



# ENERGY STAR® Program Requirements for Televisions

## Eligibility Criteria Final Draft, Version 9.0

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

### 3 **1 DEFINITIONS<sup>1</sup>**

#### 4 A) Product Types:

5 1) Television (TV)<sup>2</sup>: A product designed to produce dynamic video, contains an internal TV tuner  
6 encased within the product housing, and that is capable of receiving dynamic visual content from  
7 wired or wireless sources including but not limited to:

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

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

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

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

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

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

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

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

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

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

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

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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

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

33 4) Projector: A product that is a mains-powered, optical device, for processing analog or digital video  
34 image information, in any, broadcasting, storage or networking format to modulate a light source  
35 and project the resulting image onto an external screen<sup>3</sup>.

36 B) Operational Modes:

37 1) On Mode<sup>4</sup>: The mode of operation in which the TV/HTD is connected to mains power and is  
38 capable of producing dynamic video.

39 2) Standby-Passive Mode<sup>5</sup>: The mode of operation in which the TV/HTD is connected to mains  
40 power, produces neither sound nor picture, and can be switched into another mode with only the  
41 remote control unit or an internal signal.

42 3) Standby-Active, Low Mode<sup>6</sup>: The mode of operation in which the TV/HTD is connected to mains  
43 power, produces neither sound nor picture, can be switched into another mode with the remote  
44 control unit or an internal signal, and can additionally be switched into another mode with an  
45 external signal.

46 4) Standby-Active, High Mode<sup>7</sup>: The mode of operation in which the TV/HTD is connected to mains  
47 power, produces neither sound nor picture, is exchanging/receiving data with/from an external  
48 source, and can be switched into another mode with the remote control unit, an internal signal, or  
49 an external signal.

50 5) Off Mode<sup>8</sup>: The mode of operation in which the TV/HTD is connected to mains power, produces  
51 neither sound nor picture, and cannot be switched into any other mode of operation with the  
52 remote control unit, an internal signal, or external signal.

53 C) Additional Functions<sup>9</sup>: Functions that are not required for the basic operation of the device.

54  
55 Note: Additional functions include, but are not limited to, a VCR unit, a DVD unit, an HDD unit, a FM-  
56 radio unit, a memory card-reader unit, or an ambient lighting unit.

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

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

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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.

68 D) Special Functions<sup>10</sup>: Functions that are related to, but not required for, the basic operation of the  
69 device.  
70

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

73 1) Automatic Brightness Control (ABC): A feature that senses ambient light conditions and changes  
74 display brightness accordingly, possibly reducing power consumption.

75 2) Motion-based Dynamic Dimming (MDD): A feature that adjusts luminance in response to the  
76 amount of motion in the displayed image.

77 3) High Contrast Ratio (HCR) Display: A display where pixels can be controlled on an individual  
78 basis and emit no light when displaying a pure black color.

79 **Note:** EPA has revised the definition of HCR Display for use in this specification to reduce the likelihood  
80 that a certification body would identify a model as an HCR Display based solely on product marketing  
81 materials rather than the technology capabilities.

82 E) TV/HTD Settings and Menus:

83 1) Preset Picture Setting<sup>11</sup>(PPS): A preprogrammed factory setting obtained from the TV/HTD menu  
84 with pre-determined picture parameters such as brightness, contrast, color, sharpness, etc.  
85 Preset Picture Settings can be user-selected within the Home or Retail Configurations.

86 2) Default SDR Preset Picture Setting: The as-shipped Standard Dynamic Range (SDR) Preset  
87 Picture Setting that the TV/HTD enters immediately after making a selection from the Forced  
88 Menu. If the TV/HTD does not have a Forced Menu, this is the as-shipped SDR Preset Picture  
89 Setting. As referenced in this specification, default settings must be determined through direct  
90 observation of the as-shipped configuration.

