



ENERGY STAR® Program Requirements for Connected Thermostat Products

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the provision and labeling of ENERGY STAR connected thermostat (CT) products. The ENERGY STAR Partner must adhere to the following partner commitments:

Providing Qualified Connected Thermostat Products

1. Partner must be a connected thermostat service provider.
2. Comply with current ENERGY STAR Connected Thermostat Products Eligibility Criteria, which define performance requirements and test procedures. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
3. **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 Connected Thermostat products. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform CT device testing. A list of EPA-recognized laboratories and Certification Bodies can be found at www.energystar.gov/testingandverification.
4. A new CT product is defined as having either significantly different hardware or software features relative to an existing CT product. CT products receiving software updates are not considered new CT products.

Using the ENERGY STAR Name and Marks

5. 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.
6. Use the ENERGY STAR name and marks only in association with qualified CT products, where the CT service and CT device have been qualified together. The 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.
7. Provide clear and consistent labeling of ENERGY STAR CT products.
 - 7.1. Electronic ENERGY STAR certification marks of at least 76x78 pixels in cyan, black or white shall be on the home screen, the main menu screen, or another place where users would be expected to come across it in routine use of the mobile app or web portal (if they exist).
 - 7.2. The ENERGY STAR mark shall be clearly displayed in CT service provider product literature (i.e., user manuals, spec sheets, etc.) and on the partner's Internet site where information about ENERGY STAR qualified products is displayed.
 - 7.3. The ENERGY STAR mark shall not be physically applied to the CT device packaging

unless the CT device brand owner also brands a CT service that is qualified with the CT device as ENERGY STAR, or the CT device is co-branded with a default CT service that is ENERGY STAR certified, and the installer/user is guided towards the use of that CT service.

7.4. ENERGY STAR marks shall not be applied to the CT device including physical marks on the CT device and electronic marks in the CT Device user interface.

8. ENERGY STAR Labeling of CT products that are associated with a broader product, such as a home security system, shall clearly indicate that only the CT product is certified. Neither physical nor electronic labels shall be associated with the broader product, and product literature shall state: *“This [insert product type (e.g., security system, home automation system)] includes an ENERGY STAR Certified Connected Thermostat. Only the Connected Thermostat is certified as ENERGY STAR.”*

Note: EPA supports the adoption of open platform CT devices intended to support multiple CT services. EPA also recognizes that for each CT device currently available in retail markets, there is a CT service branded by the CT device manufacturer or a CT device and default CT service that are co-branded. Installers are instructed to connect to this CT service to enable remote access and consumer amenities. Allowing retail package labeling for CT devices that are part of an ENERGY STAR certified CT product with that “default service” will raise the profile of ENERGY STAR CTs in the retail environment. EPA expects that these requirements may need to be updated as the market evolves over the coming years.

Providing Information to EPA

9. Provide aggregate savings data and associated statistics to EPA every 6 months in accordance with the ENERGY STAR Method to Demonstrate Connected Thermostat Field Savings. Submitted data shall be representative of savings for the CT product’s U.S. installed base and must demonstrate continued compliance with the requirements of the specification. This data will also be used for program evaluation purposes:
 - 9.1. Every February 1, submit the ENERGY STAR CT Field Savings software tool output file for the previous January 1 through December 31 reporting period.
 - 9.2. Every July 1, submit the ENERGY STAR CT Field Savings software tool output file for the previous June 1 through May 31 reporting period.
10. Participate in verification of CT device hardware through a Certification Body recognized by EPA for Connected Thermostats, providing full cooperation and timely responses. EPA may also, at its discretion, conduct tests on CT products that are referred to as ENERGY STAR certified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government’s request.
11. Provide unit shipment data or other market indicators to EPA or an EPA-authorized third party annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
 - 11.1. Partner must submit the total number of units newly subscribing to the CT service portion of ENERGY STAR qualified CT products within the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner.
 - 11.2. Partner must provide subscription data segmented by meaningful product characteristics (e.g., controlled system types, presence of additional functions) as prescribed by EPA.
 - 11.3. Partner must submit subscription 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.

12. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
13. 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.

Training and Consumer Education

14. Partner shall train distributors, sales staff and installation contractors on the value of the ENERGY STAR program. This training shall include, at a minimum, identification of ENERGY STAR certified products within the Partner's offerings and on the Partner's web site.
15. All consumer information documents – operating manuals, installation instructions, etc.—must be easily accessible to consumers at a public website.

