



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

Test Method Final Draft Rev. Dec-2010

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

24 Table 1.

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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 %

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

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

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

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

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

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

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

38 3) Minimum Frequency Response: 3.0 kHz;

39 4) Minimum Sampling Frequency: 60 Hz;

40 5) Minimum Resolution:

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

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

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

44 F) Measurement Accuracy:

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

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

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

- 49 G) Power Measurement Location: All power measurements shall be taken at a point between the AC
50 mains power source and the UUT.
- 51 H) Source Signals:
- 52 1) Reference Channels:
- 53 i) Reference Channel A: Network television channel, standard definition (SD) format, minimum
54 480i resolution.
- 55 ii) Reference Channel B: Live or recorded sports channel;
- 56 (1) If the STB is HD-capable, this channel shall be in HD format, minimum 720p resolution.
- 57 (2) If the STB is not HD-capable, this channel shall be in SD format, minimum 480i resolution.
- 58 iii) Reference Channel C: 24-hour news channel, standard definition (SD) format, minimum 480i
59 resolution.

60 5 TEST CONDUCT

- 61 A) UUT Settings: The UUT shall be tested in its “as-shipped” configuration. For products that offer a
62 choice of user-configurable options, all options shall be set to their default condition.
- 63 B) UUT Control: The UUT shall be controlled with the factory-supplied remote control (I/R or RF) to the
64 extent possible. For units that do not ship with a remote control, or for functions that cannot be
65 exercised with the supplied remote control, control interfaces on the face or body of the UUT may be
66 used.
- 67 C) Tuning: Tuning to a broadcast video source shall entail the following:
- 68 1) Acquisition of an encrypted digital video service by one tuner; and
- 69 2) Rendering of the acquired video service on all analog audio/video outputs (e.g., RF modulated, S-
70 Video, composite, and component) and on all S/PDIF audio outputs, as applicable.
- 71 D) Satellite Low Noise Block (LNB): Incremental power required to operate LNBs shall be supplied from
72 an independent source. If LNB power must be drawn from the STB during non qualification and
73 verification testing, the power consumed by the LNBs may be subtracted from the appropriate power
74 measurements. It is preferable that all LNB power drawn be supplied separately.
- 75 E) Head-end System Interaction:
- 76 1) STBs with POD/CableCARD-encrypted content shall decrypt by POD/CableCARD.
- 77 2) Cable STBs shall interact with Conditional Access (CA) system data via DOCSIS Set-top
78 Gateway (DSG) or SCTE-55.
- 79 3) Telcocom QAM/IP STBs shall interact with CA system data via SCTE-55 and/or via an applicable
80 LAN technology (e.g., MoCA).
- 81 4) IP STBs shall interact with CA system data via applicable LAN technology (e.g., IEEE-802.3,
82 MoCA).

83 5) Satellite STBs shall interact with CA system via LNB and POTS modem or applicable Home
84 Network Interface as defined in the ENERGY STAR specification.

85 **Note:** *The preceding statement has been updated to allow for CA interaction with a Home Network*
86 *Interface.*

87 6) Terrestrial STBs shall interact with an ATSC signal from a live source.

88 F) Secondary Device Functions: The following UUT functions shall be tested in their “as-shipped”
89 configuration (i.e., if the functions are enabled by default upon shipment, they must be enabled for
90 testing):

91 1) WiFi, unless video streaming over WiFi is the primary means of content delivery;

92 2) Voice Over IP (VOIP); and

93 3) Data services that are made available to the end-user (e.g., broadband services).

94 G) Conditional Access: If the UUT uses POD or CableCARD for CA system control, conditional access
95 hardware shall be installed in the UUT prior to applying power.

96 H) Battery Powered Devices: For products designed to operate using batteries when not connected to
97 the mains, the battery shall be fully charged before beginning the test and left in place for the test.

98 I) A/V Interconnections: If the UUT offers several audio and video interconnection options, select and
99 configure the system with one of the following interconnections, in order of preference: HDMI,
100 component, S-video, and composite.

101 J) Untested Features: Any features not tested in this test procedure should be tested in their “as-
102 shipped” configuration.

103 K) Power Management: Any power management capability that reduces the power consumption of
104 inactive features may be enabled as it would be when deployed to an end-user under the same
105 conditions.

