



ENERGY STAR® Program Requirements for Televisions

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

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for Televisions. A list of eligible products and their corresponding Eligibility Criteria can be found at 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 Televisions. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform Televisions testing. A list of EPA-recognized laboratories and certification bodies can be found at www.energystar.gov/testingandverification.
3. **Ensure that any model associated with the ENERGY STAR name or mark** meets the following standards:
 - 3.1. Product material requirements as defined in restriction of hazardous substances (RoHS) regulations, as generally accepted. This includes exemptions in force at the date of product manufacture, where the maximum concentration values tolerated by weight in homogeneous materials are: lead (0.1%), mercury (0.1%), cadmium (0.01%), hexavalent chromium (0.1%), polybrominated biphenyls (PBB) (0.1%), or polybrominated diphenyl ethers (PBDE) (0.1%). Batteries are exempt.
 - 3.2. The generally accepted attributes of a recyclable product at the date of product manufacture: where products shall be designed for ease of disassembly and recyclability where external enclosures, sub-enclosures, chassis and electronic subassemblies are easily removable with commonly available tools, by hand, or by a recycler's automated processes.

Notes:

- The explicit intention is to harmonize with EU RoHS.
- For purposes of ENERGY STAR third-party certification, these requirements shall not be reviewed when products are initially qualified nor during subsequent verification testing. Rather, EPA reserves the right to request supporting documentation at any time.

Using the ENERGY STAR Name and Marks

4. 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.
5. 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.
6. Provide clear and consistent labeling of ENERGY STAR qualified Televisions.
 - 6.1. The ENERGY STAR mark must be clearly displayed on product packaging, in product literature (i.e., user manuals, spec sheets, etc.), and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed.

6.2. ENERGY STAR qualified TVs must also be labeled according to one of the following three options:

6.2.1. Permanent label on the top/front of the TV;

6.2.2. Temporary label on the top/front of the TV; or

6.2.3. Use of an electronic label so that the ENERGY STAR certification mark appears on the TV's menu-screen for pre-set picture settings.

Verifying Ongoing Product Qualification

7. Participate in third-party verification testing through a Certification Body recognized by EPA for Televisions, 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

8. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:

8.1. Partner must submit the total number of ENERGY STAR qualified Televisions 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).

8.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

8.3. 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.

9. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.

10. 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.

Performance for Special Distinction

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 Televisions 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.
- 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.



ENERGY STAR® Program Requirements for Televisions

Eligibility Criteria Version 9.0

Following is the Version 9.0 ENERGY STAR Product Specification for Televisions. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS¹

A) Product Types:

- 1) Television (TV)²: 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).

- 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

¹ Where applicable, these definitions are based on definitions in 10 CFR 430. When in conflict, the definitions in the Federal Test Procedure in 10 CFR 430 take precedence, including any future updates to the test procedure.

² 10 CFR 430.2

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.

4) Projector: A product that is a mains-powered, optical device, for processing analog or digital video image information, in any, broadcasting, storage or networking format to modulate a light source and project the resulting image onto an external screen³.

B) Operational Modes:

1) On Mode⁴: The mode of operation in which the TV/HTD is connected to mains power and is capable of producing dynamic video.

2) Standby-Passive Mode⁵: 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 Mode⁶: 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.

4) Standby-Active, High Mode⁷: 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.

5) Off Mode⁸: 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 Functions⁹: 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.

³ AEA, Building on the Eco-design Directive, EuP Group Analysis: ENTR Lot 3 Sound and Imaging Equipment Task 1-7 Report, <http://ec.europa.eu/DocsRoom/documents/10198/attachments/1/translations/en/renditions/pdf>.

⁴ 10 CFR 430, Subpart B, Appendix H, Section 2.14

⁵ 10 CFR 430, Subpart B, Appendix H, Section 2.18

⁶ 10 CFR 430, Subpart B, Appendix H, Section 2.20

⁷ 10 CFR 430, Subpart B, Appendix H, Section 2.19

⁸ 10 CFR 430, Subpart B, Appendix H, Section 2.13

⁹ 10 CFR 430, Subpart B, Appendix H, Section 2.1, which references International Electrotechnical Commission (IEC) Standard 62087 Ed. 3.

- 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 Functions¹⁰: 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): A feature that senses ambient light conditions and changes display brightness accordingly, possibly reducing power consumption.
- 2) Motion-based Dynamic Dimming (MDD): A feature that adjusts luminance in response to the amount of motion in the displayed image.
- 3) High Contrast Ratio (HCR) Display: A display where pixels can be controlled on an individual basis and emit no light when displaying a pure black color.

