



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

Draft 1 Version 3.0

Table of Contents

Partner Commitments

Commitment	2
Performance for Special Distinction	3

Eligibility Criteria

1. Definitions	5
2. Qualifying Products	8
2.1. Included Products	8
2.2. Excluded Products	8
3. Energy Efficiency Criteria	8
3.1. General Qualification Criteria	8
3.2. TEC Allowance	9
3.3. TEC Assessment	11
3.4. STBs with Multi-room Capability	13
4. Testing	13
5. User Interface	14
6. Effective Date	14
7. Future Specification Revisions	14

Appendix A: ENERGY STAR Test Procedure

1. Overview	16
2. Applicability	16
3. Definitions	16
4. Test Setup	16
4.1. Test Conditions	16
4.2. Calibration	17
4.3. Power Measurement Location	17
4.4. Source Signals	17
4.5. UUT Configuration and Control	17
4.6. UUT Initialization	18
5. Test Procedures	18
5.1. Watching Live TV (P_{TV})	18
5.2. Recording Live TV (P_{Record})	19
5.3. Playing Back Recorded TV ($P_{Playback}$)	19
5.4. Removable Media Playback Test ($P_{Playback}$)	20
5.5. Removable Media Record Test (P_{Record})	20
5.6. Sleep Test (P_{Sleep})	20
5.7. Auto Power Down (P_{AutoPD})	21



ENERGY STAR® Program Requirements for Set-top Boxes

Draft 1 Version 3.0 Partner Commitments

1 Commitment

Note: EPA has updated the Partner Commitment language to address some issues raised by STB manufacturers and Service Providers from the Version 2.0 specification. The language in this portion of the document is subject to additional changes due to an ongoing review of all ENERGY STAR partner commitments by EPA. Subsequent changes will be included and discussed in the next draft of this Version 3.0 specification.

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture of ENERGY STAR qualified set-top boxes (STBs). 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 STBs and specifying the testing criteria for STBs. 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 STB model within six months of activating the STB portion of the agreement. When the manufacturing Partner qualifies the product, it must meet the specification in effect at that time;
- for all qualified STBs, clearly display the ENERGY STAR label:
 - on product packaging;
 - in product literature (e.g., user manuals, spec sheets); and
 - on the Partner's Web site where information about ENERGY STAR qualified models is displayed. 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;
- for all qualified STBs **sold at retail or directly to the consumer**, provide clear and consistent labeling of ENERGY STAR qualified STBs. Clearly display the ENERGY STAR mark via electronic notification or via physical labeling, as follows:
 - electronic notification:
 - the ENERGY STAR mark must appear in cyan, black, or white, as described in the ENERGY STAR Identity Guidelines, which can be found at www.energystar.gov/marks;
 - the ENERGY STAR mark must be at least 10% of the screen by area, may not be smaller than 76 pixels x 78 pixels, and must be legible;

- 38 • the ENERGY STAR mark must appear on average at least once per day for a
39 duration of not less than five seconds.
- 40 • physical labeling via a permanent or temporary label on the product, as described in the
41 ENERGY STAR Identity Guidelines, which can be found at www.energystar.gov/marks;
- 42 • for all qualified STBs **sold to Service Providers that are ENERGY STAR partners**, the
43 manufacturing Partner may provide labeling. If labeling is provided, then it must meet the
44 requirements above for electronic notification or physical labeling. The STB may only bear the
45 ENERGY STAR certification mark if the Service Provider to whom the box is sold has joined as an
46 ENERGY STAR partner. Appropriate labeling of STBs provided to subscribers is the responsibility
47 of the Service Provider. Partner must clearly communicate the requirements for configuration and
48 installation that are necessary for the STB to maintain ENERGY STAR qualification and receive
49 labeling;
- 50 • for all qualified STBs **sold to Service Providers that are not ENERGY STAR partners**, STBs
51 must NOT bear the ENERGY STAR mark, although the manufacturing Partner is welcome to
52 explain that the box meets ENERGY STAR levels and may point the Service Provider to the
53 ENERGY STAR qualified product list for verification;

54 **Note:** Some manufacturers have requested that they be permitted to use the ENERGY STAR mark on
55 ALL boxes that meet ENERGY STAR requirements regardless of the partner status of the service provider
56 customer. EPA welcomes feedback from stakeholders on this proposal. Specifically, it would be useful to
57 understand the situations in which energy consumption of boxes could NOT change despite service
58 provider actions, and how manufacturers propose reporting such claims to EPA.

- 59 • explain the conditions under which the model is able to earn the ENERGY STAR in product guide
60 and specification sheets for each qualified product. For STBs sold at retail, include information on
61 how using the product in conjunction with a Service Provider subscription can impact the product's
62 energy use, and what steps the consumer must take to assure that the product still meets
63 ENERGY STAR criteria. In addition, these materials shall notify Service Providers that they must
64 complete an ENERGY STAR Partnership Agreement before labeling any STB, or claiming to
65 provide ENERGY STAR qualified STBs in advertising or promotions;
- 66 • provide to EPA, on an annual basis, an updated list of ENERGY STAR qualified STB models.
67 Once the Partner submits its first list of ENERGY STAR qualified STB models, the Partner will be
68 listed on the ENERGY STAR Web site. Partner must provide annual updates in order to remain
69 on the list of participating product manufacturers;
- 70 • provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in
71 determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total
72 number of ENERGY STAR qualified STBs shipped (in units by model) or an equivalent
73 measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide
74 ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics
75 (e.g., type, presence of additional functions, or other as relevant), total unit shipments for each
76 model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The
77 data for each calendar year should be submitted to EPA, preferably in electronic format, no later
78 than the following March and may be provided directly from the Partner or through a third party.
79 The data will be used by EPA only for program evaluation purposes and will be closely controlled.
80 Any information used will be masked by EPA so as to protect the confidentiality of the Partner;
- 81 • notify EPA of a change in the designated responsible party or contacts for STBs within 30 days.