106 L) Home Network Interface: If the UUT supports more than one type of home network interface, one
107 interface link shall be connected and available for data transfer during testing. For multi-room
108 devices, the selected link type shall be able to support multiple client device access. STBs sold at
109 retail shall be tested in the default as-shipped configuration. For leased or multi-room STBs, the
110 interface shall be selected in the following order of preference:

111 1) MoCA

112 2) HPNA

113 3) WiFi

114 4) Other

115 **6 UUT PRE-TEST INITIALIZATION**

116 A) Prior to the start of testing, the UUT shall be initialized as follows:

- 117 1) Set up the UUT per the instructions in the supplied operating manual.
- 118 2) Connect the UUT to a display device via an A/V Interconnection as specified above (e.g., HDMI).
- 119 3) Connect the power meter to the power source and connect the UUT to the power outlet on the
120 power meter.
- 121 4) Power on the UUT with the remote control and perform initial system configuration, as applicable.
122 Ensure that UUT features and functions are in their as-shipped configuration.
- 123 5) Connect the UUT to the signal source.
- 124 6) Let the UUT sit for at least 15 minutes, or until the unit has completed initialization and is ready for
125 use.
- 126 7) Measure and record the AC mains input voltage and frequency.
- 127 8) Measure and record the test room ambient temperature.

128 **7 TEST PROCEDURES**

129 **7.1 Watching Live TV (P_{TV})**

- 130 1) Verify that the UUT is turned on and tuned to a live television channel.
 - 131 i) If the UUT base type is IP, and the UUT does not have the capability to play back live,
132 streaming video content (i.e., the UUT is a “download-only” device), the Live TV portion of the
133 test procedure shall be performed while video content is simultaneously being played back
134 and downloaded.
 - 135 ii) If the UUT offers DVR functionality, the Live TV portion of the test procedure shall be
136 performed with the primary video stream paused for 5%, in fast forward for 10% and in rewind
137 for 10% of the total test time, while raw video input is simultaneously being buffered. This
138 requirement does not increase the total test duration.
- 139 2) Tune to Reference Channel A.
- 140 3) Measure and record the average power over a 5-minute period.
- 141 4) Tune to Reference Channel B (if the UUT is HD capable, Reference Channel B should be in HD
142 format).
- 143 5) Measure and record the average power over a 10-minute period.
- 144 6) Tune to Reference Channel C.
 - 145 i) If the UUT has the ability to handle multiple simultaneous video streams, set a second tuner to
146 Reference Channel A and render it simultaneously in a second window embedded in the
147 primary display window (i.e., Picture-in-Picture).
 - 148 ii) The second window shall be as near to 25% of the total display screen area as possible.

- 149 iii) If no picture-in-picture capability exists, the second channel shall be recorded in the
150 background.
- 151 7) Measure and record the average power over a 5-minute period.
- 152 8) Calculate and record the average power (P_{TV}) over the three measurement periods.
- 153 9) If the UUT offers place-shifting capability, repeat the Live TV test with the place-shifting feature
154 turned on. Record the individual power measurement results from the place shifting test

155 **Note:** EPA has removed the requirement for place-shifting test results to be factored into the calculation of
156 Live TV power consumption, since place-shifting functionality is not yet widespread in the STB market.
157 Power consumption with place-shifting enabled must still be measured per Step 7.1.9.

158 **7.2 Recording Live TV to DVR (P_{RECORD})**

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

172 **7.3 Playing Back Recorded TV from DVR ($P_{PLAYBACK}$)**

- 173 1) Verify that the UUT is turned on and tuned to a live television channel.
- 174 i) If the UUT base type is IP, and the UUT does not have the capability to play back live,
175 streaming video content (i.e., the UUT is a “download-only” device), this portion of the test
176 procedure shall be performed with video playback from disk storage and no simultaneous file
177 download.
- 178 ii) If the UUT offers DVR functionality, this portion of the test procedure shall be performed with
179 the primary video stream paused for 5%, in fast forward for 10%, and in rewind for 10% of the
180 total test time, while raw video input is simultaneously being buffered. In addition, this portion
181 of the test procedure shall be performed with a second tuner engaged and recording at all
182 times.

