



# ENERGY STAR® Program Requirements for Set-top Boxes

## Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

### Qualifying Products

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1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for Set-top Boxes (STBs). A list of eligible products and their corresponding Eligibility Criteria can be found at [www.energystar.gov/specifications](http://www.energystar.gov/specifications).
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by EPA for STBs. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform STB testing. A list of EPA-recognized laboratories and certification bodies can be found at [www.energystar.gov/testingandverification](http://www.energystar.gov/testingandverification).

### Using the ENERGY STAR Name and Marks

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3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at [www.energystar.gov/logouse](http://www.energystar.gov/logouse).
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale in the U.S and/or ENERGY STAR partner countries.
5. Provide clear and consistent labeling of ENERGY STAR qualified STBs.
  - 5.1. For all qualified STBs sold at retail or directly to the consumer, the ENERGY STAR mark must be clearly displayed on the product or via electronic notification.
    - 5.1.1. Via electronic notification:
      - 5.1.1.1. The ENERGY STAR mark must appear in cyan, black, or white (as described in the ENERGY STAR Identity Guidelines).
      - 5.1.1.2. 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.
      - 5.1.1.3. The ENERGY STAR mark must appear on average at least once per day for a duration of not less than five seconds.
    - 5.1.2. Via a permanent or temporary label on product:
      - 5.1.2.1. Label must follow guidance for certification marks provided in the ENERGY STAR Identity Guidelines ([www.energystar.gov/logouse](http://www.energystar.gov/logouse)).

- 5.2. For all qualified STBs sold to Service Providers, Partner may, but is not required to, provide labeling. If labeling is provided, then it must meet the requirements above for electronic notification or physical labeling. Appropriate labeling of STBs provided to subscribers is the responsibility of the Service Provider. However, Partner may provide this labeling for Service Providers. Partner must clearly communicate the requirements for configuration and installation that are necessary for the STB to maintain ENERGY STAR qualification and receive labeling.
- 5.3. For all qualified products, clearly display the ENERGY STAR mark:
  - 5.3.1. In product literature (i.e., user manuals, spec sheets, etc.);
  - 5.3.2. On product packaging for products sold at retail; and
  - 5.3.3. On the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed;

### **Verifying Ongoing Product Qualification**

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6. Participate in third-party verification testing through a Certification Body recognized by EPA for STBs, providing full cooperation and timely responses, EPA/DOE may also, 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 the government's request.

### **Providing Information to EPA**

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7. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
  - 7.1. Partner must submit the total number of ENERGY STAR qualified STBs shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).
  - 7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.
  - 7.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at [www.energystar.gov/mesa](http://www.energystar.gov/mesa).

### **Performance for Special Distinction**

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

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.

- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit [www.epa.gov/smartway](http://www.epa.gov/smartway).
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit [www.epa.gov/greenpower](http://www.epa.gov/greenpower).



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

## Eligibility Criteria Version 2.0

**Note:** The February 2011 revision of this product specification deletes the Tier 2 Version 2.0 qualification criteria and effective date. Tier 2 Version 2.0 requirements have been superseded by Version 3.0 requirements. The Tier 1 Version 2.0 requirements will remain in effect until the Version 3.0 specification effective date of September 1, 2011.

### **1) Definitions:** Below are the definitions of the relevant terms in this document.

**STB Types:** All STB types can come as stand-alone tuners or as part of a larger device with other tuners and/or secondary functions such as, but not limited to, DVR and DVD playback/recording.

- A. **Cable STB:** A STB whose principal function is to receive television signals from a broadband, hybrid fiber/coaxial, community cable distribution system and deliver them to a consumer display and/or recording device. Source: CSA C380-08 modified.
- B. **Internet Protocol (IP) STB:** A STB whose principal function is to receive television/video signals encapsulated in IP packets and deliver them to a consumer display and/or recording device. Source: CSA C380-08.
- C. **Satellite STB:** A STB whose principal function is to receive television signals from satellites and deliver them to a consumer display and/or recording device. Source: CSA C380-08.
- D. **Terrestrial STB:** Any STB whose principal function is to receive television signals over the air (OTA) and deliver them to a consumer display and/or recording device. Source: CSA C380-08.
- E. **Thin-Client/Remote:** A STB that is designed to interface between a Multi-Room STB and a TV (or other output device) that has no ability to interface with the Service Provider directly and relies solely on a Multi-Room box for content. Any STB that meets the definition of Cable, Satellite, IP or Terrestrial STB is not a Thin-Client/Remote STB.

### **Components**

- F. **Conditional Access:** The encryption, decryption, and authorization techniques employed to protect content from unauthorized viewing. CableCARD and Downloadable Conditional Access (DCAS) are examples of this technology.
- G. **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.

### **Functionalities**

- H. **Base Functionality:** For purposes of this specification, the primary functionality that defines the criteria that apply to a STB. The Base Functionality is one of the following: Cable, Satellite, IP, Terrestrial or Thin-Client/Remote. (See Section 3 below.)

