ENERGY STAR® Program Requirements
Product Specification for Televisions

Eligibility Criteria
Draft 1 Version 8.0

Following is the Version 8.0 ENERGY STAR Product Specification for Televisions. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

A) Product Types:

1) Television (TV)[1]: A product designed to produce dynamic video, contains an internal TV tuner encased within the product housing, and that is capable of receiving dynamic visual content from wired or wireless sources including but not limited to:

   a) Broadcast and similar services for terrestrial, cable, satellite, and/or broadband transmission of analog and/or digital signals; and/or

   b) Display-specific data connections, such as HDMI, Component video, S-video, Composite video; and/or

   c) Media storage devices such as a USB flash drive, a memory card, or a DVD; and/or

   d) Network connections, usually using Internet Protocol, typically carried over Ethernet or Wi-Fi.

2) Home Theater Display (HTD): A product with diagonal viewable screen size greater than 25 inches, that is designed to produce dynamic video, that does not contain an internal TV tuner encased within the product housing, that is primarily marketed for use in home theater applications, and that is capable of receiving dynamic visual content from wired or wireless sources including but not limited to:

   a) Display-specific data connections, such as HDMI, Component video, S-video, Composite video; and/or

   b) Media storage devices such as a USB flash drive, a memory card, or a DVD; and/or

   c) Network connections, usually using Internet Protocol, typically carried over Ethernet or Wi-Fi.

   Home Theater Display does not include Computer Monitors or Signage Displays (defined in the ENERGY STAR Product Specification for Displays).

1 10 CFR 430.2

Note: EPA is proposing to expand the scope of the ENERGY STAR TV specification to include Home Theater Displays, which support TV viewing through streaming rather than via a tuner. EPA is proposing this change based on input from Television Partners that numerous future products, including high-volume products, will be shipping without a tuner. Since such products would not meet the regulatory definition of a Television (10 CFR 430.2) which is also used in this ENERGY STAR TV specification, they would not be able to participate in the ENERGY STAR Televisions program. Further, EPA understands that consumers are seeking products for use cases that do not call for a tuner such as those associated with pay-TV services or those used exclusively for streaming content. Since EPA does not anticipate significant energy consumption differences between these tunerless "Home Theater Display" products and conventional Televisions, it is proposing to extend the scope of the Televisions specification to include these new products and apply the same eligibility criteria to them. This way, consumers will be able to choose energy efficiency whether or not their use case requires a tuner.

The proposed HTD definition includes most of the requirements of the regulatory TV definition but excludes the tuner. It also clarifies that these products do not include Computer Monitors or Signage Displays, which are subject to separate requirements in the ENERGY STAR Product Specification for Displays. Finally, to further prevent miscategorization of Computer Monitors, EPA is proposing that HTDs include only products with diagonal viewable screen size greater than 25 inches. EPA welcomes comments on the proposed definition. EPA seeks feedback on whether the proposed definition clearly differentiates between HTDs and Signage displays.

In addition to providing a HTD definition and expanding the scope, EPA is proposing a number of small changes to clarify that all specification requirements also apply to these new products.

3) Hospitality Television/Home Theater Display: A TV or HTD product which includes the following features:

   a) A control port for bi-directional communication (DB-9, RJ11, RJ12, RJ45, coaxial cable, or HDMI-CEC); and

   b) Activated hospitality protocol software (e.g., SmartPort, Meeting Professionals International (MPI), Multiple Television Interface (MTI), Serial Protocol) to provide direct access to Video-On-Demand (VOD) systems, non-video hotel services or a digital media player designed for hospitality-specific applications.

B) Operational Modes:

1) On Mode[2]: The mode of operation in which the TV/HTD is connected to mains power, and is capable of producing dynamic video.

2) Standby-Passive Mode[3]: The mode of operation in which the TV/HTD is connected to mains power, produces neither sound nor picture, and can be switched into another mode with only the remote control unit or an internal signal.

3) Standby-Active, Low Mode[4]: The mode of operation in which the TV/HTD is connected to mains power, produces neither sound nor picture, can be switched into another mode with the remote control unit or an internal signal, and can additionally be switched into another mode with an external signal.

2 10 CFR 430, Subpart B, Appendix H, Section 2.14
3 10 CFR 430, Subpart B, Appendix H, Section 2.18
4 10 CFR 430, Subpart B, Appendix H, Section 2.20

4) Standby-Active, High Mode[5]: The mode of operation in which the TV/HTD is connected to mains power, produces neither sound nor picture, is exchanging/receiving data with/from an external source, and can be switched into another mode with the remote control unit, an internal signal, or an external signal.

   a) Download Acquisition Mode: The power mode in which the product is connected to a mains power source, produces neither sound nor picture, and is actively downloading data. Data downloads may include channel listing information for use by an Electronic Program Guide, TV/HTD setup data, channel map updates, firmware updates, monitoring for emergency messaging/communications or other network communications.