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 displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating

with EPA on one print advertorial and one live press event.

- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- 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 Product Specification for Connected Thermostat Products

Final Draft Eligibility Criteria Version 1.0

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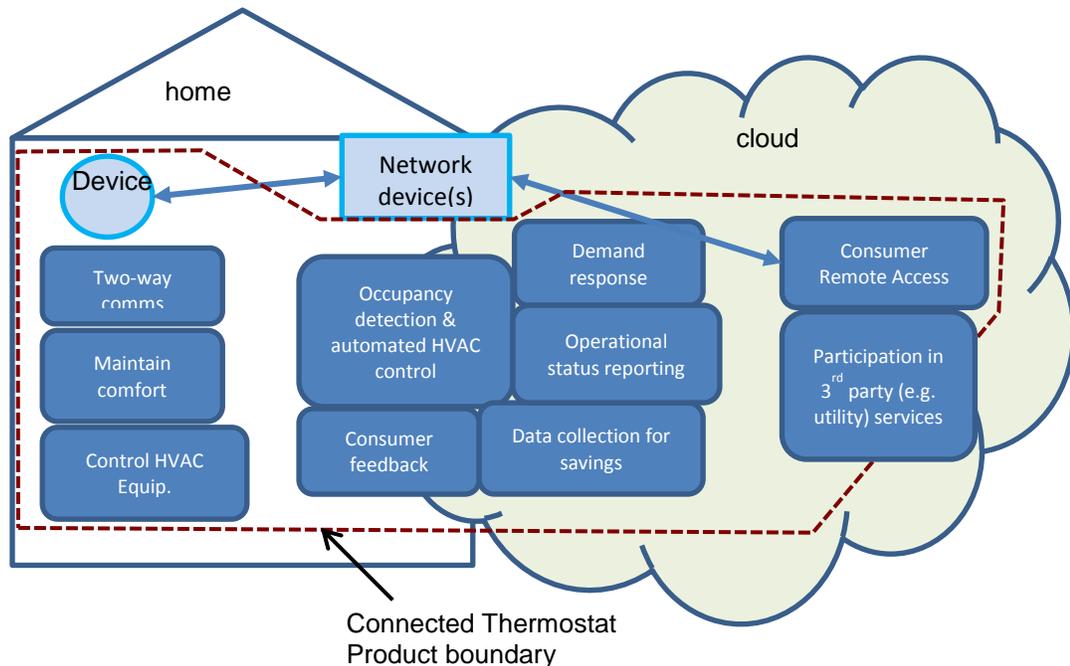
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8 Following are the eligibility requirements for the Version 1.0 ENERGY STAR Connected Thermostats
9 program. Connected Thermostat (CT) products shall meet all of the identified criteria to earn the
10 ENERGY STAR.

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12 1) Definitions:

- 13 A. Communication Link: The mechanism for bi-directional data transfers between the CT device
14 and one or more external applications, devices or systems.
- 15 B. Connected Thermostat Device: A device that controls heating, ventilation, and air-conditioning
16 (HVAC) equipment to regulate the temperature of the room or space in which it is installed, and
17 has the ability to communicate with sources external to the HVAC system. For connection, the
18 CT device may rely on a Wi-Fi home area network and an internet connection that is
19 independent of and not part of the CT Device. Where the CT device relies upon other devices
20 that are not reasonably expected to be in the home, e.g. Zigbee gateway, these devices are part
21 of the CT device.
- 22 C. Connected Thermostat Product: For the purposes of this specification, the CT product includes
23 the CT device in the home with associated firmware, which is assumed to be updated during the
24 time the CT device is used in the home, as well as a CT service supported by hardware and
25 software outside of the home. The CT service would typically provide web and smart phone
26 based thermostat control. See below for a pictorial representation. Functions in the left-most
27 group must be physically located in the home. Functions in the middle group commonly operate
28 using a combination of hardware that is physically located within the home and services that rely
29 fully or partially on communication with the cloud. The functions on the right typically reside in
30 the cloud.



