ENERGY STAR® Program Requirements
Product Specification for Room Air Conditioners

Eligibility Criteria
Final Draft Version 5.0

Following is the **Final Draft Version 5.0** ENERGY STAR Product Specification for Room Air Conditioners. A product shall meet all of the identified criteria to earn the ENERGY STAR.

1 DEFINITIONS:

Below are the definitions of the relevant terms in this document. Where noted below, definitions are identical to the definitions in the U.S Department of Energy (DOE) test procedure at 10 Code of Federal Regulations (CFR) 430, Subpart B, Appendix F or in 10 CFR 430.2. The definitions from the CFR have been reprinted for ease of use, however, the CFR definitions take precedence and may be modified by DOE during the rulemaking process.

A. Room Air Conditioner (RAC)[1]: A window-mounted or through-the-wall-mounted encased assembly, other than a "packaged terminal air conditioner," that delivers cooled, conditioned air to an enclosed space, and is powered by single-phase electric current. It includes a source of refrigeration and may include additional means for ventilating and heating.

   1. Casement-only[1]: A RAC designed for mounting in a casement window with an encased assembly with a width of 14.8 inches or less and a height of 11.2 inches or less.

   2. Casement-slider[1]: A RAC with an encased assembly designed for mounting in a sliding or casement window with a width of 15.5 inches or less.

   3. Reverse Cycle[2]: A RAC that employs a means for reversing the function of the indoor and outdoor coils such that the indoor coil becomes the refrigerating system condenser, allowing for heating of the air in the conditioned space; similarly, the outdoor coil becomes the evaporator, utilizing outdoor air as a source of heat.

   4. Through the Wall (TTW): A RAC without louvered sides. These units may also be referred to as "built-in" units.

   5. Electromechanical: A RAC that measures room temperature with a thermostat that undergoes a physical change (dimensional, phase change, etc.) relative to temperature, and utilizes mechanical rotary, switch, or similar user controls for cooling output, fan speed, desired temperature, or other features.

B. Basic Model[1]: All units of a given type of covered product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.

C. Tested Basic Connected Model (TBCM): A basic model that has been tested to validate it meets Demand Response criteria in section 4.G.

D. Cooling Capacity[3]: The amount of cooling, in British thermal units per hour (Btu/h), provided to a conditioned space, measured under the specified conditions.

E. Cooling Mode[3]: An active mode in which a room air conditioner has activated the main cooling function according to the thermostat or temperature sensor signal or switch (including remote control).

F. Combined Energy Efficiency Ratio (CEER): The energy efficiency of a room air conditioner as measured in accordance with the test procedure at 10 CFR 430, Subpart B, Appendix F or, a DOE-approved test procedure waiver pursuant to 10 CFR Part 430.27 expressed in units of BTU per watt-hour (BTU/Wh).

G. Ethylene Propylene Diene Monomer (EPDM): A closed-cell rubber that is used for outdoor gasketing and/or heating, ventilating, and air conditioning applications.

H. Louvered Sides: Exterior side vents on a RAC enclosure to facilitate airflow over the outdoor coil.

I. Packaged Terminal Air Conditioner (PTAC)[1]: A wall sleeve and a separate unencased combination of heating and cooling assemblies specified by the builder and intended for mounting through the wall. It includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating availability energy.

J. Portable Air Conditioner[4]: A portable encased assembly, other than a "packaged terminal air conditioner," "room air conditioner," or "dehumidifier," that delivers cooled, conditioned air to an enclosed space, and is powered by single-phase electric current. It includes a source of refrigeration and may include additional means for air circulation and heating.

K. Represented Value: The represented value is determined pursuant to 10 CFR Part 429, Subpart B § 429.15 and is the identical value certified to DOE, listed on the ENERGY STAR QPL, and shown on consumer facing materials.

2 SCOPE:

A. Included Products: Products that meet the definition of a room air conditioner as specified herein are eligible for ENERGY STAR certification, with the exception of those products listed in Section 2.B.

B. Excluded Products: PTACs, portable air conditioners, and room air conditioner models with electric resistance heat as the primary heat source are not eligible for ENERGY STAR certification under this specification. Products that are covered under other ENERGY STAR product specifications, e.g., dehumidifiers, are not eligible for certification under this specification.

One stakeholder recommended EPA eliminate the non-louvered product classes from scope for ENERGY STAR certification out of a concern that lower efficiency non-louvered window AC units would be sold next to and be selected instead of the higher efficiency louvered window AC units. EPA appreciates the stakeholder comments however it is EPA's understanding that the non-louvered products serve a unique use case (TTW installations) and thus are not expected to compete with louvered units.