5) Off Mode[6]: The mode of operation in which the TV/HTD is connected to mains power, produces neither sound nor picture, and cannot be switched into any other mode of operation with the remote control unit, an internal signal, or external signal.

C) Additional Functions[7]: Functions that are not required for the basic operation of the device.

Note: Additional functions include, but are not limited to, a VCR unit, a DVD unit, an HDD unit, a FM-radio unit, a memory card-reader unit, or an ambient lighting unit.

1) Thin Client Capability: The ability of the TV/HTD to receive, decrypt, and display encrypted content provided by a Multichannel Video Programming Distributor (MVPD) over the Local Area Network via a server device co-located on the customer premises without the need for a client device at the TV/HTD.

2) Full Network Connectivity: The ability of the TV/HTD to maintain network presence while in Standby-Active, Low mode. Presence of the TV/HTD, its network services, and its applications, is maintained even if some components of the TV/HTD are powered down. The TV/HTD can elect to change power states based on receipt of network data from remote network devices, but should otherwise stay in Standby-Active, Low mode absent a demand for services from a remote network device. Full network connectivity is not limited to a specific set of protocols. Also referred to as “network proxy” functionality and described in the Ecma-393 standard.

D) Special Functions[8]: Functions that are related to, but not required for, the basic operation of the device.

Note: Special functions include, but are not limited to, special sound processing, power saving functions (e.g., Automatic Brightness Control).

1) Automatic Brightness Control (ABC): The self-acting mechanism that controls the brightness of a display as a function of ambient light.

2) Gesture Recognition: Ability to recognize non-verbal communication through a movement of the body, head, or limbs to express or emphasize an idea, sentiment, or command.

3) Voice Recognition: Ability to recognize spoken words or phrases and to convert said communication into text or commands to which meaning has been assigned.

E) TV/HTD Settings and Menus:

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5 10 CFR 430, Subpart B, Appendix H, Section 2.19,
6 10 CFR 430, Subpart B, Appendix H, Section 2.13
7 10 CFR 430, Subpart B, Appendix H, Section 2.1, which references International Electrotechnical Commission (IEC) Standard 62087 Ed. 3.
8 10 CFR 430, Subpart B, Appendix H, Section 2.17, which references IEC 62087 Ed. 3.

1) Preset Picture Setting[9]: A preprogrammed factory setting obtained from the TV/HTD menu with pre-determined picture parameters such as brightness, contrast, color, sharpness, etc. Preset Picture Settings can be selected within the Home or Retail Configurations.

2) Default Picture Setting[10]: The Preset Picture Setting that the TV/HTD enters into immediately after making a selection from the Forced Menu. If the TV/HTD does not have a Forced Menu, this is the as-shipped Preset Picture Setting.

3) Brightest Selectable Preset Picture Setting[11]: The Preset Picture Setting in which the TV/HTD produces the highest screen luminance within either the Home or Retail Configuration.

4) Home Configuration[12]: The TV/HTD configuration selected from the Forced Menu which is designed for typical consumer viewing and is recommended by the manufacturer for home environments.

5) Retail Configuration[13]: The TV/HTD configuration selected from the Forced Menu which is designed to highlight the TV/HTD's features in a retail environment. This configuration may display demos, disable configurable settings, or increase screen brightness in a manner which is not desirable for typical consumer viewing.

6) High Dynamic Range (HDR) Upscaling: A user-selectable Special Function that extends the luminance of the brightest scene elements and apparent saturation of colors of standard-dynamic range content in a manner similar to those provided by HDR 10 or Dolby Vision encoding.

Note: EPA is proposing the above definition to permit testing of HDR Upscaling to characterize the energy performance of these settings. In contrast to true HDR picture settings, sometimes referred to by manufacturers as 'modes,' which require HDR encoded content, these settings can be used with all standard dynamic range (SDR) content, with a potential corresponding impact on annual energy consumption.

7) Forced Menu[14]: A series of menus which require the selection of initial settings before allowing the user to utilize primary functions. Within these menus contains an option to choose the viewing environment between Retail and Home Configurations.

8) Electronic Program Guide (EPG): An interactive on-screen menu of TV/HTD program information downloaded from an external source or embedded interstitially in broadcast video streams (e.g., program time, date, and descriptions).

