



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

Eligibility Criteria Draft 1 Version 4.1

1 Following is the Version 4.1 ENERGY STAR product specifications for Set-top Boxes (STBs). A product
2 shall meet all of the identified criteria if it is to earn the ENERGY STAR.

3 1 DEFINITIONS

4 **Note:** EPA has reworded the product type definitions for consistency with the latest draft of CEA-2043
5 Set-top Box (STB) Power Measurement test procedure and reviewed them for consistency with the
6 Proposed U.S. Department of Energy (DOE) Test Procedure for Set-top Boxes contained in the Notice of
7 Proposed Rulemaking published in the Federal Register on January 23, 2013, 78 FR 5076. EPA will
8 harmonize with the final DOE Test procedure.

9
10 **Note:** EPA has removed the distinction between the Base Types (specified below) and Base
11 Functionalities, which were separate categories used to calculate the Typical Energy Consumption
12 requirement, TEC_{MAX} in Version 3.0 (renamed to Maximum Annual Energy Consumption specification
13 requirement, AEC_{SPEC_MAX}). To enable this simplification, EPA has added the requirements for classifying
14 STBs (formerly in Section 3.3.3.i in Version 3.0) directly into the Base Type definitions, below.

15 A) Set-top Box (STB): A device combining hardware components with software programming designed
16 for the primary purpose of receiving television and related services from terrestrial, cable, satellite,
17 broadband, or local networks, providing video output using at least one direct video connection.

18 B) Displayless Video Gateway: A device that receives, encodes, and decodes video content which is
19 then delivered to a recording device or Client, but not a Display Device, through quadrature amplitude
20 modulation (QAM) or Multimedia over Coaxial Alliance (MoCA) video with a Digital Living Networking
21 Alliance (DLNA) or similar security layer.

22 **Note:** EPA has added a definition for a new type of included product that, because of its inability to send
23 video directly to a Display Device, will be tested according to a separate test method based in part on
24 draft CEA-2043. Below is a table illustrating the capabilities of devices and whether they are included in
25 this or other ENERGY STAR specifications. EPA welcomes comment on the definition and whether the
26 list of video protocols is sufficient to cover all current and foreseeable product configurations.

		Video Delivery to Display Device?		
		Yes	No	
			Video Delivery to Recording Device or Client Through QAM or MoCA?	
		Yes	No	
Direct Service Provider source Input?	Yes	STB	Displayless Video Gateway	Small Network Equipment covered in separate ENERGY STAR Specification
	No	Thin Client/ Remote STB	Excluded from Scope	

28

29

- 30 C) Product Type (Base Type): The primary means of access to video content for a STB or Displayless
31 Video Gateway.
- 32 1) Cable: A STB or Displayless Video Gateway whose primary function is to receive television
33 signals from a broadband, hybrid fiber/coaxial, or community cable distribution system with
34 Conditional Access (CA) or a STB capable of receiving cable service after installation of a
35 CableCARD or other type of Conditional Access system.
- 36 2) Satellite: A STB or Displayless Video Gateway that receives and decodes video content as
37 delivered from a Service Provider satellite network and that is not Cable.
- 38 3) Cable Digital Transport Adapter (DTA): A minimally-configured STB whose primary function is to
39 receive television signals from a broadband, hybrid fiber/coaxial, or community cable distribution
40 system.
- 41 4) Internet Protocol (IP): A STB or Displayless Video Gateway whose primary function is to receive
42 television/video signals encapsulated in IP packets and that is not Cable, Satellite, or Cable DTA.
- 43 i) Over-the-top (OTT) Internet Protocol (IP): An IP STB that does not receive signals from a
44 Multichannel Video Programming Distributor (MVPD).
- 45 ii) Service Provider Internet Protocol (IP): An IP STB that receives signals from a MVPD.
- 46 5) Terrestrial: A STB whose primary function is to receive television signals over the air (OTA) or via
47 community cable distribution system without Conditional Access (CA) and that is not Cable,
48 Satellite, Cable DTA, or IP.
- 49 6) Thin-client / Remote: A STB that can receive content over an HNI from another STB, but is
50 unable to interface directly to the Service Provider network.
- 51 D) Additional Functionality:
- 52 1) Advanced Video Processing: The capability to encode, decode, and/or transcode audio/video
53 signals in accordance with standards H.264/MPEG 4 or SMPTE 421M.
- 54 2) CableCARD: The capability to decrypt premium audio/video content and services and provide
55 other network control functions via a plug-in Conditional Access module that complies with the
56 ANSI/SCTE 28 HOST-POD Interface Standard¹.
- 57 3) Digital Video Recorder (DVR): A STB feature that records television signals on a hard disk drive
58 (HDD) or other non-volatile storage device integrated into the STB. A DVR often includes features
59 such as: Play, Record, Pause, Fast Forward (FF), and Fast Rewind (FR). STBs that support a
60 Service Provider network-based "DVR" service are not considered DVR STBs for purposes of this
61 specification. The presence of DVR functionality does not mean the device is defined to be a
62 STB.
- 63 4) DOCSIS[®]: The capability to distribute data and audio/video content over cable television
64 infrastructure in accordance with the CableLabs[®] Data Over Cable Service Interface
65 Specification².
- 66 5) High Definition (HD) Resolution: The capability to transmit or display video signals with a
67 minimum output resolution of 1280x720 pixels in progressive scan mode at minimum frame rate
68 of 59.94 fps (abbreviated 720p60) or a minimum output resolution of 1920x1080 pixels in
69 interlaced scan mode at 29.97 fps (abbreviated 1080i30).
- 70 6) Home Network Interface (HNI): An interface with external devices over a local area network
71 (example: Institute of Electrical and Electronics Engineers (IEEE) 802.11 (Wireless-Fidelity) or Wi-

