



ENERGY STAR[®] Program Requirements Product Specification for Set-top Boxes

Test Method
Rev. Jan-2011

1 OVERVIEW

The following test method shall be used for determining product compliance with requirements in the ENERGY STAR Eligibility Criteria for Set-top Boxes.

2 APPLICABILITY

The test procedures herein are applicable to all Set-top Box products under the ENERGY STAR program. The test procedures in Section 7 are intended to be performed in the sequence that is presented in this document, as applicable.

- Test procedures in Section 7.1 and 7.6 are applicable to all products.
- Test procedures in Section 7.2 and 7.3 are applicable to products with DVR capability.
- Test procedures in Section 7.4 and 7.5 are applicable to products with Removable Media Player capability.
- Test procedures in Section 7.7 are applicable to products with APD functionality.
- Test procedures in Section 7.8 are applicable to products with Deep Sleep functionality.
- Test procedures in Section 7.9 are applicable to products with Multi-room capability.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Set-top Boxes.

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 in Canadian Standards Association (CSA) C380-08, Section 4, unless otherwise noted in this document. In the event of conflicting requirements, the ENERGY STAR test method shall take precedence.
- B) Input Power: Input power shall be as specified in Table 1.

Table 1: Input Power Requirements

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

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

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

E) Power Meter: Power meters shall possess the following attributes¹:

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

i) The peak of the current waveform measured during Sleep Mode and On Mode shall determine the crest factor rating requirement and the appropriate current range setting.

ii) The full-scale value of the selected current range multiplied by the crest factor for that range shall be at least 15% greater than the peak current.

2) Bandwidth: Minimum bandwidth as determined by an analysis of current and voltage to determine the highest frequency component (harmonic) with a magnitude greater than 1% of the fundamental frequency under the test conditions.

3) Minimum Frequency Response: 3.0 kHz;

4) Minimum Sampling Frequency: 60 Hz;

5) Minimum Resolution:

i) 0.01 W for measurement values less than 10 W;

ii) 0.1 W for measurement values from 10 W to 100 W; and

iii) 1.0 W for measurement values greater than 100 W.

F) Measurement Accuracy:

1) Power measurements with a value greater than or equal to 0.5 W shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level.

2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W at the 95% confidence level.

¹ Characteristics of approved meters derived from IEC 62301 Ed 1.0.

- G) Power Measurement Location: All power measurements shall be taken at a point between the AC mains power source and the UUT.
- H) Source Signals: The following Reference Channels shall be used for testing. For STBs without conventional tuners (e.g., IP STBs), equivalent video content, from a source representative of typical consumer usage, shall be substituted for each channel described below.
- 1) Reference Channel A: Network television channel, standard definition (SD) format, minimum 480i resolution.
 - 2) Reference Channel B: Live or recorded sports channel;
 - i) If the STB is HD-capable, this channel shall be in HD format, minimum 720p resolution.
 - ii) If the STB is not HD-capable, this channel shall be in SD format, minimum 480i resolution.
 - 3) Reference Channel C: 24-hour news channel, standard definition (SD) format, minimum 480i resolution.

5 TEST CONDUCT

- A) UUT Settings: The UUT shall be tested in its “as-shipped” configuration. For products that offer a choice of user-configurable options, all options shall be set to their default condition.
- B) 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 exercised with the supplied remote control, control interfaces on the face or body of the UUT may be used.
- C) Tuning: Tuning to a broadcast video source shall entail the following:
- 1) Acquisition of an encrypted digital video service by one tuner; and
 - 2) Rendering of the acquired video service on all analog audio/video outputs (e.g., RF modulated, S-Video, composite, and component) and on all S/PDIF audio outputs, as applicable.
- D) Satellite Low Noise Block (LNB): Incremental power required to operate LNBs shall be supplied from an independent source. If LNB power must be drawn from the STB, the power consumed by the LNB may be subtracted from the total power measurement. It is preferable that all LNB power be supplied independently of the STB.
- E) Head-end System Interaction:
- 1) STBs with POD/CableCARD-encrypted content shall decrypt by POD/CableCARD.
 - 2) Cable STBs shall interact with Conditional Access (CA) system data via DOCSIS Set-top Gateway (DSG) or SCTE-55.
 - 3) Telcoom QAM/IP STBs shall interact with CA system data via SCTE-55 and/or via an applicable LAN technology (e.g., MoCA).
 - 4) IP STBs shall interact with CA system data via applicable LAN technology (e.g., IEEE-802.3, MoCA).

