[6450-01-P]

DEPARTMENT OF ENERGY

[Case Number 2018-003; EERE-2018-BT-WAV-0006]

Notice of Petition for Waiver of LG Electronics USA, Inc. from the Department of Energy Room Air Conditioner Test Procedure and Notice of Grant of Interim Waiver

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of petition for waiver and grant of an interim waiver, and request for comments.

SUMMARY: This document announces receipt of and publishes a petition for waiver from LG Electronics USA, Inc. ("LG"), which seeks an exemption from the U.S. Department of Energy ("DOE") test procedure used for determining the efficiency of specified room air conditioner basic models. LG seeks to use an alternate test procedure to address issues involved in testing the basic models identified in its petition. According to LG, the current DOE test procedure for room air conditioners, which provides for testing at full-load performance only, does not take into account the benefits of room air conditioners that use variable-speed compressors ("variable speed air conditioners"), with their part-load performance characteristics, and misrepresents their actual energy consumption. LG requests that it be permitted to test the specified basic models at four rating conditions instead of a single rating condition and to calculate the test unit's

weighted-average combined energy efficiency ratio (CEER), which can then be compared to the expected performance of a comparable single-speed room air conditioner across the same four rating conditions. The performance improvement would be applied to the measured performance of the variable-speed room air conditioner when tested under the high-temperature rating condition of the DOE test procedure for room air conditioners to determine the test unit's final rated CEER value. DOE grants LG an interim waiver from the DOE's room air conditioner test procedure for the specified basic models, subject to use of the alternate test procedure as set forth in the Interim Waiver Order. DOE solicits comments, data, and information concerning LG's petition and its suggested alternate test procedure to inform its final decision on LG's waiver request.

DATES: Written comments and information are requested and will be accepted on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *http://www.regulations.gov*. Alternatively, interested persons may submit comments, identified by case number "2018-003", and Docket number "EERE-2018-BT-WAV-0006," by any of the following methods:

- *Federal eRulemaking Portal*: *http://www.regulations.gov*. Follow the instructions for submitting comments.

- *E-mail*: *LG2018WAV0006@ee.doe.gov* Include the case number [Case No. 2018-003] in the subject line of the message.
- *Postal Mail*: Ms. Lucy deButts, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, Mailstop EE-5B, Petition for Waiver Case No. 2018-003, 1000 Independence Avenue, SW., Washington, DC 20585-0121. If possible, please submit all items on a compact disc ("CD"), in which case it is not necessary to include printed copies.
- *Hand Delivery/Courier*: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW., Room 6046, Washington, DC, 20024. If possible, please submit all items on a "CD", in which case it is not necessary to include printed copies.

No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting comments and additional information on this process, see section V of this document.

Docket: The docket, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at *http://www.regulations.gov*. All documents in the docket are listed in the *http://www.regulations*.gov index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket web page can be found at *http://www.regulations.gov/docket?D=EERE-2018-BT-WAV-0006*. The docket web page contains simple instruction on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through *http://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

Ms. Lucy deButts, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC 20585-0121. E-mail: *AS_Waiver_Request@ee.doe.gov*.

Sarah Butler, U.S. Department of Energy, Office of the General Counsel, Mail Stop GC-33, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585-0103. Telephone: (202) 586-1777. E-mail: *Sarah.Butler@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

I. Background and Authority

The Energy Policy and Conservation Act of 1975 ("EPCA" or "the Act"),[1] Public Law 94-163 (42 U.S.C. 6291–6317, as codified), among other things, authorizes DOE to regulate the energy efficiency of a number of consumer products and industrial equipment. Title III, Part B[2]

[1] All references to EPCA in this document refer to the statute as amended through the EPS Improvement Act of 2017, Public Law 11-115 (January 12, 2018).
[2] For editorial reasons, upon codification in the U.S. Code, Part B was re-designated Part A.

of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program that includes room air conditioners, which are the subject of this document. (42 U.S.C. 6292(a)(2))

DOE regulations set forth at 10 CFR 430.27 contain provisions that allow any interested person to seek a waiver from test procedure requirements for a particular basic model when the petitioner's basic model for which the petition for waiver was submitted contains one or more design characteristics that either (1) prevent testing according to the prescribed test procedure, or (2) cause the prescribed test procedures to evaluate the basic model in a manner so unrepresentative of its true energy consumption characteristics as to provide materially inaccurate comparative data. 10 CFR 430.27(f)(2). A petitioner must include in its petition any alternate test procedures known to the petitioner to evaluate the basic model in a manner representative of its energy consumption characteristics. 10 CFR 430.27(b)(1)(iii).