¹ <http://www.scte.org/standards/>

² <http://www.cablelabs.com/specifications/>

- 72 Fi), Multimedia over Coax Alliance (MoCA), HomePNA alliance (HPNA), IEEE 802.3, HomePlug
73 AV) that is capable of transmitting video content.
- 74 i) MIMO Wireless HNI: IEEE 802.11n/ac and related MIMO enabled WiFi functionality that
75 supports more than one spatial stream in both send and receive (Antenna support is not
76 relevant, thus the device must be $2 \times n : 2^3$ or better to fall under this definition).
- 77 7) Multi-room: The capability to provide independent live and/or real time transfer of audio/video
78 content to multiple devices (2 or more clients) within a single family dwelling. This definition does
79 not include the capability to manage gateway services for multi-subscriber scenarios.
- 80 8) Multi-stream: A STB feature that may provide independent video content to one or more Clients,
81 one or more directly connected Display Devices, or a DVR. This definition does not include the
82 capability to manage gateway services for multi-subscriber scenarios.
- 83 9) Removable Media Player: The capability to decode digitized audio/video signals on DVD or Blu-
84 ray Disc optical media.
- 85 10) Removable Media Player / Recorder: The capability to decode and record digitized audio/video
86 signals on DVD or Blu-ray Disc optical media.
- 87 E) Auto Power Down (APD): A STB feature that monitors parameters correlated with the user activity or
88 viewing. If the parameters collectively indicate that no user activity or viewing is occurring, the APD
89 feature enables the STB to transition to Sleep or Off Mode.
- 90 F) Principal Function: Functions necessary for selecting, receiving, decoding, decompressing, or
91 delivering live or recorded audio/video content to a Display Device, local/remote recording device, or
92 Client. Monitoring for user or network requests is not considered a Principal Function for STBs.
- 93 G) Secondary Function: Functions that enable, supplement, or enhance a Primary Function including the
94 activation or deactivation of a Primary Function by remote switch (e.g., remote control, internal
95 sensor, and timer).
- 96 H) Operational Modes:
- 97 1) On Mode: The STB is connected to a mains power source. At least one Principal Function is
98 activated and all Principal Functions are provisioned for use. The power consumption in On Mode
99 may vary based on specific use and configuration.
- 100 2) Sleep Mode: A range of reduced power states where the STB is connected to a mains power
101 source and is not providing any Principal Function. The STB may transition to On or Off Mode
102 due to user action, internal signal, or external signal. The power consumed in this mode may vary
103 based on specific use or configuration. If any Principal Function is activated while operating in this
104 mode, the STB is assumed to transition to On Mode. Monitoring for user or network requests is
105 not considered a Principal Function. The STB shall be able to transition from this mode to On
106 Mode within 30 seconds to be considered in Sleep Mode.
- 107 3) Deep Sleep State: A power state characterized by reduced power consumption and more than 30
108 seconds required to return to full On Mode functionality.
- 109 I) Other Definitions
- 110 1) Display Device (DD): A device (e.g., TV, Computer Monitor, or Portable TV) that receives its
111 content directly from a STB through a video interface (example: High-Definition Multimedia
112 Interface (HDMI), Component Video, Composite Video, or S-Video), not through a HNI, and
113 displays it for viewing.

3 The description "2 x n : 2" means 2 send streams x n antennas : 2 receive streams, where n will always be the same or larger as the largest number of streams (in this case 2).

114 2) Client: A device (e.g., STB, Thin-Client STB, Smart TV, Mobile Phone, Tablet, PC, etc.) that can
115 receive content over a HNI from another STB.

116 **Note:** EPA has added definitions for Display Device and Client to be consistent with the terminology used
117 in draft CEA-2043 and the DOE test procedure.
118

119 3) External Power Supply (EPS): Also referred to as External Power Adapter. An external power
120 supply circuit that is used to convert household electric current into dc current or lower-voltage ac
121 current to operate a consumer product.

122 **Note:** EPA has added the definition for External Power Supply (EPS) consistent with its inclusion in other
123 ENERGY STAR consumer electronics specifications.

124 4) Service Provider: A business entity that provides video content, a delivery network, and
125 associated installation and support services to subscribers with whom it has an ongoing
126 contractual relationship.

127 5) Conditional Access: The encryption, decryption, and authorization techniques employed to
128 protect content from unauthorized viewing. CableCARD and Downloadable Conditional Access
129 System (DCAS) are examples of Conditional Access technology.

130 **Note:** EPA has removed the definition for Out-of-band Tuner, as that is no longer being referenced by the
131 updated Multi-stream definition.
132

133 **Note:** EPA has also removed the definition of Game Console, as those products are addressed outside
134 the ENERGY STAR program.
135

136 **Note:** Lastly, EPA has removed the definition of Digital Television Adapter, as those products are
137 assumed to be no longer available in the market.

138 6) Annual Energy Consumption (AEC): A means for evaluating energy efficiency through a
139 calculation of expected energy consumption for a typical household over a one year period,
140 expressed in units of kWh/year.

141 **Note:** EPA has renamed the annual energy consumption metric to harmonize with that in the proposed
142 DOE Test Procedure for Set-top Boxes, 78 FR 5076.
143

144 7) Unit Under Test (UUT): The STB being tested.

145 J) Basic Model: Basic model means all units of a given type of covered product (or class thereof)
146 manufactured by one manufacturer, having the same primary energy source, and which have
147 essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy
148 consumption, energy efficiency, water consumption, or water efficiency.

149 **Note:** The definition of Product Family has been dropped in favor of DOE's definition of Basic Model,
150 contained in 10 CFR Part 430.2. DOE's definition of Basic Model will determine which Set-top Boxes shall
151 be tested for reporting.

152 2 SCOPE

153 2.1 Included Products

154 2.1.1 Products that meet the definition of Set-top Box or Displayless Video Gateway, and a Set-top Box
155 Base Type as specified herein are eligible for ENERGY STAR qualification, with the exception of
156 products listed in Section 2.2.

157 **2.2 Excluded Products**

158 2.2.1 Products that are covered under existing ENERGY STAR product specifications are not eligible
159 for qualification under the STB specification. The list of specifications currently in effect can be
160 found at www.energystar.gov/specifications.

161 2.2.2 Cable DTAs.

162 **Note:** EPA has removed Cable DTAs from the scope of the Version 4.1 ENERGY STAR specification
163 because they are being phased out of the market over the next couple of years and none are expected to
164 ship in 2013
165

166 **3 QUALIFICATION CRITERIA**

167 **3.1 Significant Digits and Rounding**

168 3.1.1 All measured and calculated power values shall be rounded as follows:

- 169 i. 0.01 W or better for power measurements of 10 W or less;
- 170 ii. 0.1 W or better for power measurements of greater than 10 W and up to 100 W; and
- 171 iii. 1 watt or better for power measurements of greater than 100 W.