- I. Additional Functionalities: Additional Functionalities consist of one or more of the following: Additional Tuners, Additional Tuners – OTA/IP, Advanced Video Processing, DVR, High Definition Resolution (does not apply to terrestrial), Removable Media Player, Removable Media Player/Recorder, Multi-Room, and CableCARD.

### **Additional Functionalities**

- J. Additional Tuners: An additional tuner provides a second source of media content either from a physically separate A/V input or from the primary input (used concurrently); they need not be for the same source media type. Out-Of-Band tuners built in compliance with standards ANSI/SCTE 55-1 2002 and ANSI/SCTE 55-2 2002 and other similar types of technologies are not considered additional tuners for the purposes of this specification. For example, a device with additional tuners has the ability to tune into two or more separate streams of video simultaneously and place those on separate outputs (outputs being either physical outputs, picture-in-picture, or recording mechanisms). Note that network-based outputs are not covered under the additional tuners definition but are covered under the definition of a Multi-Room device.
- K. Additional Tuners – Terrestrial/IP: An Additional Tuner of Terrestrial or IP type.
- L. Advanced Home Network Interface: An advanced network interface such as WiFi, MOCA, etc. that allows a STB to interface with external devices through a network. This allowance can be applied only to devices that are NOT Multi-Room or thin client devices (as the network capability of those devices is already accounted for in their allowances).
- M. Advanced Video Processing/Codecs: Advanced methods for video encoding, transcoding and decoding. Examples include, but are not limited to, H.264/MPEG 4 and SMPTE 421M.
- N. CableCARD<sup>(TM)</sup>: A plug-in card that complies with the ANSI/SCTE 28 interface that is inserted into a Digital Cable Ready device to enable the decryption of premium services and provide other network control functions. Also known as a “Card” or a “Point of Deployment” (POD module). CableCARD<sup>(TM)</sup> is a registered trademark of CableLabs<sup>®</sup>. Source: CSA C380-08 modified.
- O. Digital Versatile Disk (DVD): An optical disc storage media format that can be used for data storage, including movies, with high video and sound quality.
- P. Digital Video Recorder (DVR): A device that stores video in a digital format to a rewritable disk drive or other non-volatile storage media local to the unit. The term covers DVR functions integrated in a STB; it does not include software for personal computers that enables video capture and playback to and from the computer’s data storage nor does it include server based DVR capabilities.
- Q. High Definition Resolution: Video output with resolutions greater than 480i/p.
- R. Multi-Room STB: A STB that meets the definition for Cable, Satellite, IP or Terrestrial STB above and is capable of providing independent content to multiple TVs within a single family dwelling. Products handling gateway services to multi-subscriber scenarios are not covered under this specification.
- S. Removable Media Player: A device, such as a DVD player, whose primary purpose is the decoding of digitized video signals on a DVD.
- T. Removable Media Player/Recorder: A device, such as a DVD recorder, whose primary purpose is the production or recording of digitized video/audio signals on a DVD.

### **Operational Modes and Power States**

- U. On/Active: An operational state in which the STB is actively delivering one or more of its principal functions and some or all of its applicable secondary functions.

- V. Sleep: A state in which the STB has less power consumption, capability, and responsiveness than in the On/Active state. The STB may enter a Sleep state from the On/Active state after:
- a. the STB receives a notification from the user to enter a sleep state via a power button press on a remote control or front panel of the unit, or through an electronic signal or data packet received via a digital interface on the STB; or
  - b. the STB auto powers down to a Sleep state. The energy consumption after auto power down to Sleep and after a user initiated power down to Sleep may, or may not be, equivalent.

### **Miscellaneous**

- W. Auto Power Down: The capability to automatically switch from the On state to a Sleep state after a period of time without user input, generally based on the amount of time the unit has remained "idle" from last active use, i.e., user input such as channel change, volume change, menu access, etc.
- X. Cable, Satellite, and Telecom Service Provider: An entity that provides video (and possibly other) content to subscribers with whom it has an ongoing contractual relationship. A Service Provider in the context of ENERGY STAR is one that distributes to end users STBs covered by this specification under an agreement such as a lease or rental arrangement.
- Y. CSA: The Canadian Standards Association is a not-for-profit, membership-based association that works in Canada as well as globally to develop standards that affect areas such as public safety and health, quality of life, the environment, and trade.
- Z. C380-08: CSA's test procedure for the measurement of energy consumption of STBs.
- AA. Digital Television Adapter (DTA): 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. For the purposes of this specification, the DTA category does not include converters that work with satellite or cable digital signals, nor does it cover devices with multi-functionality such as DVD players with digital to analog conversion capability. Source: ENERGY STAR Digital-to-Analog Converter Box specification.
- DTAs are addressed under the Version 1.1 ENERGY STAR specification for Digital-to-Analog Converter Boxes, and are not included in this STB specification.
- BB. Game Console: A stand-alone device whose primary use is to play video games. The primary inputs for game consoles are special hand held controllers rather than a mouse and keyboard used by conventional computers. Game consoles are also equipped with audio-visual outputs for use with televisions as the primary display, rather than an external monitor or integrated display. These devices typically do not use a conventional operating system, but often perform a variety of multimedia functions such as: DVD/CD playback, digital picture viewing, and digital music playback. Source: ENERGY STAR Version 4.0 Computers specification.
- Game consoles are addressed under the Version 4.0 ENERGY STAR specification for Computers, and are not included in this STB specification.
- CC. Out-Of-Band Tuners: Tuners compliant with standards ANSI/SCTE 55-1 2002 and ANSI/SCTE 55-2 2002 and other similar types of technologies used to gain access to data channels outside of the audio/video source signal. These may facilitate two-way communication and allow the box to send diagnostic information back to the Service Provider as well as enabling Pay-Per-View content and other rich media interactive content.

