



ENERGY STAR[®] Program Requirements Product Specification for Room Air Conditioners

Eligibility Criteria Draft 1 Version 4.0

1 Following is the **Draft 1 Version 4.0** ENERGY STAR Product Specification for Room Air Conditioners. A
2 product shall meet all of the identified criteria to earn the ENERGY STAR.

3 **1) Definitions:** Below are the definitions of the relevant terms in this document. Where noted below,
4 definitions are identical to the definitions in the U.S Department of Energy (DOE) test procedure at 10
5 Code of Federal Regulations (CFR) 430, Subpart B, Appendix F or in 10 CFR 430.2. When in
6 conflict, the definitions in the CFR take precedence.

7 A. Room Air Conditioner (RAC)¹: A consumer product, other than a “packaged terminal air
8 conditioner,” which is powered by a single phase electric current and which is an encased
9 assembly designed as a unit for mounting in a window or through the wall for the purpose of
10 providing delivery of conditioned air to an enclosed space. It includes a prime source of
11 refrigeration and may include a means for ventilating and heating.

12 1. Casement-only¹: A RAC designed for mounting in a casement window with an encased
13 assembly with a width of 14.8 inches or less and a height of 11.2 inches or less.

14 2. Casement-slider¹: A RAC with an encased assembly designed for mounting in a sliding or
15 casement window with a width of 15.5 inches or less.

16 3. Reverse Cycle²: A RAC that employs a means for reversing the function of the indoor and
17 outdoor coils such that the indoor coil becomes the refrigerating system condenser, allowing
18 for heating of the air in the conditioned space; similarly, the outdoor coil becomes the
19 evaporator, utilizing outdoor air as a source of heat.

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

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

26 B. Basic Model¹: All units of a given type of covered product (or class thereof) manufactured by one
27 manufacturer, having the same primary energy source, and which have essentially identical
28 electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption,
29 energy efficiency, water consumption, or water efficiency.

30 C. Combined Energy Efficiency Ratio (CEER): The ratio of measured annual cooling output (in BTU)
31 to the sum of the measured average annual electrical energy input (in watt-hours) and measured
32 annual standby/off-mode energy use (in watt-hours). CEER is expressed in BTUs per watt-hour.

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

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

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

¹ 10 CFR 430.2

² Derived from ASHRAE 58 – Method of Testing for Rating Room Air Conditioner and Package Terminal Air
Conditioner Heating Capacity

40 G. Portable Air Conditioner³: A single package air conditioner typically mounted on wheels for the
41 purpose of moving the unit from place to place within a building or structure.
42

43 **Note:** Consistent with other recent ENERGY STAR residential appliance specification revisions, EPA is
44 incorporating a number of minor updates in this Draft 1, including: 1) clarifying the Section 1 introduction
45 that in the case of a conflict between the definition provided in Section 1 and the definition found in the
46 DOE CFR, the CFR definition takes precedence; 2) incorporating new footnotes with citations for
47 definitions included in Section 1; and 3) replacing the term “qualification” with “certification” throughout the
48 document.
49

50 EPA also removed all references to energy efficiency ratio (EER), as it will no longer be applicable to
51 ENERGY STAR certification. Energy criteria shall be expressed using combined energy efficiency ratio
52 (CEER).

53 **2) Scope:**

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

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

61 **3) Certification Criteria:**

62
63 A. Combined Energy Efficiency Ratio (CEER): CEER shall be greater than or equal to the Minimum
64 CEER ($CEER_{MIN}$) as calculated per Equation 1.

65 **Equation 1. Calculation of Minimum CEER**

$$CEER_{MIN} = CEER_{BASE} - CEER_{Adder_Connected}$$

66 *where,*

67 $CEER_{BASE}$ is the value provided in Table 1, 2 or 3 below, depending on product type

68 $CEER_{Adder_Connected}$ is the CEER connected allowance derived using the calculation
69 provided in Table 4, below
70

³ CSA C370-09 – Cooling Performance of Portable Air Conditioners
ENERGY STAR Program Requirements for Room Air Conditioners – Eligibility Criteria

93 **Note (cont.)**

- 94 • Product energy performance can be measured and verified with testing; and
95 • Labeling would effectively differentiate products and be visible for purchasers.