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- 32 D. Connected Thermostat Service Provider: The organization that brands the CT service. CT
33 services typically include smart phone and web control applications, messaging relevant to
34 energy consumption, and APIs that enable consumer-authorized interconnection with utilities
35 and other 3rd parties.
- 36 E. Core Heating Day/Core Cooling Day: A core heating day has more than 30 minutes of heating
37 equipment run time and no cooling equipment run time. Similarly, a core cooling day has more
38 than 30 minutes of cooling equipment run time and no heating equipment run time.
- 39 F. Demand Response (DR): Changes in electric usage by demand-side resources from their
40 normal consumption patterns in response to changes in the price of electricity over time, or to
41 incentive payments designed to induce lower electricity use at times of high wholesale market
42 prices or when system reliability is jeopardized¹.
- 43 G. Demand Response Management System (DRMS): The system operated by a program
44 administrator, such as the utility or third party, which dispatches signals with DR instructions
45 and/or price signals to the ENERGY STAR CT products and receives messages from the CT
46 product.
- 47 H. Interface Specification: A document or collection of documents that contains detailed technical
48 information to facilitate access to relevant data and product capabilities over a communications
49 interface
- 50 I. Line Voltage Thermostat: thermostat that is powered by and/or switches > 30 Vac.
- 51 J. Load Management Entity: DRMS, home energy management system, and the like.
- 52 K. Network Standby: A state where the CT device is:
- 53 1. installed and interconnected in accordance with provided instructions,
54 2. with no direct or remote user interaction (e.g., smart phone app, web interface, occupancy
55 detection), and
56 3. sufficient time has elapsed to allow the CT device to enter a low power state, as applicable.
57 For example, the screen has dimmed or turned off automatically.
- 58 L. Open Standards: Communication with entities outside the connected thermostat that use, for all
59 communication layers, standards:
- 60 • Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,² and/or
61 • Included in the NIST Smart Grid Framework Tables 4.1 and 4.2, and/or
62 • Adopted by the American National Standards Institute (ANSI) or another well-established
63 international standards organization such as the International Organization for
64 Standardization (ISO), International Electrotechnical Commission (IEC), International
65 Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or
66 Internet Engineering Task Force (IETF).
- 67 M. Product Family: A group of closely related CT products sharing a primary strategy for delivering
68 savings, and using similar CT devices. All members of a product family shall share one score on
69 the field savings metrics for heating and cooling. CT products using different strategies to
70 produce savings shall be in different product families.
- 71 N. Static temperature accuracy: The deviation in the room temperature displayed and/or
72 communicated by the CT device from 70°F (21°C); after one hour in a calibrated temperature
73 chamber set to 70°F (21°C).³

¹ Federal Energy Regulatory Commission, <https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential.asp>

² http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

³ The static temperature accuracy definition is based on requirements in National Electrical Manufacturers

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Note: EPA has expanded the definition of the CT device to include any additional items, such as gateways or remote sensors that are needed to enable the full functionality of the CT product. This will enable such items to be properly included in the standby power measurement (see section 4E). A definition for line voltage thermostat was added, as requested by a commenter, and the definition for static temperature accuracy was revised to indicate it applies to the displayed by and/or to the temperature communicated by the CT device.

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2) Scope:

83 A. Included Products: Only products that meet the definition of a CT product, as specified herein, are
84 eligible for ENERGY STAR certification. CT products provided as part of a larger product
85 offering, such as a home security system, may be certified but will be subject to specific labeling
86 requirements.

87 B. Excluded Products:

- 88 1 CT products that are unable to collect the required data for the energy savings metric (as
89 required by Section 3B4)
- 90 2 Line voltage thermostats.

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3) Eligibility Criteria:

93 A. Connected Thermostat Device Requirements:

94 Each CT device in a product family shall fulfill these requirements.

- 95 1. In the absence of connectivity to the CT service provider, retain the ability for residents to
96 locally:
 - 97 a. view the room temperature,
 - 98 b. view and adjust the set temperature, and
 - 99 c. switch between off, heating and cooling.
- 100 2. Meet requirements set out in Table 1, below.

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Table 1. Connected Thermostat Device Criteria

Parameter	Performance Requirement	Applicable Products
Static Temperature Accuracy	≤ ± 2.0°F	All
Network Standby average power consumption ¹	≤ 3.0 W average	
Time to enter network standby after user interaction (on device, remote or occupancy detection)	≤ 5.0 minutes	

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¹ Includes all equipment necessary to establish connectivity to the CT service provider's cloud, except those that can reasonably be expected to be present in the home, such as Wi-Fi routers and smart phones.