- 183 2) Use the remote control to begin playback of the recording of Reference Channel A.
- 184 3) Measure and record the average power over the playback period.
- 185 4) When playback is complete, delete the recording. If automatically prompted to delete, select the
186 affirmative prompt.
- 187 5) Use the remote control to begin playback of the recording of Reference Channel B.
- 188 6) Measure and record the average power over the playback period.
- 189 7) When playback is complete, delete the recording. If automatically prompted to delete, select the
190 affirmative prompt.
- 191 8) Use the remote control to begin playback of the recording of Reference Channel C.
- 192 9) Measure and record the average power over the playback period.
- 193 10) When playback is complete, delete the recording. If automatically prompted to delete, select the
194 affirmative prompt.
- 195 11) Calculate and record the average power consumption (P_{PLAYBACK}) over the three measurement
196 periods.

197 **7.4 Recording Live TV to Removable Media (P_{RECORD})**

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

209 **7.5 Playing Back Recorded TV from Removable Media (P_{PLAYBACK})**

- 210 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 211 2) Begin the power measurement.

- 212 3) Use the remote control to activate the UUT's removable media playback function. Note that if this
213 function is automatically activated when the removable media door is actuated, or when a disc is
214 inserted, this step of the test procedure may be omitted.
- 215 4) Insert the removable media. Open and close the disc tray, as necessary.
- 216 5) Use the remote control to begin playback of removable media video content. Note that if playback
217 begins automatically upon insertion of removable media, this step of the test procedure may be
218 omitted.
- 219 6) Play the recording for 20 minutes.
- 220 7) Use the remote control to stop playback and eject the removable media.
- 221 8) Measure and record the average power consumption (P_{PLAYBACK}) over the full duration of the test.
- 222 9) If the UUT is capable of playing back HD content, repeat the test with an HD video stream that
223 meets the requirements of Reference Channel B. Calculate and record the average power
224 (P_{PLAYBACK}) over the two measurement periods.

225 **7.6 Sleep Mode (P_{SLEEP})**

- 226 1) Verify that the UUT is turned on and tuned to Reference Channel A. Ensure that at least the
227 "Watching Live TV" tests have been completed immediately prior to the start of this portion of the
228 test procedure.
- 229 2) Use the remote control to place the system into a lower power state.
- 230 3) Begin the power measurement.
- 231 4) Measure and record the average power consumption (P_{SLEEP}) over a 20-minute period.

232 **7.7 Auto Power Down (P_{APD})**

- 233 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 234 2) Allow the UUT to automatically power down to Sleep Mode.
- 235 3) Verify that the UUT is in the expected low power state.
- 236 4) Begin the power measurement.
- 237 5) Measure and record the average power consumption (P_{APD}) over a 20-minute period.

238 **7.8 Deep Sleep State ($P_{\text{DEEP_SLEEP}}$)**

- 239 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 240 2) Allow the UUT to automatically power down to Sleep Mode and transition to Deep Sleep State, or
241 manually initiate Deep Sleep State.
- 242 3) Verify that the UUT is in the expected low power state.

- 243 4) Begin the power measurement.
- 244 5) Measure and record the average power consumption ($P_{\text{DEEP_SLEEP}}$) over a 20-minute period.

245 7.9 Multi-room and Client STB

246 **Note:** *This portion of the test method has been updated with instructions for testing remote (client) STBs*
247 *for use in multi-room configurations.*

- 248 A) At the completion of testing of a multi-room-capable UUT in a single-display configuration, per
249 Sections 7.1 through 7.8, the UUT shall be tested in a multi-room configuration. A client STB, if
250 required by the multi-room STB, shall also be tested in a multi-room configuration, as follows:
- 251 1) Attach a single remote STB (or client device such as a television) to the server STB in a standard
252 multi-room configuration.
- 253 2) Tune the server STB to Reference Channel A, and ensure that Reference Channel A is displaying
254 on the primary local video output of the server STB.
- 255 3) Begin recording Reference Channel A on the server STB, and allow recording to continue for the
256 duration of testing.
- 257 4) Test the remote STB according to sections 7.1 through 7.8 of this test procedure, as applicable.
- 258 5) Measure and record power consumption of both the server STB and the remote STB, as
259 applicable, for all tests that are performed.