96
97 Since the start of the previous specification development process, which initiated in December 2010,
98 DOE issued new federal minimum efficiency requirements for RACs effective June 1, 2014. The
99 amended federal standard is more stringent such that, for some product classes, the current ENERGY
100 STAR criteria do not offer significant differentiation. EPA is proposing new performance levels that offer
101 consumers energy savings above standard product offerings. EPA also sees an opportunity to provide
102 optional recognition of products with connected functionality, which are being introduced into the market.
103

104 **Efficiency Criteria**

105 In May 2014, EPA finalized a Version 3.1 specification, which harmonized with the amended DOE energy
106 conservation standard for RACs and enabled certification using CEER. In Draft 1 Version 4.0, EPA is
107 proposing that to certify as ENERGY STAR, RACs must be at least 10% more efficient than the 2014
108 minimum federal efficiency standard. Given the limited number of models that are currently able to meet
109 the proposed Draft 1 criteria, EPA sought information from manufacturers on incremental efficiency gains
110 that could be made with new components and technologies, as well as incremental product cost. Based
111 on the provided information, the Agency was able to estimate a weighted average payback of 4.6 years,
112 with most product classes falling below 5 years. Further information is available in the supplemental data
113 and analysis spreadsheet, which accompanies this draft specification. Furthermore, EPA anticipates that
114 as manufacturers revise RAC designs in order to meet the amended federal standard, there will be
115 opportunity to reduce the incremental cost to achieve ENERGY STAR, by leveraging existing
116 technologies and design options for use in RAC products, such as enhanced heat exchangers, more
117 efficient motors, and the use of alternative refrigerants. EPA's initial findings regarding these
118 technologies are provided below. Stakeholders are encouraged to comment on the proposed efficiency
119 levels and provide additional details regarding these and other energy-efficient technologies.
120

121 *Enhanced/Enlarged Heat Exchangers*

122 EPA understands that measures that increase heat transfer also increase energy efficiency. These
123 measures include increasing fan speed, use of microchannel heat exchangers and upsizing coils. While
124 increased fan speed can be accomplished at minimal incremental cost, energy efficiency gains typically
125 come at the expense of increased product noise. As noted in the 2011 DOE rule, microchannel heat
126 exchangers offer nominal efficiency gains and enable increased performance from heat exchangers that
127 are smaller and lighter than traditional fin and tube arrangements. These heat exchangers have proven
128 to be reliable in under-hood (outdoor) automotive applications, but incremental cost may be a barrier for
129 use in RACs¹. As discussed in the 2011 DOE TSD, enlarging the RAC chassis enables use of larger heat
130 exchangers that increase heat transfer without impacting noise performance.
131

132 *1. Microchannel Technology: More Efficient, Compact, and Corrosion Resistant Technology for Air Cooled Chiller*
133 *Applications.* Carrier Corporation. Syracuse, NY. April 2006.
134

135 *Efficient Motors*

136 Through continued research and stakeholder engagement, EPA identified direct current (DC) motors as a
137 means of improving RAC product efficiency when compared to products with conventional alternating
138 current (AC) motors used to operate the fan/blower system. DOE analyzed DC motor technology as a
139 part of their rulemaking effort and found that an AC motor has a typical efficiency of 50% while a DC
140 motor has an estimated motor efficiency of 80%. EPA is aware that DC motors are typically larger than
141 AC motors but concurs with DOE's assessment that the change in size does not preclude them from use
142 in RAC products. This is further substantiated by EPA's ongoing discussions with stakeholders indicating
143 that manufacturers are considering DC motors for certain RAC product classes as a means of improving
144 product efficiency.
145

146 *Alternative Refrigerants*

147 In comments on the November 2013 Version 4.0 framework document, manufacturers noted safety and
148 technical feasibility concerns associated with adoption of non-ozone-depleting, low global warming
149 potential (GWP) alternative refrigerants that are flammable.
150

151 **Note (cont.):** In July 2014, EPA’s Significant New Alternatives Policy (SNAP) program proposed to list
152 additional climate-friendly, flammable substitutes as acceptable, subject to use conditions, in room air
153 conditioning: HFC-32, propane (R-290), and a hydrocarbon blend R-441A. The SNAP proposed rule
154 contains use conditions to address potential flammability risks of the refrigerants, including limits on
155 charge size, use in newly manufactured equipment only, use of colored pipes and/or hoses, and meeting
156 relevant Underwriters Laboratories (UL) standards.

157
158 EPA believes that there are opportunities for increasing efficiency through the use of these alternative
159 refrigerants. Daikin indicates that switching from ozone-depleting hydrochlorofluorocarbon (HCFC)-22, or
160 from high GWP HFC-410A, to HFC-32 refrigerant may offer an increase in overall RAC efficiency of 2-
161 3%.² Organizations have also reported energy efficiency gains in the range of 10-30% with hydrocarbon
162 refrigerants. For example, Gree³ and Midea⁴ propane air conditioners may use 15% less energy than an
163 HCFC-22 unit. The California Air Resources Board (ARB) estimates that in general, hydrocarbon
164 refrigerants use 10-30% less energy than comparable HFC systems.⁵ Anticipating broader availability of
165 alternative refrigerants for use in room air conditioners, EPA supports their broader use in ENERGY
166 STAR products. EPA welcomes additional feedback and data on the potential efficiency gains associated
167 with the use of low GWP refrigerants.

