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

Eligibility Criteria Final Draft Version 3.0 and 4.0

Following are the Version 3.0 and 4.0 ENERGY STAR Product Specifications for Set-top Boxes (STB). A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

A) Product Type (Base Type): The primary means of access to video content for a STB. All base types may be configured as a simple STB that provides a single primary function, or as part of a complex STB that provides a primary function and one or more additional functionalities.

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

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

3) Cable Digital Transport Adapter (DTA): A minimally-configured STB whose primary function is to receive television signals from a broadband, hybrid fiber/coaxial, or community cable distribution system and deliver them to a consumer display and/or recording device.

Note: *EPA has modified the DTA definition to remove the requirement for "no additional functionalities," to accommodate a change to Additional Functionality rules to allow HD DTAs to qualify under this specification, as per clause 3.3.3.ii.*

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

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

6) Thin-client / Remote: A STB that (1) is designed to interface between a Multi-room STB and a TV (or other output device), (2) has no ability to directly interface with a Service Provider, and (3) relies solely on a Multi-room STB for content. Any STB that meets the definition of a cable, satellite, IP, or terrestrial STB is not a thin-client/remote STB.

B) Product Features:

1) Base Functionality: The primary functionality that defines the ENERGY STAR criteria applicable to a particular STB. Base Functionality is one of the following: Cable, Satellite, IP, Terrestrial or Thin-Client/Remote.

2) Additional Functionality:

i) Advanced Video Processing: The capability to encode, decode, and/or transcode audio/video signals in accordance with standards H.264/MPEG 4 or SMPTE 421M.

ii) CableCARD: The capability to decrypt premium audio/video content and services and provide other network control functions via a plug-in conditional access module that complies with the ANSI/SCTE 28 HOST-POD Interface Standard[1].

iii) Digital Video Recorder (DVR): The capability to store video in a digital format to a rewritable disk drive or other non-volatile storage device integrated into a STB. This definition excludes video capture software for personal computers or server-based DVR capabilities.

iv) DOCSIS®: The capability to distribute data and audio/video content over cable television infrastructure in accordance with the CableLabs® Data Over Cable Service Interface Specification[2].

v) High Definition (HD) Resolution: The capability to transmit or display video signals with resolution greater than or equal to 720p.

vi) Home Network Interface: The capability to interface with external devices over a high bandwidth network (e.g., IEEE 802.11 (WiFi), MoCA, HPNA). For purposes of this specification, IEEE 802.3 wired Ethernet is not considered a Home Network Interface.

Note: *Per stakeholder comment, the HNI definition has been modified from Draft 2 to include all high bandwidth network interfaces, with the specific exclusion of wired Ethernet, which does not qualify for a power allowance under this specification.*

vii) Multi-room: The capability to provide independent audio/video content to multiple devices within a single family dwelling. This definition does not include the capability to manage gateway services for multi-subscriber scenarios.

viii) Multi-stream: The capability to deliver two or more simultaneous audio/video streams to a consumer display, thin-client/remote STB, or recording device. The simultaneous streams may be delivered via a physically separate input or via the primary input. This definition does not include out-of-band tuners.

ix) Removable Media Player: The capability to decode digitized audio/video signals on DVD or Blu-ray Disc optical media.

x) Removable Media Player / Recorder: The capability to decode and record digitized audio/video signals on DVD or Blu-ray Disc optical media.

C) Automatic Power Down (APD): The capability of a device to switch itself 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) The device has ceased performance of all primary functions; or

1 http://www.scte.org/standards/
2 http://www.cablelabs.com/specifications/

2) The last user input has been received (e.g., remote control signal, volume adjustment).

D) Primary Function:

1) Delivery of live or recorded audio/video content to a thin-client/remote STB or local/remote recording device is considered a primary function;

2) Delivery of live or recorded audio/video content to a consumer display within 4 hours of last user interaction/input is considered a primary function;

3) Continuous device functions (e.g., clocks, status displays, indicator lamps) are NOT considered primary functions.