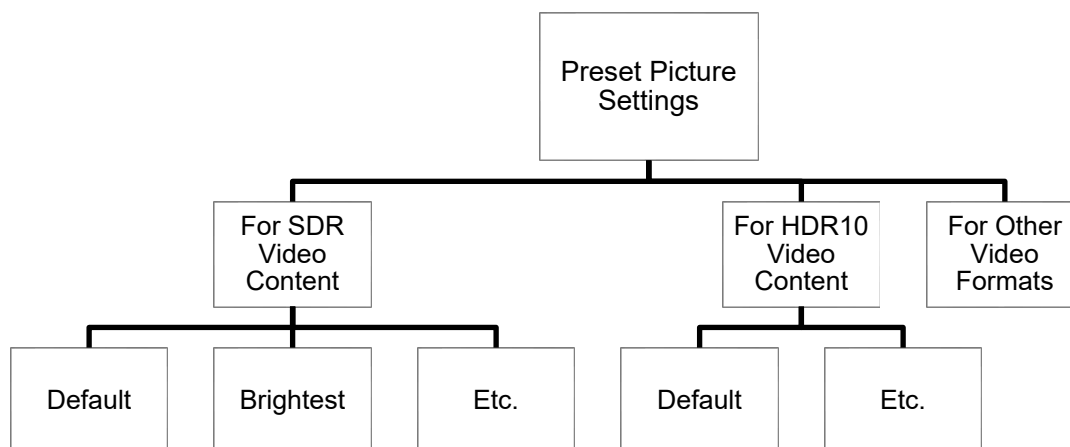
E) TV/HTD Settings and Menus:

- 1) Preset Picture Setting¹¹(PPS): 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 user-selected within the Home or Retail Configurations.
- 2) Default SDR Preset Picture Setting: The as-shipped Standard Dynamic Range (SDR) Preset Picture Setting that the TV/HTD enters immediately after making a selection from the Forced Menu. If the TV/HTD does not have a Forced Menu, this is the as-shipped SDR Preset Picture Setting. As referenced in this specification, default settings must be determined through direct observation of the as-shipped configuration.
- 3) Brightest SDR Preset Picture Setting: The user-selectable SDR Preset Picture Setting within the Home Configuration in which the TV/HTD produces the highest screen luminance.
- 4) Default HDR10 Preset Picture Setting: The as-shipped Preset Picture Setting when playing HDR10 content. This setting may not always be available for manual user selection and may instead be automatically entered when an HDR10 input signal is detected.

¹⁰ 10 CFR 430, Subpart B, Appendix H, Section 2.17, which references IEC 62087 Ed. 3.

¹¹ 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.

Figure 1: The Classification of Picture Setting Selection Options for TV/HTDs



- 5) Home Configuration¹²: 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.
- 6) Retail Configuration¹³: 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.
- 7) Forced Menu: A series of menus which require the selection of initial settings before allowing the user to utilize primary functions. Within these menus, an option is often presented to allow a choice between setting-up the TV/HTD for use in either the Retail or Home Configurations.

F) Power Devices:

- 1) External Power Supply (EPS)¹⁴: 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 Battery¹⁵: A battery capable of powering the TV/HTD to produce dynamic video without the support of mains power.

G) Product Characteristics:

- 1) Luminance¹⁶: 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/m²).
- 2) Illuminance¹⁷: The photometric measure of the total luminous flux incident on a surface, per unit area, expressed in lux.

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 430.2

¹⁵ 10 CFR 430, Subpart B, Appendix H, Section 2.12

¹⁶ 10 CFR 430, Subpart B, Appendix H, Section 2.11

¹⁷ 10 CFR 430, Subpart B, Appendix H, Section 2.10

- 3) Dynamic Luminance (DL): The luminance averaged across the entire screen area as measured during dynamic video play.
 - 4) 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.
 - 5) 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).
 - 6) Horizontal Resolution: The number of visible physical lines along the horizontal axis of the TV/HTD (e.g., a TV/HTD with a screen resolution of 1920 x 1080 (horizontal x vertical) would have a Horizontal Resolution of 1920).
 - 7) Contrast Ratio: The ratio between the luminance of the brightest white and the darkest black that a TV can produce.
 - 8) HD Display: A display with a resolution of 1920x1080 pixels.
 - 9) 4K Display: A display with a resolution of 3840x2160 pixels.
 - 10) 8K Display: A display with a resolution of 7680x4320 pixels.
- H) Basic Model¹⁸: 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)¹⁹: 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) High Definition Multimedia Interface (HDMI): An audio and video interface as defined by HDMI[®] Specification Informational Version 1.0 or greater. For reference, see HDMI specification²⁰.
- K) 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

¹⁸ 10 CFR 430.2, with references to water consumption and other specific covered products removed.