168
169 2. SNAP Submission to EPA for HFC-32 in residential and light commercial air conditioning and heat pumps. Daikin
170 U.S. Corporation. 6/13/11. Docket #EPA-HQ-OAR-2013-0748-0047

171
172 3. Comments on Draft 1 Version 3.0 ENERGY STAR Room Air Conditioner specification. Schecco. 1/25/11.

173
174 4. UNIDO project to green Chinese air-conditioning production serves as example for Africa and West Asia. Press
175 Release. UNIDO Implementation Project. 1/17/14.

176
177 5. Comments on SNAP proposed rule. Bart E. Croes, Chief, Research Division, California Air Resources Board
178 (ARB). 9/2/14. Docket #EPA-HQ-OAR-2013-0748-0062

179
180 **B. Energy Saver Mode:**

- 181
182 1. Product shall have an “Energy Saver Mode,” which may be consumer override-able. In this
183 mode, fan operation shall occur only in conjunction with compressor operation, with the
184 following exceptions:
185
186 a. The fan may continue to run for a period not exceeding 5 minutes after the compressor is
187 switched off.
188
189 b. After the above period, when the compressor is off, the fan may be cycled on for up to
190 17% of the total compressor off cycle time to facilitate accurate control of room
191 temperature. For example, the fan may run for 1 minute then cycle off for at least 5
192 minutes or the fan may run for 2 minutes then cycle off for at least 10 minutes.
193 Manufacturers may use other fan run durations, but fan run time shall not exceed 17% of
194 total cycle time
195
196 c. Through the Wall RACs, as defined in Section 1 may include an installer accessible
197 setting that disables Energy Saver Mode functionality. The setting may be accessible
198 from the product’s controls or may use a physical switch, jumper or the like. Appropriate
199 measures shall be taken to ensure that the setting is implemented as an installer setting
200 not intended to be consumer accessible. For example, physical switches or jumpers shall
201 require the use of tool(s), removal of a panel, or the like; settings accessible in the
202 product’s controls shall require a unique sequence of button presses, shall be in a hidden
203 menu, shall require an installer password, or the like.
204
205 2. Products, excepting electromechanical RACs as defined in Section 1, shall ship with Energy
206 Saver Mode enabled as the default setting.
207

208 3. Products, excepting electromechanical RACs as defined in Section 1, shall default to Energy
209 Saver Mode each time the unit is switched on. However, products are not required to default
210 to Energy Saver Mode upon restoration of power after an electrical power outage that results
211 in a loss of power to the unit.
212

213 C. Filter Reminder:

- 214
- 215 1. Products, excepting electromechanical RACs as defined in Section 1, shall have a filter
216 reminder that provides visual notification recommending the filter be checked, cleaned or
217 replaced, as applicable. The filter reminder may be based on operating hours, sensing
218 technology, or other means.
219
 - 220 2. TTW RACs, as defined in Section 1, may include an installer accessible setting that disables
221 Filter Reminder functionality. The setting may be accessible from the product's controls or
222 may use a physical switch, jumper or the like. Appropriate measures shall be taken to ensure
223 that the setting is implemented as an installer setting not intended to be consumer
224 accessible. For example, physical switches or jumpers shall require the use of tool(s),
225 removal of a panel, or the like; settings accessible in the product's controls shall require a
226 unique sequence of button presses, shall be in a hidden menu, shall require an installer
227 password, or the like.
228

229 D. Installation Requirements:

- 230
- 231 1. *Installation Materials (window units only):* Room air conditioners intended for window
232 installations shall be shipped with weather stripping and/or gasket materials appropriate for
233 all intended applications when installed according to provided instructions. The materials
234 shall minimize air leaks (seal) between the room air conditioner and the window opening, as
235 well as seal gaps between fixed and movable window sashes. Acceptable weather stripping
236 or gasket material includes vinyl clad foam, EPDM cellular rubber, silicone rubber, or
237 comparable alternatives. Room air conditioner side curtains must be tight fitting to minimize
238 air leaks and contain insulation in the panel with a minimum insulation value of R1 as
239 determined by the FTC's Labeling and Advertising of Home Insulation regulations, 16 CFR
240 part 460.
241
 - 242 2. *Installation Instructions:* Products shall ship with detailed installation documentation that
243 includes text and, where applicable, diagrams intended to facilitate installation that minimizes
244 air leakage and thermal losses. Instructions shall include recommendations on the proper
245 locations to install weather stripping or gaskets and, optionally, the use of temporary tape or
246 removable caulk to seal the unit in place.
247
 - 248 3. *Insulating Cover (TTW only):* RACs intended for TTW installation as defined in Section 1 shall
249 include an appropriately sized cover which has a minimum insulation value of R1 as
250 determined by the FTC's Labeling and Advertising of Home Insulation regulations, 16 CFR
251 part 460. User instructions shall prompt consumers to install the insulating cover when the
252 RAC is not in use to provide additional insulation and reduce air leakage.
253