Certification Criteria

A. Combined Energy Efficiency Ratio (CEER): CEER shall be greater than or equal to the minimum CEER as shown in Table 1.

[1] 10 CFR 430, Subpart A, Section 430.2
[2] Derived from ASHRAE 58 – Method of Testing for Rating Room Air Conditioner and Package Terminal Air Conditioner Heating Capacity
[3] 10 CFR 430, Subpart B, Appendix F
[4] 10 CFR 430.2

Table 1: Room Air Conditioner Efficiency Requirements

Product Class	Version 5.0 CEER (Btu/Wh)
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	13.1
2. Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	13.7
3. Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	14.7
4. Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	14.4
5a. Without reverse cycle, with louvered sides, and 20,000 to 27,999 Btu/h	12.7
5b. Without reverse cycle, with louvered sides, and 28,000 Btu/h or more	12.2
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	12.8
7. Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	12.8
8a. Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h	13.0
8b. Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h	12.8
9. Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	12.6
10. Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	12.7
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	13.2
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	12.6
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	12.6
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	11.7
15. Casement-Only	12.8
16. Casement-Slider	14.0

Note: EPA received mostly supportive, but some concerned feedback on the Version 5.0 ENERGY STAR Room Air Conditioner Draft 2 specification.

While few models on the current market would meet the Draft 1 levels, many more including the current ENERGY STAR Most Efficient models would meet the Draft 2 levels. Most stakeholders agreed with EPA's Draft 2 proposal to relax the levels from Draft 1 to ensure more ENERGY STAR model availability for the 2024 cooling season. Additionally, through conversations with manufacturers during this specification revision process, EPA understands more models meeting the Draft 2 levels will be available for the 2024 cooling season.

One stakeholder expressed concern that EPA relaxed the levels in Draft 2 from Draft 1 and proposed EPA revert back to the more aggressive levels in Draft 1.

In Draft 2, EPA published its intent for Version 6. Most stakeholders found publishing this intent helpful, however, one stated it is premature to set Version 6 levels as a percentage better than the new DOE standards when the new DOE standards are not yet final. EPA removed the Version 6 levels from this Version 5 Final Draft. EPA will continue the Version 6 process subsequently and in consideration of DOE's process.

B. Energy Saver Mode:

1. Product shall have an "Energy Saver Mode," which may be consumer override-able. In this mode, fan operation shall occur only in conjunction with compressor operation, with the following exceptions:

    a. The fan may continue to run for a period not exceeding 5 minutes after the compressor is switched off.

b. After the above period, when the compressor is off, the fan may be cycled on for up to 17% of the total compressor off cycle time to facilitate accurate control of room temperature. For example, the fan may run for 1 minute then cycle off for at least 5 minutes or the fan may run for 2 minutes then cycle off for at least 10 minutes. Manufacturers may use other fan run durations, but fan run time shall not exceed 17% of total cycle time

c. TTW RACs, as defined in Section 1 may include an installer accessible setting that disables Energy Saver Mode functionality. The setting may be accessible from the product's controls or may use a physical switch, jumper or the like. Appropriate measures shall be taken to ensure that the setting is implemented as an installer setting not intended to be consumer accessible. For example, physical switches or jumpers shall require the use of tool(s), removal of a panel, or the like; settings accessible in the product's controls shall require a unique sequence of button presses, shall be in a hidden menu, shall require an installer password, or the like.

d. The fan may continue to run when necessary for compliance with the applicable safety standards.

2. Products, excepting electromechanical RACs as defined in Section 1, shall ship with Energy Saver Mode enabled as the default setting.

3. Products, excepting electromechanical RACs as defined in Section 1, shall default to Energy Saver Mode each time the unit is switched to cooling mode. However, products are not required to default to Energy Saver Mode upon restoration of power after an electrical power outage that results in a loss of power to the unit.

Note: EPA received a comment with a concern relating to TTW RAC products meeting safety standards while in the Energy Saver mode. The commenter recommended that the specification allow for fan operation in accordance with "relevant safety standards" and recommended the text in section 3.B.1.d. This recommended language will allow products using lower GWP, flammable refrigerants to meet their respective safety standards and still qualify for ENERGY STAR certification.

C. Filter Reminder:

1. Products, excepting electromechanical RACs as defined in Section 1, shall have a filter reminder that provides visual notification recommending the filter be checked, cleaned, or replaced, as applicable. The filter reminder may be based on operating hours, sensing technology, or other means.