82 **Performance for Special Distinction**

83 In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the
84 ENERGY STAR Partner may consider the following voluntary measures and should keep EPA informed
85 on the progress of these efforts:

- 86 • provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase
87 availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR
88 and its message;
- 89 • consider energy efficiency improvements in company facilities and pursue benchmarking buildings
90 through the ENERGY STAR Buildings program;
- 91 • purchase ENERGY STAR qualified products. Revise the company purchasing or procurement
92 specifications to include ENERGY STAR. Provide procurement officials' contact information to
93 EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product
94 information to employees for use when purchasing products for their homes;
- 95 • feature the ENERGY STAR mark(s) on Partner Web site and in other promotional materials. If
96 information concerning ENERGY STAR is provided on the Partner Web site as specified by the
97 ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources
98 section on the ENERGY STAR Web site at www.energystar.gov), EPA may provide links where
99 appropriate to the Partner Web site;
- 100 • ensure the power management feature is enabled on all ENERGY STAR qualified displays and
101 computers in use in company facilities, particularly upon installation and after service is
102 performed;
- 103 • provide general information about the ENERGY STAR program to employees whose jobs are
104 relevant to the development, marketing, sales, and service of current ENERGY STAR qualified
105 product models;
- 106 • provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the
107 program requirements listed above. By doing so, EPA may be able to coordinate, communicate,
108 and/or promote Partner's activities, provide an EPA representative, or include news about the
109 event in the ENERGY STAR newsletter, on the ENERGY STAR Web pages, etc. The plan may
110 be as simple as providing a list of planned activities or planned milestones that Partner would like
111 EPA to be aware of. For example, activities may include: (1) increase the availability of ENERGY
112 STAR qualified products by converting the entire product line within two years to meet ENERGY
113 STAR guidelines; (2) demonstrate the economic and environmental benefits of energy efficiency
114 through special in-store displays twice a year; (3) provide information to users (via the Web site
115 and user's manual) about energy-saving features and operating characteristics of ENERGY STAR
116 qualified products; and (4) build awareness of the ENERGY STAR Partnership and brand identity
117 by collaborating with EPA on one print advertorial and one live press event;
- 118 • provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase
119 availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR
120 and its message;
- 121 • join EPA's SmartWay Transport Partnership to improve the environmental performance of the
122 company's shipping operations. SmartWay Transport works with freight carriers, shippers, and
123 other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse
124 gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway;
- 125 • join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions.
126 Through participation, companies create a credible record of their accomplishments and receive
127 EPA recognition as corporate environmental leaders. For more information on Climate Leaders,
128 visit www.epa.gov/climateleaders;
- 129 • join EPA's Green Power partnership. EPA's Green Power Partnership encourages organizations
130 to buy green power as a way to reduce the environmental impacts associated with traditional fossil
131 fuel-based electricity use. The partnership includes a diverse set of organizations including
132 Fortune 500 companies, small and medium businesses, government institutions as well as a
133 growing number of colleges and universities; visit www.epa.gov/grnpower.



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

Draft 1 Version 3.0 Eligibility Criteria

134 Below is the Version 3.0 product specification for ENERGY STAR qualified set-top boxes. A product must
135 meet all of the identified criteria if it is to earn the ENERGY STAR.

136 1. Definitions

137 A) Base Type: For purposes of this specification, base type is the primary means of access to video
138 content for a STB. All base types may be configured in a simple STB with only one stand-alone tuner
139 or as part of a complex STB with additional functionality (e.g., DVR, DVD playback/recording).

140 1) Cable STB: A STB whose principal function is to receive television signals from a broadband,
141 hybrid fiber/coaxial, or community cable distribution system with conditional access (CA) and
142 deliver them to a consumer display, thin-client/remote STB, and/or recording device.

143 2) Satellite STB: A STB whose principal function is to receive television signals from satellites and
144 deliver them to a consumer display, thin-client/remote STB, and/or recording device.

145 3) Cable / Satellite Digital Transport Adapter (DTA): A minimally-configured STB with no “Additional
146 Functionalities” whose principal function is to receive television signals from (1) a broadband,
147 hybrid fiber/coaxial, or community cable distribution system or (2) a satellite distribution system,
148 and deliver them to a consumer display and/or recording device.

149 4) Internet Protocol (IP) STB: A STB whose principal function is to receive television/video signals
150 encapsulated in IP packets and deliver them to a consumer display, thin-client/remote STB,
151 and/or recording device.

152 5) Terrestrial STB: A STB whose principal function is to receive television signals over the air (OTA)
153 or via community cable distribution system without conditional access (CA) and deliver them to a
154 consumer display, thin-client/remote STB, and/or recording device.

155 6) Thin-client / Remote STB: A STB that is designed to interface between a Multi-room STB and a
156 TV (or other output device) that has no ability to interface with the Service Provider directly and
157 relies solely on a multi-room STB for access to content. Any STB that meets the definition of a
158 cable, satellite, IP, or terrestrial STB is not a thin-client/remote STB.

159 **Note:** The STB Base Type definitions have been modified in this draft as follows:

160 ▪ The “STB Type” and “STB Base Functionality” definitions from the Version 2.0 specification have been
161 merged into a single “STB Base Type” definition for simplicity.

162 ▪ The Cable, IP, Satellite, and Terrestrial STB base type definitions now explicitly include content
163 delivery to Thin-client/Remote STBs, in order to accommodate new Multi-room system architectures.

164 ▪ The Cable & Terrestrial STB base type definition now explicitly include reference to Conditional
165 Access. Cable STBs without CA are to be considered Terrestrial STBs.

166 ▪ The Cable / Satellite DTA base type has been added as a means of differentiating Transport Adaptors
167 from more full-featured STBs. Cable/Satellite DTAs are similar in function to Terrestrial DTAs that are
168 eligible for qualification under the ENERGY STAR DTA specification, and will be subject to similar
169 energy efficiency targets under the Version 3.0 STB specification.

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Note: EPA is considering further modifications to the IP Base Type definitions to differentiate IP STBs that are distributed under traditional Service Provider lease agreements from those that are sold directly to the consumer or through retail channels. Supplementary data collection is in progress to validate the assumption that there is a significant variation in energy performance between these subcategories of IP STB. Stakeholders are asked to submit comments on the differences across types of IP STBs that may affect energy efficiency.

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B) Additional Functionality:

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1) Additional Tuners: One or more tuners (exclusive of the base type tuner) that receive television signals or other A/V content and deliver them to a consumer display, thin-client/remote STB, or recording device. An additional tuner may receive content from a physically separate A/V input or in a concurrent stream from the primary input. Out-of-band tuners built in compliance with ANSI/SCTE 55-1 2002 and ANSI/SCTE 55-2 2002 or similar specifications are not considered additional tuners under this specification.

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2) Additional Tuners – Terrestrial / IP: An additional tuner of Terrestrial or IP type. A device with two tuners (one base type tuner plus one additional tuner) has the ability to simultaneously tune two separate streams of video for delivery on separate outputs (outputs being either physical outputs, picture-in-picture, or recording mechanisms).