E) Operational Modes:

1) On Mode: Where the product is connected to a mains power source, has been activated and may be providing one or more primary functions. The common terms “active”, “in-use” and “normal operation” also describe this mode.

2) Sleep Mode: Where the product is connected to a mains power source, is not providing a primary function, and offers one or more of the following user oriented or protective functions which may persist for an indefinite time:

i) To facilitate the activation of other modes (including activation or deactivation of On mode) by remote switch (including remote control), internal sensor, timer;

ii) Continuous function: information or status displays including clocks;

iii) Continuous function: sensor-based functions.

3) Deep Sleep State: A power state within Sleep Mode characterized by reduced power consumption and increased time required to return to full On Mode functionality.

Note: *EPA has added a definition for “Deep Sleep” in this draft specification, to encourage manufacturers to implement the capability for lower-power Sleep states in their products in a manner that will not adversely impact the customer experience. To that end, two unique benefits are included: First, service providers who deploy products with the capability for Deep Sleep are rewarded with a 1.5X multiplier to count towards their annual purchase requirement (see the Service Provider Partner Commitments document). Second, manufacturers who include Deep Sleep functionality that is enabled by default are rewarded with a modified TEC equation (see Equation 3 in this specification) for use in meeting product qualification criteria. EPA believes that these two incentives will expedite greater availability of these energy savings features/approaches.*

F) Other Definitions:

1) Service Provider: A business entity that provides audio/video content to subscribers with whom it has an ongoing contractual relationship. A Service Provider distributes ENERGY STAR qualified STBs to end users under a lease or rental arrangement.

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

3) Digital Television Adapter (DTA): A device that receives terrestrial (over the air) digital signals and converts them to an analog output suitable for analog TVs. DTAs do not provide digital signal output. This definition does not include converters for satellite or cable digital signals or devices that perform multiple functions (e.g., DVD players with DTA capability).

4) Game Console: A stand-alone device whose primary function is to process video game content. The primary inputs for game consoles are special hand-held controllers rather than the mouse and keyboard used by a conventional computer. Game consoles are equipped with audio/video outputs for use with televisions as the primary display, rather than an external monitor or integrated display. Game consoles typically do not use a conventional general-purpose operating system, but often perform a variety of multimedia functions such as: DVD/CD playback, digital picture viewing, and digital music playback.

5) Out-of-band Tuner: A tuner compliant with standards ANSI/SCTE 55-1 2002, ANSI/SCTE 55-2 2002, or similar, that is used to gain access to data channels outside of the primary audio/video source signal. These tuners may facilitate two-way communication to allow a STB to exchange data (e.g., diagnostics) with the Service Provider, and may enable access to Pay-Per-View or other rich-media interactive content.

6) Typical Energy Consumption (TEC): A means for evaluating energy efficiency through a calculation of expected energy consumption for a typical user over a one year period, expressed in units of kWh/year.

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

G) Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR qualification criteria, and (3) of a common basic design. Product models within a family differ from each other according to one or more characteristics or features that either (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2) are specified herein as acceptable variations within a product family. For Set-top Boxes, acceptable variations within a product family include aesthetic housing changes that do not affect the thermal characteristics of the device (e.g., color, labeling, or other cosmetic modifications).

2 SCOPE

2.1 Included Products

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

2.2 Excluded Products

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

3 QUALIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be performed with actual measured or observed values. Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from rounding.

3.2 General Qualification Criteria

3.2.1 External Power Supply: If a product is shipped with an EPS, the EPS shall meet the level V performance requirements under the International Efficiency Marking Protocol and include the level V marking. Additional information on the Marking Protocol is available at www.energystar.gov/powersupplies.

3.2.2 Maintenance Activities:

i. Products may automatically exit Sleep Mode on a regular schedule to download content, scan for program and schedule information, and perform maintenance activities. The total time spent in this state should not exceed an average of two hours in any 24-hour period, exclusive of activities scheduled by the end-user (e.g., video recording of a regularly scheduled program). Video downloads that are not user-requested (e.g., "speculative recording", or "push") should be counted against the two hour average per day requirement.

ii. Products that have exited Sleep Mode and completed download/scan activities should automatically return to Sleep Mode in less than 15 minutes.

