ENERGY STAR® Program Requirements for Audio/Video

Version 2.0 DRAFT 1

Table of Contents

ENERGY STAR® Program Requirements for Audio/Video

Version 2.0 DRAFT 1 Partner Commitments

Commitment

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

- comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must be met for use of the ENERGY STAR certification mark on Audio/Video products and specifying the testing criteria for AV products. EPA may, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at EPA's request;
- comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR marks and name may be used. Partner is responsible for adhering to these guidelines and for ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance;
- qualify at least one ENERGY STAR Audio/Video product within six months of activating a Partnership agreement. When Partner qualifies a product, it must meet the specification in effect at that time;
- provide clear and consistent labeling of ENERGY STAR qualified AV products. Partner must use the ENERGY STAR mark in all of the following ways:
    - Via permanent or temporary label on the product. All temporary labeling must be affixed to the top/front of product with an adhesive or cling-type application. Partner must comply with guidance for certification marks provided in the ENERGY STAR Identity Guidelines, which can be found at www.energystar.gov/marks.
    - 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
    - On product packaging/boxes for products sold at retail.
    - If additional information about the ENERGY STAR program(s) or other products is provided by the Partner on its Web site, Partner must comply with the ENERGY STAR Web Linking Policy, which can be found at www.energystar.gov/partners.
- work with Value Added Resellers (VARs) of Partner's products to help ensure that AV products remain in compliance with ENERGY STAR requirements. 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.
- if a VAR makes any modifications to an AV product that was previously qualified under this Version 2.0 specification, re-brands the product, and promotes it as ENERGY STAR, it must become an ENERGY STAR Partner and follow the requirements outlined in this Version 2.0 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 that Partner would like EPA to be aware of. 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.

1. Definitions

a) APD (Auto-Power Down): The capability to automatically switch a device or component from ON mode to SLEEP mode after a period of time without user input, generally based on the amount of time the component has remained idle from last active use while not performing a primary function, i.e., user input such as channel change, volume change, menu access, etc.

Note: The definition for APD has been revised since the Specification Framework Document to include the text "while not performing a primary function". This is in response to stakeholder feedback that many AV products, such as emergency PA systems or audio amplifiers for background music in retail outlets, remain on for long periods of time without user intervention. A requirement for APD on these devices would be in conflict with their intended application.

b) 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) for the purpose of powering the AV product. An external power adapter must connect to the AV product via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.

c) Functional Adder: A functional adder is a product feature that adds functionality to the basic capability of a product. The Operational Mode portion of this specification contains additional power allowances for certain functional adders.

d) 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.

e) High Definition Resolution: Video output with resolution greater than 480i/p.

f) Operational Modes:[1]

Note: EPA is interested in stakeholder feedback regarding power modes. Specifically, are there additional power modes or additional product functions within the specified modes that need to be considered? For example, do any products download content from the internet as a background process? If so, when does this occur, for how long, and how frequently? How much power is required to provide this functionality?

1) ON Mode: Where the product is connected to a mains power source, has been activated and is providing one or more of its principal functions. The common terms "active", "in-use" and "normal operation" also describe this mode.

[1] Operational mode definitions are derived from IEC 62301Ed. 2.0

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 principal 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.

Note: EPA understands from conversations with stakeholders that AV products use a variety of control mechanisms (infrared, RF, RS-232 hardwire, etc.) to remotely activate products out of SLEEP mode, and that these features require varying amounts of power to operate. EPA is interested in stakeholder feedback about the types of remote control used in the industry and the power consumption characteristics of each.

3) 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.

g) Product Classifications:

1) Commercial Product: Any AV product manufactured primarily for use in a public or commercial setting. Typical markets for Commercial AV products include: Schools and universities, government, military, office, healthcare, legal, retail, museums, churches, sports arenas, entertainment, and transportation. A commercial product has at least @@ of the following characteristics: TBD.

2) Residential Product: Any AV product manufactured primarily for use in a private residence for personal rather than commercial purposes. For purposes of this specification, any product that does not meet the definition of a commercial product shall be considered a residential product.

Note: In order to explicitly categorize products as “Residential” or “Commercial” for purposes of ENERGY STAR qualification, EPA will need to identify a discrete set of characteristics specific to commercial products. EPA is interested in input from manufacturers as to an appropriate set of characteristics.

h) 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 reasons other than amplification.