172 3.1.2 All measured and calculated energy values shall be rounded as follows:

- 173 i. If the computed AEC value is 100 kWh or less, the rated value shall be rounded to the
174 nearest tenth of a kWh.
- 175 ii. If the computed AEC value is greater than 100 kWh, the rated value shall be rounded to the
176 nearest kWh.

177
178 **Note:** EPA has updated the significant digits and rounding procedures to be consistent with the rounding
179 requirements proposed in the DOE test procedure.
180

181 **3.2 General Qualification Criteria**

182 3.2.1 External Power Supplies (EPSs): Single- and Multiple-voltage EPSs shall meet the level V
183 performance requirements under the International Efficiency Marking Protocol when tested
184 according to the Uniform Test Method for Measuring the Energy Consumption of External Power
185 Supplies, Appendix Z to 10 CFR Part 430.

- 186 i. Single- and Multiple-voltage EPSs shall include the level V marking.
- 187 ii. Additional information on the Marking Protocol is available
188 at www.energystar.gov/powersupplies.

189 **Note:** EPA has added requirements for multiple-voltage EPSs, and referenced the DOE test procedure.
190

191 3.2.2 Maintenance Activities:

- 192 i. Products may automatically exit Sleep Mode and/or Deep Sleep State on a regular schedule
193 to download content, scan for program and schedule information, and perform maintenance
194 activities. The total time spent performing maintenance activities shall not exceed an average
195 of two hours in any 24-hour period, exclusive of activities scheduled by the end-user (e.g.,
196 video recording of a regularly scheduled program). Video downloads that are not user-

197 requested (e.g., “speculative recording”, or “push”) shall be counted against the two hour
198 average per day requirement.

199 ii. Products that have exited Sleep Mode or Deep Sleep State and completed maintenance or
200 other user-requested activities shall automatically return to Sleep Mode or Deep Sleep State
201 in less than 15 minutes.

202 iii. Products that provide a speculative recording function shall provide a user-accessible menu
203 option to permit users to disable the functionality. Instructions for disabling speculative
204 recording shall be included in printed and/or electronic product manuals.

205 3.2.3 Auto Power Down (APD): Products that offer an APD feature shall meet the following
206 requirements:

207 i. Products shipped with software from the manufacturer shall ship with APD enabled by
208 default, with APD timing set to engage after a period of inactivity less than or equal to
209 4 hours.

210 ii. All energy-related default settings shall persist until an end-user chooses to manually either
211 (1) disable APD, or (2) modify the default settings.

212 3.3 Annual Energy Consumption (AEC) Requirements

213 3.3.1 For STBs, AEC as determined per the DOE test procedure, multiplied by a factor relating to the
214 Deep Sleep incentive and the client-only incentive, shall be less than or equal to the Maximum
215 AEC Specification Requirement (AEC_{SPEC_MAX}), as illustrated in Equation 1.

Note: EPA has revised the requirement to reflect the calculation of a weighted AEC requirement in the proposed DOE Test Procedure for Set-top Boxes. EPA is further proposing to apply incentives to the AEC metric below (Equation 1) to make it clear that the Deep Sleep and Client Only incentives reward functionalities that save energy. For instance, a model with Deep Sleep would apply a 17% incentive prior to comparison to the AEC_{SPEC_MAX} requirement as an incentive for implementing Deep Sleep functionality.

223 Equation 1: Maximum AEC Specification Requirement for STBs

$$(1 - Incentive_{DEEP_SLEEP} - Incentive_{CLIENT_ONLY}) \times AEC \leq AEC_{SPEC_MAX} = AEC_{BASE_MAX} + \sum_1^n AEC_{ADDL_i}$$

224 *Where:*

- 225 ▪ AEC is the Annual Energy Consumption, as measured in the DOE test
226 procedure;
- 227 ▪ $Incentive_{DEEP_SLEEP}$ is an incentive of 17% provided to models with Deep
228 Sleep, as specified in Section 3.3.3; and
- 229 ▪ $Incentive_{CLIENT_ONLY}$ is an incentive for Multi-room STBs, as specified in
230 Section 3.3.4;
- 231 ▪ AEC_{SPEC_MAX} is the maximum AEC Specification Requirement—the level for
232 ENERGY STAR qualification;
- 233 ▪ AEC_{BASE_MAX} is the Base Type AEC Allowance (kWh), as specified in Table 1;
234 and
- 235 ▪ AEC_{ADDL_i} is each applicable Additional Functionality AEC Allowance (kWh),
236 as specified in Table 2, subject to the requirements in Section 3.3.2i, below.

237 3.3.2 For Displayless Video Gateways, AEC as determined per Section 4.6, multiplied by a factor
238 relating to the Deep Sleep incentive, shall be less than or equal to the Maximum AEC
239 Specification Requirement (AEC_{SPEC_MAX}), as illustrated in Equation 2.

Note: The calculation of the AEC requirement for Displayless Video Gateways is similar to that for STBs, but does not include a client-only incentive (as the Displayless Video Gateway always operates in client-only mode) and is based on CEA-2043 tests, rather than those in the DOE NOPR, which excludes testing

243 of Displayless Video Gateways.

244

245 **Equation 2: AEC Requirement for Displayless Video Gateways**

$$(1 - Incentive_{DEEP_SLEEP}) \times AEC \leq AEC_{SPEC_MAX} = AEC_{BASE_MAX} + \sum_1^n AEC_{ADDL_i}$$

246

Where:

247

▪ AEC is the Annual Energy Consumption, as measured in Section 4.6;

248

▪ $Incentive_{DEEP_SLEEP}$ is an incentive of 17% provided to models with Deep Sleep, as specified in Section 3.3.3; and

249

250

▪ AEC_{SPEC_MAX} is the maximum AEC Specification Requirement—the level for ENERGY STAR qualification;

251

252

▪ AEC_{BASE_MAX} is the Base Type AEC Allowance (kWh), as specified in Table 1; and

253

254

▪ AEC_{ADDL_i} is each applicable Additional Functionality AEC Allowance (kWh), as specified in Table 2, subject to the requirements in Section 3.3.2i, below.