9 10 CFR 430, Subpart B, Appendix H, Section 2.15, with the exception of "Home or Retail Configurations"; Section 2.15 uses "home or retail mode" instead.
10 10 CFR 430, Subpart B, Appendix H, Section 2.4
11 10 CFR 430, Subpart B, Appendix H, Section 2.3
12 10 CFR 430, Subpart B, Appendix H, Section 2.6
13 10 CFR 430, Subpart B, Appendix H, Section 2.16
14 10 CFR 430, Subpart B, Appendix H, Section 2.5

Figure 1: Illustration of Picture Settings for TV/HTDs with a Forced Menu [15]

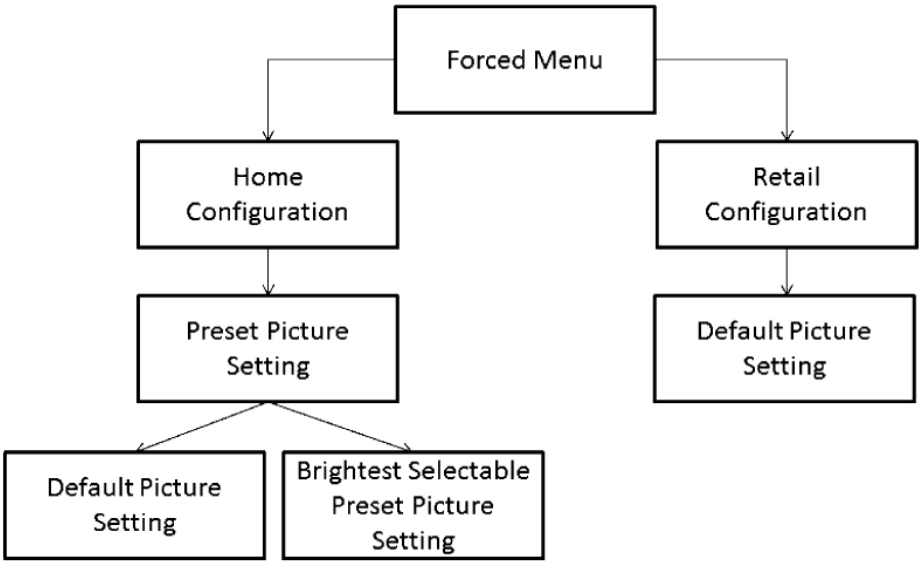
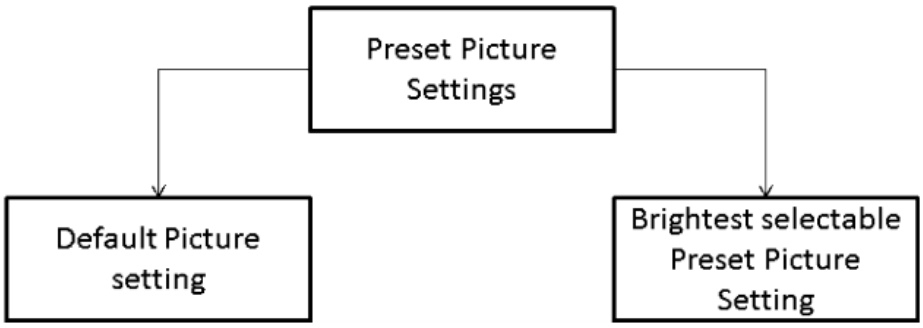


Figure 2: Illustration of Picture Settings for TV/HTDs without a Forced Menu[16]



F) Power Devices:

1) External Power Supply (EPS)[17]: Also referred to as External Power Adapter. An external power supply circuit that is used to convert household electric current into dc current or lower-voltage ac current to operate a consumer product.

2) Main Battery[18]: A battery capable of powering the TV/HTD to produce dynamic video without the support of mains power.

G) Product Characteristics:

15 U.S. Department of Energy, Energy Conservation Program: Test Procedures for Television Sets; Final rule, *Federal Register,* October 25, 2013, 78 FR 63828.
16 U.S. Department of Energy, Energy Conservation Program: Test Procedures for Television Sets; Final rule, *Federal Register,* October 25, 2013, 78 FR 63829.
17 10 CFR 430.2
18 10 CFR 430, Subpart B, Appendix H, Section 2.12

1) Luminance[19]: The photometric measure of the luminous intensity per unit area of light traveling in a given direction, expressed in units of candelas per square meter (cd/m^2).

2) Screen Area: The viewable screen area of the product, calculated by multiplying the viewable image width by the viewable image height. For curved screens, the measurements shall be made along the curvature on the face of the screen rather than along a straight line/chord.

3) Native Vertical Resolution**:** The number of visible physical lines along the vertical axis of the TV/HTD (e.g., a TV/HTD with a screen resolution of 1920 x 1080 (horizontal x vertical) would have a Native Vertical Resolution of 1080).

H) Basic Model[20]: All units of a given type of product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional characteristics that affect energy consumption and energy efficiency.