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3) Advanced Video Processing: Advanced methods for video encoding, transcoding and decoding (e.g., H.264/MPEG 4, SMPTE 421M).

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4) CableCARD:¹ A plug-in conditional access module that complies with ANSI/SCTE 28. A CableCARD is inserted into a digital cable-ready device to enable the decryption of premium content and services and provide other network control functions. Also known as a “Card” or a “Point of Deployment” (POD) module.

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5) Data Over Cable Service Interface Specification (DOCSIS): An international suite of standards that define interface requirements for cable modems involved in high-speed data and video/audio content distribution over cable television systems.

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6) Digital Video Recorder (DVR): A function that allows video content to be stored locally on a hard disk drive or other non-volatile storage media in the STB. For purposes of this specification, the DVR functionality must be integral to the STB (e.g., does not apply to use of a connected personal computer DVR, or to server-based DVR capabilities made available through Service Provider Video On Demand (VOD) services).

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7) High Definition (HD) Resolution: Video output with resolutions greater than 480i/p.

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8) Home Network Interface: An interface (e.g., WiFi, MOCA) that allows a STB to interface with external devices through a network.

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9) Multi-room STB: A Cable, Satellite, IP or Terrestrial STB that is capable of distributing simultaneous, independent streams of video content to multiple displays or thin-client/remote STBs within a single family dwelling. For the purposes of this specification, a connected display must have a resolution of no less than 480i. Products that provide gateway services in multi-subscriber scenarios are not considered multi-room STBs under this specification.

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10) Removable Media Player: A device whose primary purpose is the decoding of digitized video signals on DVD or Blu-ray Disc optical media.

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11) Removable Media Player / Recorder: A device whose primary purpose is the production or recording of digitized video/audio signals on DVD or Blu-ray Disc optical media.

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C) Automatic Power Down (APD): The capability to automatically switch a device from On mode to Sleep mode after a predetermined period of time (APD timing) has elapsed. APD timing begins when the following criteria have been met:

¹ CableCARD is a registered trademark of CableLabs®

- 216 1) the device has ceased performance of all primary functions, or
217 2) the last user input has been received (e.g., remote control signal, volume adjustment).
218 D) Primary Function: For purposes of this specification, a primary function is defined as follows:
219 1) delivery of live or recorded A/V content to a thin-client/remote STB or local/remote recording
220 device is considered a primary function;
221 2) delivery of live or recorded A/V content to a consumer display within 4 hours of last user
222 interaction/input is considered a primary function;
223 3) continuous device functions (e.g., clocks, status displays, indicator lamps) are NOT considered
224 primary functions.

225 **Note:** The definitions for APD and Primary Function have been updated to be more consistent with the
226 definition in the Version 2.0 ENERGY STAR Audio/Video specification. When implemented, the APD
227 function is expected to switch a STB that is delivering content to a display from On mode to Sleep mode
228 after 4 hours without user interaction. The same STB is not expected to APD if there is an active
229 recording in progress, or if the device is engaged in delivery of video content to a thin-client / remote STB.

- 230 E) Operational Modes:
- 231 1) On Mode: Where the product is connected to a mains power source, has been activated and may
232 be providing one or more primary functions. The common terms “active”, “in-use” and “normal
233 operation” also describe this mode.
- 234 2) Sleep Mode: Where the product is connected to a mains power source, is not providing a primary
235 function, and offers one or more of the following user oriented or protective functions which may
236 persist for an indefinite time:
- 237 i) to facilitate the activation of other modes (including activation or deactivation of On mode) by
238 remote switch (including remote control), internal sensor, timer;
- 239 ii) continuous function: information or status displays including clocks;
- 240 iii) continuous function: sensor-based functions.

241 **Note:** The definitions of Operational Modes have been updated to be more consistent with the definitions
242 in the Version 2.0 ENERGY STAR Audio/Video specification and other recent ENERGY STAR
243 specification updates.

- 244 F) Miscellaneous:
- 245 1) Service Provider: An entity that provides video (and possibly other) content to subscribers with
246 whom it has an ongoing contractual relationship. For purposes of this specification, a Service
247 Provider distributes STBs covered by this specification to end users under a lease or rental
248 arrangement.
- 249 2) Conditional Access (CA): The encryption, decryption, and authorization techniques employed to
250 protect content from unauthorized viewing. CableCARD and Downloadable Conditional Access
251 System (DCAS) are examples of conditional access technology.

252 **Note:** The definitions for Digital Television Adapter and Game Console have been removed from this
253 specification in favor of a reference (see Section 2.2 “Excluded Products”) to definitions that are included
254 in the ENERGY STAR specifications for those products.

- 255 3) Out-of-band Tuner: A tuner compliant with ANSI/SCTE 55-1 2002 and ANSI/SCTE 55-2 2002 or
256 similar specifications that is used to access data channels outside of the audio/video source
257 signal. Out-of-band tuners may facilitate two-way communication between a STB and Service

258 Provider for purposes of enabling system diagnostics or access to Pay-Per-View or other
259 interactive content.

260 4) Typical Energy Consumption (TEC): An estimation of energy consumption (in kWh) over a specific
261 period of time (typically one year) that is intended to represent consumption by an average end-
262 user. TEC is determined by measuring average power consumption in various operational modes
263 and then multiplying by an assumed duty cycle.

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

265 **2. Qualifying Products**

266 *2.1. Included Products*

267 A product must meet the definition of a STB provided in Section 1 to be eligible for ENERGY STAR
268 qualification under this specification, with the exception of products identified in Section 2.2.

269 *2.2. Excluded Products*

270 Products that are covered under existing ENERGY STAR product specifications are not eligible for
271 qualification under the STB specification. The list of specifications currently in effect can be found at
272 www.energystar.gov/products. Products which meet the definition of a Display, Television, Computer,
273 Computer Server, Game Console, Audio/Video Product, or Digital Television Adapter (DTA) per the
274 definitions in ENERGY STAR requirements for those product categories are excluded from qualification
275 under this specification.

276 **3. Energy Efficiency Criteria**

277 A product must meet all of the requirements specified below to be eligible for ENERGY STAR qualification
278 under this specification.

279 *3.1. General Qualification Criteria*

280 1) Products Sold with an External Power Supply: To qualify for ENERGY STAR, STB products that
281 are sold with an External Power Supply must use either; (1) an EPS that is ENERGY STAR
282 qualified, or (2) an EPS that meets the applicable No-load mode limits, Active mode efficiency
283 levels, and power factor requirements provided in the latest version of the ENERGY STAR
284 Program Requirements for Single Voltage External AC-AC and AC-DC Power Supplies. The EPS
285 specification and qualified product list can be found at www.energystar.gov/powersupplies.

