



ENERGY STAR® Program Requirements Product Specification for Audio/Video

Test Method

1 OVERVIEW

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

2 APPLICABILITY

ENERGY STAR test requirements are dependent upon the feature set of the product under evaluation. The following guidelines shall be used to determine the applicability of each section of this document:

- Power mode tests (Section 7) shall be performed on every product;
- Optical media player tests (Section 8) shall be performed on any product capable of playback of audio and/or video stored on optical media (e.g., CD, SA-CD, DVD, Blu-ray Disc); and
- Audio amplification tests (Section 9) shall be performed on any product that offers audio amplification.
- Tests of the auto-power down (APD) function (Section 7.1) shall be performed on all products except those subject to 3rd-party performance standards that prohibit APD.

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

3 DEFINITIONS

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

4 TEST SETUP

- A) Test Setup and Instrumentation: Test setup and instrumentation for all portions of this procedure shall be in accordance with the requirements of IEC 62301, Ed. 2.0, "Measurement of Household Appliance Standby Power", Section 4, "General Conditions for Measurements". In the event of conflicting requirements, the ENERGY STAR test method shall take precedence.

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Note: The reference procedure for test setup has been updated to the most recent version (2.0) of IEC 62301.

29 B) Input Power: Input power shall be as specified in Table 1 and Table 2.

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

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 V ac	+/- 1.0 %	2.0 %	60 Hz	+/- 1.0 %
Europe, Australia, New Zealand	230 V ac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
Japan	100 V ac	+/- 1.0 %	2.0 %	50 Hz/60 Hz	+/- 1.0 %

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

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

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

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

36 **5 TEST CONDUCT**

37 A) As-shipped Condition: Products must be tested in their “as-shipped” configuration. For products that
38 offer a choice of user-configurable options, all options shall be set to their default condition. If the
39 device has different low power modes that can be manually selected, the measurement shall be taken
40 with the device in the version of the mode that the power button on the remote control or front panel
41 will initiate.

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

- 47 C) Measurement Location: All power measurements shall be taken at a point between the ac power
48 source and the UUT.
- 49 D) Multi-component Systems: For products composed of multiple components in separate housings, all
50 components shall be connected together in a typical end-use configuration. Power shall be measured
51 at each unique plug connection to the power source.
- 52 E) Signal Input Location: If the UUT does not have accessible signal input terminals, test signal input
53 may be through the device antenna, optical disc player, or other accessible means typical of customer
54 use.
- 55 F) Audio Sources: A 1 kHz sine wave input signal shall be used as the audio source for all amplifier tests
56 in Section 9. For stereo testing, sine wave signals shall be in-phase, with identical frequency.

57 **Note:** ENERGY STAR would like to re-evaluate the use of sine waves and consider again the use of a
58 variable audio source such as Pink Noise. EPA has an interest in ensuring that testing for ENERGY
59 STAR qualification resembles intended product usage. In doing so, EPA is best able to ensure real
60 consumer savings when ENERGY STAR products are used. EPA welcomes stakeholder feedback on
61 this point.

- 62 G) Video Sources: SD and HD “dynamic broadcast” video content from IEC 62087 Ed. 3.0 shall be used
63 as the video source for optical disc player tests in Section 6.
- 64 H) Option to Test with Only HD Video Sources: If the UUT is found to have negligible differences in
65 power when processing SD and HD video sources, tests with SD video sources may be eliminated,
66 and all testing performed only with HD video sources.
- 67 I) Output Volume: UUT output volume shall be set to minimum for the duration of all tests except as
68 noted in the audio amplifier test procedures in Section 9.
- 69 J) Battery Powered Devices: If the UUT contains rechargeable batteries, or can be integrated with
70 another device that contains rechargeable batteries, all batteries shall be fully charged prior to the
71 start of testing and shall remain in place for the duration of testing.
- 72 K) Amplifiers:
- 73 1) For devices with multiple independent audio amplifiers, all amplifiers shall be connected and
74 tested simultaneously.
- 75 2) Products that offer surround sound processing shall be tested in the default surround sound
76 mode.
- 77 L) Speaker Outputs:
- 78 1) If the UUT includes speaker outputs, connect a resistive load across each pair of output terminals
79 equivalent to the minimum nominal rated load impedance (e.g., 6 ohm if rated 6–8 ohm). The
80 same resistive load shall be used for all amplifier tests.
- 81 2) For self-powered or internal speakers with no accessible output terminals, output power must be
82 measured across the speaker input leads, using the attached speaker as the load.
- 83 M) AV Signal Interconnections: If the UUT offers several audio and video interconnection options, select
84 and configure the system with one of the following interconnections, in order of preference: HDMI,
85 component, S-video, and composite.