DOE may grant the waiver subject to conditions, including adherence to alternate test procedures. 10 CFR 430.27(f)(2). As soon as practicable after the granting of any waiver, DOE will publish in the *Federal Register* a notice of proposed rulemaking to amend its regulations so as to eliminate any need for the continuation of such waiver. 10 CFR 430.27(l). As soon thereafter as practicable, DOE will publish in the *Federal Register* a final rule. *Id*.

The waiver process also provides that DOE may grant an interim waiver if it appears likely that the underlying petition for waiver will be granted and/or if DOE determines that it

would be desirable for public policy reasons to grant immediate relief pending a determination on the underlying petition for waiver. 10 CFR 430.27(e)(2). Within one year of issuance of an interim waiver, DOE will either: (i) publish in the *Federal Register* a determination on the petition for waiver; or (ii) publish in the *Federal Register* a new or amended test procedure that addresses the issues presented in the waiver. 10 CFR 430.27(h)(1). When DOE amends the test procedure to address the issues presented in a waiver, the waiver will automatically terminate on the date on which use of that test procedure is required to demonstrate compliance. 10 CFR 430.27(h)(2).

II. LG's Petition for Waiver and Petition for Interim Waiver

On April 6, 2018, LG filed a petition for waiver and a petition for interim waiver from the test procedure applicable to room air conditioners set forth in appendix F. According to LG, the current DOE test procedure for room air conditioners, which provides for testing at full-load performance only (*i.e.*, at a single indoor and high-temperature outdoor operating condition), does not take into account the benefits of variable-speed room air conditioners, with their part-load performance characteristics, and misrepresents their actual energy consumption.[3] Appendix F requires room air conditioners be tested only with full-load performance, in part, as a result of DOE having previously concluded that widespread use of part-load technology in room air conditioners was not likely to be stimulated by the development of a part-load metric. 76 FR 972, 1016 (January 6, 2011).

[3] The specific basic models for which the petition applies are room air conditioner basic models LG LW2217IVSM, LG LW1817IVSM, and LG LW1517IVSM. These basic model names were provided by LG in its April 6, 2018 petition.

LG states that variable-speed room air conditioners use frequency controls constantly to adjust the compressor rotation speed to maintain the desired temperature in the home without turning the motor on and off; that the compressor responds automatically to surrounding conditions to operate in the most efficient possible manner; and that this results in both dramatic energy savings and faster cooling compared to a room air conditioner without a variable-speed compressor. LG asserted that this ability to adjust to conditions results in both dramatic energy savings and faster cooling compared to products room air conditioners without variable-speed compressors. LG further stated that variable-speed room air conditioners also have a higher/lower operating range (10 Hz to 120 Hz). LG asserts that because the DOE test procedure does not account for part-load characteristics, the results of the test procedure are not representative of the actual energy consumption of variable-speed room air conditioners.

LG also requests an interim waiver from the existing DOE test procedure. DOE will grant an interim waiver if it appears likely that the petition for waiver will be granted, and/or if DOE determines that it would be desirable for public policy reasons to grant immediate relief pending a determination of the petition for waiver. See 10 CFR 430.27(e)(2).

DOE understands that, absent an interim waiver, the test procedure does not accurately measure the energy consumption of variable-speed room air conditioners, and without waiver relief, the part-load characteristics of the basic models identified in LG's petition would not be captured.

III. Requested Alternate Test Procedure

EPCA requires that manufacturers use DOE test procedures when making representations about the energy consumption and energy consumption costs of products covered by the statute. (42 U.S.C. 6293(c)) Consistent representations are important for manufacturers to use in making representations about the energy efficiency of their products and to demonstrate compliance with applicable DOE energy conservation standards. Pursuant to its regulations applicable to waivers and interim waivers from applicable test procedures at 10 CFR 430.27, and after consideration of public comments on the petition, DOE will consider setting an alternate test procedure for the equipment identified by LG in a subsequent Decision and Order.