¹⁹ As defined in 47 USC § 522(13)

²⁰ 10 CFR 430.2, <https://www.hdmi.org/spec/index>

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. Projectors.
 - ii. TV/HTDs with a Main Battery that enables operation without connected mains power.
 - iii. 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 *Rounding* of the Federal Test Procedure, 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 online 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 as-shipped TV/HTD configurations and settings, including the implications of software or firmware updates; 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 features that are enabled when tested unless that feature provides comparable energy savings during typical viewing experiences (i.e., the duration of a variety of common or prevalent programming). This prohibition applies irrespective of whether the function's primary or intended purpose is energy savings. Further, this applies to features that may be downloaded in the future.
- 3.2.4 **Forced Menu:** For any product that includes a Forced Menu where consumers are provided a choice of Home Configuration or Retail Configuration at initial start-up:
- i. Upon selection of Retail Configuration, the product must 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.
 - ii. Partners may use alternative terminology if approved by the U.S. Environmental Protection Agency (EPA).
- 3.2.5 **Standby-Active, High Mode Capability:** TV/HTDs with Standby-Active, High Mode shall automatically return to the 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

The following On Mode requirements are based on measurements taken per the *ANSI/CTA-2037-C: Determination of Television Set Power Consumption*.

- 3.3.1 For all TV/HTDs, On Mode Power (P_{OA}) metrics shall be determined through the following process:
- i. **For PPSs tested without ABC enabled:** The metrics gathered while testing with ABC disabled shall represent P_{OA} and the DL for the PPS.
 - ii. **For PPSs tested with ABC enabled:** Measurements at different illuminance conditions are thus taken (at 4, 17, 50, and 140 lux) per the *ANSI/CTA-2037-C: Determination of Television Set Power Consumption*:
 - a) **To calculate DL for the PPS:** The value of DL used to represent the PPS for the purpose of calculating $P_{OA_Average_Limit}$ per Equation 5 shall be the calculated average of the DL measurements taken at each illuminance condition, as outlined by Equation 1.
 - b) **To calculate P_{OA} for the PPS:** The value of P_{OA} that represents the PPS for the purpose of calculating $P_{OA_Average}$ per Equation 4 shall be the calculated average of the P_{OA} measurements for the PPS taken at each illuminance condition, as outlined by Equation 2.
 - c) Should the Brightest SDR PPS as determined through *ANSI/CTA-2037-C* have ABC enabled by default, the default ABC-disabled metrics gathered while testing the PPS shall represent P_{OA} and the DL for the PPS. Performing calculations per Equations 1 and 2 will thus not be necessary for the PPS.

- iii. If the value for the DL used to represent an SDR PPS is measured or calculated to be less than 20 cd/m², then 20 cd/m² shall be the DL value used to represent the PPS for the purpose of determining certification, and the value of P_{OA} used to represent the PPS shall be the interpolated P_{OA} value of the PPS when the TV/HTD is set to a DL of 20 cd/m². Likewise, if the value of the DL for an HDR10 PPS is less than 10 cd/m², then 10 cd/m² shall be used as the DL representing the PPS for the purpose of determining certification, and the value of P_{OA} used to represent the PPS shall be the interpolated P_{OA} value of the PPS when the TV/HTD is set to a DL of 10 cd/m².
 - a) The P_{OA} values of a PPS correlating to a projected DL of 20 cd/m² or 10 cd/m² shall be calculated through interpolation of the 2nd order polynomial trendline created by plotting all the PPS's measured P_{OA} value datapoints against the measured DL values at the same points.
 - 1) If the P_{OA} value for the Brightest SDR PPS needs to be interpolated and the PPS has ABC enabled by default, include the ABC-enabled datapoints as measured per ANSI/CTA-2037-C when creating the 2nd order polynomial.

Equation 1: Calculation of Dynamic Luminance for Preset Picture Settings Where ABC is Enabled by Default

$$DL = \frac{DL_4 + DL_{17} + DL_{50} + DL_{140}}{4}$$

Where:

- DL is the Dynamic Luminance for a Preset Picture Setting where ABC is enabled by default, in cd/m²; and
- DL₄, DL₁₇, DL₅₀, and DL₁₄₀ are the dynamic luminance measurements taken per ANSI/CTA-2037-C: *Determination of Television Set Power Consumption* when illuminance conditions are configured to 4 lux, 17 lux, 50 lux, and 140 lux, respectively.