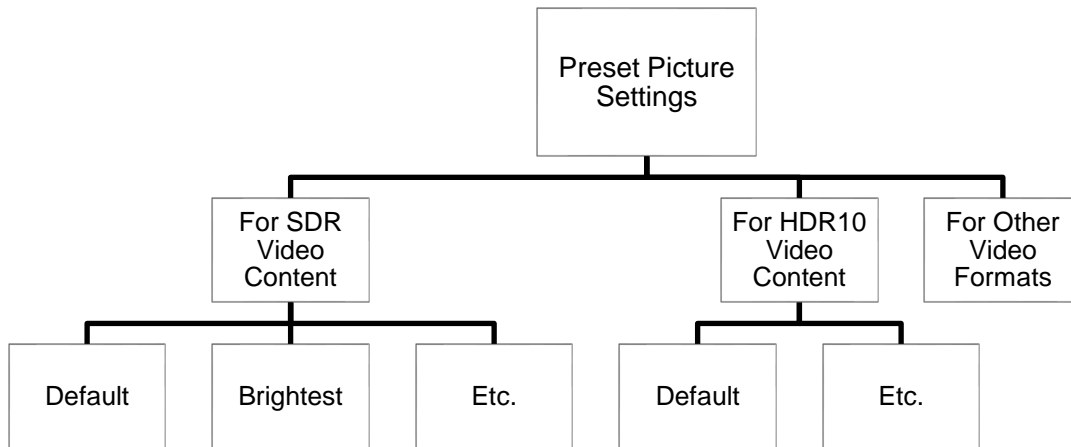
91 3) Brightest SDR Preset Picture Setting: The user-selectable SDR Preset Picture Setting within the  
92 Home Configuration in which the TV/HTD produces the highest screen luminance.

93 4) Default HDR10 Preset Picture Setting: The as-shipped Preset Picture Setting when playing  
94 HDR10 content. This setting may not always be available for manual user selection and may  
95 instead be automatically entered when an HDR10 input signal is detected.

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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**

97

98 5) Home Configuration<sup>12</sup>: The TV/HTD configuration selected from the Forced Menu which is  
 99 designed for typical consumer viewing and is recommended by the manufacturer for home  
 100 environments.

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

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

108 F) Power Devices:

109 1) External Power Supply (EPS)<sup>14</sup>: Also referred to as External Power Adapter. An external power  
 110 supply circuit that is used to convert household electric current into dc current or lower-voltage ac  
 111 current to operate a consumer product.

112 2) Main Battery<sup>15</sup>: A battery capable of powering the TV/HTD to produce dynamic video without the  
 113 support of mains power.

114 G) Product Characteristics:

115 1) Luminance<sup>16</sup>: The photometric measure of the luminous intensity per unit area of light traveling in  
 116 a given direction, expressed in units of candelas per square meter (cd/m<sup>2</sup>).

117 2) Illuminance<sup>17</sup>: The photometric measure of the total luminous flux incident on a surface, per unit  
 118 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

- 119 3) Dynamic Luminance (DL): The luminance averaged across the entire screen area as measured  
120 during dynamic video play.
- 121 4) Screen Area: The viewable screen area of the product, calculated by multiplying the viewable  
122 image width by the viewable image height. For curved screens, the measurements shall be made  
123 along the curvature on the face of the screen rather than along a straight line/chord.
- 124 5) Native Vertical Resolution: The number of visible physical lines along the vertical axis of the  
125 TV/HTD (e.g., a TV/HTD with a screen resolution of 1920 x 1080 (horizontal x vertical) would  
126 have a Native Vertical Resolution of 1080).
- 127 6) Horizontal Resolution: The number of visible physical lines along the horizontal axis of the  
128 TV/HTD (e.g., a TV/HTD with a screen resolution of 1920 x 1080 (horizontal x vertical) would  
129 have a Horizontal Resolution of 1920).
- 130 7) Contrast Ratio: The contrast ratio is the ratio between the luminance of the brightest white and  
131 the darkest black that a TV can produce, as measured by the method defined in Section 4.4  
132 below.
- 133 8) HD Display: A display with a resolution of 1920x1080 pixels.
- 134 9) 4K Display: A display with a resolution of 3840x2160 pixels.
- 135 10) 8K Display: A display with a resolution of 7680x4320 pixels.
- 136 H) Basic Model<sup>18</sup>: All units of a given type of product (or class thereof) manufactured by one  
137 manufacturer, having the same primary energy source, and which have essentially identical electrical,  
138 physical, and functional characteristics that affect energy consumption and energy efficiency.
- 139 I) Multichannel Video Programming Distributor (MVPD)<sup>19</sup>: A person such as, but not limited to, a cable  
140 operator, a multichannel multipoint distribution service, a direct broadcast satellite service, or a  
141 television receive-only satellite program distributor, who makes available for purchase, by subscribers  
142 or customers, multiple channels of video programming.
- 143 J) High Definition Multimedia Interface (HDMI): An audio and video interface as defined by HDMI®  
144 Specification Informational Version 1.0 or greater. For reference, see HDMI specification<sup>20</sup>.
- 145 K) Unit Under Test (UUT): The unit currently undergoing testing.