In its petition, LG requests testing the basic models listed in the petition according to the test procedure for room air conditioners prescribed by DOE in appendix F, except that the variable-speed room air conditioner would be tested at four rating conditions instead of a single rating condition. The suggested test conditions are presented in Table III.1.

Table III.1: Indoor and Outdoor Inlet Air Test Conditions – Variable-Speed Room Air Conditioners

Test Condition	Evaporator Inlet Air, °*F*		Condenser Inlet Air, °*F*		Compressor Speed
	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb	
Test Condition 1	80	67	95	75	Maximum
Test Condition 2	80	67	92	72.5	Maximum
Test Condition 3	80	67	87	69	Intermediate

Test Condition 4	80	67	82	65	Minimum

Under the suggested test procedure, the test unit's weighted-average combined energy efficiency ratio (CEER) metric is calculated from the individual CEER values obtained at the four rating conditions, with the weighting factors derived from the fractional temperature bin hours for each rating temperature provided in Table 19 of DOE's test procedure for central air conditioners (10 CFR part 430, subpart B, appendix M ("appendix M")). This weighted-average value is adjusted to normalize it against the expected weighted-average CEER under the same four rating conditions of a comparable single-speed room air conditioner that has the same performance as the variable-speed test unit at the 95 degree Fahrenheit (°F) test condition but differing performance at the other rating conditions due to optimization of the refrigeration system efficiency through compressor speed adjustments to better match the cooling load and eliminate cycling losses. This average performance improvement resulting from the implementation of a variable-speed compressor across multiple rating conditions would then be applied to the measured performance of the variable-speed room air conditioner when tested at the 95 °F rating condition according to appendix F to determine the test unit's final rated CEER value. LG states that this approach takes into account performance and efficiency improvements associated with variable-speed room air conditioners as compared to room air conditioners with single-speed compressors and isolates the effects just attributable to the variable speed operation.

IV. Grant of an Interim Waiver

DOE has reviewed the marketing materials, website, and brochure for the specific basic models for which this petition applies. The materials that DOE reviewed support LG's assertion of the part-load characteristics of the variable-speed room air conditioners and that the DOE test procedure may evaluate the basic models in a manner unrepresentative of their true energy consumption characteristics. In particular, the DOE test procedure does not capture the relative efficiency improvements that can be achieved by variable-speed room air conditioners over a range of operating conditions compared to single-speed room air conditioners. In the absence of an alternate test procedure, the CEER values of variable-speed room air conditioners would suggest that such room air conditioners would consume at least as much energy annually as a comparable single-speed room air conditioner, despite the anticipated benefits of improved performance under part-load conditions. Furthermore, DOE has reviewed the alternate procedure suggested by LG, along with additional performance modeling and analysis performed by DOE using rating conditions specified in an industry standard for single-package air conditioning equipment with variable speed compressors, American National Standards Institute ("ANSI")/Air-Conditioning, Heating, and Refrigeration Institute ("AHRI") Standard 210/240:2008, "Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment." Based on this review it appears that the suggested alternate test procedure, with additional specification regarding the required compressor speeds,[4] will allow for a more accurate measurement of efficiency of the specified basic models of variable-speed room air conditioners, while alleviating the testing problems associated with LG's implementation of

[4] DOE derived the specification for determining the intermediate compressor speed from the DOE test procedure provisions for central air conditioners with variable-speed compressors (section 3.2.4.a of appendix M of 10 CFR part 430 subpart B).

room air conditioner testing for the basic models specified in its petition. Specifically, the suggested alternate test procedure will produce CEER values for the variable-speed room air conditioners under the DOE test procedure's existing rating condition that will more accurately reflect the average performance improvement associated with variable-speed compressors at differing operating conditions (*i.e.*, optimization of the refrigeration system efficiency through compressor speed adjustments to better match the cooling load and eliminate cycling losses), as compared to the performance changes that comparable single-speed room air conditioners would experience under those same conditions. Consequently, it appears likely that LG's petition for waiver will be granted. Furthermore, DOE has determined that it is desirable for public policy reasons to grant LG immediate relief pending a determination of the petition for waiver.