I) Multichannel Video Programming Distributor (MVPD)[21]: A person such as, but not limited to, a cable operator, a multichannel multipoint distribution service, a direct broadcast satellite service, or a television receive-only satellite program distributor, who makes available for purchase, by subscribers or customers, multiple channels of video programming.

J) Unit Under Test (UUT): The unit currently undergoing testing.

2 SCOPE

2.1 Included Products

2.1.1 Products that are: (1) marketed to the consumer as a TV/HTD (i.e., TV/HTD is the primary function); (2) capable of being powered from a wall outlet or with an external power supply; and (3) meet one of the following product type definitions, are eligible for ENERGY STAR certification, with the exception of products listed in Section 2.2:

i. TVs
ii. Hospitality TV/HTDs
iii. Home Theater Displays

Note: EPA has included Home Theater Displays in the scope of the specification, per the above definition, based on input from Television Partners that numerous future products, including high-volume products, will be shipping without a tuner.

2.2 Excluded Products

2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for certification under this specification. The list of specifications currently in effect can be found at www.energystar.gov/specifications.

2.2.2 Products that satisfy one or more of the following conditions are not eligible for ENERGY STAR certification under this specification:

i. TV/HTDs with a Main Battery that enables operation without connected mains power.

19 10 CFR 430, Subpart B, Appendix H, Section 2.11
20 10 CFR 430.2, with references to water consumption and other specific covered products removed.
21 As defined in 47 USC § 522(13)

ii. Products with a computer input port (e.g., VGA), that are marketed and sold primarily as computer monitors or other displays, and that do not contain an integrated TV tuner encased within the product housing.

3 CERTIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be carried out with directly measured (unrounded) values. Only the final result of a calculation shall be rounded.

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

3.1.3 Annual Energy Consumption (AEC) values less than 100 kWh shall be rounded to the nearest tenth of a kWh; otherwise, they shall be rounded to the nearest kWh, as specified in Section 8.2 of Appendix H to 10 CFR Part 430, for reporting on the ENERGY STAR website.

3.1.4 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.2 General Requirements

3.2.1 External Power Supplies (EPSs): Single- and Multiple-voltage EPSs shall meet the Level VI or higher performance requirements under the International Efficiency Marking Protocol when tested according to the Uniform Test Method for Measuring the Energy Consumption of External Power Supplies, Appendix Z to Subpart B of 10 CFR Part 430.

i. Single- and Multiple-voltage EPSs shall include the Level VI or higher marking.
ii. Additional information on the Marking Protocol is available at http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0218.

3.2.2 General User Information: The product shall ship with consumer informational materials located in either (1) the hard copy or electronic user manual, or (2) a package or box insert. These materials shall include:

i. Information about the ENERGY STAR program,
ii. Information on the energy consumption implications of changes to default as-shipped TV/HTD configuration and settings, and
iii. Notification that enabling certain optional features and functionalities (e.g., instant-on), may increase energy consumption beyond the limits required for ENERGY STAR certification, as applicable.

3.2.3 Energy Saving Features: A TV/HTD may not be certified with any detectable or undetectable energy saving feature (e.g., Motion Detection Dimming) enabled during testing unless that feature provides comparable energy savings during typical viewing experiences (i.e., the duration of a variety of popular programming) as to those realized when tested according to Appendix H to Subpart B of 10 CFR Part 430. This prohibition applies irrespective of whether the function's primary or intended purpose is energy savings.

Note: EPA is adding language to the specification prohibiting certification of TVs as ENERGY STAR if they have enabled energy saving features during testing with the IEC test clip that do not offer comparable savings when tested with content that reflects a variety of typical viewing experiences.

EPA understands that certain features besides ABC are employed in some TVs and may not consistently deliver energy savings. To illustrate this point, EPA examined data, as shown in the table below, where three organizations tested a number of televisions containing a feature termed Motion Detection Dimming (MDD), enabled by default.

		IEC Clip			Realistic Clip			Realistic Clip Compared to IEC		
Testing Organization	Realistic Clip Content	MDD Off Power (W)	MDD On Power (W)	MDD Savings (W)	MDD Off Power (W)	MDD On Power (W)	MDD Savings (W)	% Difference in non-MDD Power	% Difference in MDD Power	% Difference in MDD Savings
CLASP	STEP Test Clip	72.3	61.5	10.8	70.0	68.0	2.0	3%	-11%	81%
		141.7	131.6	10.1	134.1	135.9	-1.8	5%	-3%	118%
		236.0	130.0	106.0	240.0	191.0	49.0	-2%	-47%	54%
DOE	Movies, News, Sports	70.5	52.7	17.8	70.2	55.6	14.6	0%	-6%	18%
		103.3	91.1	12.2	103.9	97.8	6.1	-1%	-7%	50%
		60.7	42.6	18.1	60.7	55.3	5.4	0%	-30%	70%
NRDC	Drama, News, Comedy, Sports, Commercials	124.9	99.7	25.2	124.2	125.0	-0.8	1%	-25%	103%
		180.5	124.9	55.6	178.2	144.4	33.8	1%	-16%	39%
		119.1	75.3	43.8	118.9	105.3	13.6	0%	-40%	69%
AVERAGE		**123.2**	**89.9**	**33.3**	**122.2**	**108.7**	**13.5**	**1%**	**-21%**	**59%**

