tier 3 All Products</i>
Base Limit (All Products)	N/A	5.0 W		
Audio Amplification	N/A	$P = (0.10 * P_{OUT})$ or 5 W, whichever is greater <i>Where:</i> P_{OUT} = Output Power @ 1/8 MUP 1kHz Sine Wave		

Note: Based on test data received to date, EPA assumes that the overhead required to operate a product with amplifier circuitry turned off is approximately 10% of the power required to operate with a 1/8 MUP sine wave input signal. The defined limits for amplifier Idle power have been updated to be based on amplifier output power, rather than mains input power, to avoid penalizing higher-efficiency amplifiers.

4. Testing

Partners are required to perform tests and self-certify those products that meet the ENERGY STAR guidelines. The test results must be reported to the EPA using the Audio/Video Qualifying Product Information (QPI) Form or Online Product Submission (OPS) Tool. Test results must be included with the product submission. All testing shall be performed per the ENERGY STAR Audio/Video test procedure included as Appendix B of this document.

5. User Interface

Although not mandatory, manufacturers are strongly recommended to design products in accordance with IEEE 1621 "Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments." Compliance with IEEE 1621 will make power controls more consistent and intuitive across all electronic devices. For more information on the standard, visit <http://eetd.lbl.gov/controls>.

6. Effective Date

The date that products must meet the requirements specified under the Version 2.0 Audio/Video specification will be defined as the effective date of the agreement. Any previously executed agreement on the subject of ENERGY STAR qualified Audio/DVD products shall be terminated effective November 16, 2009 for products eligible under the Version 1.0 Program Requirements for Audio/DVD Products.

a) Qualifying and Marking products under the Tier 1 Version 2.0 specification: Effective dates for Tier 1 Version 2.0 ENERGY STAR Program Requirements for Audio/Video are listed in Table 7. Note that the requirements for Consumer AV Products originally eligible for qualification under the Version 1.0 ENERGY STAR Audio/DVD specification have been transferred into this specification for the Tier 1 timeframe. Commercial AV products must meet the new applicable Tier 1 requirements specified in the main body of this document in order to qualify for ENERGY STAR.

All products with a date of manufacture on or after the applicable Tier 1 Version 2.0 effective date must meet Tier 1 Version 2.0 requirements in order to qualify for ENERGY STAR (including additional shipments of products originally qualified under Version 1.0). 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.

b) Qualifying and Marking products under the Tier 2 Version 2.0 specification: Effective dates for Tier 2 Version 2.0 ENERGY STAR Program Requirements for Audio/Video are listed in Table 7. All products with a date of manufacture on or after the applicable Tier 2 Version 2.0 effective date must meet the Tier 2 Version 2.0 requirements in order to qualify for ENERGY STAR. 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.

c) Qualifying and Marking products under the Tier 3 Version 2.0 specification: Effective dates for Tier 3 Version 2.0 ENERGY STAR Program Requirements for Audio/Video are listed in Table 7. All products with a date of manufacture on or after the applicable Tier 3 Version 2.0 effective date must meet the Tier 3 Version 2.0 requirements in order to qualify for ENERGY STAR. 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 7: Version 2.0 Specification Effective Dates

<i>Audio/Video Product</i>	<i>Tier 1 Version 2.0 Effective Date</i>	<i>Tier 2 Version 2.0 Effective Date</i>	<i>Tier 3 Version 2.0 Effective Date</i>
All Products	November 16, 2009	July 30, 2010	March 30, 2012

Note: EPA has incorporated the Audio/DVD Version 1.0 requirements into this document under the tier 1 requirements for consumer AV products. This is to ensure the 9-month transition period for product types previously eligible under the Version 1.0 Audio/DVD specification.