For the reasons stated, DOE has granted an interim waiver to LG for the specified room air conditioner basic models in LG's petition.

Therefore, DOE has issued an Order, stating:

(1) LG must test and rate the following room air conditioner basic models with the alternate test procedure set forth in paragraph (2):

(A) LG LW2217IVSM, LG LW1817IVSM, and LG LW1517IVSM

(2) The alternate test procedure for the LG basic models listed in subparagraph (1)(A) is the test procedure for room air conditioners prescribed by DOE at appendix F to subpart B of 10 CFR

part 430 (Appendix F), except the combined energy efficiency ratio (CEER) will be determined as detailed below. All other requirements of Appendix F and DOE's regulations remain applicable.

In Section 1, *Definitions*, add:

1.8 "Single-speed" means a type of room air conditioner that does not automatically adjust either the compressor or fan speed, or both, based on the detected outdoor conditions.

1.9 "Variable-speed" means a type of room air conditioner that can automatically adjust compressor and fan speed, only compressor speed, or only fan speed, based on the detected outdoor conditions.

Add to the end of Section 2.1 *Cooling*:

For a variable-speed room air conditioner, the cooling mode test shall be repeated 3 additional times with alternate outdoor test conditions, as described in section 3.1 of this appendix. For a variable-speed room air conditioner, a psychrometric chamber may alternatively be used in accordance with ANSI/ASHRAE Standard 37-2009 (incorporated by reference; see §430.3), in place of a calorimeter chamber, which is required in accordance with appendix F. If using the psychrometric chamber approach, set-up and instrument the variable-speed room air conditioner in accordance with Section 5 and Section 6 of ANSI/ASHRAE Standard 37-2009, measure the indoor cooling capacity in accordance with Section 7.3 of ANSI/ASHRAE Standard 37-2009, and measure the average electrical input power in Watts at the nameplate voltage for each of the rating test condition.

Add to the end of Section 3.1, *Cooling mode*:

However, for variable-speed room air conditioners, the set of four cooling mode tests shall be conducted with the following test conditions, presented in Table 1 of this appendix.

Table 1: Indoor and Outdoor Inlet Air Test Conditions – Variable-Speed Room Air Conditioners

Test Condition	Evaporator Inlet Air, °*F*		Condenser Inlet Air, °*F*		Compressor Speed
	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb	
Test Condition 1	80	67	95	75	Maximum
Test Condition 2	80	67	92	72.5	Maximum
Test Condition 3	80	67	87	69	Intermediate
Test Condition 4	80	67	82	65	Minimum

Determine the intermediate compressor speed cited in Table 1 using:

$$Intermediate\ Speed = Minimum\ Speed + \frac{Maximum\ Speed - Minimum\ Speed}{3}$$

where a tolerance of plus 5 percent or the next higher inverter frequency step from that calculated is allowed.

Add to the end of Section 4.1, *Cooling mode*:

If using the psychrometric chamber approach for a variable-speed room air conditioner, measure the indoor cooling capacity in accordance with Section 7.3 of ANSI/ASHRAE Standard 37-2009 and measured power input in cooling mode in accordance with Section 5.4 of ANSI/ASHRAE Standard 37-2009.

Add to the end of Section 5.1:

For variable-speed room air conditioners, determine cooling capacity, $Capacity_m$, for each of the four cooling mode rating test conditions. Notwithstanding the requirements of §430.23(f), the cooling capacity used in §430.23(f) and reported in §429.15(b)(2) shall be the cooling capacity determined for test condition 1 in Table 1 of this appendix.

Add to the end of Section 5.2:

For variable-speed room air conditioners, determine electrical power input, P_m, for each of the four cooling mode rating test conditions. Notwithstanding the requirements of §430.23(f), the electrical power input used in §430.23(f) and reported in §429.15(b)(2) shall be the value measured for test condition 1 in Table 1 of this appendix.

Add following Section 5.3, *Standby mode and off mode annual energy consumption*:

5.4 *Variable-speed room air conditioner combined energy efficiency ratio.* Calculate the combined energy efficiency ratio for variable-speed room air conditioners as follows, which shall be the combined energy efficiency ratio reported in §429.15(b)(2) for variable-speed room air conditioners.