- 5) Satellite STBs shall interact with CA system via LNB and POTS modem or applicable Home Network Interface as defined in the ENERGY STAR specification.
 - 6) Terrestrial STBs shall interact with an ATSC signal from a live source.
- F) Secondary Device Functions: The following UUT functions shall be tested in their “as-shipped” configuration (i.e., if the functions are enabled by default upon shipment, they must be enabled for testing):
- 1) WiFi, unless video streaming over WiFi is the primary means of content delivery;
 - 2) Voice Over IP (VOIP); and
 - 3) Data services that are made available to the end-user (e.g., broadband services).
- G) Conditional Access: If the UUT uses POD or CableCARD for CA system control, conditional access hardware shall be installed in the UUT prior to applying power.
- H) Battery Powered Devices: For products designed to operate using batteries when not connected to the mains, the battery shall be fully charged before beginning the test and left in place for the test.
- I) A/V Interconnections: If the UUT offers several audio and video interconnection options, select and configure the system with one of the following interconnections, in order of preference: HDMI, component, S-video, and composite.
- J) Untested Features: Any features not identified in this test procedure shall be configured in their “as-shipped” configuration.
- K) Power Management: Any power management capability that reduces the power consumption of inactive features may be enabled as it would be when deployed to an end-user under the same conditions.
- L) Home Network Interface: If the UUT supports more than one type of home network interface, one interface link shall be connected and available for data transfer during testing. For multi-room devices, the selected link type shall be able to support multiple client device access. STBs sold at retail shall be tested in the default as-shipped configuration. For leased or multi-room STBs, the interface shall be selected in the following order of precedence:
- 1) MoCA
 - 2) HPNA
 - 3) WiFi
 - 4) Other

6 UUT PRE-TEST INITIALIZATION

- A) Prior to the start of testing, the UUT shall be initialized as follows:
- 1) Set up the UUT per the instructions in the supplied operating manual.
 - 2) Connect the UUT to a display device via an A/V Interconnection as specified above (e.g., HDMI).

- 3) Connect the power meter to the power source and connect the UUT to the power outlet on the power meter.
- 4) Power on the UUT with the remote control and perform initial system configuration, as applicable. Ensure that UUT features and functions are in their as-shipped configuration.
- 5) Connect the UUT to the signal source.
- 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.

7 TEST PROCEDURES

7.1 Watching Live TV (P_{TV})

- 1) Verify that the UUT is turned on and tuned to a live television channel.
 - i) If the UUT base type is IP, and the UUT does not have the capability to play back live, streaming video content (i.e., the UUT is a “download-only” device), the Live TV portion of the test procedure shall be performed while video content is simultaneously being played back and downloaded.
 - ii) If the UUT offers DVR functionality, the Live TV portion of the test procedure shall be performed with the primary video stream paused for 5%, in fast forward for 10% and in rewind for 10% of the total test time, while raw video input is simultaneously being buffered. This requirement does not increase the total test duration.
- 2) Tune to Reference Channel A.
- 3) Measure and record the average power over a 5-minute period.
- 4) Tune to Reference Channel B (if the UUT is HD capable, Reference Channel B should be in HD format).
- 5) Measure and record the average power over a 10-minute period.
- 6) Tune to Reference Channel C.
 - i) If the UUT has the ability to handle multiple simultaneous video streams, set a second tuner to Reference Channel A and render it simultaneously in a second window embedded in the primary display window (i.e., Picture-in-Picture).
 - ii) The second window shall be as near to 25% of the total display screen area as possible.
 - iii) If no picture-in-picture capability exists, the second channel shall be recorded in the background.
- 7) Measure and record the average power over a 5-minute period.

- 8) Calculate and record the average power (P_{TV}) over the three measurement periods.
- 9) If the UUT offers place-shifting capability, repeat the Live TV test with the place-shifting feature turned on. Record the individual power measurement results from the place shifting test

7.2 Recording Live TV to DVR (P_{RECORD})

- 1) This portion of the test procedure shall be performed with a second tuner engaged and recording at all times. It is permissible to create a series of pre-programmed back-to-back recording sessions for these tests to avoid menu prompts.
- 2) Verify that the UUT is turned on and tuned to a live television channel.
- 3) Tune to Reference Channel A.
- 4) Measure and record the average power over a 5-minute period.
- 5) Tune to Reference Channel B (if the UUT is HD capable, Reference Channel B should be in HD format).
- 6) Measure and record the average power over a 10-minute period.
- 7) Tune to Reference Channel C.
- 8) Measure and record the average power over a 5-minute period.
- 9) Calculate and record the average power (P_{RECORD}) over the three measurement periods.
- 10) Save the recordings for the Playback test.