Equation 2: Calculation of P_{OA} for Preset Picture Settings Where ABC is Enabled by Default

$$P_{OA} = \frac{P_{OA_4} + P_{OA_{17}} + P_{OA_{50}} + P_{OA_{140}}}{4}$$

Where:

- P_{OA} is the On Mode Power for a Preset Picture Settings where ABC is enabled by default, in watts; and
- P_{OA_4}, P_{OA_17}, P_{OA_50}, and P_{OA_140} are the On Mode Power measurements taken per ANSI/CTA-2037-C: *Determination of Television Set Power Consumption* when illuminance conditions are configured to 4 lux, 17 lux, 50 lux, and 140 lux, respectively.

3.3.2 Products shall meet the On Mode Power Requirement as outlined by Equation 3:

- i. Should a TV not be capable of reading an HDR10 signal (e.g., the TV displays an error or blank screen when fed an HDR10 signal), P_{OA} metrics associated with the HDR10 picture setting shall be omitted from calculations as presented by Equations 4 and 5.

Equation 3: On Mode Power Requirement

$$P_{OA_Average} \leq P_{OA_Average_Limit} \times AF$$

Where:

- $P_{OA_Average}$ is the average of the On Mode Power in each applicable preset picture setting as calculated per Equation 4, in watts;
- $P_{OA_Average_Limit}$ is the average limit of On Mode Power in each applicable preset picture setting as calculated per Equation 5, in watts; and
- AF is the Adjustment Factor, dependent on the TV/HTD, calculated from the corresponding equations in Table 2.

Equation 4: Average On Mode Power, $P_{OA_Average}$

$$P_{OA_Average} = \frac{P_{OA_Default} + P_{OA_Brightest} + P_{OA_HDR}}{n}$$

Where:

- $P_{OA_Average}$ is the average of the On Mode Power in each applicable preset picture setting as calculated per Equation 4, in watts;
- $P_{OA_Default}$ is the On Mode Power for the Default SDR Preset Picture Setting, as determined by Section 3.3.1, in watts;
- $P_{OA_Brightest}$ is the On Mode Power for the Brightest SDR Preset Picture Setting, as determined by Section 3.3.1, in watts;
- P_{OA_HDR} is the On Mode Power for the Default HDR Preset Picture Setting, as determined by Section 3.3.1, in watts; and
- n is the number of PPSs for which DL and P_{OA} metrics have been gathered (i.e., n equals 2 if the TV/HTD is not capable of displaying HDR content).

Equation 5: Average Limit of On Mode Power, $P_{OA_Average_Limit}$

$$P_{OA_Average_Limit} = \frac{P_{OA_Default_Limit} + P_{OA_Brightest_Limit} + P_{OA_HDR_Limit}}{n}$$

Where:

- $P_{OA_Average_Limit}$ is the average limit of On Mode Power in each applicable preset picture setting as calculated per Equation 5, in watts;
- $P_{OA_Default_Limit}$ is the limit for On Mode Power of the Default SDR Preset Picture Setting, as determined by Table 1, in watts;
- $P_{OA_Brightest_Limit}$ is the limit for On Mode Power of the Brightest SDR Preset Picture Setting, as determined by Table 1, in watts;
- $P_{OA_HDR_Limit}$ is the limit for On Mode Power of the Default HDR Preset Picture Setting, as determined by Table 1, in watts; and
- n is the number of PPSs for which DL and P_{OA} metrics have been gathered (i.e., n equals 2 if the TV/HTD is not capable of displaying HDR content).

Table 1: On Mode Power Limits

Preset Picture Setting	Functions:	
	Limit 1: Performance-based efficiency limit	Limit 2: Power cap
Default ($P_{OA_Default_Limit}$)	$0.94 \times ((0.0007 \times A + 0.5736) \times DL + (0.0055 \times A + 18.9667))$	$1.15 \times ((0.0249 \times A) + 46.5902)$
Brightest ($P_{OA_Brightest_Limit}$)	$0.94 \times ((0.0007 \times A + 0.5424) \times DL + (0.005 \times A + 19.8365))$	$1.15 \times ((0.0819 \times A) + 18.4228)$
HDR10 ($P_{OA_HDR_Limit}$)	$0.94 \times ((0.0013 \times A + 1.866) \times DL + (0.0069 \times A + 17.1106))$	$1.15 \times ((0.0576 \times A) + 31.6067)$

Where:

- DL is the dynamic luminance for the Preset Picture setting, as determined in Section 3.3.1;
- A is the viewable Screen Area of the product in square inches; and
- The lesser of the two limit values calculated for a Preset Picture Setting is to be used in the $P_{OA_Average_Limit}$ calculation.