Note: EPA received suggestions from stakeholders to consider combining Audio Signal Processing & Video Signal Processing into a single “Signal Processing” function, since AV signals often include audio and video content in the same stream. EPA is interested in additional stakeholder feedback on this suggestion.

3) Audio Tuner: A function by which a device receives and decodes broadcast audio signals and delivers them to a speaker and/or recording device. Broadcast signals may be from over-the-air (OTA) terrestrial or satellite sources.

4) Data Storage: A function by which a device can read and/or write data to integrated, on-board memory (e.g. Hard disk drive, Flash memory).

5) High Resolution Display: A function by which a device converts a video signal of at least TBD dots per inch (dpi) resolution into a visual output (e.g. backlit LCD panel, Plasma display panel). Any displays less than TBD dpi resolution are considered Status Displays for purposes of this specification.

6) Indicator Light: A function by which a device indicates power mode or other binary status via an LED or other lamp.

7) Network Connectivity: A function by which a device can connect to an IP-based network for transmission and receipt of data. The connection may be wired (e.g. Ethernet, Power-line), or wireless (e.g. WiFi, Bluetooth, Wireless HDMI, Wireless Audio Distribution).

8) Optical Media Drive: A function by which a device can read and/or write data to removable disk media (e.g. CD, CD-R, CD-RW, DVD, DVD-R, Blu-ray Disc).

9) Other Removable Media Drive: A function by which a device can read and/or write data to removable solid state media (e.g. USB Flash drive, Card reader).

10) Remote Control: A function by which a product can receive control signals from a handheld device (e.g. radio frequency (RF), infrared (IR)).

11) Status Display: A function by which a device converts an electronic signal into a visual status indicator (e.g. LCD character or numeric displays).

12) Video Camera: A function by which a device records moving images and converts them into electronic form.

13) Video Signal Processing: A function by which a device modifies a video signal.

i) TEC (Typical Energy Consumption): A method of testing and comparing the energy performance of AV products in normal operation over a specified time period. In this specification, efficiency criteria are noted in terms of calculated energy use over a year for a typical user (kWh/yr) rather than power (Watts) for ON and SLEEP modes.

j) 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.

k) UUT (Unit Under Test): The device being tested.

2. Qualifying Products

2.1. Included Products:

Products covered under this specification include commercial and residential AV products as defined in Section 1.G of this document.

2.2. Excluded Products:

Products which 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.

b) Primarily battery-powered products

c) Products for use in automotive applications

d) Video projectors

e) Home automation & control products

Note: Video projectors and control systems are not covered by existing ENERGY STAR specifications, nor does EPA have enough information at this time to include these products in the list of qualifying products for this Draft 1 Version 2.0 AV specification. Several stakeholders have expressed to EPA that there is significant opportunity for energy savings for video projectors and control systems. If data can be provided to demonstrate potential energy savings, and if suitable test procedures are made available, EPA will consider including these products in the Version 2.0 or subsequent ENERGY STAR specifications.

3. Energy Efficiency Criteria

3.1. General Qualification Criteria:

a) Mandatory Auto-Power Down: To qualify for ENERGY STAR, AV products must offer APD functionality that is enabled by default.

Note: The proposed mandatory APD requirement is intended to promote power down of components that are not in use, in order to minimize the net power consumption of the AV product. EPA will consider exceptions to this requirement for specific products.

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.

3.2. Modal Qualification Criteria:

Note: EPA plans to implement modal qualification criteria for both residential and commercial products. EPA believes the most significant energy savings will be achieved through the broad implementation of APD functionality and by setting limits on both ON mode and SLEEP mode power consumption. EPA will determine whether APD, ON mode, and SLEEP mode requirements are appropriate for specific products based on product data and feedback received from stakeholders.

EPA is still open to considering a TEC approach for products that are in the ON mode a significant percentage of the time and that follow a consistent and predictable duty cycle. Stakeholders are encouraged to provide feedback regarding which products might be appropriate to consider for TEC. For an example of TEC in the ENERGY STAR program, see Section 4 of the *ENERGY STAR® Program Requirements for Set-top Boxes Version 2.0*

a) SLEEP Mode Power Allowance: To qualify for ENERGY STAR, SLEEP mode power consumption must not exceed the SLEEP mode power allowance listed in Table 2:

Table 1: SLEEP Mode Power Allowance

Power Mode	*Power Allowance (W)*
SLEEP	TBD

b) ON Mode Power Allowance: To qualify for ENERGY STAR, the calculated ON mode power consumption for a product must not exceed the sum of the power allowances for each applicable product feature listed in Table 3. ON mode power allowances may not be applicable to every product feature.