The data show energy savings with MDD enabled to be greater using the IEC clip than with the non-IEC test clips reflecting a range of content and typical viewing experiences. The column titled "% Difference in MDD Power" demonstrates an average 21% variance in power consumption with MDD enabled when testing with the IEC test clip versus testing with the non-IEC, typical viewing content. Moreover, as shown in the column titled "% Difference in MDD Savings," on average, TVs with MDD enabled demonstrate a 59% greater energy savings using the IEC test clip than with more realistic clips.

Thus, these data do not indicate comparable performance between testing with the IEC clip and testing with the typical viewing experiences. EPA's limited understanding of certain energy saving features and how they are evolving in the market, along with the energy savings variability demonstrated by these external testing sources, underscore the need to demonstrate comparable energy savings between the IEC test clip and savings in typical viewing situations (such as full viewing of popular programming) when such features are enabled for product certification. To address these concerns, EPA is not allowing TV certification with energy saving features enabled unless the manufacturer is confident of comparable energy savings in typical viewing experiences. As always, EPA encourages manufacturers to engage with EPA regarding new energy saving features for TVs to enable proper treatment of them in the ENERGY STAR Television specification.

3.2.4 Forced Menu: Any product that includes a Forced Menu upon initial start-up shall:

i. Provide users with a choice of Home Configuration or Retail Configuration. Partners may use alternative terminology if approved by the U.S. Environmental Protection Agency (EPA).
ii. Upon selection of Retail Configuration at initial start-up, either (1) display a second prompt requiring the user to confirm the choice of Retail Configuration, or (2) display information on the start-up menu that the Home Configuration is the setting in which the product qualifies for ENERGY STAR. If option (2) is selected, additional detail about ENERGY STAR certification and energy consumption expectations shall be included in printed product literature and on the product information page on the Partner's website.

3.2.5 Preset Picture Setting Menu: For any product where consumers have the option of selecting different picture settings from a preset menu at any time:

i. The product shall display on-screen information that the Default Picture Setting reflects the setting under which the product qualifies for the ENERGY STAR. For example, such information may be indicated by including an electronic ENERGY STAR mark alongside the name or description of that picture setting or in the form of a message displayed each time any setting other than the Default Picture Setting is selected.

ii. For products with ABC enabled in the Default Picture Setting, the product will display on-screen information that the energy savings feature is being disabled when another Preset Picture Setting is selected that does not also have ABC enabled by default.

3.2.6 Manual Adjustments to TV Parameters: For products with ABC enabled in the Default Picture setting, ABC functionality must remain enabled during manual adjustments to any of the TV's picture parameters, such as screen brightness, backlight, and contrast ratio.

3.2.7 Special Functions: The TV/HTD shall alert the user that energy consumption will increase when activating a more energy consuming Special Function (e.g., HDR Upscaling).

Note: EPA proposes to include a requirement that the TV/HTD alert the user that energy consumption will increase when selecting a Preset Picture Setting that does not have ABC enabled by default or when more energy consumptive features are activated, such as HDR upscaling. EPA considers that these proposed requirements will help consumers better understand the energy impacts of TVs when selecting other picture settings and functions. Additionally, EPA seeks to ensure that manual adjustments to screen brightness and contrast ratio do not automatically disable ABC.

3.2.8 Standby-Passive Mode and Standby-Active, Low Mode Settings: If users can select and enable Standby-Passive Mode or Standby-Active, Low Mode functions from a display prompt in On Mode or a settings menu other than a Forced Menu, and if these functions may alter power consumption from the default, as-tested Home Configuration:

i. The product shall display on-screen information that the default as-shipped settings reflect the settings under which the product qualifies for the ENERGY STAR. For example, such information may be indicated by including an electronic ENERGY STAR mark alongside the name or description of the default as-shipped settings or in the form of a message displayed each time any setting other than the default as-shipped setting is selected.
ii. Products with a physical ENERGY STAR mark affixed to the front or top of the TV/HTD may alternatively display on-screen information that enabling settings other than the default as-shipped settings may change the energy consumption of the product.