255

256

257 **Note:** As mentioned in the Definitions section, EPA has removed the distinction between the Base Types
258 and Base Functionalities, which were based on the Base Types, but were separate categories used to
259 calculate the requirement. To enable this simplification, EPA has added the requirements for classifying
260 STBs (formerly in this Section) directly into the Base Type definitions, in Section 1.

261

262

Table 1: Base Type AEC Allowance (AEC_{BASE_MAX})

Base Type	Version 4.0 Allowance (kWh/year)
Cable	45
Satellite	50
Cable DTA	0
Service Provider Internet Protocol (IP)	45
Over-the-top (OTT) Internet Protocol (IP)	10
Terrestrial	18
Thin-client / Remote	10

263

264 **Note:** EPA has made the following changes to the Base Allowances from those proposed in Version 4.0:

265

• Cable DTA: EPA has removed Cable DTAs from the scope of the Version 4.1 ENERGY STAR specification because they are being phased out of the market.

266

267

• IP: EPA has divided the IP STB base into two types depending on distribution and expected functionality.

268

269

• Service Provider IP: EPA has increased the allowance based on stakeholder comment that the functionality in complex IP STBs distributed by service providers is comparable to Cable and Satellite STBs.

270

271

272
273
274
275
276
277
278
279
280
281
282

- Over-the-top IP: EPA has decreased the allowance based on the lower functionality of these boxes compared to those distributed by service providers.
- Thin-client/Remote: EPA has decreased the allowance based on similarities between these STBs and IP STBs Sold at Retail as well as information regarding forthcoming client STBs with Deep Sleep functionality.

EPA has received stakeholder information that indicates Thin-client/Remote box energy efficiency has improved more quickly than anticipated in Version 4.0. EPA intends for the ENERGY STAR requirements to highlight the top performers in a product category when the specification takes effect. In order to recognize leadership products in early 2014, EPA is proposing a reduced allowance for Thin-Client/Remote boxes in this Draft 1.

283
284
285

- i. Additional Functionality AEC Allowances (AEC_{ADDL_i}) shall be as specified in Table 4, subject to the following requirements:

286
287
288
289

Note: EPA is proposing to eliminate some of the adders for additional functionalities (indicated by 0 kWh/year in Table 2, below) and will revise the Definitions section and additional requirements below to reflect these removals in a subsequent Draft of the Version 4.1 specification.

290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315

- a. The HIGH DEFINITION allowance is the only additional functionality allowance that may be applied to STBs with CABLE DTA base functionality.
- b. The ADVANCED VIDEO PROCESSING, HOME NETWORK INTERFACE, MIMO WiFi HNI, HIGH DEFINITION, REMOVABLE MEDIA PLAYER, and REMOVABLE MEDIA PLAYER/RECORDER allowances are the only additional functionality allowances that may be applied to STBs with THIN CLIENT / REMOTE base functionality.
- c. The ADVANCED VIDEO PROCESSING allowance may only be applied once per STB, regardless of the number of advanced video processing options offered by the STB.
- d. The CableCARD allowance may only be applied once per STB, regardless of the number of CableCARDS installed in the STB.
- e. The DOCSIS allowance may only be applied to STBs that are installed in a Service Provider network with DOCSIS capability.
- f. The HIGH DEFINITION (HD) allowance shall not be applied to STBs with TERRESTRIAL base functionality.
- g. The MULTI-ROOM allowance may only be applied once per STB, regardless of the number of remote outputs served by the STB.
- h. The MULTI-ROOM allowance may not be combined with the HOME NETWORK INTERFACE allowance on a single STB.
- i. The MIMO WiFi HNI can only be combined with HOME NETWORK INTERFACE or MULTI-ROOM allowance and only when the device is tested with WiFi as the HOME NETWORK INTERFACE. It cannot be used at any other time and must be used in conjunction with the HOME NETWORK INTERFACE or MULTI-ROOM allowance.
- j. The MULTI-STREAM allowances may only be applied once per STB, regardless of the number of simultaneous streams supported by the STB.

Table 2: Additional Functionality AEC Allowance (AEC_{ADDDL_i})

Additional Functionality	Version 4.0 Allowance (kWh/year)
Advanced Video Processing	8
CableCARD	15
Digital Video Recorder (DVR)	36
DOCSIS®	15
High Definition (HD)	16
Home Network Interface	8
MIMO WiFi HNI	$N_{2.4\text{ GHz}} + 2 \times N_{5\text{ GHz}}$, Where: N is the number of spatial streams at the given frequency
Multi-room	40
Multi-stream – Cable/Satellite	8
Multi-stream – Terrestrial/IP	6
Removable Media Player	0
Removable Media Player / Recorder	0

317

318

319

320

321

322

323

324

325

Note: EPA is proposing to remove Removable Media Player and Removable Media Player / Recorder allowances because these functionalities are only available on one qualified model.

Also, EPA is proposing to increase the Multi-room allowance from the previously proposed 30 kWh/yr and add an MIMO WiFi HNI allowance to reflect the higher functionality of new servers STBs, though EPA expects the MIMO WiFi HNI allowance to decrease in subsequent Versions of the specification as the technology matures.

326

327

328

329

330

3.3.3 Deep Sleep Incentive: For a power state to qualify as a Deep Sleep, and a model to receive the Deep Sleep Incentive in Equation 1 or Equation 2, measured power consumption in Sleep Mode or Deep Sleep State shall be less than or equal to 15% of the power consumption in On Mode (P_{WATCH}), or 3.0 watts, whichever is greater, as shown in Equation 3 for STBs and Equation 4 for Displayless Video Gateways, below, and subject to the following requirements.

331

332

- i. The Deep Sleep Incentive will be a factor of 17% applied to the measured AEC in Equation 1 or Equation 2.

333
334
335
336
337
338
339
340
341

Note: The Version 3.0 and 4.0 specifications provided a Deep Sleep incentive by modifying the number of hours in each mode such that 4 hours that were previously assumed spent in Sleep Mode were spent in Deep Sleep. For STBs with equal On Mode, Sleep Mode, and APD Power, and a Deep Sleep Power equal to 15% of that, the savings would be equivalent to providing a AEC allowance of approximately 17%, which is what is being proposed in Section 3.3.3i.