## 146 2 SCOPE

### 147 2.1 Included Products

- 148 2.1.1 Products that are: (1) marketed to the consumer as a TV/HTD (i.e., TV/HTD is the primary  
149 function); (2) capable of being powered from a wall outlet or with an external power supply; and  
150 (3) meet one of the following product type definitions, are eligible for ENERGY STAR certification,  
151 with the exception of products listed in Section 2.2:
- 152 i. TVs
  - 153 ii. Hospitality TV/HTDs
  - 154 iii. Home Theater Displays

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

<sup>19</sup> As defined in 47 USC § 522(13)

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

155 **2.2 Excluded Products**

156 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for  
157 certification under this specification. The list of specifications currently in effect can be found at  
158 [www.energystar.gov/specifications](http://www.energystar.gov/specifications).

159 2.2.2 Products that satisfy one or more of the following conditions are not eligible for ENERGY STAR  
160 certification under this specification:

- 161 i. Projectors.
- 162 ii. TV/HTDs with a Main Battery that enables operation without connected mains power.
- 163 iii. Products with a computer input port (e.g., VGA), that are marketed and sold primarily as  
164 computer monitors or other displays, and that do not contain an integrated TV tuner encased  
165 within the product housing.

166 **3 CERTIFICATION CRITERIA**

167 **3.1 Significant Digits and Rounding**

168 3.1.1 All calculations shall be carried out with directly measured (unrounded) values. Only the final  
169 result of a calculation shall be rounded.

170 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact  
171 values without any benefit from rounding.

172 3.1.3 Annual Energy Consumption (AEC) values less than 100 kWh shall be rounded to the nearest  
173 tenth of a kWh; otherwise, they shall be rounded to the nearest kWh, as specified in Section 8.2  
174 *Rounding* of the Federal Test Procedure, for reporting on the ENERGY STAR website.

175 3.1.4 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR  
176 website shall be rounded to the nearest significant digit as expressed in the corresponding  
177 specification limit.

178 **3.2 General Requirements**

179 3.2.1 External Power Supplies (EPSs): Single- and Multiple-voltage EPSs shall meet the Level VI or  
180 higher performance requirements under the International Efficiency Marking Protocol when tested  
181 according to the Uniform Test Method for Measuring the Energy Consumption of External Power  
182 Supplies, Appendix Z to Subpart B of 10 CFR Part 430.

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

186 3.2.2 General User Information: The product shall ship with consumer informational materials located in  
187 either (1) the hard copy or online electronic user manual, or (2) a package or box insert. These  
188 materials shall include:

- 189 i. Information about the ENERGY STAR program;
- 190 ii. Information on the energy consumption implications of changes to as-shipped TV/HTD  
191 configurations and settings, including the implications of software or firmware updates; and
- 192 iii. Notification that enabling certain optional features and functionalities (e.g., instant-on), may  
193 increase energy consumption beyond the limits required for ENERGY STAR certification, as  
194 applicable.

195 3.2.3 Energy Saving Features: A TV/HTD may not be certified with any detectable or undetectable  
196 energy saving features that are enabled when tested unless that feature provides comparable  
197 energy savings during typical viewing experiences (i.e., the duration of a variety of common or  
198 prevalent programming). This prohibition applies irrespective of whether the function's primary or  
199 intended purpose is energy savings. Further, this applies to features that may be downloaded in  
200 the future.