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

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

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

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

3.2.4 Deep Sleep:

i. For a power state to qualify as a Deep Sleep, measured power consumption (P_{DEEP_SLEEP}) shall be less than or equal to 15% of the power consumption in On Mode as measured per the ENERGY STAR test procedure for "Watching Live TV" (P_{TV}), or 3.0 watts, whichever is greater.

ii. A means of manually activating Deep Sleep shall be accessible to the end user via a dedicated button or switch on the remote control and/or the front face of the STB.

Note: *In response to stakeholder requests for further definition of Deep Sleep requirements, EPA has included some basic requirements and a metric that is tied to On Mode power consumption to allow Deep Sleep power to scale with increasing product functionality. To avoid a scenario in which the Deep Sleep power consumption limit reduces to near-zero as STB efficiency improves, a 3 watt lower limit is included. Based on currently available capability in like products, EPA believes that such a decrease in modal power consumption from On Mode is achievable.*

EPA has included only the most basic functional requirements for Deep Sleep in this version of the specification, with the intent of allowing manufacturers to implement this feature in a manner that best meets the needs and expectations of their customers. By the start of the next specification revision cycle in 2012, EPA expects that stakeholders will have actual examples of Deep Sleep implementations and performance/usage data available to inform the development of more detailed requirements, as appropriate.

3.3 Typical Energy Consumption (TEC) Requirements

3.3.1 Combined TEC ($TEC_{COMBINED}$), as determined in Section 3.3.2 shall be less than or equal to the Maximum TEC Requirement (TEC_{MAX}), as determined in Section 3.3.3.

3.3.2 Combined TEC shall be calculated per Equation 1.

Equation 1: Calculation of Combined TEC ($TEC_{COMBINED}$)

$$TEC_{COMBINED} = TEC_{PRIMARY} + TEC_{PLAY/REC}$$

Where:

- $TEC_{PRIMARY}$ *is the Primary TEC calculated per Equation 2, Equation 3, or Equation 4; and*
- $TEC_{PLAY/REC}$ *is the Playback/Record TEC calculated per Equation 5.*

i. For products with no default APD and no default Deep Sleep, Primary TEC ($TEC_{PRIMARY}$) shall be calculated per Equation 2.

Equation 2: Calculation of Primary TEC ($TEC_{PRIMARY}$) for Products with No Default APD and No Default Deep Sleep

$$TEC_{PRIMARY} = 0.365 \times \left(\left(14.0 \times P_{TV}\right) + \left(10.0 \times P_{SLEEP}\right) \right)$$

Where:

- P_{TV} *is the measured power in On Mode (W); and*
- P_{SLEEP} *is the measured power in Sleep Mode (W).*

ii. For products with default APD and no default Deep Sleep, Primary TEC ($TEC_{PRIMARY}$) shall be calculated per Equation 3.

Equation 3: Calculation of Primary TEC ($TEC_{PRIMARY}$) for Products with Default APD and No Default Deep Sleep

$$TEC_{PRIMARY} = 0.365 \times \left(\left(7.0 \times P_{TV}\right) + \left(10.0 \times P_{SLEEP}\right) + \left(7.0 \times P_{\mathrm{APD}}\right) \right)$$

Where:

- P_{TV} *is the measured power in On Mode (W);*
- P_{SLEEP} *is the measured power in Sleep Mode (W); and*
- P_{APD} *is the measured power after APD (W).*

iii. For products with default APD and default Deep Sleep, Primary TEC ($TEC_{PRIMARY}$) shall be calculated per Equation 4.