3.2.9 Thin Client Capability and MVPD-ready Information: Products that have Thin Client Capability as-shipped or are otherwise MVPD-ready shall:

i. Report the presence of Thin Client Capability and supporting information including, but not limited to, interoperability protocols, decryption, and decoding functions for display on the ENERGY STAR certified products list; and
ii. Inform the consumer in the user manual and/or on-screen prompt that the TV/HTD may be capable of operating without a set-top box from an MVPD.

3.2.10 Standby-Active, High Mode Capability: TV/HTDs with Standby-Active, High Mode shall automatically return to the default as-tested Standby-Active, Low Mode or Standby-Passive Mode following a manufacturer firmware update or other maintenance operation in Standby Active, High Mode within a period less than or equal to 15 minutes from the completion of said update/maintenance operation.

3.3 On Mode Requirements

3.3.1 For all TV/HTDs, On Mode power, as determined per Section 7.1.2 *On Mode Test for TVs without ABC Enabled by Default* or Section 7.1.3.2 *On Mode Power Calculation* (for TVs with ABC Enabled by Default) in Appendix H shall be less than or equal to the Maximum On Mode Power Requirement (P_{ON_MAX}) and high resolution allowance, as shown in Equation 1, subject to the following requirement:

i. For TVs with ABC Enabled by Default: TVs with up to four Preset Picture Settings shall have only one or no Preset Picture Setting without ABC enabled by default, and TVs with more than four Preset Picture Settings shall have no more than two Preset Pictures Settings without ABC enabled by default. If the TV does not meet these requirements, a second test shall be performed, whereby ABC shall not be enabled during On Mode testing. For this second test, the TV shall be tested per Section 7.1.2 of Appendix H to Subpart B of 10 CFR 430, *On Mode Test for TVs without ABC Enabled by Default* and the resulting On Mode power shall be less than or equal to P_{ON_MAX} and high resolution allowance, as shown in Equation 1. In TVs that offer both Home and Retail configurations, only the total number of Preset Picture Settings available under the Home configuration under test conditions shall be considered.

Note: For the Version 8.0 specification, for TVs that certify with ABC, EPA seeks to ensure its persistence across as many Preset Picture Settings as possible. As such, EPA proposes that, to qualify for the ENERGY STAR with ABC enabled, TVs with up to four Preset Picture Settings are permitted to have only one Preset Picture Setting without ABC enabled by default and TVs with more than four Preset Picture Settings are permitted no more than two Preset Pictures Settings without ABC enabled by default. TVs that do not meet this requirement would not be permitted to qualify with ABC enabled by default. EPA believes that this proposed approach both encourages the persistence of quality implementations of ABC to deliver energy savings and provides flexibility in implementing ABC. EPA understands, from stakeholder input, that implementing ABC is not feasible or is undesirable to the consumer experience in certain Preset Picture Settings. EPA proposes excluding the picture setting in the Retail configuration from the number of picture settings required to have ABC enabled by default in order to certify a product using ABC; Retail configurations are intended for non-home viewing environments.

EPA has also learned that in certain TVs, Preset Picture Settings dedicated to displaying true HDR content—not HDR upscaled content—appear to consumers only once the TV detects incoming true HDR content. In these TVs, such Preset Picture Settings do not appear when non-HDR content is displayed. Since the test clip used when certifying TVs to the ENERGY STAR contains non-HDR content, EPA proposes that the total number of Preset Picture settings to be considered under this requirement are those displayed with regular, non-HDR content.

Equation 1: On Mode Power Requirement for All TV/HTDs

$$P_{ON} \leq P_{ON\_MAX} + P_{HR}$$

Where:

- P_{ON} *is On Mode Power in watts;*
- P_{ON_MAX} *is the Maximum On Mode Power requirement in watts, calculated in Equation 2; and*
- P_{HR} *is a high resolution allowance in watts, as applicable, calculated in Equation 3.*

3.3.2 The Maximum On Mode Power Requirement (P_{ON_MAX}) in watts shall be calculated per Equation 2.

Equation 2: Maximum On Mode Power Requirement for All TV/HTDs

$$P_{ON\_MAX} = 78.5 \times \tanh[0.0005 \times (A - 140) + 0.038] + 14$$

Where:

- P_{ON_MAX} *is the maximum allowable On Mode Power consumption in watts;*
- *A is the viewable Screen Area of the product in square inches; and*
- *tanh is the hyperbolic tangent function.*

3.3.3 TV/HTDs with Native Vertical Resolution greater than or equal to 2160 lines are eligible for a high resolution On Mode Power Allowance (P_{HR}) as calculated per Equation 3.