201 3.2.4 Forced Menu: For any product that includes a Forced Menu where consumers are provided a  
202 choice of Home Configuration or Retail Configuration at initial start-up:

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

211 3.2.5 Standby-Active, High Mode Capability: TV/HTDs with Standby-Active, High Mode shall  
212 automatically return to the as-tested Standby-Active, Low Mode or Standby-Passive Mode  
213 following a manufacturer firmware update or other maintenance operation in Standby Active, High  
214 Mode within a period less than or equal to 15 minutes from the completion of said  
215 update/maintenance operation.

### 216 3.3 On Mode Requirements

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

219 3.3.1 For all TV/HTDs, On Mode Power ( $P_{OA}$ ) metrics shall be determined through the following  
220 process:

- 221 i. For PPSs tested **without** ABC enabled: The metrics gathered while testing with ABC  
222 disabled shall represent  $P_{OA}$  and the DL for the PPS.
- 223 ii. For PPSs tested **with** ABC enabled: Measurements at different illuminance conditions are  
224 thus taken (at 4, 17, 50, and 150 lux) per the *CTA-2037C: Determination of Television Set  
225 Power Consumption*:
  - 226 a) To calculate DL for the PPS: The value of DL used to represent the PPS for the  
227 purpose of calculating  $P_{OA\_Average\_Limit}$  per Equation 5 shall be the calculated average of  
228 the DL measurements taken at each illuminance condition, as outlined by Equation 1.
  - 229 b) To calculate  $P_{OA}$  for the PPS: The value of  $P_{OA}$  that represents the PPS for the  
230 purpose of calculating  $P_{OA\_Average}$  per Equation 4 shall be the calculated average of the  
231  $P_{OA}$  measurements for the PPS taken at each illuminance condition, as outlined by  
232 Equation 2.
  - 233 c) Should the Brightest SDR PPS as determined through *CTA-2037C* have ABC enabled  
234 by default, the default ABC-disabled metrics gathered while testing the PPS shall  
235 represent  $P_{OA}$  and the DL for the PPS. Performing calculations per Equations 1 and 2  
236 will thus not be necessary for the PPS.

- 237 iii. If the value for the DL used to represent an SDR PPS is measured or calculated to be less  
 238 than 20 cd/m<sup>2</sup>, then 20 cd/m<sup>2</sup> shall be the DL value used to represent the PPS for the  
 239 purpose of determining certification, and the value of P<sub>OA</sub> used to represent the PPS shall be  
 240 the interpolated P<sub>OA</sub> value of the PPS when the TV/HTD is set to a DL of 20 cd/m<sup>2</sup>. Likewise,  
 241 if the value of the DL for an HDR10 PPS is less than 10 cd/m<sup>2</sup>, then 10 cd/m<sup>2</sup> shall be used  
 242 as the DL representing the PPS for the purpose of determining certification, and the value of  
 243 P<sub>OA</sub> used to represent the PPS shall be the interpolated P<sub>OA</sub> value of the PPS when the  
 244 TV/HTD is set to a DL of 10 cd/m<sup>2</sup>.
- 245 a) The P<sub>OA</sub> values of a PPS correlating to a projected DL of 20 cd/m<sup>2</sup> or 10 cd/m<sup>2</sup> shall be  
 246 calculated through interpolation of the 2<sup>nd</sup> order polynomial trendline created by  
 247 plotting all the PPS's measured P<sub>OA</sub> value datapoints against the measured DL values  
 248 at the same points.
- 249 1) If the P<sub>OA</sub> value for the Brightest SDR PPS needs to be interpolated and the PPS  
 250 has ABC enabled by default, include the ABC-enabled datapoints as measured  
 251 per CTA-2037C when creating the 2<sup>nd</sup> order polynomial.

252 **Note:** The CTA-2037C test method instructs that the determined Brightest SDR PPS shall be tested with  
 253 ABC functionality in its default state for the PPS. In Section 3.3.1.ii.c, EPA instructs that only the ABC-  
 254 disabled values for P<sub>OA</sub> and DL, which are also measured per CTA-2037C, shall be used to represent the  
 255 PPS. This proposal follows EPA's view that consumers switching to the Brightest SDR PPS are likely to  
 256 disable ABC to experience the brightest setting possible and is intended to prevent the PPS determined  
 257 to be the Brightest SDR PPS from implementing an overly-dim ABC feature that consumers would likely  
 258 disable in order to perform more efficiently during testing.