Association (NEMA) DC 3, Annex A 2013 Energy-Efficiency Requirements for Programmable Thermostats.

109 **Note:** The static temperature accuracy requirement has been loosened due to concerns that the
110 difference between temperature chamber conditions and those in a typical home may cause CT devices
111 that actually work well in the home to fail the test. EPA has specified aspects of the test method more
112 closely (see section 4F), and looks forward to working with stakeholders to improve the test over time until
113 it is truly representative. At that time EPA anticipates tightening the static temperature accuracy
114 requirement. In the meantime, with the current baseline, modest static temperature inaccuracy will have
115 little bearing on the derived field savings.

116 B. CT Product Requirements: The following capabilities may be enabled through the CT device, CT
117 service or any combination of the two. The CT product shall maintain these capabilities through
118 subsequent firmware and software changes. The CT service provider shall maintain
119 documentation that demonstrates compliance to these requirements. Initial certification of these
120 requirements will be based on a review of product literature.

- 121 1. Ability for consumers to set and modify a schedule.
- 122 2. Provision of feedback to occupants about the energy impact of their choice of settings.
- 123 3. Ability for consumer to access information relevant to their HVAC energy consumption, e.g.,
124 HVAC run time.
- 125 4. The CT product shall be capable of collecting the following data, including where noted, to
126 the indicated resolution and accuracy:
 - 127 a. Unique thermostat ID
 - 128 b. ZIP code (installed location)
 - 129 c. Controlled HVAC equipment type to the extent it can be determined by the CT product:
 - 130 • Single stage heat pump with electric resistance aux and/or emergency heat (i.e. strip
131 heat)
 - 132 • Single stage heat pump without additional and/or supplemental heating sources
 - 133 • Single stage non heat pump with single-stage central air conditioning
 - 134 • Single stage non heat pump without central air conditioning
 - 135 • Single stage central air conditioning without central heating
 - 136 • Other – e.g. multi-zone multi-stage, modulating
 - 137 d. Daily cooling equipment run time (reported to the nearest minute)
 - 138 e. Daily heating equipment run time (reported to the nearest minute)
 - 139 f. Hourly auxiliary heat run time (reported to the nearest minute)
 - 140 g. Hourly emergency heat run time (reported to the nearest minute)
 - 141 h. Hourly average conditioned space temperature (reported to nearest 0.5°F, accurate to
142 ±1.0°F)
 - 143 i. Hourly average heating setpoint temperature (reported to nearest 1.0°F)
 - 144 j. Hourly average cooling setpoint temperature (reported to nearest 1.0°F)
- 145 5. Demand Response
 - 146 a. Grid Communications – The CT product shall include a communication link that facilitates
147 the use of open standards, as defined in this specification, for all communication layers to
148 enable DR functionality.

149 **Note:** CT products that enable direct, on-premises, open-standards based

- 150 interconnection are preferred, but alternative approaches, where open-standards
151 connectivity is enabled only with use of off-premise services, are also acceptable.
- 152 b. Open Access – To enable interconnection with the CT product over the communication
153 link, an interface specification, application programming interface (API) or similar
154 documentation shall be made available that, at a minimum, enables DR functionality.
- 155 **Note:** While EPA encourages broad availability of the interface spec or API, CT service
156 providers may elect to limit dissemination of these documents to certified/qualified
157 developers, integration partners and the like.
- 158 c. Consumer Override – Consumers shall be able to override their CT product’s response to
159 any DR signal.
- 160 d. Capabilities Summary – A ≤ 250 word summary description of the CT product’s and/or
161 associated CT service provider’s DR capabilities/services shall be submitted. In this
162 summary, EPA recommends noting the following, as applicable:
- 163 • DR services that the CT product has the capability to participate in such as load
164 dispatch, ancillary services, price notification and price response
 - 165 • Whether the CT device can be directly addressed via the interface specification,
166 API or similar documentation.
 - 167 • Support for locational DR, e.g. to ZIP code(s), feeder(s), or to CT device endpoints
168 specified by the Load Management Entity.
 - 169 • List open communications supported by the CT device and/or CT service,
170 including applicable certifications.
 - 171 • Feedback to Load Management Entity, e.g. verification/M&V, override notification.
 - 172 • Measures to limit consumer comfort impacts, if any.
 - 173 • DR response configurability/flexibility by the consumer and/or Load Management
174 Entity.
 - 175 • Whether the CT device and/or the CT product comply with the [2016 California](#)
176 [Energy Commission Title 24, Part 6 Joint Appendix 5](#).
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178 **Note:** A stakeholder developed more prescriptive demand response (DR) criteria and recommended
179 EPA substitute it for the existing DR criteria. In light of the broad diversity of both DR programs and
180 methods of implementation, EPA continues to believe it appropriate to maintain high-level, non-
181 prescriptive criteria that mandate use of open communication standards, enable open access to DR
182 capabilities and ensure consumers are empowered to override. However, EPA has incorporated
183 language suggested by this stakeholder into recommended content for the DR capabilities summary.
184 These enhancements should guide partners to submit summaries that allow consumers, utilities and
185 other interested parties to better understand and to compare capabilities between ENERGY STAR CT
186 products.