254 E. Sound Performance: Measured indoor sound power level shall not exceed 60 decibels - dB(A).
255

256 **Note:**

257 **Installation**

258 As signaled in the Version 4.0 Framework document, EPA believes there is an opportunity to provide
259 greater energy savings and performance/comfort for consumers through improved installation of
260 ENERGY STAR products. Minimizing air infiltration and thermal losses enables energy savings during
261 the cooling season for all RACs, and enables year-round energy savings for RACs that remain in-place
262 during the heating season. Field studies have equated certain window RAC installations to an equivalent
263 air exchange opening of 7.6 square inches, resulting in increased energy consumption and costs for
264 space conditioning in both heating and cooling seasons.¹
265

266 **Note (cont.):** The National Renewable Energy Lab (NREL) report, Laboratory Performance Testing of
267 Residential Window Air Conditioners, estimated that improved installation can reduce air leakage by 65-
268 85% resulting in cooling energy savings of 5-10% in the field. Some stakeholder comments received on
269 the Framework document indicated that additional data quantifying energy savings of installation
270 improvements is not readily available. However, other stakeholders indicated support of EPA pursuing
271 ways to enhance installation practices through ENERGY STAR. In the Draft 1 Version 4.0 specification,
272 EPA is proposing criteria intended to ensure that, when effectively installed, RACs minimize energy costs
273 from air leakage and thermal losses.
274

275 Informed by stakeholder feedback and additional research, EPA is aware that a majority of manufacturers
276 make an effort to provide some supplemental materials (e.g., foam, weather stripping, gaskets, etc.) for
277 consumers to use when installing the RAC. Therefore, the proposed criteria are not expected to add a
278 significant cost burden. In considering installation, the Agency notes the need for RAC designs to be
279 simple to install and safe when installed, while enabling flexibility in the placement and storage of the
280 RAC. For this reason, EPA has proposed installation instructions, and noted several options for meeting
281 the proposed installation materials criteria. EPA notes a recent RAC product introduction that utilizes
282 fabric side curtains in lieu of traditional plastic accordion panels, which the Agency believes to be a step
283 towards reducing air infiltration around the unit while maintaining installation flexibility. With these
284 requirements, EPA aims to improve the quality of provided materials and instructions.
285

286 Further, based on field studies and research conducted by DOE in their recent rulemaking, EPA
287 understands that TTW units are not typically removed and stored during the winter months. In an effort to
288 minimize additional energy consumption during the heating season and improve consumer comfort, EPA
289 is proposing that TTW products be shipped with a cover that will reduce thermal losses during the off-
290 season. DOE Building Technologies Office's: *A Homeowner's Guide to Window Air Condition Installation*
291 *for Efficiency and Comfort*(2012) estimates 7% in cooling season savings, up to 280 kWh/yr, or up to
292 \$31/yr from improved installation materials and practices very similar to those proposed in this Draft 1
293 specification. While limited in scope, the Urban Green Council's: *There are Holes in Our Walls estimated*
294 *annual savings of \$32-45* associated with improved installation practices similar to those proposed by
295 EPA including use of air conditioner covers. EPA is seeking feedback on the proposed installation criteria
296 and associated energy savings.
297

298 1. Urban Green Council. (2011). *There Are Holes in Our Walls*. New York, NY: Steve Winter Associates

299 **Sound Performance**

300 Through conversations with stakeholders after the release of the Version 4.0 Framework document, EPA
301 learned that noise might be an issue as RACs attain higher levels of efficiency. Further outreach to
302 manufacturers affirmed a relationship between increasing RAC efficiency and increasing acoustic noise.
303 Utilizing higher speed fans to facilitate increased heat transfer, manufacturers are able to increase the
304 efficiency performance of the unit with minimal investment. As a result of increasing fan speeds the
305 acoustic noise of the product also increases. Manufactures have further noted that fan speeds for current
306 models are on the order of 60% higher than were used 10 years ago.