Table 2: ON Mode Power Allowance

Product Feature	*Tier 1 ON Mode Power Allowance (W)*	*Tier 2 ON Mode Power Allowance (W)*
Audio Amplification	TBD	TBD
Audio Signal Processing	TBD	TBD
Audio Tuner	TBD	TBD
Data Storage	TBD	TBD
High Resolution Display	TBD	TBD
Indicator Light	TBD	TBD
Wired Networking	TBD	TBD
Wireless Networking	TBD	TBD
Optical Disc Drive	TBD	TBD
Other Removable Media Drive	TBD	TBD
Remote Control	TBD	TBD
Status Display	TBD	TBD
Video Camera	TBD	TBD
Video Signal Processing	TBD	TBD

4. Testing

All testing shall be performed per the ENERGY STAR Audio/Video test procedure included as Appendix A 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.llb.gov/controls.

6. Effective Date

The date that Partners may begin to qualify products for Energy Star, 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 TBD. The Tier 1 Version 2.0 ENERGY STAR Program Requirements for Audio/Video products will be effective TBD. Tier 2 Version 2.0 requirements are planned to become effective TBD.

a) Qualifying and Marking products under the Tier 1 Version 2.0 specification: All products, including models originally qualified under Version 1.0, with a date of manufacture on or after TBD, must meet Tier 1 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 and available for sale.

b) Qualifying and Marking products under the Tier 2 Version 2.0 specification: All products, including models originally qualified under Tier 1 Version 2.0, with a date of manufacture on or after TBD, must meet the Tier 2 Version 2.0 requirements in order to qualify for ENERGY STAR.

c) 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 current 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 at the time of manufacture of the product.

APPENDIX A:
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 measure a representative sample of the configuration as shipped to the customer. EPA has prepared the following guidelines for testing of Audio/Video products:

a) Power mode tests described in Section 3 should be performed on every product,

b) Video device tests (Section 4) should be performed on any product that offers storage for recording and playback of live video,

c) Removable media player device tests (Section 5) should be performed on any product capable of playback or recording of audio and/or video stored on removable media (e.g. Flash drive, CD, DVD, Blu-ray Disc), and

d) Amplifier tests (Section 6) should be performed on any product that offers audio amplification.

e) Under the guidelines, a HTIB system with an integrated DVD player/recorder and audio amplifiers would likely be subject to the low-power tests in Section 3, several of the removable media player tests in Section 5, and the amplifier tests in Section 6. In contrast, a stand-alone rack-mount audio amplifier would likely only be subject to the low-power tests in Section 3 and the amplifier tests in Section 6.

f) Audio/Video products must be tested in their as-shipped configuration.

Note: Step 2.f has been added to the test procedure to specify that products must be tested in the configuration and condition that they are shipped from the manufacturer's facility to the consumer.

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

4.1. Test Equipment

The following test equipment is recommended for performing ENERGY STAR power consumption tests:

a) Oscilloscope or Power Analyzer, with a current probe, to monitor AC line current waveform, amplitude, and frequency;

b) True RMS volt meter, to measure voltage at the input of the unit being tested (optional if AC source output is sufficiently accurate);

c) Frequency counter, to measure frequency at the input of the unit being tested (optional if AC source output is sufficiently accurate);

d) Signal Generator(s), Analog or Digital, to produce signal inputs for amplifier testing, as appropriate; and

e) Timer, for measuring test durations.

4.2. Calibration

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

4.3. Power Measurement Test Conditions

a) Test Setup: Test setup 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.

b) Measurement Location: All power measurements shall be made at a point between the AC power source and the UUT.

c) Component-level Measurement: In the case of products that include many sub-components (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. All components may be tested simultaneously, but each power-consuming device must be metered separately (e.g. power consumption must be measured at each plug connection to mains power). Power consumption data for each sub-component shall be summed to determine the total power consumption of the product.

d) Measurement Methods: Average power consumption shall be determined in accordance with the requirements of IEC 62301, Ed. 1.0, "Measurement of Household Appliance Standby Power", Section 5.3.2, using either the average power or accumulated energy approaches outlined below.

    1) Average Power Approach: where the instrument can record a true average power over a user selected period, the period selected shall not be less than 10 minutes.

    2) Accumulated Energy Approach: where the instrument can accumulate energy over a user selected period, the period selected shall not be less than 10 minutes. The integrating period shall be such that the total recorded value for energy and time is more than 200 times the resolution of the meter for energy and time. Determine the average power by dividing the accumulated energy by the time for the monitoring period.