- 187 C. Field Savings: CT products shall demonstrate typical product performance in the field by one of
188 two methods. To be certified, CT products must have at least twelve months of interval data.
189 These requirements refer to reported performance of the CT product.
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192 1. Metric Performance:

193 **Table 2. Connected Thermostat Energy Savings Criteria**

Metric	Statistical measure	Performance Requirement
annual % run time reduction, heating (HS)	Lower 95% confidence limit of weighted national average	≥ 8%
	Weighted national average of 10 th percentiles	≥ 4%
annual % run time reduction, cooling (CS)	Lower 95% confidence limit of weighted national average	≥ 10%
	Weighted national average of 10 th percentiles	≥ 5%
Average resistance heat utilization for heat pump installations (RU)	National mean in 5°F outdoor temperature bins from 0 to 60°F	Reporting requirement

215 **Note:** Stakeholders expressed support for the metric performance levels proposed in Draft 3, and they
 216 remain unchanged. In addition, stakeholders requested that some information about CT products'
 217 performance in various regions be available on the qualified product list. EPA does not feel information on
 218 metric performance for individual CT products will be helpful (and may be misleading). However, we agree
 219 that it is important to manage customer expectations, and will include information on the expected
 220 performance of ENERGY STAR CT products in general in various regions in our consumer information.

- 221 2. A/B Study: In lieu of meeting metric performance requirements outlined in Table 2, partner
 222 may propose an A/B study which demonstrates the mean reduction of run time (or mean
 223 reduction in energy use) for homes using their CT product as compared to a typical
 224 thermostat. To earn the ENERGY STAR, field savings studies shall show that the lower 95%
 225 confidence limit of run time reduction for heating is at least 6% and for cooling is at least 7%.
 226 In addition, studies shall show that no more than 20% of homes in the study showed savings
 227 of 1% or lower in heating or in cooling. Partners using this allowance shall also apply the
 228 ENERGY STAR Method to Demonstrate Connected Thermostat Field Savings and submit
 229 the output at time of certification and periodically as required for all CT products. All studies
 230 must be pre-approved and shall meet the following requirements:
- 231 a. Two groups of consumers shall have products present in their home that they use as the
 232 thermostat(s) for their homes during the study period. The test group shall have
 233 capabilities available equivalent to the CT products the study covers. The control group
 234 shall have capabilities available to them that represent a typical thermostat and provide a
 235 reasonable baseline for comparison.
 - 236 b. Both groups of consumers shall be large enough, and will use the products for a sufficient
 237 length of time, to estimate savings on core heating and cooling days with statistically
 238 significant results.
 - 239 c. Results of the study will be lower 95% confidence limit of the mean % run time reduction
 240 or mean % energy savings in the test group compared to the control group, for both
 241 heating and cooling as required by the specification. The confidence limit may be

242 calculated with the simplifying assumption that the relative energy or run time reduction
243 has a Gaussian distribution around the mean.

244 d. If only a smaller sample of homes is available, a study design using a pre-study matching
245 period in which test and control groups have access to the same capabilities may be
246 proposed. Application of a correction factor derived from the comparison of groups in the
247 pre-test period may be used to account for fluctuations in home properties between
248 groups. In this case, the pre-test and test periods shall be as close together in time as
249 possible, and the uncertainty shall be estimated as half what it would have been without
250 the correction from the pre-test period.

251 e. Results of the study shall be representative of mean savings across the U.S.

252 f. The study shall provide a method for ongoing monitoring of results, equivalent to semi-
253 annual reporting of metric scores. This may involve periodically re-running the study on a
254 smaller set of consumers, for instance.