2. TTW RACs, as defined in Section 1, may include an installer accessible setting that disables Filter Reminder functionality. The setting may be accessible from the product's controls or may use a physical switch, jumper or the like. Appropriate measures shall be taken to ensure that the setting is implemented as an installer setting not intended to be consumer accessible. For example, physical switches or jumpers shall require the use of tool(s), removal of a panel, or the like; settings accessible in the product's controls shall require a unique sequence of button presses, shall be in a hidden menu, shall require an installer password, or the like.

D. Installation Requirements:

1. *Installation Materials (window units only)*: Room air conditioners intended for window installations shall be shipped with weather stripping and/or gasket materials appropriate for all intended applications, including the window size(s) the unit is typically used for, when installed according to provided instructions. The materials shall minimize air leaks (seal) between the room air conditioner and the window opening, including the area between the room air conditioner and the window sash, and the area between the room air conditioner and the windowsill (if bottom-mounted) or the window head (if top-mounted). The materials shall also seal gaps between fixed and movable window sashes. Acceptable weather

stripping or gasket material includes, but is not limited to, vinyl clad foam, EPDM cellular rubber, silicone rubber, or comparable alternatives that resist air and water infiltration as well as degradation due to ultraviolet (UV) radiation exposure. Room air conditioner side curtains must be tight fitting to minimize air leaks and contain insulation in the panel with a minimum insulation value of R1 as determined by the Federal Trade Commission's (FTC) Labeling and Advertising of Home Insulation regulations, 16 CFR part 460.

2. *Installation Instructions*: Products shall ship with detailed installation documentation that includes text and, where applicable, diagrams intended to facilitate installation that minimizes air leakage and thermal losses. Instructions shall include recommendations on the proper locations to install weather stripping or gaskets and, optionally, the use of temporary tape or removable caulk to seal the unit in place. If the product is a TTW unit, instructions shall also include a recommendation that the consumer install an appropriately sized cover, to include recommended specifications that facilitate satisfactory fit, when the RAC is not in use to provide additional insulation and air sealing.

E. Model Numbers: Model numbers used for ENERGY STAR certified product submissions shall be consistent with FTC (as specified in 16 CFR 305) and DOE (as specified in 10 CFR 429.15(b)) submissions.

F. Additional Reporting Requirements**:** Report the type of refrigerant used in the room air conditioner, for example R-32 or R-290.

3 CONNECTED PRODUCT CRITERIA:

The following optional connected criteria are applicable to Included Products, Section 2.A., that meet the definition of a room air conditioner.