DD. TEC: Total Energy Consumption. TEC is an assessment tool used in this specification that provides flexibility to approach the issue of energy efficiency while retaining a comparable metric to assess performance. In this specification, efficiency criteria are noted in terms of calculated energy use over a year for a typical user (kWh/yr) rather than power (watts) for On and Sleep states.

EE. UUT: Unit Under Test (UUT) refers to the product being tested. Source: CSA C380-08 modified.

**2) Qualifying Products:** In order to qualify as ENERGY STAR under Tier 1 of this specification, STBs must meet the definition for these products in Section 1 and meet the technical requirements in Section 3. The following devices that fall within the definition of a STB, or provide functions similar to STBs, do not qualify under this Tier 1 specification. EPA envisions that the below excluded products list will likely be modified for the Tier 2 phase of this specification:

**Tier 1 Excluded Products:**

- Game Consoles (See definition above)
- DTAs (See definition above)
- IP STBs sold or provided outside of a dedicated service or service contract
- Products that meet the definitions in the ENERGY STAR® Program Requirements for Consumer Audio and DVD Products

**3) Energy Efficiency and Power Management Criteria:** Only those products addressed by the Qualifying Products definition in Section 2 that meet the following criteria may qualify for ENERGY STAR.

**A) Calculated TEC Criteria**

The criterion for ENERGY STAR qualified STBs is a calculated TEC (in annual kWh). The criterion (herein called an “allowance”) is an allowance for Base Functionality, plus allowances for specific, additional functionalities present across a duty cycle. This duty cycle is further explained in Section 4.

**B) Base Functionality Allowance**

The Base Function shall be established as detailed below.

- a. If the STB meets the definition of Cable STB above, regardless of whether the cable reception is considered the “principal function” by the manufacturer or Service Provider, and/or the STB is capable of receiving cable service after installation of a CableCARD™ or other type of conditional access (CA) system, the Base Functionality is CABLE.
- b. If the STB Base Function is not CABLE, and the STB meets the definition of Satellite STB above, regardless of whether the satellite reception is considered the “principal function” by the manufacturer or Service Provider, the Base Functionality is SATELLITE.
- c. If the STB Base Function is not CABLE or SATELLITE, and the STB meets the definition of IP STB above, regardless of whether the IP reception is considered the “principal function” by the manufacturer or Service Provider, the Base Functionality is IP.
- d. If the STB Base Function is not CABLE, SATELLITE, or IP, and the STB meets the definition of Terrestrial STB above, regardless of whether the terrestrial reception is considered the “principal function” by the manufacturer or Service Provider, the Base Functionality is TERRESTRIAL.

- e. If the STB Base Function is not CABLE, SATELLITE, IP or TERRESTRIAL, and the STB otherwise meets the definition of Thin-Client/Remote, the Base Function is THIN-CLIENT/REMOTE.

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

Base Functionality	Tier 1 Annual Energy Allowance (kWh/year)	Tier 2 <sup>1</sup> Annual Energy Allowance (kWh/year)
Cable	70	N/A
Satellite	88	N/A
IP	45	N/A
Terrestrial	27	N/A
Thin-Client/Remote	27	N/A

**C) Additional Functionalities Allowance**

The Additional Functionalities Allowance, if applicable, shall be determined using values from Table 2.

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

Additional Functionalities	Tier 1 Annual Energy Allowance (kWh/year)	Tier 2 Annual Energy Allowance (kWh/year)
Additional Tuners <sup>2</sup>	53	N/A
Additional Tuners – Terrestrial /IP <sup>3</sup>	14	N/A
Adv. Video Processing <sup>4</sup>	18	N/A
DVR	60	N/A
High Definition <sup>5</sup>	35	N/A
Removable Media Player	12	N/A
Removable Media Player/Recorder	23	N/A
Multi-Room <sup>6</sup>	44	N/A
CableCARD <sup>7</sup>	15	N/A
DOCSIS <sup>8</sup>	20	N/A
Home Network Interface	20	N/A

**D) Calculating Device Allowance**

To calculate the ENERGY STAR allowance for a given device, take the sum of the base functionality allowance and all applicable additional functionalities allowances. (Note there may not be any additional functions in devices such as standard cable or satellite STBs.) This sum is the calculated annual kWh limit, or TEC value. This sum equals the maximum amount of energy the box can use in a given year as calculated following the ENERGY STAR test procedure.