Equation 4: Calculation of Primary TEC ($TEC_{PRIMARY}$) for Products with Default APD and Default Deep Sleep

$$TEC_{PRIMARY} = 0.365 \times \left((7.0 \times P_{TV}) + (6.0 \times P_{SLEEP}) + (4.0 \times P_{DEEP\_SLEEP}) + (7.0 \times P_{APD}) \right)$$

Where:

- P_{TV} *is the measured power in On Mode (W);*
- P_{SLEEP} *is the measured power in Sleep Mode (W);*
- P_{DEEP_SLEEP} *is the measured power in Deep Sleep State (W); and*
- P_{APD} *is the measured power after APD (W).*

iv. For products with DVR, Removable Media Playback, or Removable Media Playback / Record capabilities, Playback/Record TEC ($TEC_{PLAY/REC}$) shall be calculated per Equation 5, with weightings for Playback and Record mode as specified in Table 1. Only one playback/record function may be selected per product. For all other products, Playback/Record TEC ($TEC_{PLAY/REC}$) shall be equal to zero.

Equation 5: Calculation of Playback/Record TEC ($TEC_{PLAY/REC}$) For Products with DVR or Removable Media Player

$$TEC_{PLAY/REC} = 0.365 \times \left[\left((P_{PLAYBACK} - P_{TV}) \times H_{PLAYBACK} \right) + \left((P_{RECORD} - P_{TV}) \times H_{RECORD} \right) \right],$$

Where:

- $P_{PLAYBACK}$ *is the measured power during recorded video playback (W);*
- P_{RECORD} *is the measured power during video recording (W); and*
- $H_{PLAYBACK}$ *and* H_{RECORD} *are weightings for time spent in playback and record, as specified in Table 3.*

Table 1: Weightings for Playback/Record TEC Calculation

Function	DVR	Removable Media Playback	Removable Media Playback w/ Record
Playback Duration ($H_{PLAYBACK}$)	2.0 hrs/day	2.0 hrs/day	2.0 hrs/day
Record Duration (H_{RECORD})	3.0 hrs/day	0	1.0 hrs/day

3.3.3 The Maximum TEC Requirement (TEC_{MAX}), shall be calculated per Equation 6.

Equation 6: Calculation of Maximum TEC Requirement (TEC_{MAX})

$$TEC_{MAX} = TEC_{BASE\_MAX} + \sum_{i-1}^{n} TEC_{ADDL\_i}$$

Where:

- *TEC_{BASE_MAX} is the Base Type TEC Allowance (kWh); and*
- *TEC_{ADDL_i} is each applicable Additional Functionality TEC Allowance (kWh).*

i. The Base Type TEC Allowance (TEC_{BASE_MAX}) shall be as specified in Table 2, subject to the following requirements:

a. If the STB meets the definition of Cable DTA base type, the Base Functionality shall be CABLE DTA.

b. If the STB meets the definition of Cable STB base type, and/or the STB is capable of receiving cable service after installation of a CableCARD or other type of conditional access system, the Base Functionality shall be CABLE.

c. If the STB Base Functionality is not CABLE, and the STB meets the base type definition of Satellite STB, the Base Functionality shall be SATELLITE.

d. If the STB Base Functionality is not CABLE, SATELLITE, or CABLE DTA, and the STB meets the base type definition of IP STB, the Base Functionality shall be IP.

e. If the STB Base Functionality is not CABLE, SATELLITE, CABLE DTA, or IP, and the STB meets the base type definition of Terrestrial STB, the Base Functionality shall be TERRESTRIAL.

f. If the STB Base Functionality is not CABLE, SATELLITE, CABLE DTA, IP, or TERRESTRIAL, and the STB otherwise meets the base type definition of Thin-Client/Remote, the Base Functionality shall be THIN-CLIENT / REMOTE.

Table 2: Base Type TEC Allowance (TEC_{BASE_MAX})

Base Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Cable	60	45
Satellite	70	50
Cable DTA	35	25
Internet Protocol (IP)	45	25
Terrestrial	22	18
Thin-client / Remote	35	20

Note: *EPA has modified the base and additional functionality allowances for Version 4.0 in light of stakeholder feedback. EPA understands that functionality like deep sleep is expected to become more prevalent in the near term allowing partners to make greater use of the alternate TEC equation to qualify for ENERGY STAR.*

ii. Additional Functionality TEC Allowances (TEC_{ADDL_i}) shall be as specified in Table 3, subject to the following requirements:

a. The HIGH DEFINITION allowance is the only additional functionality allowance that may be applied to STBs with CABLE DTA base functionality.