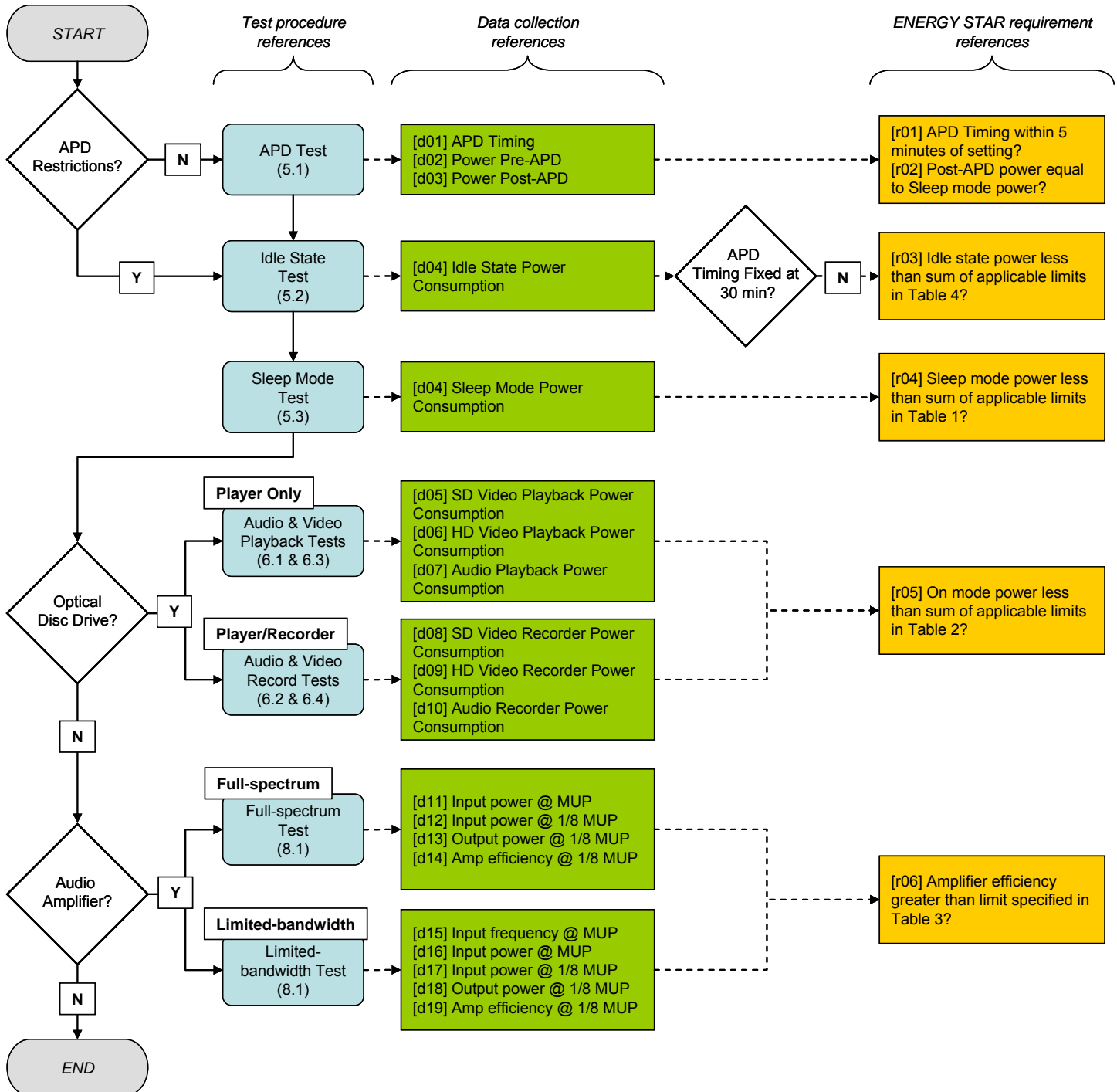
d) Elimination of Grandfathering: EPA will not allow grandfathering under this Version 2.0 ENERGY STAR specification. ENERGY STAR qualification under Version 1.0 is not automatically granted for the life of the product model. Therefore, any product sold, marketed, or identified by the manufacturing Partner as ENERGY STAR must meet the specification in effect at the time of manufacture of the product.

7. Future Specification Revisions

EPA reserves the right to revise the specification should technological and/or market changes affect its usefulness to consumers or industry or its impact on the environment. In keeping with current policy, revisions to the specification will be discussed with stakeholders. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model. Any product sold, marketed, or identified by the manufacturing Partner as ENERGY STAR must meet the program requirements in effect on the date of manufacture of the product.