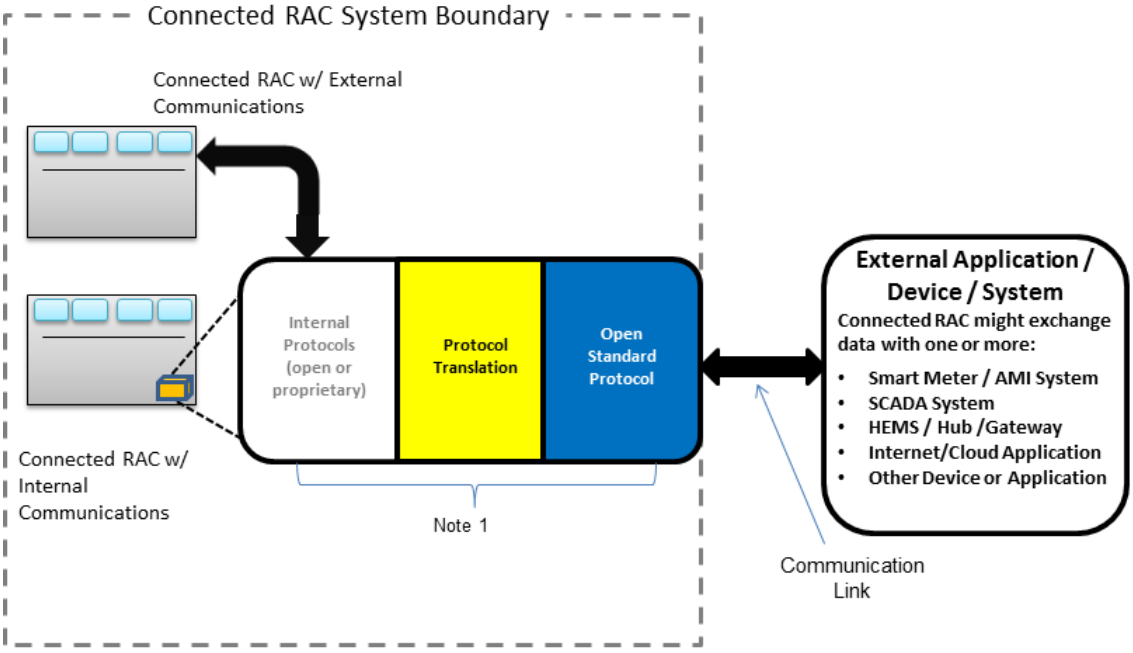
A. Connected RAC System

To be recognized as connected, a Connected RAC System, as shown in Figure 1) shall include the appliance plus all elements (hardware, software) required to enable communications in response to consumer-authorized energy related commands *(not including third-party remote management which may be made available solely at the discretion of the manufacturer)*. These elements may be resident inside or outside of the base appliance. This capability shall be supported through one or more means, as identified in Section 4.G.

The specific design and implementation of the Connected RAC System is at the manufacturer's discretion provided it is interoperable with other devices via open communications protocol and enables economical consumer-authorized third-party access to the functionalities provided for in Sections 4.B, 4.D and 4.F., and the capabilities shall be supported through one or more means, as identified in Section 4.G.

The product must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions.

Figure 1. Connected RAC System Boundary – Illustrative Example



Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between the Connected RAC System and Energy Management Device/Application(s). These elements could be within the base appliance, and/or an external communication module, a hub/gateway, or on the Internet/cloud.

B. DR Criteria

The Connected RAC System will comply with either OpenADR 2.0B or with CTA-2045B, or both.

Note: The Version 5 Final Draft maintains the removal of the 5% credit. Four stakeholders agreed with EPA's approach and encouraged EPA to urge manufacturers to report connected functionality on the QPL. One stakeholder stated they are against EPA removing the 5% credit. Another stakeholder strongly encourages EPA to require CTA-2045 to be required in the optional connected criteria.

EPA has dropped the 5% credit for Version 5 in light of the fact that a perverse incentive is playing out. Models being recognized as ENERGY STAR with connected functionality are those that need the 5% credit to meet the ENERGY STAR efficiency requirements, whereas the highly efficient models that are Smart or Wi-Fi capable are not being certified as being connected. This works against not only the program's intent to deliver efficiency but also against the market's interest in increasing the number of connected products and furthering innovation in grid responsive technologies.

EPA allows connected recognition of products using a CTA-2045 port, Open ADR, or both. Through discussion with stakeholders, the Agency understood that programs would look to aggregators to address demand response in room air conditioners and Open ADR would suffice. As far as EPA is aware, there are currently no products on the market offering a CTA-2045 port. EPA received a comment on Draft 2 that some programs using CTA-2045 for other devices would add RACs if there were some RAC models with a CTA-2045 port. That would be a good outcome, but EPA continues to believe that a strong demand from programs is the market signal that will encourage manufacturers to include a CTA-2045 port. EPA does not believe a specification requirement would have the desired effect, and it would meanwhile make the specification useless for anyone looking for a RAC with OpenADR.

C. Open Access

To enable interconnection with the product an interface specification, API, or similar documentation shall be made available to interested parties that at a minimum, allows transmission, reception, and interpretation of the following information:

- Energy Consumption Reporting specified in Section 4.D (must include accuracy, units, and measurement interval).
- Operational Status, User Settings & Messages specified in Section 4.F (if transmitted via a communication link).

D. Energy Consumption Reporting

To enable simple, actionable energy use feedback to consumers and consumer authorized energy use reporting to third parties, the product shall be capable of transmitting energy consumption data via a communication link to energy management systems and other consumer authorized devices, services, or applications. This data shall be representative of the product's interval energy consumption. It is recommended that data be reported in watt-hours for intervals of 15 minutes or less, however, representative data may also be reported in alternate units and intervals as specified in the product manufacturer's interface specification or API detailed in Section 4.C.

The product may also provide energy use feedback to the consumer on the product itself. On-product feedback, if provided, may be in units and format chosen by the manufacturer (e.g., $/month).

E. Remote Management

The product shall be capable of receiving and responding to consumer authorized remote requests *(not including third-party remote management which may be made available solely at the discretion of the manufacturer)*, via a communication link, similar to consumer controllable functions on the product. The product is not required to respond to remote requests that would compromise performance and/or product safety as determined by the product manufacturer.

F. Operational Status, User Settings & Messages

1. The product shall be capable of providing operational / demand response (DR) status (for example: off/standby, energy saver mode, low cool, max cool, delay appliance load, temporary appliance load reduction).