Annual Energy Allowance (kWh/year) = Base Functionality Allowance + Additional Functionalities Allowance

<sup>1</sup> Tier 2 limits have been provided throughout this specification as preliminary targets that will be reevaluated by EPA and finalized at least nine months prior to the Tier 2 effective date.

<sup>2</sup> Additional Tuners adder applies only once, regardless of the number of tuners.

<sup>3</sup> Additional Tuners adder applies only once, regardless of the number of tuners.

<sup>4</sup> The Adv. Video Processing adder only applies once per box and can not be applied multiple times.

<sup>5</sup> Credit for High Definition applies to all STBs except those with Base Functionality of TERRESTRIAL.

<sup>6</sup> The Multi-room adder applies only once, regardless of the number of rooms served by the device.

<sup>7</sup> The cable card adder can be applied on a per cable card basis.

<sup>8</sup> OEMs must test with DOCSIS enabled if DOCSIS is present. Service providers can test with it and take the allowance only if they use it.

Examples:

- (A) Under Tier 1, the energy allowance for a high-definition, Cable STB with DVR to qualify for ENERGY STAR would be 165 kWh/y (70 kWh/y for the base function, 35 kWh/y for the high definition and 60 kWh/y for the DVR).
- (B) Under Tier 2, the energy allowance for the same product would drop to 94 kWh/y.

**E) STBs Using an External Power Supply**

To qualify, the external power supply (EPS) used with STBs manufactured after the effective date of this specification must be ENERGY STAR qualified or meet the no-load and active mode efficiency levels provided in the ENERGY STAR Program Requirements for Single Voltage Ac-Ac and Ac-Dc External Power Supplies, Version 2.0. The ENERGY STAR specification and qualified product list can be found at: [www.energystar.gov/powersupplies](http://www.energystar.gov/powersupplies). STBs manufactured prior to the effective date of this specification that can meet the energy-efficiency performance requirements in the ENERGY STAR STB specification do **not** need to use an ENERGY STAR qualified (or equivalent) EPS.

**F) Multi-Room STBs**

When using the Multi-Room Additional Functionalities energy allowance to establish the criteria for a STB, the following procedure must be followed. This allowance may only be used for STBs that can provide independent content to more than one display device, e.g., TV, PC, portable media player, etc. For the purposes of this specification, TV can be any device capable of streaming realtime video from the UUT to an independent display while keeping better than 480i resolution. Specific requirements for testing Multi-Room STBs are included below.

- First, test the multi-room STB and compare the results to the specification criteria assuming the STB will deliver content to only one TV, i.e., do not include the Multi-Room allowance. If the STB passes, then it qualifies as an ENERGY STAR qualified STB under any installation configuration, i.e., it can be used for one or more TVs.
- If the STB does not pass the single TV STB test, then determine if it qualifies as a Multi-Room STB.
  - Retest with a second TV running the same test simultaneously with the first.
  - Add the Multi-Room additional annual energy allowance listed in Table 2 to the criteria established for the STB. Compare the test results to the Multi-Room criteria to see if the STB qualifies for ENERGY STAR. For units that can support a second TV without the need for a thin client, and do this via widely used N/ATSC (unencrypted) via RF, the manufacturer can add in half of the relevant thin client adder.
  - If the STB qualifies as a Multi-Room STB, manufacturer must clearly indicate in product literature that product only qualifies for ENERGY STAR when providing content to more than one TV.

**G) Speculative Recording**

Devices that provide for speculative recording must have a user-accessible menu option allowing the user to disable this feature at will. Manufacturers must also include instructions for disabling speculative recording in product materials.

## **4) Testing Products for ENERGY STAR:**

### **A) Product Testing Set-up, Procedures, and Documentation**

The test results produced by the ENERGY STAR test procedure shall be used as the primary basis for determining ENERGY STAR qualification. Manufacturers are required to perform tests and self-certify those models that meet the ENERGY STAR requirements. This is confirmed by testing for ENERGY STAR qualification while the product is connected to the system, either on a live system or at a representative system in a laboratory.

When qualifying and reporting STBs for ENERGY STAR, the following procedure shall be used to determine that an appropriate representative sample size has been tested.

- 1) Select on a random basis five units of the STB model to be tested. If the units have been refurbished, all units must have undergone the same refurbishment or reconfiguration, and must have received the same new hardware components or new or updated software.
- 2) Test three units drawn at random from the pool of five units following the test procedure specified in the ENERGY STAR Program Requirements for Set-top Boxes – Version 2.0.
  - a) If all three units meet the applicable ENERGY STAR criteria, and are not within 10% of the allowance in the specification, then the STB model meets ENERGY STAR requirements and no more testing is needed.
  - b) If all three units meet the applicable ENERGY STAR criteria, but any are within 10% of the allowance in the specification, go to step 3.
  - c) If any of the three units do not meet the ENERGY STAR criteria, then the STB model does not meet ENERGY STAR requirements and cannot be referred to as ENERGY STAR qualified.
- 3) Test the additional two units in the pool. If both units meet the applicable ENERGY STAR criteria, then the STB model meets ENERGY STAR requirements and no more testing is needed. If either of the two units does not meet the applicable ENERGY STAR criteria, then the STB model does not meet ENERGY STAR requirements and cannot be referred to as ENERGY STAR qualified.