Note: *EPA has revised the additional functionality allowance rules to allow the HD allowance to be applied to DTA base types. This modification is in response to stakeholder feedback regarding the potential for future HD DTA deployments.*

b. The ADVANCED VIDEO PROCESSING, HOME NETWORK INTERFACE, 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 device.

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 device.

h. The MULTI-ROOM allowance may not be combined with the HOME NETWORK INTERFACE allowance on a single device.

i. The MULTI-STREAM allowances may only be applied once per STB, regardless of the number of simultaneous streams supported by the device.

Table 3: Additional Functionality TEC Allowance (TEC_{ADDL_i})

Additional Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Advanced Video Processing	12	8
CableCARD	15	15
Digital Video Recorder (DVR)	45	36
DOCSIS®	20	15
High Definition (HD)	25	16
Home Network Interface	10	8
Multi-room	40	30

Additional Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Multi-stream – Cable/Satellite	16	8
Multi-stream – Terrestrial/IP	8	6
Removable Media Player	8	8
Removable Media Player / Recorder	10	10

3.4 Products with Multi-room Capability:

3.4.1 Products with Multi-room capability shall be evaluated for ENERGY STAR qualification per the following requirements:

i. If the Combined TEC for the product as tested in single-output configuration is less than or equal to the Maximum TEC Requirement minus the Multi-room additional functionality allowance, the product may be qualified for ENERGY STAR for use in any configuration (e.g., single-TV installations or multi-room installations).

ii. For products that can support a second N/ATSC display output over standard RF cabling with without the need for a Thin Client, if the Combined TEC for the product as tested in dual-output configuration is less than or equal to the Maximum TEC Requirement plus one half (50%) of the Thin Client / Remote base functionality allowance, the product may be qualified for ENERGY STAR in a Multi-room configuration. Partner shall clearly indicate in product literature that the product qualifies for ENERGY STAR only when providing content to more than one TV.

iii. For products that can support a second display output via a Thin Client, if the Combined TEC for the product as tested in dual-output configuration is less than or equal to the Maximum TEC Requirement, the product may be qualified for ENERGY STAR in a Multi-room configuration. Partner shall clearly indicate in product literature that the product qualifies for ENERGY STAR only when providing content to more than one TV.

4 TEST REQUIREMENTS

4.1 Test Methods

4.1.1 When testing Set-top Box products, the test methods identified in Table 4 shall be used to determine ENERGY STAR qualification.

Table 4: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
All Products	ENERGY STAR Test Method for Set-top Boxes, Rev. Dec-2010

4.2 Number of Units Required for Testing

4.2.1 Representative Models shall be selected for testing per the following requirements:

i. For qualification of an individual product model, a product configuration equivalent to that which is intended to be marketed and labeled as ENERGY STAR is considered the Representative Model;

ii. For qualification of a product family, any product configuration within a family may be considered the Representative Model.

4.2.2 A single unit of each Representative Model shall be selected for testing. If test results for any operational mode power measurement are within 5% of ENERGY STAR requirements, two additional units of the same Representative Model with an identical configuration shall be tested.

4.2.3 All tested units shall meet ENERGY STAR qualification requirements.

4.3 International Market Qualification

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

5 USER INTERFACE

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

6 EFFECTIVE DATE

6.1.1 Effective Date: The Version 3.0 and Version 4.0 ENERGY STAR Set-top Box specifications shall take effect on the dates specified in Table 5. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

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

Table 5: Specification Effective Dates

Product Type	Version 3.0 Effective Date	Version 4.0 Effective Date
All Products	August 1, 2011	July 1, 2013

7 FUTURE SPECIFICATION REVISIONS

7.1.1 EPA will evaluate the appropriateness of the Version 4.0 limits at least nine months prior to the July 1, 2013 effective date.

7.1.2 EPA intends to investigate the following topics during the next revision of the STB specification:

i. Delete the removable media playback/record options from the TEC assessment due to lack of relevance to the STB market.

ii. Implement a mandatory Deep Sleep requirement for all qualifying STBs.

iii. Address potential new STB base types such as “Gateway STBs”