Equation 3: Calculation of On Mode Power Allowance for TV/HTDs with Native Vertical Resolution Greater than or Equal to 2160 lines

$$P_{HR} = 0.5 \times P_{ON\_MAX}$$

Where:

- *P_{HR} is the high resolution On Mode Power Allowance in watts; and*
- *P_{ON_MAX} is the maximum allowable On Mode Power consumption in watts, calculated in Equation 2.*

3.4 Standby-Passive Mode Requirements

3.4.1 Standby-Passive Mode power ($P_{STANDBY-PASSIVE}$), as measured per Section 7.3.*2 Standby-Passive Mode* of Appendix H, shall be less than or equal to 0.5 W.

3.5 Standby-Active, Low Mode Requirements

3.5.1 Standby-Active, Low Mode power ($P_{STANDBY-ACTIVE-LOW}$), as measured per Section 7.3.3 *Standby-Active, Low Mode* of Appendix H, shall be less than or equal to 3.0 W.

3.6 Luminance Requirements

3.6.1 For products with a luminance in the Brightest Selectable Preset Picture Setting (the greater value of $L_{DEFAULT\_RETAIL}$ or $L_{BRIGHTEST\_HOME}$) less than 350 cd/m^2, luminance in the Default Picture Setting ($L_{DEFAULT\_HOME}$) shall be greater than or equal to 65% of the luminance in the Brightest Selectable Preset Picture Setting.

3.6.2 For products with a luminance in the Brightest Selectable Preset Picture Setting greater than or equal to 350 cd/m^2, luminance in the Default Picture Setting shall be greater than or equal to 228 cd/m^2.

3.6.3 For products that certify to the On Mode requirements with ABC enabled by default, the average luminance at the illuminance conditions of 3, 12, 35, and 100 lux with ABC enabled shall be greater than or equal to 50% of the TV's luminance in the Brightest Selectable Preset Picture Setting.

3.6.4 For products that certify to the On Mode requirements with ABC enabled by default, the luminance at 3 lux in the Default Picture Setting, with ABC enabled, shall be greater than or equal to 150 cd/m^2.

Note: EPA proposes two additional luminance requirements to ensure that the experience with ABC is a good one. The requirement that the average luminance at 3, 12, 35, and 100 lux with ABC enabled shall be greater than or equal to 50% of the TV's luminance in the Brightest Selectable Preset Picture Setting intends to ensure that the luminance in the Default Picture Setting is acceptable to users and the ENERGY STAR certified picture setting will persist in the home. EPA also proposes that the luminance at 3 lux in the Default Picture Setting, with ABC enabled, should be greater than or equal to 150 nits, given that illuminance at 3 lux is similar to the illuminance of a dark room. The Imaging Science Foundation (ISF) advocates that ABC should not dim the TV's screen brightness below 150 nits in a dark room and "ISF Expert" dark room picture settings typically deliver a screen brightness of at least 150 nits.

EPA tested a number of TVs with ABC enabled by default with the luminance and average power in a 3 lux illuminance condition, as shown below. EPA compared these results to the luminance of the picture setting that is optimized for viewing in a darkened room (e.g., Movie, Cinema, Theater, Calibrated Dark, ISF Expert, etc.).

	A2		A1		B2		E4		F1		C1		D1	
	Luminance (Nits)	Avg. Power (W)	Luminance (Nits)	Avg. Power (W)	Luminance (Nits)	Avg. Power (W)	Luminance (Nits)	Avg. Power (W)	Luminance (Nits)	Avg. Power (W)	Luminance (Nits)	Avg. Power (W)	Luminance (Nits)	Avg. Power (W)
3 lux	14.00	65.73	23.00	48.12	25.18	93.94	72.89	52.69	154.10	71.63	100.00	78.49	140.18	76.55
Darkened Room PPS	N/A	133.51	199.27	121.73	146.65	136.20	N/A	76.81	N/A	103.14	N/A	121.31	N/A	119.58

The results of this comparison demonstrate that models with ABC enabled in default are often much dimmer and use much less power when tested at 3 lux than they do when tested in the picture setting intended for a darkened room. In order to encourage users to maintain use of the Default Preset Picture Setting, EPA is proposing the above requirements to ensure that implementation of ABC is not too dim and thus result in users disabling ABC. EPA received input from the Imaging Science Foundation (ISF) that unnaturally dim performance with ABC enabled is the most common complaint that ISF calibrators currently face when adjusting TV settings in the field. EPA requests feedback from stakeholders on this proposed requirement and, specifically, if circumstances exist where the screen luminance at 3 lux must be dimmer than the screen luminance for the picture setting intended for a darkened room.