### **B) TEC Assessment**

In this specification, the power consumed in the On and Sleep states will be multiplied by the number of hours a defined typical device spends in On and Sleep. The result will be a single energy value representing the energy usage of the device over the course of an entire year.

To determine if a STB meets the ENERGY STAR specification criteria (Annual Energy Allowance), the TEC of the STB shall be calculated as follows. If the TEC assessed for the product is less than the Annual Energy Allowance calculated from Section 3D, the product meets the criteria and has earned the ENERGY STAR.

### **C) Equation 1: Base Assessment**

*Applies To All Products*

Calculate the Base energy consumption by multiplying the measured power consumption as specified in this test procedure by the hours per day values in the equations below. If the UUT (Unit Under Test) does not include the capability for auto power down, then use the first equation (a). If the product does include auto power down capability, and it meets the requirements in section (F) below then use the second equation (b).

$P_{TV}$ ,  $P_{Sleep}$  and  $P_{Auto PD}$  are power levels in watts as measured according to the ENERGY STAR test procedure.

- a) Annual energy (kWh/yr) for a product with no auto power down

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

- b) Annual energy (kWh/yr) for a product with auto power down capability

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

**Examples:**

(C) The UUT (HD DVR cable STB, Tier 1) does not have auto power down capability, and the measurements during the test procedure are as follows:  $P_{TV} = 24.0$  watts and  $P_{Sleep} = 18.0$  watts. The annual energy consumption is then:

$$kWh_{Base} = 0.365 * ( 14 * 24.0 + 10 * 18.0 ) = 188.3 \text{ kWh/yr}$$

(D) The UUT (HD DVR cable STB, Tier 1) does have auto power down capability, and the measurements during the test procedure are similar to example A:  $P_{TV} = 24.0$  watts,  $P_{Sleep} = 18.0$  watts and  $P_{AutoPD} = 18$  watts. The annual energy consumption is then:

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

**D) Equation 2: Playback and Record Assessment**

The table and equation below illustrate how to calculate from the values measured in the test procedure the annual energy consumption for the added functionalities such as playback and record. These apply only to products with a DVR, Removable Media Playback, or Removable Media Playback with Record capabilities. Sum the results for all functionalities applicable to the UUT.

$P_{TV}$ ,  $P_{Playback}$  and  $P_{Record}$  are power levels in watts as measured according to the ENERGY STAR test procedure.

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

**Table 3: Duty Cycle**

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

**Example:**

(E) Consider the Cable STB with DVR product in example (C) above with a  $P_{TV}$  of 24.0 watts. Following the test procedure, it is found that  $P_{Playback}$  is 30.0 watts and  $P_{Record}$  is 32.0 watts.

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

## **E) Total Energy Consumption**

If the STB includes a DVR, Removable Media Playback, or Removable Media Playback with Record capability, add the results of Equation 1 and Equation 2. If the STB does not include DVR, Removable Media Playback, or Removable Media Playback w/ Record capability, the TEC is equal to Equation 1.

Example:

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

## **F) Auto Power Down**

Auto power down (APD) capability is not a requirement under this specification. However, credit for anticipated energy savings for STBs that include APD capability is provided in Section C: Equation 1: Base Assessment - if the requirements in this subsection (F) are met.

When claiming the presence of APD functionality for purposes of using equation 1b (Section C: Equation 1: Base Assessment) and calculating the TEC, the following requirements must be met:

The STB must be shipped from the manufacturer with the APD setting engaging at four hours or less of inactivity. It is acceptable for the current program to complete before switching to the Sleep state. The energy-related settings shipped as the default by the manufacturer shall persist unless the user chooses at a later date to manually: a) disable the APD, or b) adjust the default time period from four hours or less to some other value. Partner may choose to not allow user the option of changing the power down settings.

The STB may exit an automatically-initiated Sleep state in order to download content and scan for program and system information, scheduling information, or any other maintenance activity. After activity is complete, STB must return to Sleep state within no more than 15 minutes. If this occurs, the STB may exit the Sleep state for no longer than an average of two hours in a twenty-four (24) hour period. This requirement of two hours per day does not include activities that an end user schedules (e.g. video recording of a daily show). Video downloads that are **not** user-requested (e.g. "speculative recording", or "push") **are** to be counted against the two hour average per day requirement.

## **G) Submittal of Qualified Product Data to EPA**

Partners are required to report data on those models that meet the ENERGY STAR guidelines to EPA. The test results must be reported to EPA using the Set-top Box Version 2.0 Qualifying Product Information (QPI) Form.