7.3 Playing Back Recorded TV from DVR ($P_{PLAYBACK}$)

- 1) Verify that the UUT is turned on and tuned to a live television channel.
 - i) If the UUT base type is IP, and the UUT does not have the capability to play back live, streaming video content (i.e., the UUT is a “download-only” device), this portion of the test procedure shall be performed with video playback from disk storage and no simultaneous file download.
 - ii) If the UUT offers DVR functionality, this portion of the test procedure shall be performed with the primary video stream paused for 5%, in fast forward for 10%, and in rewind for 10% of the total test time, while raw video input is simultaneously being buffered. In addition, this portion of the test procedure shall be performed with a second tuner engaged and recording at all times.
- 2) Use the remote control to begin playback of the recording of Reference Channel A.
- 3) Measure and record the average power over the playback period.
- 4) When playback is complete, delete the recording. If automatically prompted to delete, select the affirmative prompt.
- 5) Use the remote control to begin playback of the recording of Reference Channel B.

- 6) Measure and record the average power over the playback period.
- 7) When playback is complete, delete the recording. If automatically prompted to delete, select the affirmative prompt.
- 8) Use the remote control to begin playback of the recording of Reference Channel C.
- 9) Measure and record the average power over the playback period.
- 10) When playback is complete, delete the recording. If automatically prompted to delete, select the affirmative prompt.
- 11) Calculate and record the average power consumption (P_{PLAYBACK}) over the three measurement periods.

7.4 Recording Live TV to Removable Media (P_{RECORD})

- 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 2) Begin the power measurement.
- 3) Use the remote control to activate the UUT's removable media recording function.
- 4) Insert the removable media. Open and close the disc tray, as necessary.
- 5) Use the remote control to begin recording to the removable media.
- 6) Record the video content for 20 minutes.
- 7) Use the remote control to stop recording and eject the removable media.
- 8) Measure and record the average power consumption (P_{RECORD}) for the full duration of the test.
- 9) If the UUT is capable of recording HD content, repeat the test with an HD video stream that meets the requirements of Reference Channel B. Calculate and record the average power (P_{RECORD}) over the two measurement periods.

7.5 Playing Back Recorded TV from Removable Media (P_{PLAYBACK})

- 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 2) Begin the power measurement.
- 3) Use the remote control to activate the UUT's removable media playback function. Note that if this function is automatically activated when the removable media door is actuated, or when a disc is inserted, this step of the test procedure may be omitted.
- 4) Insert the removable media. Open and close the disc tray, as necessary.
- 5) Use the remote control to begin playback of removable media video content. Note that if playback begins automatically upon insertion of removable media, this step of the test procedure may be omitted.
- 6) Play the recording for 20 minutes.

- 7) Use the remote control to stop playback and eject the removable media.
- 8) Measure and record the average power consumption (P_{PLAYBACK}) over the full duration of the test.
- 9) If the UUT is capable of playing back HD content, repeat the test with an HD video stream that meets the requirements of Reference Channel B. Calculate and record the average power (P_{PLAYBACK}) over the two measurement periods.

7.6 Sleep Mode (P_{SLEEP})

- 1) Verify that the UUT is turned on and tuned to Reference Channel A. Ensure that at least the "Watching Live TV" tests have been completed immediately prior to the start of this portion of the test procedure.
- 2) Use the remote control to place the system into Sleep Mode.
- 3) Begin the power measurement.
- 4) Measure and record the average power consumption (P_{SLEEP}) over a 5-minute period.

7.7 Auto Power Down (P_{APD})

- 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 2) Allow the UUT to automatically power down to Sleep Mode.
- 3) Verify that the UUT is in the expected Sleep Mode.
- 4) Begin the power measurement.
- 5) Measure and record the average power consumption (P_{APD}) over a 5-minute period.

7.8 Deep Sleep State ($P_{\text{DEEP_SLEEP}}$)

- 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 2) Allow the UUT to automatically power down to Sleep Mode and transition to Deep Sleep State, or manually initiate Deep Sleep State.
- 3) Verify that the UUT is in the expected Deep Sleep State.
- 4) Begin the power measurement.
- 5) Measure and record the average power consumption ($P_{\text{DEEP_SLEEP}}$) over a 5-minute period.

7.9 Multi-room and Client STB

- A) At the completion of testing of a multi-room-capable UUT in a single-display configuration, per Sections 7.1 through 7.8, the UUT shall be tested in a multi-room configuration. A client STB, if required by the multi-room STB, shall also be tested in a multi-room configuration, as follows:

- 1) Attach a single remote STB (or client device such as a television) to the server STB in a standard multi-room configuration.
- 2) Tune the server STB to Reference Channel A, and ensure that Reference Channel A is displaying on the primary local video output of the server STB.
- 3) Begin recording Reference Channel A on the server STB, and allow recording to continue for the duration of testing.
- 4) Test the remote STB according to sections 7.1 through 7.8 of this test procedure, as applicable.
- 5) Measure and record power consumption of both the server STB and the remote STB, as applicable, for all tests that are performed.