86 **Note:** EPA has been made aware that the energy consumption of an AV product may be impacted not
87 only by the type of interconnection in use, but also by the type, model, and state of the other product (e.g.,
88 television) connected to the AV product. To reduce variability in the test method, EPA is therefore
89 considering eliminating the interconnection requirement from the test method and welcomes feedback on
90 the magnitude of this variability and ways of limiting it during testing.

- 91 N) Networking / Control Protocols: If the UUT offers several networking / control protocol options, each
92 must be active and tested through all phases of the test procedure. Protocols may be either:
- 93 1) configured independently, with testing repeated for each available option; or
94 2) configured simultaneously, in order to expedite testing.

95 **6 PRE-TEST UUT INITIALIZATION**

- 96 A) Prior to the start of testing, the UUT shall be initialized as follows:
- 97 1) Set up the UUT per the instructions in the supplied operating manual.
98 2) If the UUT includes rechargeable batteries, ensure that all batteries are in a fully-charged state.
99 3) Connect the UUT to the power source.
100 4) Power on the UUT and perform initial system configuration, as applicable.
101 5) Ensure that all audio tone controls are set to mid-level.
102 6) Ensure that UUT settings (display brightness, etc.) are in their as-shipped configuration.
103 7) Connect the UUT to the signal source and test equipment. The input signal shall comply with the
104 requirements in Section 5, above.
105 8) Wait for 15 minutes, or until the unit has completed initialization and is ready for use.
106 9) Measure and record the ac input voltage and frequency.
107 10) Measure and record the test room ambient temperature.

108 **7 TEST PROCEDURES FOR ALL PRODUCTS**

109 The following tests shall be performed on all products.

110 7.1 Auto Power Down (APD) Function

- 111 1) Configure the UUT in a typical On Mode, Active State, with APD timing set to the default value.
112 2) Stop the UUT from performing any primary functions and turn off any input signal applied to active
113 AV inputs to cause the UUT to APD.
114 3) Begin measuring the elapsed time to APD after the product ceases performance of all primary
115 functions due to disconnection of signal.

- 116 4) Measure and record the average power before APD over a 2 minute period.
- 117 5) Allow the UUT to automatically power-down.
- 118 6) Verify that the device is in the expected APD low-power state and record the time to APD.
- 119 7) Measure and record the average power after APD over a 2 minute period.

120 7.2 Idle State

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

126 7.3 Sleep Mode

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

130 8 TEST PROCEDURES FOR OPTICAL DISC PLAYERS

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

134 8.1 Video Playback Test

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

139 8.2 Audio Playback Test

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

143 **9 TEST PROCEDURES FOR PRODUCTS WITH AUDIO**
144 **AMPLIFICATION**

- 145 1) Connect the UUT to the output of the signal generator.
- 146 2) Connect an input of the UUT to a generated 1 kHz sine wave input signal per Section 5.F).
- 147 i) For devices that accept only digital input signals, generate a representation of a 1 kHz sine
148 wave.
- 149 ii) For devices without AV inputs, play back an audio disc with a 1 kHz sine wave signal per
150 Section 8.2.
- 151 iii) If 1 kHz is outside the range of any bandwidth-limited channel in the UUT and the UUT has
152 AV inputs, sweep the input signal frequency between the upper and lower -3 dB points of
153 each channel. Record the input signal frequency when the UUT input power is at its maximum
154 and use this frequency for the bandwidth-limited channel for the remainder of the test.
- 155 3) Monitor each channel, one at a time, with a distortion analyzer and power meter.
- 156 4) Set the volume of the UUT to 100% and adjust the amplitude of the input signal until the THD of
157 one or more channels is 1% or greater. For devices without AV inputs that are tested with an
158 audio disc, adjust the volume until the THD of any single channel is 1% or greater.
- 159 5) Identify the channel or channels with the greatest output power. These shall be considered the
160 reference channels and their output power shall be considered the maximum undistorted power
161 (MUP)¹.
- 162 6) Measure and record the input power.
- 163 7) Reduce the input signal amplitude until the output power of the reference channel(s) is at 1/8
164 MUP. For devices without AV inputs that are tested with an audio disc, adjust the volume until the
165 output power of the reference channel(s) is at 1/8 MUP
- 166 8) Measure and record the input power (P_{IN}).
- 167 9) With the reference channel(s) at 1/8 MUP, measure and record the output power for all channels,
168 averaged over a 2 minute period. Record the sum (P_{OUT}) of all output power measurements.

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