While EPA maintains a Deep Sleep incentive in Version 4.1, EPA is anticipating that Version 5 will require Deep Sleep, based on stakeholder insights into the availability of products that enable Deep Sleep. EPA envisions a Version 5 taking effect 2 years after Version 4.1.

342
343
344
345

- ii. For STBs with a user interface, a means of manually activating Deep Sleep shall be accessible to the end user via a clearly marked button or switch on the remote control and/or the front face of the STB that enable Deep Sleep within 2 seconds of being pressed. Alternative button configurations will be acceptable with written approval from EPA.

346
347
348
349

Note: EPA proposes to increase the accessibility of Deep Sleep mode (when offered by the device) by specifying that a product respond to a Deep Sleep request by the user within 2 seconds of being commanded to do so.

350
351
352
353
354
355
356
357

- iii. For STBs with no user interface (e.g., “set-back boxes”) and for STBs that can switch between power states only via external network stimuli (e.g., Thin-Client / Remote STBs) to qualify for ENERGY STAR Deep Sleep benefits, Deep Sleep functionality shall be enabled by default upon shipment to the end user, and shall be initiated automatically via timer or other means not requiring direct end user manipulation of the STB (e.g., detecting demand of a downstream device via HDMI link, network message). Alternate means of detection/communication must be broadly applicable and not limited to a specific brand of TV or downstream device.

358
359
360

- iv. If Deep Sleep capability is enabled in the as-shipped default product configuration, an override function may be provided to allow the end-user to disable Deep Sleep functionality.

Equation 3: Condition for Receiving the Deep Sleep State Incentive for STBs

$$\min(P_{SLEEP_APD}, P_{SLEEP_MANUAL}, P_{SLEEP_SP_1}, \dots, P_{SLEEP_SP_n}) \leq \max(0.15 \times P_{WATCH}, 3 W),$$

361
362
363
364
365
366
367
368
369

Where:

- P_{SLEEP_APD} is the Sleep Mode Power as measured in the Auto Power Down (APD) Test of the DOE test procedure;
- P_{SLEEP_MANUAL} is the Sleep Mode Power as measured in the Manual Sleep Test of the DOE test procedure;
- $P_{SLEEP_SP_n}$ is the Power in any of n available Deep Sleep States that do not meet the definition of Sleep Mode, as measured per Section 4.7; and
- P_{WATCH} is the On Mode Power as measured in the DOE test procedure.

370
371

Equation 4: Condition for Receiving the Deep Sleep State Incentive for Displayless Video Gateways

$$\min(P_{SLEEP}, P_{SLEEP_SP_1}, \dots, P_{SLEEP_SP_n}) \leq \max(0.15 \times P_{WATCH}, 3 W),$$

372
373
374
375
376
377

Where:

- P_{SLEEP} is the Sleep Mode Power as measured in Section 4.6.2ii;
- $P_{SLEEP_SP_n}$ is the Power in any of n available Deep Sleep States that do not meet the definition of Sleep Mode, as measured per Section 4.7; and
- P_{WATCH} is the On Mode Power as measured in Section 4.6.2v.

378
379

3.3.4 Client Only Incentive: Multi-room STBs can receive an incentive for use in Equation 1 by going into a lower-power state while continuing to provide video to their connected clients, as calculated

380 in Equation 5.

381

382 **Equation 5: Calculation of Client Only Incentive for Multi-room STBs**

$$Incentive_{CLIENT_ONLY} = \frac{P_{MULTI_STREAM} - P_{CLIENT_ONLY}}{P_{MULTI_STREAM}},$$

383 *Where:*

- 384 ▪ *Incentive_{CLIENT_ONLY} is the Client Only Incentive applicable to Multi-room*
- 385 *STBs;*
- 386 ▪ *P_{MULTI_STREAM} is the On Mode Power as measured in Multi-stream Test of the*
- 387 *DOE test procedure; and*
- 388 ▪ *P_{CLIENT_ONLY} is the On Mode Power as measured in Section 4.5.*

389

390 **3.4 Products with Multi-room Capability**

391

Note: EPA has removed the multiple ways of qualifying models with Multi-room Capability (e.g., by testing in Multi-room models in single-output mode and permitting qualification if the model meets the TEC requirement minus the Multi-room additional functionality allowance) because the proposed DOE Test Procedure requires testing in both single-output and multi-output and outputs only one AEC for qualification. EPA welcomes comment on this removal and suggestions for further promoting whole-home energy savings.

398

399

Note: Products intended for sale in the US market are subject to minimum toxicity requirements. Please see ENERGY STAR® Program Requirements for Set-top Boxes: Partner Commitments for details.

402

Note: To ensure that product designers are aware of Partner Commitments specific to toxicity and recyclability, EPA has inserted the above note.

404

405 **4 TESTING**

406 **4.1 Test Methods**

407 4.1.1 Test methods identified in Table 3 shall be used to determine energy consumption..

408

Table 3: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
STBs	Proposed DOE Test Procedure for Set-top Boxes contained in the Notice of Proposed Rulemaking published in the Federal Register on January 23, 2013. 78 FR 5076.
Displayless Video Gateways	Draft CEA-2043, Set-top Box (STB) Power Measurement, Rev, Oct-2012, subject to the clarifications in Section 4.6..

Note: EPA has replaced the reference to the 2011 ENERGY STAR test method with a reference to the Proposed DOE Test Procedure for Set-top Boxes contained in the Notice of Proposed Rulemaking published in the Federal Register on January 23, 2013. 78 FR 5076. Once finalized, this test procedure shall be the sole procedure for reporting the energy consumption of Set-top Boxes in the United States and this specification will be reviewed and updated to reference the finalized test procedure.

Displayless Video Gateways do not meet DOE’s proposed definition of set-top box as outlined in the NOPR. EPA tentatively plans for Displayless Video Gateways to be tested according to the draft CEA-2043 test procedure, subject to the additional setup instructions in Section 4.6. However, EPA may revisit this decision depending on the resolution of this issue in the final DOE test procedure.