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

**6) Effective Date:** The ENERGY STAR specification for STBs (Version 2.0) Tier 1 is effective January 1, 2009. ~~Tier 2 will become effective on January 1, 2011.~~ Any previously executed agreement on the subject of ENERGY STAR qualified set-top boxes terminated effective February 2, 2005.

1. Qualifying and Marking products under the Tier 1 Version 2.0 specification: All products, including models originally qualified under Version 1.0, with a date of manufacture on or after January 1, 2009, must meet the new (Version 2.0) requirements in order to qualify for ENERGY STAR. 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.

- ~~2. **Qualifying and Marking products under the Tier 2 Version 2.0 specification:** All products, including models originally qualified under Tier 1 Version 2.0, with a date of manufacture on or after January 1, 2011, must meet the Tier 2 requirements in order to qualify for ENERGY STAR.~~
3. **Elimination of Grandfathering:** EPA will not allow grandfathering under this Version 2.0 ENERGY STAR specification. **ENERGY STAR qualification under previous Versions is not automatically granted for the life of the product model.** Therefore, any product sold, marketed, or identified by the manufacturing partner as ENERGY STAR must meet the current specification in effect at the time of manufacture of the product.

**7) Future Specification Revisions:** EPA reserves the right to revise the specification should technological and/or market changes affect its usefulness to consumers or industry or its impact on the environment. In particular, EPA will finalize Tier 2 elements identified as TBD and reevaluate the appropriateness of other Tier 2 criteria at least nine months prior to the Tier 2 effective date. In keeping with current policy, revisions to the specification will be discussed with stakeholders. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model. To qualify as ENERGY STAR, a product model must meet the ENERGY STAR specification in effect on the model's date of manufacture



## ENERGY STAR for Set-top Boxes Test Procedure

This document is being proposed for addition to *C380-08: Test procedure for the measurement of energy consumption of set-top boxes (STBs)* for purposes of testing and qualifying products under:

- (1) ENERGY STAR Program Requirements for Set-Top Boxes - Version 2.0; and
- (2) ENERGY STAR Program Requirements for Cable, Satellite, and Telecom Service Providers – Version 1.0.

*All requirements for qualifying to the ENERGY STAR requirements are contained herein.*

### 5 Duty Cycle Workload Testing Procedure

#### 5.1 Background

The purpose of this section is to provide a workload-based test procedure centered on the actions of the user and the practical output of STBs when placed in situ. These are meant to mimic general actions and general conditions of STBs when used by the average user and are not meant to represent all conditions for all possible box functions and user scenarios.

##### 5.1.1. Definitions

For purposes of this section (5 Duty Cycle Workload Testing Procedure), the definitions contained in (1) ENERGY STAR Program Requirements for Set-Top Boxes - Version 2.0, and (2) ENERGY STAR Program Requirements for Cable, Satellite, and Telecom Service Providers – Version 1.0 supercede those in section “3 Definitions and abbreviations” of *C380-08 Test procedure for the measurement of energy consumption of set-top boxes (STBs)*.

## 5.2 Preparation

### 5.2.1 Measurement of Energy Consumption

*For purposes of this workload-based test procedure, the following portions of section 4 of C380-08 as amended, shall be followed.*

#### **4.1 General**

*Average power shall be measured from the AC power source to the equipment being tested.*

#### **4.2 Test conditions**

##### **4.2.1 General**

*Unless otherwise specified, measurements shall be made under test conditions and with equipment specified below.*

##### **4.2.3 Test room**

*The tests shall be carried out in a room that has an air speed close to the UUT of  $\leq 0.5$  m/s, and the ambient temperature shall be maintained at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  throughout the test. The UUT shall be tested on a thermally non-conductive surface*

##### **4.2.4 Test voltage**

*An AC power source shall be used to provide input voltage and frequency of  $115 \pm 1\%$  at 60 Hz to the UUT.*

*The Total Harmonic Distortion (THD) of the supply voltage when supplying the UUT in the specified mode shall not exceed 2%, up to and including the 13th harmonic. The peak value of the test voltage shall be within 1.34 and 1.49 times its RMS value.*

##### **4.2.5 Test leads**

*All leads used in the test set-up shall be of a sufficient gauge and length in order to avoid the introduction of errors in the testing process.*

*Note: For further guidance, see Table B.2, "Commonly used values for wire gages and related voltage drops" in IEEE 1515.*

## **4.4 Test equipment**

### **4.4.1 General**

*The following should be considered when selecting test equipment:*

- (a) an oscilloscope with a current probe, to monitor AC line current waveform, amplitude, and frequency;*
- (b) a true rms volt meter, to verify voltage at the input of the unit being tested (optional if AC source output is sufficiently accurate); and*
- (c) a frequency counter, to verify frequency at the input of the unit being tested (optional if AC source output is sufficiently accurate).*