259 EPA has amended the instruction for how to interpolate P<sub>OA</sub> and DL values to specify that a 2<sup>nd</sup> order  
 260 polynomial shall always be used when interpolating power at 20 cd/m<sup>2</sup> and 10 cd/m<sup>2</sup>. EPA research has  
 261 shown that a 2<sup>nd</sup> order polynomial is a better predictor of power usage than a linear line. In cases where  
 262 only 2 datapoints are available, the resulting equation will look like a linear equation and the 2<sup>nd</sup> order  
 263 coefficient will be 0.

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

$$DL = \frac{DL_4 + DL_{17} + DL_{50} + DL_{150}}{4}$$

267 *Where:*

- 268 ■ DL is the Dynamic Luminance for a Preset Picture Setting where ABC is enabled by default, in cd/m<sup>2</sup>;  
 269 and
- 270 ■ DL<sub>4</sub>, DL<sub>17</sub>, DL<sub>50</sub>, and DL<sub>150</sub> are the dynamic luminance measurements taken per CTA-2037C:  
 271 *Determination of Television Set Power Consumption* when illuminance conditions are configured to 4  
 272 lux, 17 lux, 50 lux, and 150 lux, respectively.  
 273

274 **Equation 2: Calculation of P<sub>OA</sub> for Preset Picture Settings Where ABC is Enabled by Default**

$$P_{OA} = \frac{P_{OA_4} + P_{OA_{17}} + P_{OA_{50}} + P_{OA_{150}}}{4}$$

276 *Where:*

- 277 ■ P<sub>OA</sub> is the On Mode Power for a Preset Picture Settings where ABC is enabled by default, in watts;  
 278 and
- 279 ■ P<sub>OA\_4</sub>, P<sub>OA\_17</sub>, P<sub>OA\_50</sub>, and P<sub>OA\_150</sub> are the On Mode Power measurements taken per CTA-2037C:  
 280 *Determination of Television Set Power Consumption* when illuminance conditions are configured to 4  
 281 lux, 17 lux, 50 lux, and 150 lux, respectively.  
 282

283 3.3.2 Products shall meet the On Mode Power Requirement as outlined by Equation 3:



284 i. Should a TV not be capable of reading an HDR signal (e.g., the TV displays an error or blank  
 285 screen when fed an HCR signal), P<sub>OA</sub> metrics associated with the HDR10 picture setting shall  
 286 be omitted from calculations as presented by Equations 4 and 5.

287 **Equation 3: On Mode Power Requirement**

$$P_{OA\_Average} \leq P_{OA\_Average\_Limit} \times AF$$

288 Where:

- 289 ▪ P<sub>OA\_Average</sub> is the average of the On Mode Power in each applicable preset picture setting as  
 290 calculated per Equation 4, in watts;
- 291 ▪ P<sub>OA\_Average\_Limit</sub> is the average limit of On Mode Power in each applicable preset picture setting as  
 292 calculated per Equation 5, in watts; and
- 293 ▪ AF is the Adjustment Factor, dependent on the TV/HTD, calculated from the corresponding equations  
 294 in Table 2.  
 295

296 **Equation 4: Average On Mode Power, P<sub>OA\_Average</sub>**

$$P_{OA\_Average} = \frac{P_{OA\_Default} + P_{OA\_Brightest} + P_{OA\_HDR}}{n}$$

297 Where:

- 298 ▪ P<sub>OA\_Average</sub> is the average of the On Mode Power in each applicable preset picture setting as  
 299 calculated per Equation 4, in watts;
- 300 ▪ P<sub>OA\_Default</sub> is the On Mode Power for the Default SDR Preset Picture Setting, as determined by Section  
 301 3.3.1, in watts;
- 302 ▪ P<sub>OA\_Brightest</sub> is the On Mode Power for the Brightest SDR Preset Picture Setting, as determined by  
 303 Section 3.3.1, in watts;
- 304 ▪ P<sub>OA\_HDR</sub> is the On Mode Power for the Default HDR Preset Picture Setting, as determined by Section  
 305 3.3.1, in watts; and
- 306 ▪ n is the number of PPSs for which DL and P<sub>OA</sub> metrics have been gathered (i.e., n equals 2 if the  
 307 TV/HTD is not capable of displaying HDR content at all).  
 308