286 2) Speculative Recording: STBs that provide for speculative recording must have a user-accessible
287 menu option to allow the user to disable speculative recording. Manufacturers must also include
288 instructions for disabling speculative recording in product materials.

289 3) Auto Power Down (APD): APD functionality is not a requirement under this specification.
290 However, credit for anticipated energy savings for STBs with APD capability is provided in Section
291 3.3. In order to use Equation 1B and claim benefits from APD functionality, the following
292 requirements must be met:

293 i) If the APD credit is claimed for purposes of ENERGY STAR qualification, the STB must be
294 shipped from the manufacturer with APD enabled by default and APD timing of no more than
295 4 hours. Default APD settings shall persist unless the user chooses at a later date to: a)
296 manually disable APD, or b) manually modify the APD timing. Partner may choose to restrict
297 users from modifying APD settings.

298 ii) The STB may automatically exit Sleep mode in order to download content, scan for system
299 information, retrieve program scheduling information, or perform any other maintenance
300 activity. After this activity has completed, the STB must return to Sleep mode in no more than

301 15 minutes. The STB may automatically exit Sleep mode for no more than an average² of two
302 (2) hours in a twenty-four (24) hour period. This requirement is exclusive of activities
303 scheduled by the end user (e.g., scheduled DVR recording of a television program). Video
304 downloads that are not user-requested (e.g., “speculative recording”, or “push”) are to be
305 included in the two hour per day requirement.

306 3.2. TEC Allowance

307 **Note:** Based on substantial stakeholder feedback regarding the difficulty of meeting the TEC allowances
308 proposed to take effect on January 1, 2011, EPA performed a detailed EPA analysis of qualified product
309 (QP) data to identify strategic opportunities to ease the ENERGY STAR specification requirements over
310 the next three years. The following changes have been incorporated, as a result of this analysis:

- 311 ▪ Version 3.0 includes two tiers of requirements, effective June 1, 2011 and June 1, 2013, respectively.
- 312 ▪ Given recent STB technology trends, the Home Network Interface and Advanced Video Processing
313 allowances that were included for Tier 2 in the Version 2.0 specification (10kWh/year and 12
314 kWh/year, respectively) have been removed from the list of additional functionality allowances for
315 Version 3.0, and added to the base type allowances for Cable STBs in Tier 1 of this specification.
- 316 ▪ The Satellite STB base type allowance has been set to be the same as the Cable STB base type
317 allowance based on a review of existing STB data, which showed that basic Satellite STBs would be
318 able to satisfy the new base limit as enumerated in this version.
- 319 ▪ The Tier 1 Version 3.0 allowances for DVR and HD output have been increased to 45 kWh/year and
320 25 kWh/year, respectively, in order to enable more full-featured STBs to qualify for ENERGY STAR.
- 321 ▪ The Tier 1 Version 3.0 allowances for CableCARD or DOCSIS are unchanged from those specified in
322 the Version 2.0 specification.
- 323 ▪ The base type allowance for Cable / Satellite DTA has been set at 35 kWh/year for Tier 1, such that
324 the best available DTA STBs will be able to qualify for ENERGY STAR under Version 3.0.
- 325 ▪ The base type allowance for IP is listed as “TBD” pending the results of supplementary data collection
326 by EPA. Proposed allowances for IP STBs will be made available to stakeholders as soon as
327 possible.

- 328 1) Base Functionality Allowance: The STB base functionality energy allowance shall be determined
329 using values from Table 1, and shall satisfy the following requirements:
- 330 i) CABLE: If the STB meets the definition of Cable STB base type, regardless of whether the
331 cable reception is considered the “principal function” by the manufacturer or Service Provider,
332 and/or the STB is capable of receiving cable service after installation of a CableCARD™ or
333 other type of conditional access system, the Base Functionality shall be CABLE.
 - 334 ii) SATELLITE: If the STB Base Functionality is not CABLE, and the STB meets the base type
335 definition of Satellite STB, regardless of whether the satellite reception is considered the
336 “principal function” by the manufacturer or Service Provider, the Base Functionality shall be
337 SATELLITE.
 - 338 iii) CABLE / SATELLITE DTA: If the STB meets the definition of Cable / Satellite DTA base type,
339 regardless of whether the IP reception is considered the “principal function” by the
340 manufacturer or Service Provider, the Base Functionality shall be CABLE / SATELLITE DTA.

² Averaged over a time period of one month.

- 341 iv) INTERNET PROTOCOL (IP): If the STB Base Functionality is not CABLE, SATELLITE, or
 342 CABLE / SATELLITE DTA, and the STB meets the base type definition of IP STB, regardless
 343 of whether the IP reception is considered the “principal function” by the manufacturer or
 344 Service Provider, the Base Functionality shall be IP.
- 345 v) TERRESTRIAL: If the STB Base Functionality is not CABLE, SATELLITE, CABLE /
 346 SATELLITE DTA, or IP, and the STB meets the base type definition of Terrestrial STB,
 347 regardless of whether the terrestrial reception is considered the “principal function” by the
 348 manufacturer or Service Provider, the Base Functionality shall be TERRESTRIAL.
- 349 vi) THIN-CLIENT / REMOTE: If the STB Base Functionality is not CABLE, SATELLITE, CABLE /
 350 SATELLITE DTA, IP, or TERRESTRIAL, and the STB otherwise meets the base type
 351 definition of Thin-Client/Remote, the Base Functionality shall be THIN-CLIENT / REMOTE.

352 **Table 1: Base Functionality Annual Energy Allowance**

Base Functionality	Tier 1 Annual Energy Allowance (kWh/year)	Tier 2 Annual Energy Allowance (kWh/year)
CABLE	72	TBD
SATELLITE	72	
INTERNET PROTOCOL (IP)	TBD	
TERRESTRIAL	22	
THIN-CLIENT / REMOTE	22	
CABLE / SATELLITE DTA	35	

353 **Note:** In recognition of the continuing evolution of STB products, EPA is proposing two tiers of energy
 354 efficiency levels in this Version 3.0 specification. Over more than 15 years, and across a wide range of
 355 product categories in the ENERGY STAR suite, ENERGY STAR has successfully rewarded products that
 356 (1) deliver a robust, high-quality experience when in use, (2) supply power only to those components
 357 engaged in delivery of the user experience, while forcing other components to sleep, (3) shift all
 358 components to a very low power state when not in use, and (4) wake quickly and seamlessly when
 359 engaged by users. Products with these capabilities satisfy consumer expectations for both a high-quality
 360 user experience and energy savings. EPA wishes to continue to promote best-in-class energy efficiency
 361 in STBs, and is working to develop more stringent Tier 2 Version 3.0 levels that reflect this goal. To
 362 develop these levels, EPA is considering expected changes in the STB market over the next few years,
 363 especially with respect to the widespread implementation of multi-room STBs and other novel system
 364 architectures. EPA will share these proposed Tier 2 levels with stakeholders as soon as possible.