4.1.2 Test methods identified in Table 4 shall be used to determine the eligibility of STBs and Displayless Video Gateways for additional incentives.

Table 4: Test Methods for Additional Incentives

Incentive	Test Method
Client Only Incentive for Multi-room STBs	Draft CEA-2043, Set-top Box (STB) Power Measurement, Rev, Oct-2012, subject to the clarifications in Section 4.5.
Deep Sleep Incentive for STBs and Displayless Video Gateways	Draft CEA-2043, Set-top Box (STB) Power Measurement, Rev, Oct-2012, subject to the clarifications in Section 4.7.

Note: In order to receive the deep sleep and client-only incentive, as specified in Section 3.3.3, a STB or Displayless Video Gateway may further be tested according to the draft CEA-2043 test procedure, subject to the additional setup instructions in Section 4.5 and 4.7 .

4.2 Number of Units Required for Testing

4.2.1 Units shall be selected for testing as follows:

- i. For STBs (with the exception of STBs being tested for the client only incentive or the deep sleep incentive), units shall be selected for testing and results calculated according to the sampling requirements defined in 10 CFR Part 429, Subpart B § 429.55. The certified rating must be equal to or better than the ENERGY STAR specification requirements;
- ii. For Displayless Video Gateways, a single unit of each Representative Model shall be selected for testing.
- iii. For Multi-room STBs being tested for the Client Only Incentive, a single unit of each Representative Model shall be selected for testing.
- iv. For STBs and Displayless Video Gateways being tested in a Deep Sleep State Not Meeting the Definition of Sleep Mode, a single unit of each Representative Model shall be selected for testing.

4.2.2 The measured performance of units tested and of each subsequent unit manufactured shall meet the ENERGY STAR eligibility criteria. Results of the tested units may be used to qualify additional individual model variations within a Basic Model, as defined in Section 1.

- i. All models within a Basic Model must have the same certified rating per DOE’s regulations in

447 Part 429 and this rating must be used for all representations.

448 **Note:** In addition to a test procedure for STBs, the Notice of Proposed Rulemaking published in the
449 Federal Register on January 23, 2013, 78 FR 5076, also proposes a statistical sampling plan for STBs,
450 which requires the testing of multiple models of STBs to control for model-to-model variation. EPA's
451 requirements for STBs align with DOE's.

452

453 **4.3 International Market Qualification**

454 4.3.1 Products shall be tested for qualification at the relevant input voltage/frequency combination for
455 each market in which they will be sold and promoted as ENERGY STAR, as specified in Table 5.

456 **Table 5: Input Power Requirements**

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

457

458 **Note:** For reference, EPA has included the voltage/frequency table for international harmonization that is
459 found in ENERGY STAR test methods for other consumer electronics products.

460

461 **4.4 UUT Connection Precedence when Using Draft CEA-2043 for Displayless Gateway,**
462 **Additional Multi-room STB Testing**

- 463 i. STBs being tested per the DOE test procedure shall follow the connection precedence in the
464 DOE test procedure.
- 465 ii. The UUT shall be connected to the first applicable Input/Network connection(s) specified in
466 Table 6. Up to two Input/Network connections may be used with one connection for the home
467 network and any Clients, if applicable, and the second connection to Service Provider/Wide
468 Area Network (e.g., the combination of MoCa and QAM/DOCSIS is typical). One connection
469 type can be used if the connections to the home network and the Service Provider/Wide Area
470 Network are the same or there is no direct connection to the Service Provider/Wide Area
471 Network.

472

Table 6: Input/Network Connections

Connection (Protocol)
1. Coax (QAM/DOCSIS)
2. Coax (MoCa)
3. Coax (HPNA)
4. Coax (Satellite)
5. WiFi
6. Ethernet
7. HomePlug AV
8. Other

473 iii. If the UUT is a Set-top Box, it shall be connected to the Display Device with the first
474 applicable Output connection specified in Table 7.

475 **Table 7: Output Connections**

Connection (Protocol)
1. HDMI/DVI
2. Component
3. S-Video
4. Composite
5. Coax
6. Other

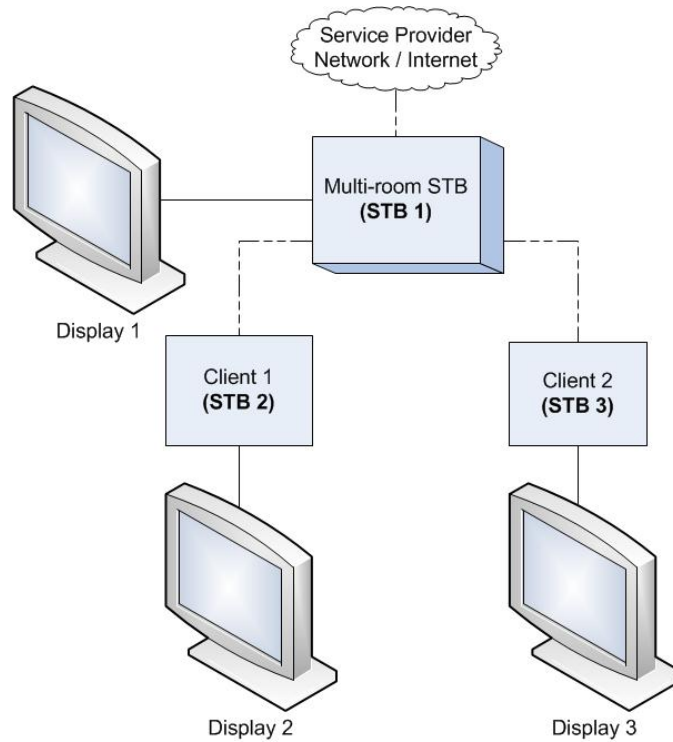
476
477 **Note:** The tables above represent a list of commonly used protocols and connection types for connecting
478 STBs to Display Devices, Clients, and the Service Provider headend.

479 **4.5 Implementation of Draft CEA-2043 for Additional Multi-room STB Testing**

480 4.5.1 Multi-room STB Test Set-Up: Multi-room STBs shall be set up per Figure 1, using the connections
481 specified in Section 4.4 and per the following requirements.