307 Recently, the European Union (EU), through its EcoDesign regulations, instituted maximum sound power
308 levels for RACs assessed under *EN 12102: Air Conditioners, liquid chilling packages, heat pumps and*
309 *dehumidifiers with electrically driven compressors for space heating and cooling – Measurement of*
310 *airborne noise – Determination of sound power levels*. Under the new EU regulation, RACs may not
311 exceed indoor sound power levels of 60 dB(A) and outdoor sound power levels of 65 dB(A). For this
312 Version 4.0 specification, EPA is proposing harmonization with the EU's indoor sound power test
313 requirements and threshold. EPA is aware that nearly all manufacturers of ENERGY STAR RACs sell
314 products in the European market, and therefore a sound performance requirement for U.S. ENERGY
315 STAR products should not require a significant new capital investment in testing rooms and equipment.
316 While RACs are subject to the EN 12102, in their determination, the EU had limited information regarding
317 the sound performance of RAC products as package terminal air conditioners (PTACs) and mini-split
318 systems are more prevalent in the EU market. As such, EPA engaged several manufacturers to
319 understand the current range of sound performance levels in the North American marketplace. EPA
320 found that most manufacturers are utilizing internally defined sound pressure tests, in lieu of a
321 standardized test method.

322 **Note (cont.):** EPA understands that sound power testing, as called for by EN 12102, offers a more
323 comprehensive assessment of a product's acoustic noise performance compared to sound pressure
324 testing. While humans perceive acoustic noise in terms of sound pressure, this metric is influenced by
325 the environment surrounding a RAC, and can be amplified or dampened as a result of the test chamber
326 or field operating conditions. Sound power testing allows for a more accurate and specific assessment of
327 the RAC as sound power accounts only for the sound energy being generated by the RAC and
328 transferred to the air. Sound power assessment of a RAC does not change based on the environment in
329 which it is operated and therefore will provide a more meaningful way in which to evaluate product sound
330 performance relative to capacity and efficiency. As such, EPA proposes the use of EN 12102.

331 Consistent with the ENERGY STAR Guiding Principles, EPA seeks to ensure that ENERGY STAR
332 efficiency requirements do not lead to a compromise in product performance. To this end, the Agency
333 has included maximum sound level criteria for ENERGY STAR ventilation fans. In proposing this sound
334 performance requirement, the Agency strives to both ensure consumer satisfaction with ENERGY STAR
335 RACs, as well as to ensure that the ENERGY STAR label is an attractive purchasing tool for a broad
336 array of consumers.

337 EPA does not intend to include RAC sound power results on the ENERGY STAR certified products list.
338 EPA welcomes stakeholder feedback on the proposed requirement for sound performance and
339 harmonization with the EU.

340 F. Significant Digits and Rounding: All calculations shall be carried out as specified in Appendix F to
341 Subpart B of Part 430 and 10 CFR Part 430.23(f).

342 G. Model Numbers: Model numbers used for ENERGY STAR qualified product submissions shall be
343 consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.

344 **4) Connected Product Criteria:**

345 The following optional connected criteria are applicable to Included Products, Section 2A,

346 **Note:** Consistent with criteria proposed for other ENERGY STAR residential appliance categories, EPA is
347 proposing optional connected criteria for RACs that are designed to provide enhanced functionality to
348 consumers and offer potential benefits to the U.S. electricity grid.

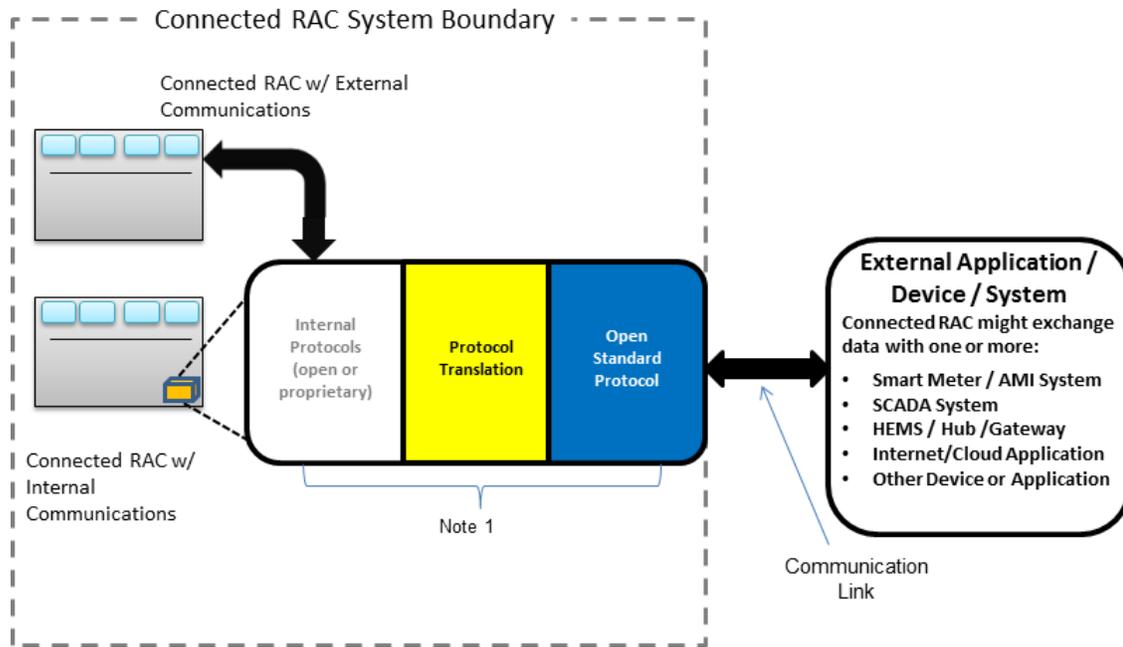
349 A. Connected Room Air Conditioner System