- 365 2) Additional Functionality Allowances: The STB additional functionality allowances shall be
 366 determined using values from Table 2, and shall satisfy the following requirements:
- 367 i) Additional functionality allowances shall not be applied to STBs with CABLE / SATELLITE
 368 DTA base functionality.
- 369 ii) The HIGH DEFINITION (HD) allowance shall not be applied to STBs with TERRESTRIAL
 370 base functionality.
- 371 iii) The ADDITIONAL TUNERS allowance shall be applied only once per STB, regardless of the
 372 number of tuners installed in the device, as applicable.

- 373 iv) The ADDITIONAL TUNERS - TERRESTRIAL / IP allowance shall be applied only once per
374 STB, regardless of the number of tuners installed in the device, as applicable.
- 375 v) The MULTI-ROOM allowance shall be applied only once per STB, regardless of the number
376 of rooms served by the device, as applicable.
- 377 vi) The CABLECARD allowance shall be applied once per each CableCARD installed in the STB,
378 as applicable.
- 379 vii) The DOCSIS allowance shall only be applied to STBs that are installed in a Service Provider
380 network with DOCSIS capability.

381 **Note:** The preceding list of requirements has been compiled from the footnotes to Table 2 in the Version
382 2.0 specification. The previous notes for Home Network Interface and Advanced Video Processing have
383 been deleted, as they are no longer applicable to this specification.

384 **Table 2: Additional Functionalities Annual Energy Allowance**

Additional Functionality	Tier 1 Annual Energy Allowance (kWh/year)	Tier 2 Annual Energy Allowance (kWh/year)
ADDITIONAL TUNERS	16	TBD
ADDITIONAL TUNERS – TERRESTRIAL / IP	8	
DIGITAL VIDEO RECORDER (DVR)	45	
HIGH DEFINITION (HD)	25	
REMOVABLE MEDIA PLAYER	8	
REMOVABLE MEDIA PLAYER / RECORDER	10	
MULTI-ROOM	25	
CABLECARD	15	
DOCSIS	20	

385

386 *Example:*

387 (A) Under Tier 1, the energy allowance for a high-definition, Cable STB with DVR to qualify for ENERGY
388 STAR would be 142 kWh/yr (72 kWh/yr base + 25 kWh/yr for HD + 45 kWh/yr for DVR).

389 **3.3. TEC Assessment**

390 To qualify for ENERGY STAR, the Combined TEC for a product must not exceed the sum of the annual
391 energy allowances for the product's base functionality and applicable additional functionalities. Note that
392 some simple Cable or Satellite STBs may not qualify for any additional functionality allowances. The
393 Combined TEC is the maximum amount of energy the STB can consume in a given year, as determined
394 by the ENERGY STAR test procedure.

- 395 1) Base TEC Assessment: Equations 1A and 1B apply to all products. Base TEC is calculated by
396 multiplying the power consumption in each state by the duty cycle values in the equations below,

397 where P_{TV} , P_{Sleep} and P_{AutoPD} are measured according to the ENERGY STAR test procedure.
 398 Equation 1A shall be used for products that do not offer Auto Power Down, and Equation 1B shall
 399 be used for products that do offer Auto Power Down.

400 i) Equation 1A: Base TEC assessment for a product with no auto power down capability:

401
$$kWh_{Base} = 0.365 \times (14 \times P_{TV} + 10 \times P_{Sleep})$$

402 ii) Equation 1B: Base TEC assessment for a product with auto power down capability:

403
$$kWh_{Base} = 0.365 \times ((7 \times P_{TV}) + (10 \times P_{Sleep}) + (7 \times P_{AutoPD}))$$

404 *Examples:*

405 (B) The UUT (Cable STB, HD, DVR, no APD) power measurements are as follows: $P_{TV} = 24.0$ watts and
 406 $P_{Sleep} = 18.0$ watts. The Base TEC assessment is then:

407
$$kWh_{Base} = 0.365 * (14 * 24.0 + 10 * 18.0) = 188 \text{ kWh/yr}$$

408 (C) The UUT (Cable STB, HD, DVR, APD) power measurements are as follows: $P_{TV} = 24.0$ watts, $P_{Sleep} =$
 409 18.0 watts and $P_{AutoPD} = 18.0$ watts. The Base TEC assessment is then:

410
$$kWh_{Base} = 0.365 * (7 * 24.0 + 10 * 18.0 + 7 * 18.0) = 173 \text{ kWh/yr}$$

411 2) Playback and Record TEC Assessment: Equation 2 applies only to products with DVR,
 412 Removable Media Playback, or Removable Media Playback with Record capability. Playback and
 413 Record TEC is calculated by multiplying the power consumption in each state by the duty cycle
 414 values in the equations below, where P_{TV} , $P_{Playback}$ and P_{Record} are measured according to the
 415 ENERGY STAR test procedure.

416 i) Equation 2: Playback and Record TEC assessment:

417
$$kWh_{Play/Record} = 0.365 \times \sum_1^2 (P_{mode} - P_{TV}) \times H_{mode}$$

418 **Table 3: Playback and Record TEC Duty Cycle**

Mode	DVR (hours/day)	Removable Media Playback (hours/day)	Removable Media Playback w/ Record (hours/day)
Hours On-Playback ($H_{Playback}$)	2	2	2
Hours On-Record (H_{Record})	3	0	1

419 *Example:*

421 (D) The UUT (Cable STB, HD, DVR, no APD) power measurements are as follows: $P_{TV} = 24.0$ watts,
 422 $P_{Playback} = 30.0$ watts and $P_{Record} = 32.0$ watts. The Playback/Record TEC assessment is then:

423
$$kWh_{Play/Record} = 0.365 * ((30.0 - 24.0) * 2 + (32.0 - 24.0) * 3) = 13.1 \text{ kWh/yr}$$

424 3) Combined TEC Assessment: If the STB includes a DVR, Removable Media Playback, or
425 Removable Media Playback with Record capability, add the results of Equation 1 and Equation 2
426 to determine Combined TEC. If the STB does not include DVR, Removable Media Playback, or
427 Removable Media Playback w/ Record capability, the Combined TEC is equivalent to the result of
428 Equation 1.