Table 2: Average Limit of On Mode Power, $P_{OA_Average_Limit}$, Adjustment Factors

P_{OA_MAX} Adjustment Factor (AF)	Value
AF_{HCR}	1.12
$AF_{Resolution}$	$(0.0469 \times P^{0.1946})/1.041$

Where:

- P is the pixel count of the TV/HTD, calculated by multiplying the TV/HTD's vertical resolution by its horizontal resolution;
- The resolution adjustment factor, $AF_{Resolution}$, applies to all TV/HTDs; and
- The HCR adjustment factor, AF_{HCR} , applies to TV/HTDs that are determined by the Certification Body, through evaluation of the TV's display technology, to meet the definition of an HCR Display.

3.4 Standby Mode Requirements

The following Standby Mode Requirements are based on measurements from the Federal Test Procedure Standby-Passive Mode Test as well as the series of additional Standby-Active Mode tests outlined in *ANSI/CTA-2037-C: Determination of Television Set Power Consumption*, that are designed to measure standby power in a more typical network environment (e.g., multicast traffic on the network).

- 3.4.1 Standby-Passive Mode Power ($P_{STANDBY-PASSIVE}$), as measured per Section 7.3.2 *Standby-Passive Mode* of the Federal Test Procedure, shall be less than or equal to 0.5 W.
- 3.4.2 For TVs capable of network connectivity, Standby-Active Mode Power ($P_{STANDBY-ACTIVE}$), as measured per *ANSI/CTA-2037-C*, shall be less than or equal to 1.0 W.

4 TESTING

4.1 Applicable Test Procedures

The certified values of annual energy consumption (AEC) and power consumption determined according to the U.S. Department of Energy's (DOE's) Federal Test Procedure shall be reported to EPA for presentation in the ENERGY STAR Product Finder.

Table 3: Test Method for All TV/HTDs

Test Method	Requirements	Applicability
Uniform Test Method for Measuring the Energy Consumption of Television Sets incorporated in Appendix H to Subpart B of 10 CFR Part 430	Report rated AEC and power consumption in On, Standby-Active, Low, and Off Modes as submitted to the Compliance Certification Database ²¹	Reporting requirement
	Test and report Standby-Passive Mode (3.4.1)	Test to determine ENERGY STAR Certification*
ANSI/CTA-2037-C: Determination of Television Set Power Consumption	Test and report On Mode (Section 3.3) and Standby-Active Mode (Section 3.4.2) Power	

*Only data used to determine compliance with ENERGY STAR requirements must be measured in an [EPA-Recognized Laboratory](#) through the [Third-Party Certification process](#).

²¹ U. S. Department of Energy's Compliance Certification Database. Available at: https://www.regulations.doe.gov/certification-data/#q=Product_Group_s%3A*

- 4.1.1 When conducting tests according to ANSI/CTA-2037-C, the AC power supply shall be used to power only the UUT. The camera photometer and ABC lamp must be powered by mains electricity.

4.2 Number of Units Required for Testing

- 4.2.1 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.

4.3 International Market Certification

- 4.3.1 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 9.0 ENERGY STAR Televisions specification shall take effect on **October 20, 2022**. 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 Backlight Control Accessibility and ABC Persistence: EPA seeks to understand if more accessible backlight controls would increase ABC persistence.
- 7.1.2 Implementation of Filmmaker Mode and Performance: EPA is interested to see if the increased implementation of a "Filmmaker Mode" Preset Picture Setting by manufacturers is followed by a tendency to apply the setting by consumers and how the characteristics unique to this setting affect energy efficiency.
- 7.1.3 Color Quality and Energy Efficiency: EPA looks to explore the relationship between image quality, with respect to color (viewing angle, gamut size, etc.), and energy efficiency.
- 7.1.4 PPS Utilization Weighted On Mode Metrics: EPA is interested in better understanding consumer TV viewing behavior to determine if weighting the power of each PPS in the On Mode criteria based on average hours each PPS is utilized by consumers is warranted to improve representativeness of how the TV is being used.