4.4. Source Signals

a) Signal Input Location: If the UUT does not have accessible signal input terminals, test signal input shall be through the device antenna or other accessible means typical of customer use.

b) Audio Sources: The following noise profiles shall be used for all audio testing:

    1) Pink Noise (A=1/f): Pink noise is a random signal within the audible frequency range, whose amplitude is inversely proportional to frequency, maintaining constant audio power per logarithmic frequency increment.

c) Video Sources: All video source signals shall be from live sources (i.e. broadcast TV, cable TV, radio, streaming Internet content, etc.) of the type used under typical device operation. If the UUT does not have a tuner, a video signal input with equivalent content and resolution shall be provided. The following reference channels shall be used as inputs when video signals are required:

    1) Reference Channel A: SD Network TV channel. This channel shall be at least 480i format.

    2) Reference Channel B: SD/HD Sports channel. If the UUT is HD-capable, this channel shall be at least 720p format. If the UUT is not HD-capable, this channel shall be at least 480i format.

    3) Reference Channel C: SD 24-hour News channel. This channel shall be at least 480i format.

    Tuning to a broadcast video source is defined as one tuner acquiring an encrypted digital video service, where the video service is rendered on all analog audio/video outputs (e.g. RF modulated, S-Video, composite and component) and on all SPDIF audio outputs (if equipped).

d) Option to Test with Only HD Video Sources: The video test procedures in Sections 6 and 7 are performed with both SD and HD video sources for devices capable of processing both SD and HD content. The overall average 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 video source tests (per the definition of Reference Channel B), in order to expedite testing.

4.5. 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 mechanisms 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 Amplifier test procedures in Section 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.

d) Optional Hardware: If the UUT uses Smart card or POD technology for conditional access system control, then insert the applicable card into the UUT prior to applying power.

4.6. UUT Pre-test Configuration

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

1) Set up the UUT per the instructions in the product operating manual. If the product manual contains several example configurations, select the most basic configuration that will allow for completion of the test procedure.

2) If the UUT includes speaker outputs, connect a resistive load across each pair of output terminals equivalent to the nominal rated load impedance. 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.

3) Connect the UUT to the power source.

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

    a. Disable any wireless networking functionality (WiFi), unless wireless networking is the UUT's primary means of accessing a network.

    b. Disable any VOIP and Data services that are exposed to the user for external use such as broadband services.

    c. Ensure that all audio tone controls are set to mid-level.

    d. Ensure that UUT components (display brightness, etc.) are in their as-shipped configuration.

Note: Items 4.6.4c and 4.6.4d have been added to the procedure since the first draft release. These steps are intended to further reinforce consistent test setup and ensure the quality of product test data.

5) Connect the UUT to the signal source. The input signal shall comply to the requirements in Section 4.4, above.

6) Let the UUT sit for at least 15 minutes, or until the unit has completed initialization and is ready for use.

7) Measure and record the AC mains input voltage and frequency.

8) Measure and record the test room ambient temperature.

5. Test Procedures for All Products

The following tests shall be performed on all Audio/Video products[2].

5.1. Auto Power-down (APD) Function (Test time: 10 minutes)

1) Configure the UUT in a typical Active mode operational state.

2) Stop any active content from playing on the UUT.

3) Measure the average power consumption before APD over a 5 minute period.

4) Allow the UUT to automatically power-down.

5) Verify that the device is in the expected APD low-power state.

6) Measure the average power consumption after APD over a 5 minute period.

5.2. Idle Condition (Test time: 5 minutes)

1) Configure the UUT in a typical Sleep or Off mode operational state.

2) Press the Power button to bring the unit into an Active mode operational state, such that no active content is playing.

3) Measure the average power consumption over a 5 minute period.

5.3. Sleep Mode (Test time: 5 minutes)

1) Configure the UUT in a typical Active or Idle mode operational state.

2) Press the Power button to bring the unit into a Sleep mode low-power operational state.

3) Measure the average power consumption over a 5 minute period.

6. Test Procedures for Video Devices

The following tests shall be performed on any product that offers storage for recording and playback of video.

6.1. Live Video Playback Test (Test time: 6 minutes)

1) Tune to Reference Channel A.

2) Measure the average power consumption over a 2 minute period.

   a. Note: If the UUT has DVR functionality, the DVR shall be in Pause for 5% of the test period, Fast Forward for 10% of the test period, and Rewind for 10% of the test period.