429 i) Equation 3: Combined TEC assessment:

$$430 \quad kWh_{Combined} = kWh_{Base} + kWh_{Play/Record}$$

431 *Example:*

432 (E) In the case of a HD STB with a DVR as used above, the Combined TEC would be the sum of Equation
433 1 and Equation 2 (188.3 + 13.1) for a total of 201.4 kWh/yr for this STB.

434 3.4. STBs with Multi-room Capability

435 To qualify for ENERGY STAR, STBs with multi-room capability must be evaluated according to the
436 following process:

- 437 1) STBs with multi-room capability must first be tested with only one display output in use (single-
438 output configuration).
- 439 2) Compare the calculated TEC for the STB in single-output configuration to the annual energy
440 allowance for the STB, excluding the Multi-room allowance.
- 441 3) If the STB meets ENERGY STAR qualification criteria in the single-output configuration without
442 the Multi-room allowance, it may be qualified for ENERGY STAR under any installation
443 configuration (i.e., it can be used for one or more TVs).
- 444 4) If the STB does not meet ENERGY STAR qualification criteria in Step 2, it must then be tested
445 with two display outputs in use (dual-output configuration).
- 446 5) Compare the calculated TEC for the STB in dual-output configuration to the annual energy
447 allowance, including:
 - 448 i) the Multi-room allowance, and
 - 449 ii) for STBs that can support a second TV without the need for a thin client, and do so over
450 standard RF cabling with common, unencrypted N/ATSC; 50% (one half) of the THIN-
451 CLIENT/REMOTE base functionality allowance.
- 452 6) If the STB meets ENERGY STAR qualification criteria in the dual-output configuration, it must be
453 qualified for ENERGY STAR only as a Multi-room STB. The manufacturer must clearly indicate in
454 product literature that the product qualifies for ENERGY STAR only when providing content to
455 more than one TV.

456 4. Testing

457 Partners are required to perform tests and self-certify those Set-top Box products that meet the ENERGY
458 STAR guidelines. A representative sample of STB products shall be tested to ensure that all units meet
459 the ENERGY STAR criteria. Test results must be reported to the EPA using the STB Qualifying Product
460 Information (QPI) Form, as directed. Test results must be included with the product submission. All testing
461 shall be performed per the ENERGY STAR Set-top Box Test Procedure included as Appendix A of this
462 document.

463 The following method shall be used to determine an appropriate representative sample size for STB
464 qualification:

- 465 1) Randomly select a pool of five (5) units of the STB model to be tested. If the units have been
466 refurbished, all must have undergone the same refurbishment or reconfiguration, and must have
467 received the same hardware and software upgrades.
- 468 2) Test three (3) units drawn at random from the pool of five according to the ENERGY STAR Set-
469 top Box Test Procedure.
- 470 i) If all three tested units meet the applicable ENERGY STAR criteria, and are not within 10% of
471 the allowance in the specification, the STB model meets ENERGY STAR requirements and
472 can be qualified as ENERGY STAR, and no more testing is needed.
- 473 ii) If all three tested units meet the applicable ENERGY STAR criteria, but one or more of the
474 units are within 10% of the allowance in the specification, go to Step 3.
- 475 iii) If any of the three tested units do not meet the applicable ENERGY STAR criteria, the STB
476 model cannot be qualified as ENERGY STAR.
- 477 3) Test the additional two units in the pool. If both units meet the applicable ENERGY STAR criteria,
478 the STB model meets ENERGY STAR requirements and can be qualified as ENERGY STAR, and
479 no more testing is needed. If either of the two units does not meet the applicable ENERGY STAR
480 criteria, the STB model cannot be qualified as ENERGY STAR.

481 5. User Interface

482 Although not mandatory, manufacturers are strongly recommended to design products in accordance with
483 the Power Control User Interface Standard — IEEE 1621 (formally known as “Standard for User Interface
484 Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments”).
485 Compliance with IEEE 1621 will make power controls more consistent and intuitive across all electronic
486 devices. For more information on the standard, see <http://eetd.LBL.gov/Controls>.

487 6. Effective Date

488 **Note:** Based on stakeholder feedback regarding the need for specification effective dates in June/July
489 versus January, EPA has changed the Tier 1 Version 3.0 effective date to June 1, 2011.

490 The date that products must meet the requirements specified under the Version 3.0 Set-top Box
491 specification will be defined as the effective date of the agreement. Any previously executed agreement
492 on the subject of ENERGY STAR qualified STB products shall be terminated effective June 1, 2011 for
493 products eligible under the Version 2.0 Program Requirements for Set-top Boxes.

- 494 1) Qualifying and Marking Products under the Tier 1 Version 3.0 Specification: All products,
495 including models originally qualified under Version 2.0, with a date of manufacture on or after June
496 1, 2011, must meet the new (Version 3.0) requirements in order to qualify for ENERGY STAR.
497 The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a
498 unit is considered to be completely assembled.
- 499 2) Qualifying and Marking Products under the Tier 2 Version 3.0 Specification: All products,
500 including models originally qualified under Tier 1 Version 3.0, with a date of manufacture on or
501 after June 1, 2013, must meet the Tier 2 requirements in order to qualify for ENERGY STAR.
- 502 3) Elimination of Grandfathering: EPA will not allow grandfathering under this Version 2.0 ENERGY
503 STAR specification. ENERGY STAR qualification under previous Versions is not automatically
504 granted for the life of the product model. Therefore, any product sold, marketed, or identified by
505 the manufacturing partner as ENERGY STAR must meet the current specification in effect at the
506 time of manufacture of the product.

507 7. Future Specification Revisions

508 EPA reserves the right to revise the specification should technological and/or market changes affect its

509 usefulness to consumers or industry or its impact on the environment. In keeping with current policy,
510 revisions to the specification will be discussed with stakeholders. In the event of a specification revision,
511 please note that ENERGY STAR qualification is not automatically granted for the life of a product model.
512 To qualify as ENERGY STAR, a product must meet the ENERGY STAR specification in effect on the date
513 of manufacture of the product.

514

APPENDIX A:

515

ENERGY STAR Test Procedure for Set-top Boxes

516 1. Overview

517 The following protocol shall be followed when measuring the power consumption of STB products for
518 compliance with the Version 3.0 ENERGY STAR Set-top Box Specification. The following workload-
519 based test procedure is centered on the actions of the end-user and is intended to represent the practical
520 output of STBs in typical end-use applications, and is not meant to be representative of every possible
521 STB function and use scenarios.