350 To be recognized as connected and to be eligible for the connected allowance, a Connected RAC
351 System, as shown in Figure 1) shall include the base appliance plus all elements (hardware,
352 software) required to enable communication in response to consumer-authorized energy related
353 commands (*not including third-party remote management which may be made available solely at
354 the discretion of the manufacturer*). These elements may be resident inside or outside of the base
355 appliance. This capability shall be supported through one or more means, as identified in section
356 4B2.

357 The specific design and implementation of the Connected RAC System is at the manufacturer's
358 discretion provided it is interoperable with other devices via open communications protocol and
359 enables economical consumer-authorized third party access to the functionalities provided for in
360 sections 4D, 4F and 4G. The capabilities shall be supported through one or more means, as
361 identified in section 4B2. A product that enables economical and direct, on-premises, open-
362 standards based interconnection is the preferred option for meeting this requirement, but
363 alternative approaches, where open-standards connectivity is enabled only outside of the
364 consumer premises, are also acceptable.

365 The product must continue to comply with the applicable product safety standards – the addition of
366 the functionality described below shall not override existing safety protections and functions. The
367 appliance must meet manufacturer's internal minimum performance guidelines, e.g., cooling
368 performance.

369 **Figure 1.** Connected Room Air Conditioner System Boundary – Illustrative Example



370
371 *Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between*
372 *the Connected Room Air Conditioner System and Energy Management Device/Application(s). These elements could be*
373 *within the base appliance, and/or an external communication module, a hub/gateway, or in the Internet/cloud.*

374 **Note:** EPA’s ENERGY STAR program is seeking to help advance the market for products with intelligent
375 features in ways that deliver immediate consumer benefits as well as support a low-carbon electricity grid
376 over the long term. In promoting connected functionality, EPA also seeks to ensure the consumer is
377 being considered such that product satisfaction is maintained or enhanced with the addition of new
378 energy savings and convenience features.

379 These connected criteria build upon the work done in other specification (e.g., refrigerators/freezers,
380 clothes washers, clothes dryers) where similar criteria were developed. The connected criteria mandate
381 open access and the use of open standards to enable consumer benefits while enabling innovation and
382 flexibility in implementation. This approach provides the Agency a basis to recognize products with
383 connected functionality as they begin to enter the market and to consider more prescriptive changes,
384 based on real-world market experience, if warranted.

385 EPA plans to also play a role in consumer education to help further the understanding of additional
386 savings opportunities associated with ENERGY STAR products that have connected functionality, as well
387 as how to best capture these savings (e.g., use of energy saving modes / opportunities for smart grid
388 connection) and in what scenarios these savings will be realized

389 EPA encourages stakeholder feedback on the connected criteria proposed in this draft.

390 **B. Communications**

391 1. Open Standards – Communication with entities outside the Connected RAC System that
392 enables connected functionality (sections 4D, 4F and 4G) must use, for all communication
393 layers, standards:

- 394 • Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,⁴ and/or
- 395 • Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
- 396 • Adopted by the American National Standards Institute (ANSI) or another well-established
- 397 international standards organization such as the International Organization for
- 398 Standardization (ISO), International Electrotechnical Commission (IEC), International
- 399 Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or
- 400 Internet Engineering Task Force (IETF).