- 482 i. The clients connected to the Multi-room STB shall be configured per draft CEA-2043.
- 483 ii. All other testing conditions shall be taken from the DOE test procedure as needed and if
484 something is not specified there, from draft CEA-2043.

485

Figure 1: Multi-room STB Configuration⁴487
488

489 4.5.2 **Multi-room STB Test Conduct:** Multi-room STBs may be tested to measure the Client Only
 490 Power, $P_{\text{CLIENT_ONLY}}$, and obtain the Client Only Incentive specified in Section 3.3.4, per the below
 491 requirements.

- 492 i. The devices in the configuration shall concurrently run all of the applicable draft CEA-2043
 493 tests specified in the draft CEA-2043 (Rev. Oct-2012) section listed in Table 8, with the Thin
 494 Client/Remote STBs serving as a background condition for the testing of the Multi-room STB
 495 (UUT).
- 496 ii. The time period for Sleep Mode power consumption measurement (T_{SLEEP}) shall be equal to
 497 or greater than 4 hours.
- 498 iii. The wait time period for Sleep Mode power consumption measurement ($T_{\text{SLEEP_WAIT}}$) shall be
 499 less than or equal to 30 seconds.

⁴ This test configuration for measuring Client Only Power, $P_{\text{CLIENT_ONLY}}$ may not be the same test configuration applicable for Multi-room STB tests specified under the DOE test procedure.

500

Table 8: Multi-room STB Client Only Test

STB in Figure 1	Draft CEA-2043 Test	Result	Notes
STB 1 (UUT)	8.3 SLEEP*	P_{CLIENT_ONLY}	Multi-room STB not being used locally for viewing or recording
STB 2	8.2.2.3: ON (Play)	Not Measured	Thin Client in On Mode over a home network
STB 3	8.2.2.3: ON (Play)	Not Measured	Thin Client in On Mode over a home network

501 * NOTE: Although the UUT is being tested per the draft CEA-2043 Sleep Mode test and should start the
 502 test in that mode, the STB may actually change to a different Mode in order to provide video to Clients,
 503 though the tester should do nothing to the UUT except switch the two clients to On Mode.

504

505 **Note:** EPA is proposing the above scenario with UUT 1 in Sleep Mode to assess the Multi-room STB's
 506 behavior and associated energy use when Clients are playing content on Display Devices. The power
 507 consumption of the UUT, the internal mode of the UUT, and any relation to Sleep Mode as measured in
 508 other scenarios is immaterial, as this measurement is solely used to calculate the Client Only Incentive.

509

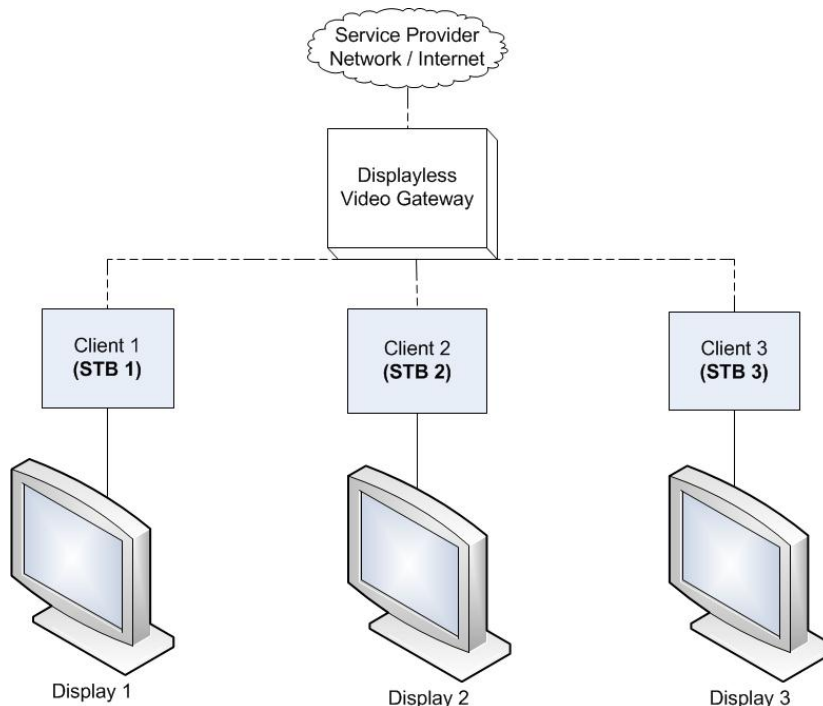
510 4.6 Implementation of CEA-2043 for Displayless Video Gateway Testing

511 4.6.1 Displayless Video Gateway Test Set-Up: Displayless Video Gateways shall be set up per Figure
 512 2, using the connections specified in Section 4.4, and subject to the requirements below.

513

514

Figure 2: Displayless Video Gateway Configuration



515

516 iii. Displayless Video Gateways shall be configured per the setup in draft CEA-2043 (Rev. Oct-
 517 2012) for multi-room devices.

- 518 iv. Displayless Video Gateways with Public Switched Telephone Network (PSTN) technology
 519 shall have a telephone line connected and be provisioned for voice services.
 520 v. Displayless Video Gateways with Ethernet or MoCA based local networking technologies
 521 shall have either an Ethernet switch supporting the same Ethernet speed of the gateway
 522 device or a compatible MoCA bridge device (in the case of the UUT supporting both, use the
 523 precedence in Table 6: Input/Network Connections to determine which one) connected via
 524 the appropriate COAX/Cat5e (or better) cable and provisioned for data services.
 525 vi. The clients connected to the Displayless Video Gateway shall be configured per draft CEA-
 526 2043.
 527 vii. All other testing conditions shall be taken from the DOE test procedure as needed and if
 528 something is not specified there, from draft CEA-2043.

529 4.6.2 Displayless Video Gateway Test Conduct: Displayless Video Gateways shall be tested to
 530 measure their AEC, per the below requirements.