3) Tune to Reference Channel B.

4) Measure the average power consumption over a 2 minute period.

   a. Note: If the UUT has DVR functionality, the DVR shall be in Pause for 5% of the test period, Fast Forward for 10% of the test period, and Rewind for 10% of the test period.

5) Tune to Reference Channel C. If the UUT has one or more Additional Tuners, tune the primary tuner to Reference Channel C, and the secondary tuner to Reference Channel A.

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

a. Note: If the UUT has PIP functionality, render the secondary image in a PIP window as near to ¼ of the total screen area as possible. If the UUT does not have PIP functionality, display the primary tuner image on the screen and record the secondary signal in the background.

6) Measure the average power consumption over a 2 minute period.

a. Note: If the UUT has DVR functionality, the DVR shall be in Pause for 5% of the test period, Fast Forward for 10% of the test period, and Rewind for 10% of the test period.

7) Calculate the average power consumption over the full test duration.

6.2. Live Video Recording Test (Test time: 6 minutes)

1) Tune to and begin DVR recording of Reference Channel A.

a. Note: If the UUT has one or more Additional Tuners, record Reference Channel A with the secondary tuner for the duration of the test.

2) Measure the average power consumption over a 2 minute period.

3) Tune to and begin DVR recording of Reference Channel B.

4) Measure the average power consumption over a 2 minute period.

5) Tune to and begin DVR recording of Reference Channel C.

6) Measure the average power consumption over a 2 minute period.

7) Calculate the average power consumption over the full test duration.

8) If the UUT is capable of recording HD signals, repeat the test with an HD input signal (Reference Channel B) and record the average power consumption from both tests.

9) Save all DVR recordings for the Recorded Video Playback Test.

6.3. Recorded Video Playback Test (Test time: 5 minutes)

1) Tune to Reference Channel A.

2) Using the on-screen menus, begin playback of a recorded program. Play back the recorded video for the duration of the test period. The playback shall be in Pause for 5% of the test period, Fast Forward for 10% of the test period, and Rewind for 10% of the test period.

3) Measure the average power consumption over a 5 minute period.

4) If the UUT is capable of recording HD signals, repeat the test with an HD input signal (Reference Channel B) and record the average power consumption from both tests.

7. Test Procedures for Removable Media Players

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

7.1. Video Playback Test (Test time: 5+ minutes)

1) Insert / install the removable media and begin playback of SD video content equivalent to Reference Channel A.

2) Measure the average power consumption over a 5 minute period.

3) If the UUT is capable of playing HD content, repeat the test with HD video content equivalent to Reference Channel B and record the average power consumption from each test.

4) Video Recording Test (Test time: 5+ minutes)

5) Insert / install the removable media and begin recording of SD video content equivalent to Reference Channel A.

6) Measure the average power consumption over a 5 minute period.

7) If the UUT is capable of recording HD content, repeat the test with HD video content equivalent to Reference Channel B and record the average power consumption from each test.

7.2. Audio Playback Test (Test time: 5+ minutes)

1) Insert / install the removable media and begin playback of a pink noise signal.

2) Measure the average power consumption over a 5 minute period.

7.3. Audio Recording Test (Test time: 5+ minutes)

1) Insert / install the removable media and begin recording of a pink noise signal.

2) Measure the average power consumption over a 5 minute period.

8. Test Procedures for Amplifiers

The following tests shall be performed on any product that contains an audio power amplifier.

8.1. Active Mode Test

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

2) Generate a 1 kHz sine wave input signal. For devices that accept only digital input signals, generate an appropriate representation of a 1 kHz sine wave. [3]

3) Increase the amplifier volume until the THD of the output is 1% or greater. This is considered the maximum undistorted power. [4]

4) Turn down the amplifier until the output is 1/3 of the maximum undistorted power.

5) Measure & record the amplifier input and output power. Calculate the amplifier efficiency at 1/3 of the maximum undistorted power.

6) Turn down the amplifier until the output is 1/8 of the maximum undistorted power.

7) Measure & record the amplifier input and output power. Calculate the amplifier efficiency at 1/8 of the maximum undistorted power.

8) Generate a pink noise input signal and repeat the test procedure beginning at Section 8.1, Step 6.

[3] If 1 kHz is outside of the range of the UUT, the signal frequency shall be the geometric mean of the upper and lower -3 dB response points of the device.

[4] 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.