⁴ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

401 2. Communications Hardware Architecture – Communication with entities outside the Connected
402 RAC System that enables connected functionality (sections 4D through 4G) shall be enabled
403 by any of the following means, according to the manufacturer’s preference:

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

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

413 C. Open Access

414 To enable interconnection with the product, in addition to section 4B1 that requires open-
415 standards, an interface specification, API or similar documentation shall be made available to
416 interested parties that at a minimum, allows transmission, reception and interpretation of the
417 following information:

- 418 ▪ Energy Consumption Reporting specified in section 4D (must include accuracy, units and
419 measurement interval);
- 420 ▪ Operational Status, User Settings & Messages specified in section 4F (if transmitted via a
421 communication link);
- 422 ▪ Demand Response specified in section 4G.

423 D. Energy Consumption Reporting

424 In order to enable simple, actionable energy use feedback to consumers and consumer
425 authorized energy use reporting to 3rd parties, the product shall be capable of transmitting energy
426 consumption data via a communication link to energy management systems and other consumer
427 authorized devices, services, or applications. This data shall be representative of the product’s
428 interval energy consumption. It is recommended that data be reported in watt-hours for intervals
429 of 15 minutes or less, however, representative data may also be reported in alternate units and
430 intervals as specified in the product manufacturer’s interface specification or API detailed in
431 section 4C.

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

435 E. Remote Management

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

441 F. Operational Status, User Settings & Messages

- 442 1. The product shall be capable of providing the following information to energy management
443 systems and other consumer authorized devices, services or applications via a communication
444 link:
 - 445 • Operational / Demand Response status (e.g., off/standby, energy saver mode, low cool,
446 max cool, delay appliance load, temporary appliance load reduction).

- 447 2. The product shall be capable of providing the following information on the product and/or to
448 energy management systems and other consumer authorized devices, services or
449 applications via communication link:
- 450 • At least two types of messages relevant to the energy consumption of the product. For
451 example, messages for room air conditioners might address a performance issue, such as
452 a clogged filter, or reporting energy consumption that is outside the product's normal
453 range.

454 G. Demand Response

455 The product shall have the capability to receive, interpret and act upon consumer-authorized
456 signals by automatically adjusting its operation depending on both the signal's contents and
457 settings from consumers. At a minimum, the product shall be capable of providing the following for
458 all cycle and setting combinations:

- 459 1. *Delay Appliance Load Capability*: The capability of the product to respond to a signal in
460 accordance with consumer settings, except as permitted below; by increasing the set
461 temperature by at least 4°F for at least 4 hours.
 - 462 a. Maximum Set Temperature – The increased set temperature shall not exceed 85°F.
 - 463 b. Consumer override – The consumer shall be able to override the product's Delay
464 Appliance Load response without limitation.
 - 465 c. The product shall be able to provide at least one Delay Appliance Load response in a
466 rolling 24-hour period.
- 467 2. *Temporary Appliance Load Reduction Capability*: The capability of the product to respond to
468 a signal in accordance with consumer settings, except as permitted below; by disabling
469 compressor operation for at least 10 minutes.
 - 470 a. Maximum Set Temperature – The product shall not respond if the set temperature is
471 $\geq 85^{\circ}\text{F}$.
 - 472 b. Consumer override – The consumer shall be able to override the product's Temporary
473 Appliance Load Reduction response without limitation.
 - 474 c. The product shall be able to provide at least three Temporary Appliance Load Reduction
475 responses in a rolling 24-hour period. The product is not required to provide more than
476 one Temporary Appliance Load Reduction response per 60-minute period.

477 **Note:** During the Version 3.0 specification development process, EPA began considering optional
478 connected functionality criteria for RACs. EPA did not propose specific Demand Response (DR) criteria
479 in the [Draft 3 Version 3.0 specification](#), but did discuss the possibility of including criteria designed to
480 provide more predictable impacts to consumers, more consistent load shed as well as to reduce
481 associated product testing burden. As this approach was supported by stakeholders in their written
482 comments, EPA elected to propose DR criteria based on this approach in this Draft 1 Version 4.0
483 specification. Such an approach, focusing on set temperatures and compressor operation, is also
484 informed by the experiences of utility programs like Con Edison's coolNYC program.

485 In the Draft 3 Version 3.0 specification, EPA also detailed potential concerns with DR criteria that required
486 percent energy use reductions relative to a baseline. More specifically, the RAC Delay Appliance Load
487 (DAL) response detailed in the Joint Petition to ENERGY STAR for Smart Appliances, calls for a 25%
488 load reduction relative to the measured product energy consumption during testing to the DOE test
489 procedure. Since the DOE energy test runs the RAC at maximum capacity, a 25% reduction in the field
490 would only be realized for RACs that are unable to provide the desired cooling capacity and are hence
491 running at full capacity.