255 Process

256 a. Partner shall submit a proposal for the study to EPA, demonstrating compliance with the
257 study requirements. This is expected to be an iterative process involving conversation
258 between the Partner and EPA. EPA will post proposed studies to a publically accessible
259 web page during the period they are under consideration.

260 b. Once the study design is approved, the Partner will execute the study and report the
261 results to EPA. Results shall include at minimum the mean percent HVAC run time or
262 HVAC energy use reduction from the control group to the test group, the associated 95%
263 confidence limits of the mean, and the 20th percentile of these quantities across homes.

264 c. EPA will confirm whether results meet the requirements of the specification and will
265 publish successful studies.

266 **Note:** One stakeholder was concerned that CT products with savings that do not meet the higher threshold
267 for metric performance might be able to be certified as ENERGY STAR using this A/B Study option. EPA
268 believes that some CT products that do not score as well on the metric will in fact show higher savings in
269 A/B studies that are designed with a more realistic baseline and which capture all savings methods. There
270 are two protections against the A/B study being used as a loophole. First, all providers using the A/B study
271 will also be required to submit metric results – EPA will expect a cogent explanation of any discrepancies.
272 In addition, EPA will approve all studies before results are generated, and will therefore have the chance
273 to ensure that savings are reliable enough that a lower confidence bound of the mean than for the metric
274 still translates to substantial savings for consumers.

275 Another stakeholder requested that proposed A/B studies be released for stakeholder comment prior to
276 being approved. Given that we are not aware of any CT service providers planning to use this path, EPA
277 will take the simpler course of posting proposed studies as we consider them on a public site where
278 stakeholders can examine them.

279 EPA has also clarified that the results of the study shall be representative across the entire U.S., not just
280 the CT product's customer base.

281 D. Significant Digits and Rounding:

282 1. All calculations shall be carried out with directly measured (unrounded) values.

283 2. Unless otherwise specified below, compliance with specification limits shall be evaluated
284 using directly measured or calculated values rounded to the nearest 0.1°F.

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

288 **4) Test Requirements:**

289 A. Product Families: A product family may be established under the following circumstances:

- 290 1. Each CT device that is part of a CT product within the product family is separately tested to
291 ensure it meets the requirements in section 3)A.
- 292 2. Each CT service/CT device combination shall comply with section 3)B.
- 293 3. All members of the product family use the same primary savings strategy or strategies.
- 294 4. All installations within a product family shall be considered as a single population for
295 determining field savings, and the metric performance scores shall apply to all members of
296 the product family.

297 *Examples of allowable variations within a product family:*

- 298 • *For CT products that derive savings from automatic temperature changes without*
299 *prompting users, the user interface differences of CT devices would be irrelevant.*
- 300 • *For CT products that rely on occupancy detection to deliver savings, any CT device with*
301 *similar occupancy sensors can be in the same product family.*
- 302 • *For CT products with variations based on electricity rates (e.g. precooling is available in*
303 *areas with time of use rates), as long as this is not one of the major savings strategies,*
304 *the variations can be within the same product family.*
- 305 • *For CT products that offer a basic energy-savings service that is certified but can add*
306 *other services that may increase energy savings, all variations may be in the same*
307 *product family.*

308 B. Software updates: Software updates are expected to either not affect product savings, or to
309 increase savings, and do not require recertification. Software changes that alter the principle
310 that savings rest upon, or which are expected to reduce savings, would define a new product
311 and would require a new certification.

312 C. Test Methods:

313 The following methods shall be used to demonstrate ENERGY STAR qualification:

314 **Table 3: Test Methods for ENERGY STAR Qualification**

ENERGY STAR Requirement	Test Method Reference
Functionality in the absence of connectivity	As per section 4.D and 4.E below
Static temperature accuracy	As per section 4.D and 4.F below
Network standby power consumption	IEC 62301, Ed. 2.0, 2011-01, Household electrical appliances – Measurement of standby power, subject to clarifications in section 4.D and 4.G below
Time to standby	
Reduction in average annual % run time, heating (HS)	ENERGY STAR Method to Demonstrate Connected Thermostat Field Savings, V1.0
Reduction in average annual % run time cooling (CS)	
Average resistance heat utilization for heat pump installations (RU)	

315 D. CT device configuration for testing

- 316 1. Configure & provision the UUT’s connected functionality, including enrollment of applicable
317 services and updating to latest version of firmware.