309 **Equation 5: Average Limit of On Mode Power, P<sub>OA\_Average\_Limit</sub>**

$$P_{OA\_Average\_Limit} = \frac{P_{OA\_Default\_Limit} + P_{OA\_Brightest\_Limit} + P_{OA\_HDR\_Limit}}{n}$$

310 Where:

- 311 ▪ P<sub>OA\_Average\_Limit</sub> is the average limit of On Mode Power in each applicable preset picture setting as  
 312 calculated per Equation 5, in watts;
- 313 ▪ P<sub>OA\_Default\_Limit</sub> is the limit for On Mode Power of the Default SDR Preset Picture Setting, as determined  
 314 by Table 1, in watts;
- 315 ▪ P<sub>OA\_Brightest\_Limit</sub> is the limit for On Mode Power of the Brightest SDR Preset Picture Setting, as  
 316 determined by Table 1, in watts;
- 317 ▪ P<sub>OA\_HDR\_Limit</sub> is the limit for On Mode Power of the Default HDR Preset Picture Setting, as determined  
 318 by Table 1, in watts; and
- 319 ▪ n is the number of PPSs for which DL and P<sub>OA</sub> metrics have been gathered (i.e., n equals 2 if the  
 320 TV/HTD is not capable of displaying HDR content at all).  
 321

322 **Table 1: On Mode Power Limits**

| Preset Picture Setting                          | Functions:   |                                 |
|---|--|---------------------------------|
|   | Limit 1: Performance-based efficiency limit                  | Limit 2: Power cap              |
| Default (P <sub>OA_Default_Limit</sub> )        | 0.94 x ((0.0007 x A + 0.5736) x DL + (0.0055 x A + 18.9667)) | 1.15 x ((0.0249 x A) + 46.5902) |
| Brightest<br>(P <sub>OA_Brightest_Limit</sub> ) | 0.94 x ((0.0007 x A + 0.5424) x DL + (0.005 x A + 19.8365))  | 1.15 x ((0.0819 x A) + 18.4228) |
| HDR10 (P <sub>OA_HDR_Limit</sub> )              | 0.94 x ((0.0013 x A + 1.866) x DL + (0.0069 x A + 17.1106))  | 1.15 x ((0.0576 x A) + 31.6067) |

323 Where:

- 324 ▪ DL is the dynamic luminance for the Preset Picture setting, as determined in Section 3.3.1;
- 325 ▪ A is the viewable Screen Area of the product in square inches; and
- 326 ▪ The lesser of the two limit values calculated for a Preset Picture Setting is to be used in the  
 327 P<sub>OA\_Average\_Limit</sub> calculation.

328

**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                               |
| $AF_{Resolution}$                    | $(0.0469 \times P^{0.1946})/1.041$ |

329  
330  
331  
332  
333  
334

Where:

- P is the pixel count of the TV/HTD, calculated by multiplying the TV/HTD's vertical resolution by its horizontal resolution;
- The  $AF_{Resolution}$  adjustment factor applies to all TV/HTDs; and
- The  $AF_{HCR}$  adjustment factor 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.

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**Note:** EPA has updated the Limit 2 equation for the Brightest SDR PPS to account for the change in only evaluating this PPS via its ABC-disabled  $P_{OA}$  and DL datapoints.

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*CTA-2037C* instructs to test all TVs with the IEC HDR10 test clip regardless of if an HDR PPS can be identified. As such, Section 3.3.2.i provides instructions for the instance where a TV may be incapable of reading an HDR signal and displaying the content in any format. EPA has not observed a TV behaving this way during testing but imagines that some TVs may exist that are not capable of reading an HDR signal.

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In response to the feedback received regarding the Limited Topic Proposal (LTP) that EPA published in September 2021, EPA has retained the proposed  $AF_{HCR}$  value of 1.12 for this Final Draft specification. Testing data used to develop the value proposed in the LTP indicated that the current value of 1.12 will allow only the most efficient HCR-capable models to earn certification. Testing data submitted in response to the LTP indicates that some of the most recently developed HCR Display models would be able to meet requirements with a smaller adjustment factor.