APPENDIX A: Audio/Video Version 2.0 Requirements Flow Chart (Not Applicable to Tier 1 Consumer AV Products)

Note: This flow chart is provided as a visual aid only and should not be used in place of the full requirements specification. In the event of a discrepancy between this flow chart and the primary document, the requirements specified in the primary document shall prevail.



APPENDIX B: ENERGY STAR Test Procedure for Audio/Video Products

1. Overview

The following protocol should be followed when measuring power consumption levels of audio/video products for compliance with the levels provided in the ENERGY STAR Version 2.0 Audio/Video Specification.

2. Applicability

Partners must test products in their “as-shipped” configuration. For products that offer a choice of user-configurable options, all options shall be set to their default condition. EPA has prepared the following guidelines for testing of Audio/Video products:

- a) Power mode tests described in Section 5 shall be performed on every product,
- b) Optical media player tests (Section 6) 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
- c) Full-spectrum audio amplifier tests (Section 7) shall be performed on any product that offers one- or two-channel audio amplification.
- d) Limited-bandwidth audio amplifier tests (Section 8) shall be performed on any product that offers surround sound multi-channel audio amplification. Products that offer surround sound processing shall be tested in the default surround sound mode.

Under these guidelines, a HTIB system with an integrated DVD player/recorder and audio amplifiers would likely be subject to the power mode tests in Section 5, 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 7. See the requirements flow chart in Appendix A to determine appropriate test and qualification requirements for a particular product.

Note that Partners who wish to qualify Consumer AV products to Tier 1 requirements need only perform the Standby mode tests in Section 5.4 of this test procedure. After the Tier 2 Version 2.0 specification becomes effective, all products must be tested to

3. Definitions

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the Version 2.0 ENERGY STAR Eligibility Criteria for Audio/Video Products.

4. Test Setup

Test setup and instrumentation shall be in accordance with the requirements of IEC 62301, Ed. 1.0, “Measurement of Household Appliance Standby Power”, Section 4, “General Conditions for Measurements”, unless otherwise noted in this document. In the event of conflicting requirements, this test procedure shall take precedence. The setup and instrumentation requirements from IEC 62301, Ed. 1.0, Section 4 are applicable to both On and Sleep mode testing for ENERGY STAR.

4.1. Calibration

All test equipment shall be annually calibrated by a laboratory accredited to ISO/IEC 17025:2005 by an ILAC recognized accreditation body.

4.2. Power Measurement Test Conditions

- a) Measurement Location: All power measurements shall be taken at a point between the AC mains power source and the UUT.

- b) Component-level Measurement: For multi-component systems (e.g. a home theater system may include a receiver, powered subwoofer, and wireless speakers); all components shall be connected together in a typical end-use configuration. Components may be tested simultaneously, but each power-consuming device must be metered separately – power consumption must be measured at each plug connection to mains power.

4.3. Source Signals

- a) Signal Input Location: If the UUT does not have accessible signal input terminals, test signal input may be through the device antenna, optical disc player, or other accessible means typical of customer use.
- b) Audio Sources: A 1 kHz sine wave input signal shall be used as the audio source for all amplifier tests in Sections 7 and 8. For stereo testing, sine wave signals shall be in-phase, with identical frequency.
- c) Video Sources: SD and HD video content from IEC-62087 shall be used as the video source for optical disc player tests in Section 6.
- d) Option to Test with Only HD Video Sources: The video test procedures in Section 6 are to be performed with both SD and HD video sources for devices capable of processing both SD and HD content. The reported power consumption for the UUT is the average of the power consumption measurements from the SD and HD video source tests. This average is intended to reward devices that can scale back power consumption when processing SD video signals.
- If the UUT is found to have negligible differences in power consumption when processing SD versus HD sources, the manufacturer may choose to perform and report results from only HD tests, in order to expedite testing.

4.4. UUT Operation

- a) UUT Control: The UUT shall be controlled with the factory-supplied remote control (I/R or RF) to the extent possible. For units that do not ship with a remote control, or for functions that cannot be accessed from the supplied remote control, control interfaces on the face or body of the UUT may be used.
- b) Output Volume: The UUT output volume should be set to minimum for the duration of all tests except as noted in the audio amplifier test procedures in Sections 7 & 8.
- c) Battery Powered Devices: If the UUT contains rechargeable batteries, or can be integrated with another device that contains rechargeable batteries, all batteries should be in a fully charged state for the duration of testing.