522 2. Applicability

523 Partners must test products in their “as-shipped” configuration. For products that offer a choice of user-
524 configurable options, all options shall be set to their default condition.

525 3. Definitions

526 Unless otherwise specified, all terms used in this test procedure are consistent with the definitions
527 contained in the Version 3.0 ENERGY STAR Eligibility Criteria for Set-top Boxes.

528 4. Test Setup

529 Test setup and instrumentation shall be in accordance with the requirements of IEC 62301, Ed. 1.0,
530 “Measurement of Household Appliance Standby Power”, Section 4, and CSA C380-08 “Test Procedure for
531 the Measurement of Energy Consumption of Set-top Boxes”, unless otherwise noted in this document. In
532 the event of conflicting requirements, this test procedure shall take precedence. The setup and
533 instrumentation requirements from IEC 62301, Ed. 1.0, Section 4 are applicable to both On and Sleep
534 mode testing for ENERGY STAR.

535 4.1. Test Conditions

Supply Voltage (Note: For products rated for greater than 1.5 kW, voltage tolerance is ± 4%)	North America	115 (± 1%) Vac, 60 Hz (± 1%)
	Europe / Australia / New Zealand	230 (± 1%) Vac, 50 Hz (± 1%)
	China	220 (± 1%) Vac, 50 Hz (± 1%)
	Japan	100 (± 1%) Vac, 50 Hz (± 1%) 100 (± 1%) Vac, 60 Hz (± 1%)
Total Harmonic Distortion (Voltage)	< 2% THD (< 5% THD for products which are rated for > 1.5 kW maximum power)	
Ambient Temperature	23°C ± 5°C	
Relative Humidity	10% min 80% max	

536 Models Capable of Operating at Multiple Voltage/Frequency Combinations: Manufacturers shall test their
537 products for qualification in every market in which they will be sold and promoted as ENERGY STAR. For

538 products that are sold as ENERGY STAR in several markets and rated for multiple input voltages, the
539 manufacturer must test at and report the required power consumption or efficiency values at all relevant
540 voltage/frequency combinations (e.g., a manufacturer that ships the same model to the United States and
541 Europe must measure, meet the specification, and report test values at both 115 Vac / 60 Hz and 230 Vac
542 / 50 Hz in order to qualify the model as ENERGY STAR in both markets). If a model qualifies as ENERGY
543 STAR at only one voltage/frequency combination, then it may only be qualified and promoted as ENERGY
544 STAR in regions that support the qualified voltage/frequency combination.

545 **4.2. Calibration**

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

548 **4.3. Power Measurement Location**

549 All power measurements shall be taken at a point between the AC mains power source and the UUT.

550 **4.4. Source Signals**

551 a) Reference Channels:

552 [A] Network television channel, standard definition (SD) format, 480i minimum resolution.

553 [B] Live or recorded sports channel;

554 (a) If the STB is HD capable, this channel shall be in HD format, minimum 720p
555 resolution.

556 (b) If the STB is not HD capable, this channel shall be in SD format, minimum 480i
557 resolution.

558 [C] 24-hour news channel, standard definition (SD) format, 480i minimum resolution.

559 b) Headend System Interaction:

560 (1) All STBs with POD/CableCARD-encrypted content must decrypt by POD/CableCARD.

561 (2) All Cable STBs must interact with Conditional Access (CA) system data via DOCSIS Set-
562 top Gateway (DSG) or SCTE-55.

563 (3) All Telcocom QAM/IP STBs must interact with CA system data via SCTE-55 and/or via an
564 applicable LAN technology (e.g., MoCA).

565 (4) All IP STBs must interact with CA system data via applicable LAN technology (e.g. IEEE-
566 802.3, MoCA).

567 (5) All Satellite STBs must interact with CA system via LNB and POTS modem.

568 (6) All Terrestrial STBs must interact with an ATSC signal from a live source.

569 **4.5. UUT Configuration and Control**

570 a) UUT Control: The UUT shall be controlled with the factory-supplied remote control (I/R or RF) to
571 the extent possible. For units that do not ship with a remote control, or for functions that cannot
572 be exercised with the supplied remote control, control interfaces on the face or body of the UUT
573 may be used.

574 b) Tuning: For purposes of this specification, tuning to a broadcast video source is defined as one
575 tuner acquiring an encrypted digital video service, where the video service is rendered on all
576 analog audio/video outputs (e.g., RF modulated, S-Video, composite, and component) and on
577 all S/PDIF audio outputs, as applicable.

578 c) Satellite Low Noise Block (LNB): Incremental power required to operate LNB(s), if drawn from
579 the STB, may be subtracted from all power measurements. It is preferable that all LNB power

- 580 drawn be supplied separately. Otherwise, the amount subtracted must be clearly noted on the
581 Qualified Product Information (QPI) form.
- 582 d) Secondary Device Functions: The following UUT secondary functions shall be disabled for
583 testing, as applicable:
- 584 (1) WiFi, unless video streaming over WiFi is the primary means of content delivery.
585 (2) Voice Over IP (VOIP)
586 (3) Data Services that are made available to the end-user (e.g., broadband services)
- 587 e) Conditional Access: If the UUT uses POD or CableCARD for conditional access system control,
588 then insert the applicable card into the UUT prior to applying power.
- 589 f) Battery Powered Devices: If the UUT contains rechargeable batteries, or can be integrated with
590 another device that contains rechargeable batteries, all batteries shall be in a fully charged state
591 for the duration of testing.
- 592 g) A/V Interconnections: If the UUT offers several audio and video interconnection options, select
593 and configure the system with one of the following interconnections, in order of preference:
594 HDMI, component, S-video, and composite.

595 **4.6. UUT Initialization**

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

- 597 1) Set up the UUT per the instructions in the supplied operating manual.
598 2) Connect the UUT to a display device via an A/V Interconnection as specified above (e.g., HDMI).
599 3) Connect the UUT to the power source.
600 4) Power on the UUT with the remote control and perform initial system configuration, as applicable.
601 Ensure that UUT features and functions are in their as-shipped configuration.
602 5) Connect the UUT to the signal source. The input signal shall comply with the requirements in
603 Section 4.3, above.
604 6) Let the UUT sit for at least 15 minutes, or until the unit has completed initialization and is ready for
605 use.
606 7) Measure and record the AC mains input voltage and frequency.
607 8) Measure and record the test room ambient temperature.