492 RACs that are more lightly loaded would not need to provide as great a response, or if running at 75% or
493 lower capacity, would not need to respond at all. In effect, the RACs that are struggling to keep up with
494 cooling demands would be required to provide the greatest load shed; potentially resulting in significant
495 comfort impacts, while RACs that are more lightly loaded might not need to respond at all. As such, EPA
496 believes that proposing DAL criteria that mandates a minimum, defined set temperature shift will better
497 limit consumer comfort impacts, provide more predictable load shed and significantly reduce test burden.

498 **Note (cont.):** Similarly, the joint petition to ENERGY STAR called for a RAC Temporary Appliance Load
 499 Reduction (TALR) response that provides an 80% load reduction relative to the measured product energy
 500 consumption during testing to the DOE test procedure. Stakeholders informed EPA that RACs would
 501 need to switch off the compressor in order to comply. While EPA believes this deeper percent reduction
 502 criteria does provide a reasonable assurance of similar reductions in the field, EPA has proposed a
 503 maximum temperature approach that calls for switching off the compressor in the interest of significantly
 504 reduced test burden. DOE and EPA recognize that mandating RACs disable compressor operation
 505 during TALR responses would avoid the need to establish a baseline and monitor RAC energy
 506 consumption; effectively reducing test burden for TALR in a similar manner as with DAL.

507 The proposed DAL and TALR criteria both include an 85°F maximum adjusted set temperature limit to
 508 protect consumers from extreme temperatures, and include consumer override criterion that ensures
 509 consumers have the ability to override a response when necessary. EPA recognizes that the set
 510 temperature may not reflect the room temperature and is seeking comment on whether a maximum set
 511 temperature of 85°F will sufficiently prevent an excessively high room temperature. While EPA sought a
 512 health-based resource to cite on a temperature, the Agency did not identify an agreed upon maximum
 513 temperature. As such, EPA proposes a reasonable temperature as a starting point and seeks
 514 stakeholder feedback regarding sources for health-based maximum temperature thresholds. EPA
 515 welcomes stakeholder comment on the proposed DR criteria for RACs.

516 H. Information to Consumers

517 If additional modules, devices, services and/or infrastructure are part of the configuration required
 518 to activate the product’s communications capabilities, prominent labels or other forms of consumer
 519 notifications with instructions shall be displayed at the point of purchase and in the product
 520 literature. These shall provide specific information on what consumers must do to activate these
 521 capabilities (e.g. “*This product has Wi-Fi capability and requires Internet connectivity and a*
 522 *wireless router to enable interconnection with an Energy Management System, and/or with other*
 523 *external devices, systems or applications.*”).

524 **5) Test Requirements:**

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

- 527 1. A representative unit shall be selected for testing based on the definition for Basic Model
 528 provided in Section 1. above; or
- 529 2. Units shall be selected for testing per the sampling requirements defined in 10 CFR 429.15,
 530 which references 10 CFR 429.11.

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

533 **Table 5: Test Methods for ENERGY STAR Certification**

ENERGY STAR Requirement	Test Method Reference
CEER	10 CFR 430, Subpart B, Appendix F
Sound Performance	EN12102

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

536 D. Compliance with Connected functionality, as specified in Section 4, shall be through examination
 537 of product and/or product documentation. In addition, demand response functionality will be
 538 certified using the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand
 539 Response – **Date TBD** in order to be eligible for the connected allowance.

540

541 **Note:** Sound performance must be tested in accordance with the test method *EN 12102: Air*
542 *Conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven*
543 *compressors for space heating and cooling – Measurement of airborne noise – Determination of sound*
544 *power levels*, currently used in the EU. Since many ENERGY STAR brand owners ship RACs to the EU,
545 use of the EN 12102 method will reduce testing burden for purposes of certification.

546 EPA welcomes stakeholder feedback on use of the EN12102 test method for sound power, and its
547 accuracy in representation of sound performance in the US RAC market.
548

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

553 **Note:** EPA is aware that room air conditioners are a seasonal product with specific manufacturing cycles
554 to support an April-August retail sales cycle. EPA intends to finalize this Version 4.0 specification early in
555 2015 and anticipates it would be effective 9 months later. As with other ENERGY STAR specifications,
556 early certification will be available once the specification has been finalized.

557 **7) Future Specification Revisions:** EPA reserves the right to change the criteria should federal
558 requirements, technological and/or market changes affect its usefulness to consumers, industry or the
559 environment. In keeping with current policy, revisions to the specification are arrived at through
560 industry discussions. In the event of a specification revision, please note that ENERGY STAR
561 certification is not automatically granted for the life of a product model.