- 531 i. When testing On Mode for Displayless Gateways, there shall be data transferring to one or
 532 more clients. When testing Sleep Mode for Displayless Gateways, there shall be no video
 533 traffic being sent to client devices. Regardless of the internal state of the device, this shall be
 534 considered the definition of the modes for Display-less Gateway devices. These values will
 535 be used for the purposes of calculating the AEC based on draft CEA-2043/DOE NOPR.
 536 ii. Sleep Mode: The devices in the configuration shall be running the CEA-2043 (Rev. Oct-2012)
 537 tests specified in Table 9 concurrently, with the Thin Client/Remote STBs serving as a
 538 background condition for the testing of the Displayless Video Gateway.
 539 iii. The time period for Sleep Mode power consumption measurement (T_{SLEEP}) shall be equal to
 540 or greater than 4 hours.
 541 iv. The wait time period for Sleep Mode power consumption measurement (T_{SLEEP_WAIT}) shall be
 542 less than or equal to 30 seconds.

543

544

Table 9: All Sleep Scenario 1

Device in Figure 2	CEA-2043 Test	Result	Notes
Displayless Video Gateway (UUT)	8.3.4.1 SLEEP	P_{SLEEP}	All Clients in SLEEP mode
STB 1	8.3.4.1 SLEEP	Not Measured	Thin Client/Remote STB in SLEEP mode over a home network
STB 2	8.3.4.1 SLEEP	Not Measured	Thin Client/Remote STB in SLEEP mode over a home network
STB 3	8.3.4.1 SLEEP	Not Measured	Thin Client/Remote STB in SLEEP mode over a home network

545

- 546 v. On Mode: The devices in the configuration shall be running the CEA-2043 (Rev. Oct-2012)
 547 tests specified in Table 10 concurrently, with the Thin Client/Remote STBs serving as a
 548 background condition for the testing of the Displayless Video Gateway.
 549 vi. The time period for On Mode power consumption measurement (T_{ON}) shall be equal to or
 550 greater than 5 minutes.

551

Table 10: All On Scenario 2

Device in Figure 2	CEA-2043 Test	Result	Notes
Displayless Video Gateway (UUT)	8.2.2.1: ON (Watch)	P_{MULTI_STREAM}	All Clients in On Mode
STB 1	8.2.2.1: ON (Watch)	Not Measured	Watching TV on a Display Device connected to Thin Client/Remote STB over a home network
STB 2	8.2.2.1: ON (Watch)	Not Measured	Watching TV on a Display Device connected to Thin Client/Remote STB over a home network
STB 3	8.2.2.1: ON (Watch)	Not Measured	Watching TV on a Display Device connected to Thin Client/Remote STB over a home network

552

553

554

vii. Calculate the AEC per Equation 6.

555

556

Equation 6: Calculation of Displayless Video Gateway AEC

$$AEC = 0.365 \times (P_{MULTI_STREAM} \times H_{MULTI_STREAM} + P_{SLEEP} \times [H_{SLEEP} + H_{APD}]),$$

557

Where:

558

- AEC is the Displayless Video Gateway AEC;

559

- P_{MULTI_STREAM} is the On Mode Power as measured in the On Mode test, above;

560

- H_{MULTI_STREAM} is the number of hours assumed in On Mode, per Table 11;

561

- P_{SLEEP} is the Sleep Mode Power as measured in the Sleep Mode test, above;

562

- H_{SLEEP} is the number of hours assumed in Sleep Mode, per Table 11; and

563

- H_{APD} is the number of hours assumed in Automatic Power Down, as specified in Section 3.2.3, per Table 11.

564

565

Table 11: Number of Hours Assigned to Each Displayless Video Gateway Mode of Operation

APD Enabled by Default	H_{MULTI_STREAM}	H_{SLEEP}	H_{APD}
No	14	10	0
Yes	7	10	7

566

567

4.7 Implementation of CEA-2043 for STBs and Displayless Video Gateways with a Deep Sleep State Not Meeting the Definition of Sleep Mode

568

569

4.7.1 Deep Sleep State Test Setup: Units for test shall be set up per the following requirements.

570

i. All devices shall be configured per draft CEA-2043.

571

ii. The number of Clients, Display Devices or Recording Devices connected to the UUT is unspecified; however, all devices shall be in Sleep Mode.

572

573

iii. All other testing conditions shall be taken from the DOE test procedure as needed and if something is not specified there, from draft CEA-2043.

574

575

576 4.7.2 Deep Sleep State Test Conduct: STBs and Displayless Video Gateways with a Deep Sleep State
577 not meeting the definition of Sleep Mode (e.g., requiring more than 30 seconds to transition to On
578 Mode) shall be tested per Section 8.3 of Draft CEA-2043 (Rev. Oct-2012), following the additional
579 instructions in Section 8.3.3 of Draft CEA-2043 (Rev. Oct-2012) and per the following
580 requirements.

- 581 i. The time period for Sleep Mode power consumption measurement (T_{SLEEP}) shall be equal to
582 or greater than 4 hours.
- 583 ii. The wait time period for Sleep Mode power consumption measurement ($T_{\text{SLEEP_WAIT}}$) shall be
584 less than or equal to 30 seconds.
- 585 iii. Any measurements of power in Deep Sleep State not meeting the definition of Sleep Mode
586 shall be used to determine the Deep Sleep Incentive in Equation 3, and shall not be reported.

587 **5 USER INTERFACE**

588 5.1.1 Partners are encouraged to design products in accordance with the user interface standard IEEE
589 P1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in
590 Office/Consumer Environments. For details, see <http://eetd.LBL.gov/Controls>.

591 **6 EFFECTIVE DATE**

592 6.1.1 Effective Date: The Version 4.1 ENERGY STAR Set-top Box specification shall take effect on
593 **TBD**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR
594 specification in effect on its date of manufacture. The date of manufacture is specific to each unit
595 and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

596 **Note**: EPA anticipates finishing the Version 4.1 specification late this spring and will set an effective date
597 closer to the completion date for this specification development effort.

598 6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should
599 technological and/or market changes affect its usefulness to consumers, industry, or the
600 environment. In keeping with current policy, revisions to the specification are arrived at through
601 stakeholder discussions. In the event of a specification revision, please note that the ENERGY
602 STAR qualification is not automatically granted for the life of a product model.

603 **7 FUTURE SPECIFICATION REVISIONS**

604 7.1.1 EPA intends to include the following topics in the next revision of the STB specification:

- 605 i. Implement a mandatory Deep Sleep requirement for all qualifying STBs.