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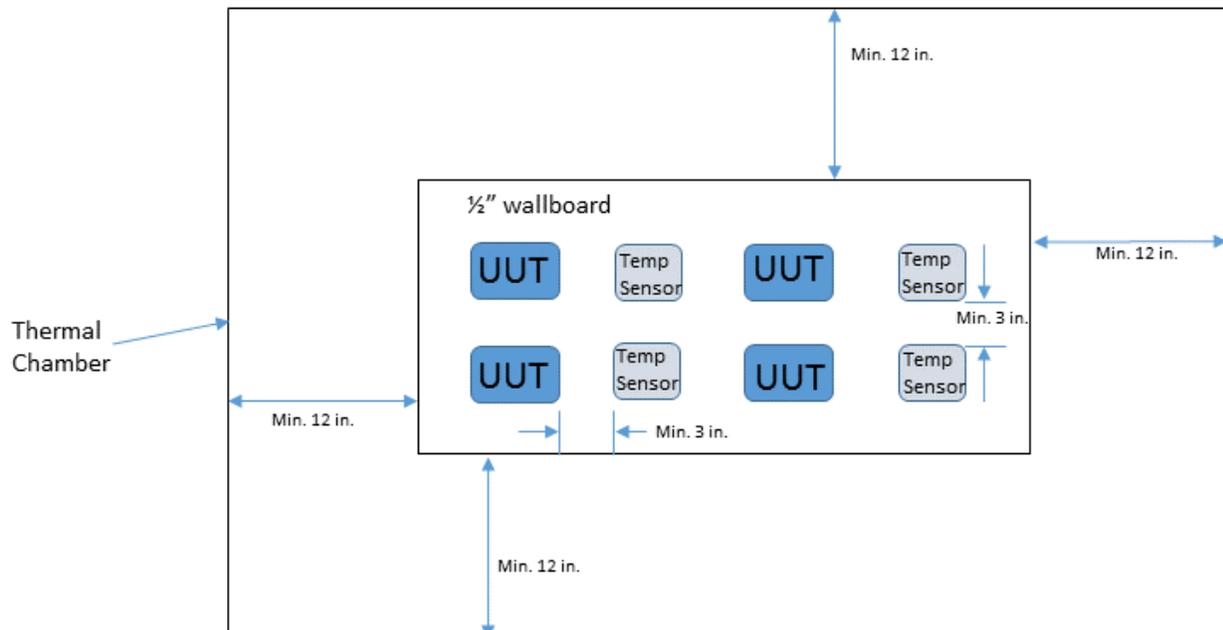
E. Functionality in the absence of connectivity

- 320 1. Install and configure the CT device either into a test environment or to control compatible
321 HVAC heating and cooling source equipment. Ensure that the test setup enables
322 observation of the UUT's HVAC control signals or actions, e.g. monitoring the UUTs wiring
323 terminals for state changes or observing switching of HVAC equipment.
- 324 2. Disable connectivity, for example by shutting down the WLAN.
- 325 3. Verify (pass/fail) the capability for a user to interact with the CT device to:
- 326 a. Observe the room temperature,
327 b. Observe and adjust the setpoint, and
328 c. Switch between off, heating and cooling

329 F. Static temperature accuracy

- 330 1. Install and configure four (4) CT devices and four (4) temperature sensors with a calibrated
331 temperature logger onto a ½" wallboard panel with at least 3" separation between each UUT
332 and temperature sensor or logger. The temperature sensors/logger shall have minimum
333 ±0.1°F accuracy.
- 334 2. Suspend the wallboard panel in the center of a thermal chamber ensuring at least 12" of
335 separation from chamber walls, ceiling and floor.

336 *Mounting the UUTs in this manner approximates typical mounting in homes. Keeping the*
337 *mounting panel and the CT devices at least a foot from the chamber minimizes the effect of*
338 *any heat radiating off of these surfaces. CT devices generate a small amount of heat.*
339 *Maintaining a 3" or greater separation between adjacent CT devices and temperature*
340 *loggers will minimize the effects of adjacent CT devices on measured temperatures.*



341
342

Typical Test Setup

- 343 3. Provide power to each UUT. It is not necessary to connect to HVAC heating and cooling
344 source equipment or to monitor the UUTs wiring terminals. Ensure that the test setup
345 enables observation of the UUTs indoor temperature reading.