3.7 Download Acquisition Mode (DAM) Requirements for Hospitality TV/HTDs

3.7.1 A product may automatically exit Standby-Passive Mode or Standby-Active, Low Mode and enter Download Acquisition Mode according to a predefined schedule, in order to:

i. Download channel listing information for use by an electronic programming guide,
ii. Monitor for emergency messaging/communications, or
iii. Communicate via a network protocol.

3.7.2 DAM energy consumption for all DAM states (E_{DAM}), as measured per the CEA Procedure for DAM Testing, shall be less than or equal to 40 watt-hours per day (0.04 kWh/day).

Note: Products intended for sale in the US market are subject to minimum toxicity and recyclability requirements. Please see ENERGY STAR Program Requirements for Televisions: Partner Commitments for details.

4 TESTING

4.1 Test Methods

4.1.1 Test methods identified in Table 1 shall be used for certification.

Table 1: Test Methods for ENERGY STAR Certification

Product Type	Test Method
All Ac Mains-powered TV/HTDs	Uniform Test Method for Measuring the Energy Consumption of Television Sets incorporated in Appendix H to Subpart B of 10 CFR Part 430.

4.2 Additional Required Test for TV/HTDs with HDR Upscaling

4.2.1 For products with HDR Upscaling, one of the following additional tests is required for ENERGY STAR certification:

i. For products with HDR Upscaling as a Special Function selectable from within the Default Picture Setting, enable this feature and record the average power consumption value over a 10-minute period following the guidance in Section 7.1.2 of Appendix H to Subpart B of 10 CFR Part 430; or

ii. For products with a separate Preset Picture Setting with built-in HDR Upscaling that is not the Default Picture Setting or Brightest Selectable Preset Picture Setting, choose that Preset Picture Setting and record the average power consumption over a 10-minute period following the guidance in Section 7.1.2 of Appendix H to Subpart B of 10 CFR Part 430 and record the luminance following Sections 7.2.1.2 through 7.2.3 of Appendix H to Subpart B of 10 CFR Part 430.

4.3 Additional Required Test for TV/HTDs with Standby-Active, Low Mode

4.3.1 The following method in Table 2 shall be used for TV/HTDs with a Standby-Active, Low mode:

Table 2: Methods for TV/HTDs with Standby-Active, Low

Product Type	Method
TV/HTDs with Standby-Active, Low Mode	CEA-2037-A, Determination of Television Set Power Consumption

4.3.2 If the TV/HTD is network-enabled and tested in Standby-Active, Low per Appendix H, the following additional test is required for ENERGY STAR certification:

i. Perform all procedures specified in Section 6.7.5 *Standby-active, Low* of CEA-2037-A with the additional preconditions:

1) Place the UUT in On Mode as tested per Section 7.1.1 *On Mode Test* of Appendix H and momentarily press the power button on the remote control; and
2) Wait 5 minutes after pressing the power button before beginning the Section 6.7.5 procedures in CEA-2037-A.

ii. TV/HTDs for which availability can be confirmed with one of the methods in Section 6.7.5.2 *Availability* of CEA-2037-A shall be reported as having Full Network Connectivity.

4.4 Additional Required Test for Hospitality TV/HTDs

4.4.1 DAM energy consumption of Hospitality TV/HTDs shall be measured using the following method in Table 3:

Table 3: Method for Hospitality TV/HTDs

Product Type	Method
Hospitality TV/HTDs	CEA Procedure for DAM Testing: For TVs, Rev. 0.3, Sept. 2010

4.5 Number of Units Required for Testing

4.5.1 One of the following sampling plans shall be used to test for ENERGY STAR certification:

i. A single representative unit shall be selected for testing the Basic Model;
ii. Units shall be selected for testing per the sampling requirements defined in 10 CFR 429.25, which references 10 CFR 429.11.

4.6 International Market Certification

4.6.1 Products shall be tested for certification 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 1621: 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 8.0 ENERGY STAR Televisions specification shall take effect on **TBD, 2017**. 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 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 certification is not automatically granted for the life of a product model.

7 CONSIDERATIONS FOR FUTURE REVISIONS

7.1.1 Standby-Active, High Mode: EPA and DOE are interested in learning more about Standby-Active, High Mode. EPA anticipates exploring this issue and potential power limits and duty cycle requirements in the next specification revision.

7.1.2 Trends and Improvements in Energy Efficiency: EPA anticipates continued gains in energy efficiency to be achieved in the next few years with advances in technology such as LED efficacy, the addition of reflective polarizing film, power supply improvements, lower screen reflectance, improved backplanes (Low Temperature Polysilicon and Indium Gallium Zinc Oxide), quantum dot technology, and next generation Organic Light Emitting Diodes (OLED). As such, EPA anticipates an opportunity for proposing further limits on power consumption in future revisions.