4.5. UUT Pre-test Configuration

Prior to the start of testing, the UUT shall be configured as follows:

- 1) Set up the UUT per the instructions in the supplied operating manual. If several audio and video interconnections are available, select and configure the system with one of the following interconnections, in order of preference: HDMI, component, S-video, and composite.

Note: Per conversations with stakeholders, EPA has included further detail about UUT setup requirements for systems that offer several options for audio/video interconnection. Note that the test procedure for APD requires APD to be verified using the interconnection option selected in 4.5.1, though APD is required to function on all available AV inputs.

- 2) If the UUT includes speaker outputs, connect a resistive load across each pair of output terminals equivalent to the nominal rated load impedance or lowest impedance of the rated impedance range. (e.g. 6 ohm if rated 6-8 ohm). The same resistive load must be used for all amplifier tests.
- a) For self-powered or internal speakers with no accessible output terminals, output power shall be measured across the speaker input leads, using the attached speaker as a resistive load.

- 561 3) Connect the UUT to the power source.
- 562 4) Power on the UUT and perform initial system configuration, as applicable.
- 563 a) Disable any wireless networking functionality (WiFi), unless wireless networking is the UUT's
- 564 primary means of accessing a network.
- 565 b) Ensure that all audio tone controls are set to mid-level.
- 566 c) Ensure that UUT components (display brightness, etc.) are in their as-shipped configuration.
- 567 5) Connect the UUT to the signal source. The input signal shall comply with the requirements in
- 568 Section 4.4, above.
- 569 6) Let the UUT sit for at least 15 minutes, or until the unit has completed initialization and is ready for
- 570 use.
- 571 7) Measure & record the AC mains input voltage and frequency.
- 572 8) Measure & record the test room ambient temperature.

573 5. Test Procedures for All Products

574 The following tests shall be performed on all Audio/Video products².

575 5.1. Auto Power-down (APD) Function

- 576 1) Configure the UUT in a typical On mode operational state, with APD timing set to the default value,
- 577 or 30 minutes.
- 578 2) Stop the UUT from performing any primary functions and turn off any input signal applied to the
- 579 active AV input.
- 580 3) Measure & record the average power consumption before APD over a 2-minute period.
- 581 4) Allow the UUT to automatically power-down. Record the time elapsed before the APD event.
- 582 Verify that the elapsed time is within 5 minutes of the default APD timing value.
- 583 5) Verify that the device is in the expected APD low-power state.
- 584 6) Measure & record the average power consumption after APD over a 2-minute period.

585 **Note:** The APD test procedure has been revised to reflect recent changes to APD timing options, and to

586 include verification of APD timing.

587 5.2. Idle State

- 588 1) Configure the UUT in a typical Sleep or Off mode operational state.
- 589 2) Press the Power button to bring the unit into an On mode operational state, such that no active
- 590 content is playing.
- 591 3) Wait 60 seconds.
- 592 4) Measure & record the average power consumption over a 2-minute period.

593 **Note:** The Idle state test procedure has been revised to include a 60-second delay before performing

594 power measurements, to allow time for the product to manage power consumption of internal high-power

595 devices.

² NOTE: The APD test (5.1) is not required for products that are not required to offer an APD function. The Sleep Mode test (5.3) is not required for products that do not offer a Sleep mode.

5.3. Sleep Mode

- 1) Configure the UUT in a typical On mode operational state.
- 2) Press the Power button to bring the unit into a Sleep mode low-power operational state.
- 3) Measure & record the average power consumption over a 2-minute period.

5.4 Standby Mode

**** ONLY APPLICABLE TO CONSUMER AV PRODUCTS FOR TIER 1 ****

- 1) Power on all test equipment and properly adjust operation range
- 2) Connect the test equipment and unit under test.
- 3) Check for normal operation of the test unit and leave all customer adjustment to factory default settings.
- 4) Bring the test unit into Standby mode (not Off mode) either by using the remote control device or by using the ON/OFF switch on the test unit cabinet.
- 5) Either verify that the wall outlet power is within specifications or adjust the AC power source output to Voltage: $115 \text{ Vrms} \pm 3 \text{ Vrms}$, Frequency: $60\text{Hz} \pm 3\text{Hz}$.
- 6) Set the power meter current range. The full-scale value selected multiplied by the crest factor rating ($I_{\text{peak}}/I_{\text{rms}}$) of the meter must be greater than the peak current reading from the oscilloscope.
- 7) After the unit under test reaches operating temperature and the readings on the power meter stabilize (approximately 90 minutes), take the true power reading in watts from the power meter.
- 8) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value to within a +10% - 0% error. If the device has different standby modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive mode. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

Note: The Standby mode test procedure is equivalent to the test procedure in the Version 1.0 ENERGY STAR Audio/DVD specification.