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The observed increases in efficiency between this sample of adjacent model years support EPA's belief that there are readily available means by which manufacturers can increase efficiency and reinforces the viewpoint that by making ENERGY STAR certification obtainable for these products, there is an incentive for manufacturers to do so. Additionally, these models observed to meet requirements after some redevelopments are far more efficient than comparable models that have not been updated, which supports the notion that the models that have been engineered to perform well above the baseline should be recognized. EPA has maintained the 1.12 value as further restriction of the adjustment factor risks making certification unobtainable for the most efficient HCR-capable models, thus eliminating the incentive to increase efficiency.

### 357 **3.4 Standby Mode Requirements**

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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 *CTA-2037C: 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).

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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.

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3.4.2 For TVs capable of network connectivity, Standby-Active Mode Power ( $P_{STANDBY-ACTIVE}$ ), as measured per *CTA-2037C*, shall be less than or equal to 1.0 W.

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**Note:** EPA has renamed the Standby Mode requirement presented in Section 3.4.2 as a Standby-Active Mode requirement as opposed to a Standby-Active, Low Mode requirement to reinforce that the measurement evaluated by this requirement should be taken per *CTA-2037C*, where the mode is referred to as Standby-Active Mode.

370 **4 TESTING**

371 **4.1 Applicable Test Procedures**

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

375 **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 <sup>21</sup> | Reporting requirement                        |
|  | Test and report Standby-Passive Mode (3.4.1)   | Test to determine ENERGY STAR Certification* |
| CTA-2037C: Determination of Television Set Power Consumption   | Test and report On Mode (Section 3.3) and Standby-Active Mode (Section 3.4.2) Power  |  |

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

378 **Note:** EPA acknowledges that the development of CTA-2037C is now complete and that the document is  
379 now available for reference.

380 4.1.1 When conducting tests according to CTA-2037C, the AC power supply shall be used to power  
381 only the UUT. The camera photometer and ABC lamp must be powered by mains electricity.

382 **4.2 Number of Units Required for Testing**

383 4.2.1 One of the following sampling plans shall be used to test for ENERGY STAR certification:  
384 i. A single representative unit shall be selected for testing the Basic Model;  
385 ii. Units shall be selected for testing per the sampling requirements defined in 10 CFR 429.25,  
386 which references 10 CFR 429.11.

387 **4.3 International Market Certification**

388 4.3.1 Products shall be tested for certification at the relevant input voltage/frequency combination for  
389 each market in which they will be sold and promoted as ENERGY STAR.

390 **5 USER INTERFACE**

391 5.1.1 Partners are encouraged to design products in accordance with the user interface standard IEEE  
392 1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in  
393 Office/Consumer Environments. For details, see <http://eetd.LBL.gov/Controls>.

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

394 **6 EFFECTIVE DATE**

395 6.1.1 Effective Date: The Version 9.0 ENERGY STAR Televisions specification shall take effect on  
396 **October 4, 2022**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR  
397 specification in effect on its date of manufacture. The date of manufacture is specific to each unit  
398 and is the date on which a unit is considered to be completely assembled.

399 6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should  
400 technological and/or market changes affect its usefulness to consumers, industry, or the  
401 environment. In keeping with current policy, revisions to the specification are arrived at through  
402 stakeholder discussions. In the event of a specification revision, please note that the ENERGY  
403 STAR certification is not automatically granted for the life of a product model.

404 **7 CONSIDERATIONS FOR FUTURE REVISIONS**

405 7.1.1 Backlight Control Accessibility and ABC Persistence: EPA seeks to understand if more  
406 accessible backlight controls would increase ABC persistence.

407 7.1.2 Implementation of Filmmaker Mode and Performance: EPA is interested to see if the increased  
408 implementation of a "Filmmaker Mode" Preset Picture Setting by manufacturers is followed by a  
409 tendency to apply the setting by consumers and how the characteristics unique to this setting  
410 affect energy efficiency.

411 7.1.3 Color Quality and Energy Efficiency: EPA looks to explore the relationship between image quality,  
412 with respect to color (viewing angle, gamut size, etc.), and energy efficiency.