- 346 4. Configure the CT communications, connect to the default CT service and ensure the CT
347 devices are able to maintain a connectivity with the chamber door closed.
- 348 5. Configure the UUTs so that they will not be calling for heating, fan, or cooling at the test
349 temperature of 70°.
- 350 6. Test Conduct
- 351 a. Close the chamber door and set it to 70°F. Once this temperature is reached, hold the
352 chamber at 70°F for at least 1 hour.
- 353 b. Deactivate all thermal chamber fans.
- 354 *Fan-forced air flow in a thermal chamber is not representative of typical convection*
355 *currents in a home and can impact the accuracy of temperatures displayed by the CT*
356 *device.*
- 357 c. Record the difference between the room temperature displayed by each UUT and
358 recorded by its adjacent temperature sensor at 30, 45 and 60 minutes after deactivating
359 the fan. If a higher resolution temperature is reported over the communications link, use
360 this as the UUT “displayed” temperature. (Test labs must generally work with CT service
361 providers in order to obtain this data.)
- 362 d. Calculate static temperature accuracy as the average of these 12 values.

363 G. Implementation of IEC 62301 for Connected Thermostat Testing

364 **Note:** This test is not applicable to UUTs or parts of UUTs (e.g. remote sensors) that are
365 powered solely by batteries. Where the CT device relies upon other devices that are not
366 reasonably expected to be in the home, e.g. Zigbee gateway, these devices are part of the CT
367 device and shall be included in this test.

- 368 1. Assure that the CT device is appropriately configured as per section 4.B.
- 369 a. This test need not be performed in a temperature chamber.
- 370 b. Configure the UUT in accordance with the requirements of IEC 62301, Ed. 2.0, 2011-01,
371 “Measurement of Household Appliance Standby Power,” Section 4, “General Conditions
372 for Measurements,” unless otherwise noted in this document. In the event of conflicting
373 requirements, this ENERGY STAR test method shall take precedence.
- 374 2. Test Conduct – Measure power consumption at the power input to the UUT using the
375 sampling method, section 5.3.2 of IEC 62301, Edition 2.0 2011-01.
- 376 a. Verify ability to control the UUT over the communication link, then close all apps & web
377 interfaces.
- 378 b. Increase the setpoint using the CT device controls.
- 379 c. Wait 5 minutes, while taking appropriate measures to allow the UUT to enter into and
380 remain in network standby mode for the duration of the test, e.g.
- 381 • No additional UUT user interactions
382 • Ensure occupancy sensing UUTs do not detect occupancy,
383 • Ensure apps and/or web remote interfaces remain closed.
384
- 385 d. Separately measure and record average energy consumption over a 5-minute period.
- 386 e. Check measurement stability in accordance with IEC 62301, Edition 2.0 2011-01, and
387 section 5.3.2.
- 388 f. If stability criteria are not satisfied, repeat the test, starting from step 2b, with the test
389 period extended in 5-minute increments (i.e. 10m, 15m, 20m...) as necessary to
390 establish requisite measurement stability.

391 g. Once stable, repeat the test over two additional test periods, starting from step 2b.

392 h. Record power consumption as the average over the second and third test periods.

393 **Note:** Stakeholders were supportive of EPA's proposed product family structure, with a request for some
394 clarification. EPA has added examples of allowable variation in order to make the definition clearer. In
395 addition, EPA has procedures in place to ensure consistency between CBs when questions of
396 specification interpretation arise.

397 The static temperature accuracy test has been modified in order to minimize measurement error, to more
398 accurately simulate in-home CT mounting and to improve repeatability.

399 **5) Effective Date:**

400 The ENERGY STAR Connected Thermostat specification shall take effect on 12/30/2016. To qualify for
401 ENERGY STAR, a Connected Thermostat Product shall meet the ENERGY STAR specification in effect
402 on the date of connection. The date of connection is specific to each unit and is the date on which a unit
403 is considered to be a Connected Thermostat Product.

404 **Note:** EPA anticipates finishing the specification before the end of the calendar year. Once the
405 specification is final, it will take a few weeks to set up the infrastructure to certify products, for instance
406 training and recognizing CBs. At that point, CT service providers will be able to submit CT products for
407 certification.

408 **6) Future Criteria Revisions:**

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