6. Test Procedures for Optical Disc Players

The following tests shall be performed on any product capable of playback or recording of audio and/or video stored on optical disc media (e.g. CD, DVD, Blu-ray Disc).

6.1. Video Playback Test

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

6.2. Video Recording Test

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

6.3. Audio Playback Test

- 1) Insert / install the optical disc media and begin playback of a pink noise signal per section 4.3.b.

636 2) Measure & record the average power consumption over a 2-minute period.

637 **6.4. Audio Recording Test**

638 1) Insert / install the optical disc media and begin recording of a pink noise signal per section 4.3.b.

639 2) Measure & record the average power consumption over a 2-minute period.

640 **7. Test Procedures for Full-spectrum Audio Amplifiers**

641 The following tests shall be performed on any product that contains one or more full-spectrum audio
642 power amplifiers.

643 **7.1. Active State Test**

644 1) Connect the UUT to the output of the signal generator. For devices with multiple independent audio
645 amplifiers, all amplifiers should be connected and tested simultaneously.

646 2) Generate a 1 kHz sine wave input signal per Section 4.3.b. For devices that accept only digital
647 input signals, generate an appropriate representation of a 1 kHz sine wave.

648 3) Monitor each channel, one at a time, with a distortion analyzer and power meter.

649 4) Set the volume of the UUT to 100% and adjust the amplitude of the input signal until the THD of
650 any single channel is 1% or greater. This shall be considered the maximum undistorted power
651 (MUP)³ of the channel, and this channel shall be considered the reference channel for testing.

652 5) Measure & record the mains input power.

653 6) Reduce the sine wave input signal amplitude until the output power of the reference channel is at
654 1/8th MUP.

655 7) Measure & record the mains input power.

656 8) With the reference channel at 1/8th MUP, measure and record the output power for all channels,
657 averaged over a 2-minute period. Record the sum of all the output power measurements.

658 **8. Test Procedures for Limited-bandwidth Audio Amplifiers**

659 The following tests shall be performed on any product that contains a limited-bandwidth audio power
660 amplifier, including surround sound amplifiers.

661 **8.1. Active State Test**

662 1) Connect the UUT to the output of the signal generator.

663 2) Generate a 1 kHz sine wave input signal per Section 4.3.b. For devices that accept only digital
664 input signals, generate an appropriate representation of a 1 kHz sine wave. If 1 kHz is outside the
665 range of any bandwidth-limited channel in the UUT, sweep the input signal frequency between the
666 upper and lower -3 dB response points of the channel. Record the input signal frequency when the
667 UUT input power is at its maximum.

668 3) Using the input signal frequency determined for each channel in 8.1.2, monitor each channel, one
669 at a time, with a distortion analyzer and power meter.

670 4) Set the volume of the UUT to 100% and adjust the amplitude of the input signal until the THD of the
671 output is 1% or greater. Record the output power measured on each channel at 1% THD. This shall
672 be considered the maximum undistorted power (MUP) of the selected channel.

673 5) Measure & record the mains input power.

³ If the UUT performs signal processing such that the amplifier output does not clip at 1% THD, maximum undistorted power shall be obtained by monitoring input signal amplitude and output power simultaneously to identify the point at which input signal amplitude is increased and output power remains constant.

- 674 6) Determine which channel created the highest power draw in 8.1.3. This channel shall be
675 considered the reference channel for testing.
- 676 7) Reduce the sine wave input signal amplitude until the output power of the reference channel is at
677 1/8th MUP.
- 678 8) Measure & record the mains input power.
- 679 9) With the reference channel at 1/8th MUP, measure and record the output power for all channels,
680 averaged over a 2-minute period. Record the sum of all the output power measurements.