2. The product shall be capable of providing at least two types of messages relevant to its energy consumption on the product and/or to energy management systems and other consumer authorized devices, services, or applications via a communication link. For example, messages for room air conditioners might include filter change reminders, address performance issues, or report energy consumption that is outside the product's normal range.

G. Communication Hardware Architecture

Communication with entities outside the Connected RAC System that enables connected functionality (Sections 4.B, 4.D, 4.E and 4.F) shall be enabled by any of the following means, according to the manufacturer's preference:

a. Built-in communication technology
b. Manufacturer-specific external communication module(s) and/or device(s)
c. Open standards-based communication port on the appliance combined with open standards-based communications module
d. Open standards-based communication port(s) on the appliance in addition to a, b, or c above

If option b or c is used, the communication module/device(s) must be easy for a consumer to install and shipped with the appliance, provided to the consumer at the time of sale, or provided to the consumer in a reasonable amount of time after the sale.

H. Information to Consumers

If additional modules, devices, services and/or infrastructure are part of the configuration required to activate the product's communications capabilities, prominent labels, or other forms of consumer notifications with instructions shall be displayed at the point of purchase and in the product literature. These shall provide specific information on what consumers must do to activate these capabilities (e.g., "*This product has Wi-Fi capability and requires Internet connectivity and a*

wireless router to enable interconnection with an Energy Management System, and/or with other external devices, systems or applications.").

4 TEST REQUIREMENTS:

A. One of the following sampling plans shall be used to test energy performance for certification to ENERGY STAR:

1. A single unit is selected, obtained, and tested. The measured performance of this unit and of each subsequent unit manufactured must be equal to or better than the ENERGY STAR specification requirements. Note that to determine the represented value per 10 CFR Part 429, Subpart B § 429.15, additional testing outside of ENERGY STAR is required. The represented value must also be equal to or better than the ENERGY STAR specification requirements.

2. At least two units are selected, obtained, and tested. The represented value is calculated from the test results according to the sampling requirements defined in 10 CFR Part 429, Subpart B § 429.15. The represented value must be equal to or better than the ENERGY STAR specification requirements.

Results of the tested unit(s) may be used to certify additional individual model variations within a Basic Model as long as the definition for Basic Model provided in Section 1, above, and in 10 CFR Part 430.2 is met.

B. When testing room air conditioners, the following test method shall be used to determine ENERGY STAR certification:

Table 5: Test Methods for ENERGY STAR Certification

ENERGY STAR Requirement	Test Method Reference
CEER	10 CFR 430, Subpart B, Appendix F OR DOE-approved test procedure waiver pursuant to 10 CFR Part 430.27*

* DOE understands that various basic models may need a test procedure waiver to show the benefits of various operations pursuant to 10 CFR Part 430.27.

C. Compliance with Energy Saver Mode, Filter Reminder, and Installation criteria shall be through examination of product and/or product documentation.

D. Compliance with connected functionality requirements, as specified in Section 4, shall be demonstrated through examination of product and/or product documentation. Verifying demand response functionality using the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response (June 2017) is permitted, but not required for compliance with connected functionality requirements.

E. Significant Digits and Rounding: All calculations shall be carried out as specified in Appendix F to Subpart B of Part 430 and 10 CFR Part 430.23(f). Do not round individual test results. Rounding is specified in 10 CFR Part 429 for the represented value.

5 EFFECTIVE DATE:

A. Effective Date: The ENERGY STAR Room Air Conditioner specification shall take effect on **TBD**. Any product model with a date of manufacture on or after this date shall meet this specification to earn the ENERGY STAR. The date of manufacture is specific to each unit and is the date on which a unit is considered completely assembled.

Note: EPA is aware that RACs are a seasonal product with specific manufacturing cycles to support an April-August retail sales cycle. EPA intends to finalize the Version 5.0 specification in February 2023 and anticipates Version 5.0 would take effect 9 months later, in October 2023, to be available for the 2024 cooling season. As with other ENERGY STAR specifications, certification will be available once the specification has been finalized, and prior to the 2024 cooling season.

6 CONSIDERATIONS FOR FUTURE REVISIONS:

EPA is aware of new room air conditioner models with innovative and efficient heating modes. Given the current DOE test procedure does not measure energy consumption in heating mode, DOE and EPA plan to develop a test to measure this energy consumption. EPA encourages any interested stakeholder to work with EPA and DOE on this effort.

EPA reserves the right to change the criteria should federal requirements, 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 industry discussions. In the event of a specification revision, please note that ENERGY STAR certification is not automatically granted for the life of a product model.