608 **5. Test Procedures**

609 **5.1. Watching Live TV (P_{TV})**

- 610 1) Verify that the UUT is turned on and tuned to a live television channel. If the UUT base type is IP,
611 and the UUT does not have the capability to play back live, streaming video content (i.e., the UUT
612 is a "download-only" device), this portion of the test procedure must be performed while the video
613 content is simultaneously being played back and downloaded.
- 614 2) If the UUT offers DVR functionality, this portion of the test procedure must be performed with the
615 primary video stream paused for 5%, in fast forward for 10% and in rewind for 10% of the total test
616 time, while raw video input is simultaneously being buffered. This requirement does not increase
617 the total overall test times.
- 618 3) Tune to Reference Channel A.
619 4) Measure and record the average power consumption over a 5-minute period.
620 5) Tune to Reference Channel B (if the UUT is HD capable, Reference Channel B should be in HD
621 format).

- 622 6) Measure and record the average power consumption over a 10-minute period.
- 623 7) Tune to Reference Channel C. If the UUT has one or more Additional Tuners, set a second tuner
- 624 to Reference Channel A and render it simultaneously in a window embedded in the primary
- 625 display window (i.e., Picture-in-Picture). The second window shall be as close to 25% of the total
- 626 display screen area as possible. If no picture-in-picture capability exists, the second channel shall
- 627 be recorded in the background.
- 628 8) Measure and record the average power consumption over a 5-minute period.
- 629 9) Record the average power consumption for the full duration of the test period.
- 630 10) If the UUT offers place-shifting capability, repeat the test with the place-shifting feature turned on.
- 631 Average and record the power consumption from both tests.

632 5.2. Recording Live TV (P_{Record})

- 633 1) Verify that the UUT is turned on and tuned to a live television channel.
- 634 2) If the UUT offers DVR functionality, this portion of the test procedure must be performed with a
- 635 second tuner engaged and recording at all times. It is permissible to create a series of pre-
- 636 programmed back-to-back recording sessions for these tests to avoid menu prompts.
- 637 3) Tune to Reference Channel A.
- 638 4) Measure and record the average power consumption over a 5-minute period.
- 639 5) Tune to Reference Channel B (if the UUT is HD capable, Reference Channel B should be in HD
- 640 format).
- 641 6) Measure and record the average power consumption over a 10-minute period.
- 642 7) Tune to Reference Channel C.
- 643 8) Measure and record the average power consumption over a 5-minute period.
- 644 9) Record the average power consumption for the full duration of the test period.
- 645 10) Save the recordings for the Playback test.

646 5.3. Playing Back Recorded TV ($P_{Playback}$)

- 647 1) Verify that the UUT is turned on and tuned to a live television channel. If the UUT base type is IP,
- 648 and the UUT does not have the capability to play back live, streaming video content (i.e., the UUT
- 649 is a "download-only" device), this portion of the test procedure must be performed with video
- 650 playback from disk storage and no simultaneous file download.
- 651 2) If the UUT offers DVR functionality, this portion of the test procedure must be performed with the
- 652 primary video stream paused for 5%, in fast forward for 10%, and in rewind for 10% of the total
- 653 test time, while raw video input is simultaneously being buffered. In addition, this portion of the
- 654 test procedure must be performed with a second tuner engaged and recording at all times.
- 655 3) Use the remote control to begin playback of the recording of Reference Channel A.
- 656 4) Measure and record the average power consumption over the playback period.
- 657 5) When playback is complete, delete the recording. If automatically prompted to delete, select the
- 658 affirmative prompt.
- 659 6) Use the remote control to begin playback of the recording of Reference Channel B.
- 660 7) Measure and record the average power consumption over the playback period.
- 661 8) When playback is complete, delete the recording. If automatically prompted to delete, select the
- 662 affirmative prompt.
- 663 9) Use the remote control to begin playback of the recording of Reference Channel C.

- 664 10) Measure and record the average power consumption over the playback period.
- 665 11) When playback is complete, delete the recording. If automatically prompted to delete, select the
666 affirmative prompt.
- 667 12) Record the average power consumption for the full duration of the test period.

668 **5.4. Removable Media Playback Test ($P_{Playback}$)**

- 669 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 670 2) Begin the power consumption measurement.
- 671 3) Use the remote control to activate the UUT's removable media playback function. Note that if this
672 function is automatically activated when the removable media door is actuated, or when a disc is
673 inserted, this step of the test procedure may be omitted.
- 674 4) Insert the removable media. Open and close the disc tray, as necessary.
- 675 5) Use the remote control to begin playback of removable media video content. Note that if playback
676 begins automatically upon insertion of removable media, this step of the test procedure may be
677 omitted.
- 678 6) Play the recording for 20 minutes.
- 679 7) Use the remote control to stop playback and eject the removable media.
- 680 8) Measure and record the average power consumption for the full duration of the test.
- 681 9) If the UUT is capable of playing back HD content, repeat the test with an HD video stream that
682 meets the requirements of Reference Channel B. Average and record the power consumption
683 from both tests.

684 **5.5. Removable Media Record Test (P_{Record})**

- 685 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 686 2) Begin the power consumption measurement.
- 687 3) Use the remote control to activate the UUT's removable media recording function.
- 688 4) Insert the removable media. Open and close the disc tray, as necessary.
- 689 5) Use the remote control to begin recording to the removable media.
- 690 6) Record the video content for 20 minutes.
- 691 7) Use the remote control to stop recording and eject the removable media.
- 692 8) Measure and record the average power consumption for the full duration of the test.
- 693 9) If the UUT is capable of recording HD content, repeat the test with an HD video stream that meets
694 the requirements of Reference Channel B. Average and record the power consumption from both
695 tests.

696 **5.6. Sleep Test (P_{Sleep})**

- 697 1) Verify that the UUT is turned on and tuned to Reference Channel A. Ensure that at least the
698 "Watching Live TV" tests have been completed immediately prior to the start of this portion of the
699 test procedure.
- 700 2) Use the remote control to place the system into a lower power state.
- 701 3) Begin the power consumption measurement.
- 702 4) Measure and record the average power consumption over a 20-minute period.

703 **5.7. Auto Power Down (P_{AutoPD})**

- 704 1) Verify that the UUT is turned on and tuned to Reference Channel A.
- 705 2) Allow the UUT to automatically power down.
- 706 3) Verify that the UUT is in the expected low power state.
- 707 4) Begin the power consumption measurement.
- 708 5) Measure and record the average power consumption over a 20-minute period.