#### 4.4.2 Calibration

*Test instruments shall be calibrated annually to traceable national standards to ensure limits of error in measurement no greater than  $\pm 0.5\%$  of the measured value over the required bandwidth of the output.*

#### 4.4.3 True power watt meter

##### 4.4.3.1 Crest Factor

*A true power watt meter, with accuracy and, resolution in accordance with 4.4.2, and 4.4.3.4 and sufficient bandwidth, and crest factor rating appropriate for the waveforms being measured, shall be used.*

*The selected watt meter's crest factor rating shall be capable of reading the available current waveform without clipping the waveform.*

*The peak of the current waveform measured during SLEEP and ON states for the UUT shall determine the crest factor rating requirement and the appropriate current range setting.*

*The full-scale value of the selected current range multiplied by the crest factor for that range shall be at least 15% greater than the peak current to prevent any measurement error.*

##### 4.4.3.2 Bandwidth

*The current and voltage signal shall be analyzed to determine the highest frequency component (harmonic) with a magnitude greater than 1% of the fundamental frequency under the test conditions. This shall determine the minimum bandwidth of the test instruments.*

*The meter shall be capable of sampling at a minimum of one second intervals.*

##### 4.4.3.3 Frequency response

*A watt meter with a frequency response of at least 9 kHz shall be used, which accounts for harmonics up to the 50th.*

*Note: Electronic equipment can cause harmonic waveforms that lead to inaccuracies in power measurements.*

##### 4.4.3.4 Resolution

*The power measurement instrument shall have a resolution of:*

- *0.01 W or better for power measurements of 10 W or less;*
- *0.1 W or better for power measurements of greater than 10 W up to 100 W;*  
*and*
- *1 W or better for power measurements of greater than 100 W.*

## 5.2.2 General

The box and test conditions should be prepared according to section 5.2.1 above.

- a. Begin the test by connecting all relevant A/V connectors.
- b. Next plug the box into the power source and let the unit sit for 15 minutes as the unit initializes and comes to a ready state.
- c. Do not attach external devices that are not required for operation and/or that will not be used with the device under normal operation.
- d. For signal source input, ensure that the box is connected to the input source and the input source conforms to the source signal requirements below
- e. Connect the UUT to a display device (e.g. TV) via the applicable interface(s) supported by the UUT (e.g. composite video output).
- f. If the UUT supports conditional access system control, then provision the UUT as applicable for the UUT type (e.g. Cable, Satellite, Telcocom, or IP STB).
- g. Functions to disable: WiFi (unless WiFi is the primary network connection), VOIP and data services (those exposed to the user for external use such as broadband services)
- h. Source Signals
  - a. All Cable STBs interacting with Conditional Access (CA) system data via DOCSIS Set-top Gateway (DSG) or SCTE-55 as applicable for the product
  - b. All Telcocom QAM/IP STBs interacting with CA system data via SCTE-55 and/or via an applicable LAN technology (e.g. Multimedia Over Coax - MoCA).
  - c. All IP STBs interacting with CA system data via applicable LAN technology (e.g. IEEE-802.3, Multimedia Over Coax - MoCA)
  - d. STBs with POD/CableCard - encrypted content is decrypted by POD/CableCard
  - e. All Satellite STBs - interacting with CA system via LNB and POTS modem
  - f. All Terrestrial STBs – ATSC signal from a live source.

## 5.2.3 Duty Cycle Specific Test Conditions

- a. Remote: In all cases, user input should be accomplished with the remote in cases where the unit ships with one, otherwise the unit's face controls should be utilized. In cases where the functionality needed is not on the remote, then for that particular function the face mounted controls should be utilized.
- b. Reset the meter after each test.
- c. When tuning to a broadcast video source, this is defined as one tuner acquiring an encrypted digital video service, where the video service is rendered on all analog audio/video output (e.g. RF modulated, S-Video, composite and component) and on all SPDIF audio outputs (if equipped).
- d. If the UUT uses Smart card or POD technology for conditional access system control, then insert the applicable card into the UUT prior to applying power.
- i. Reference Channels:
  - a. [A] Standard Definition network TV (minimum 480i)
  - b. [B] Live/Recorded Sporting channel. When the box is HD-capable, this channel should be the HD version. (minimum 480i in SD, 720p in HD)
  - c. [C] Standard Definition news channel, i.e., 24 hour news channel. (minimum 480i)

## 5.2.4 Other Specific Test Conditions

The following additional test conditions apply.

- a. Satellite Low Noise Block (LNB): incremental power required to operate the LNB(s), if drawn from the STB, may be subtracted from the power measurements. It is preferable that all LNB power drawn be supplied separately. Otherwise, the amount subtracted must be clearly noted on the Qualified Product Information (QPI) form.
- b. Functions to Disable: WiFi (unless WiFi is the primary network connection), VOIP and Data services (those exposed to the user for external use such as broadband services)

## 5.3 Active Tests

### 5.3.1 Live TV ( $P_{TV}$ )

- a. To begin the active portion of the test, press the button on the remote, if one is shipped with the unit, responsible for turning on the tuner and/or tuning to a live TV signal. If there is no "on" button and the unit's tuner is designed to be on continuously, then ensure that the tuner is in a state where it is tuned to live TV.
- b. Proceed to change the channel on the tuner, to Reference Channel A as a starting point.
- c. Begin to measure average power at this point and continue for 5 minutes.
- d. After 5 minutes, switch the channel to Reference Channel B and continue to measure average power. If the device is an HD device, select an HD stream for Reference Channel B
- e. After ten minutes, switch the channel to Reference Channel C. If the UUT has one or more Additional Tuners as defined in the ENERGY STAR specification then with the second tuner acquire Channel A and render in a window embedded in the primary window while the primary tuner displays in the primary picture window Channel C In the case of multiple sizes available to the user, the one closest to the size of  $\frac{1}{4}$  the screen size will be chosen. In the case where no picture-in-picture capability exists, simply record the second channel in the background instead.
- f. Wait 5 minutes and note the average power used during the test. Total test time should be twenty minutes.
- g. When testing a DVR or unit with similar functionality, the video must be paused 5% of the time, in fast forward 10% and in rewind 10% during each Channel test above, all the while the raw video feed is being buffered. However, this does not increase the overall test times.

### 5.3.2 Recording Live TV ( $P_{Record}$ )

- a. Tune to the Reference Channel.
- b. Begin the test by starting the meter
- c. Begin recording Channel A for 5 minutes.
  - a. Note that for certain devices it may be more accurate to create a series of programmed back-to-back recording sessions to avoid HID prompts. This is allowed.
- d. Switch to Channel B for 10 minutes.
- e. Switch to Channel C for 5 minutes.
- f. Stop the meter and note the average power value for the past 20 minutes of recording time.
- g. Save the recordings for the Playback test.
- h. In the case of a DVR or unit with similar functionality, a second tuner, if available on the UUT, must be engaged in recording during the entire time.

### 5.3.3 Playing Back Recorded TV ( $P_{Playback}$ )

- a. Tune to Reference Channel A.
- b. Begin the test by starting the meter
- c. Press the button on the remote to bring the menu containing previously recorded recordings onto the screen.
- d. Begin watching the first recording from Channel A.
- e. When done delete the recording (if prompted to do so simply select the affirmative prompt).
- f. Proceed to the recordings menu and select the second recording.
- g. Begin watching the second recording from Channel B.
- h. When done delete the recording (if prompted to do so simply select the affirmative

- prompt).
- i. Begin watching the second recording from Channel C.
- j. When done delete the recording (if prompted to do so simply select the affirmative prompt).
- k. Stop the meter and note the average power value for the playback time.
- l. When testing a DVR or unit with similar functionality, the video playback must be paused 5% of the time, in fast forward 10% and in rewind 10% during each Channel test above, all the while the raw video feed is being buffered. However, this does not increase the overall test times.
- m. In the case of a DVR or unit with similar functionality, a second tuner, if available on the UUT, must be engaged in recording during the entire time.

#### 5.3.4 Removable Media Playback Test ( $P_{\text{Playback}}$ )

- a. To begin the media playback test, tune to Reference Channel A.
- b. Start the meter.
- c. Press the button to activate the media playback functionality.
  - a. Note that if the playback function is automatically started when the door for the removable media is opened, this is sufficient.
- d. If applicable, open the media door, insert the media and if applicable, close the media door.
- e. Either allow the media to automatically begin playback or begin playback by using the menu or “play” button on the remote.
- f. Playback the recording for 20 minutes.
- g. Press “stop” on the remote.
- h. Eject the media if applicable.
- i. Stop the meter and note the average power for the test.

#### 5.3.5 Removable Media Record Test ( $P_{\text{Record}}$ )

- a. To begin the media record test, tune to Reference Channel A.
- b. Start the meter.
- c. If applicable, open the media door, insert the media and if applicable, close the media door.
- d. Press the button to activate the media record functionality.
- e. Either begin recording by using the menu or “play” button on the remote.
- f. Record the recording for 20 minutes.
- g. Press “stop” on the remote.
- h. Eject the media if applicable.
- i. Stop the meter and note the average power for the test.
- j. If the unit is HD recording capable, perform the test with an HD stream and average the value of both tests.

### 5.4 Inactive Tests

#### 5.4.1 Sleep Test ( $P_{\text{Sleep}}$ )

- a. To begin the inactive system tests, run through at least the Watching Live TV test in 5.3.1.
- b. Press the power/standby button on the remote to place the system into its lower power state.
- c. Soon thereafter start the meter.
- d. After 20 minutes take the reading of average power off of the meter.

#### 5.4.2 Auto Power Down ( $P_{\text{Auto PD}}$ )

- a. Place the unit in a state where it is tuned to live TV.
- b. Allow the STB to auto power down.
- c. Verify that the device went into the expected lower power state.
- d. Soon thereafter start the meter.
- e. After 20 minutes take the reading of average power off of the meter.