5.4.1 *Comparable single-speed room air conditioner*. Calculate the cooling capacity, expressed in British thermal units per hour (Btu/h), and electrical power input, expressed in watts, for a comparable single-speed room air conditioner at all cooling mode test conditions. A comparable single-speed room air conditioner has the same cooling capacity and electrical power input, with no cycling losses, as the variable-speed room air conditioner under test at test condition 1 in Table 1.

$$Capacity_{SS\_m} = Capacity_{95} \times (1 + (M_c \times (T_{95} - T_m)))$$

$$P_{SS\_m} = P_{95} \times (1 - (M_p \times (T_{95} - T_m)))$$

Where:

$Capacity_{SS\_m}$ = comparable single-speed room air conditioner cooling capacity, in Btu/h, calculated for each of the cooling mode test conditions in Table 1.

$Capacity_{95}$ = variable-speed room air conditioner cooling capacity, in Btu/h, determined in section 5.1 of this appendix for test condition 1 in Table 1.

P_{SS_m} = comparable single-speed room air conditioner electrical power input, in watts, calculated for each of the cooling mode test conditions in Table 1.

P_{95} = variable-speed room air conditioner electrical power input, in watts, determined in section 5.2 of this appendix for test condition 1 in Table 1.

M_c = adjustment factor to determine the increased capacity at lower outdoor test conditions, 0.0099.

M_p = adjustment factor to determine the reduced electrical power input at lower outdoor test conditions, 0.0076.

T_{95} = outdoor dry-bulb temperature for test condition 1 in Table 1, 95 °F.

T_m = outdoor dry-bulb temperature for each of the test conditions in Table 1.

m represents the cooling mode test condition ("95" test condition 1 (95 °F), "92" test condition 2 (92 °F), "87" test condition 3 (87 °F), and "82" test condition 4 (82 °F)).

5.4.2 *Variable-speed annual energy consumption for cooling mode at each cooling mode test condition.* Calculate the annual energy consumption for cooling mode under each test condition, AEC_m, expressed in kilowatt-hours per year (kWh/year).

$$AEC_m = P_m \times t \times k$$

Where:

AEC_m = variable-speed room air conditioner annual energy consumption, in kWh/year, in cooling mode for each test condition in Table 1.

P_m = electrical power input, in watts, in cooling mode for each test condition in Table 1.

m as defined in section 5.4.1 of this appendix.

t = number of annual operating hours in cooling mode, 750.

k = 0.001 kWh/Wh conversion factor from watt-hours to kilowatt-hours.

5.4.3 *Comparable single-speed room air conditioner annual energy consumption for cooling mode at each cooling mode test condition.* Calculate the annual energy consumption for a comparable single-speed room air conditioner for cooling mode under each test condition, AEC_{SS_m}, expressed in kWh/year.

$$AEC_{SS\_m} = P_{SS\_m} \times t \times k$$

Where:

AEC_{SS_m} = comparable single-speed room air conditioner annual energy consumption, in kWh/year, in cooling mode for each test condition in Table 1.

P_{SS_m} = comparable single-speed room air conditioner electrical power input, in watts, in cooling mode for each test condition in Table 1, determined in section 5.4.1 of this appendix.

m as defined in section 5.4.1 of this appendix.

t and k as defined in section 5.4.2 of this appendix.

5.4.4 *Variable-speed room air conditioner combined energy efficiency ratio at each cooling mode test condition.* Calculate the variable-speed room air conditioner combined energy efficiency ratio, $CEER_m$, for each test condition, expressed in Btu/Wh.

$$CEER_m = \frac{Capacity_m}{\left(\frac{AEC_m + E_{TSO}}{k \times t}\right)}$$

Where:

$CEER_m$ = variable-speed room air conditioner combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1.

$Capacity_m$ = variable-speed room air conditioner cooling capacity, in Btu/h, for each test condition in Table 1, determined in section 5.1 of this appendix.

AEC_m = variable-speed room air conditioner annual energy consumption, in kWh/yr, in cooling mode for each test condition in Table 1, determined in section 5.4.2 of this appendix.

E_{TSO} = standby mode and off mode annual energy consumption for room air conditioners, in kWh/year, determined in section 5.3 of this appendix.

m as defined in section 5.4.1 of this appendix.

t and k as defined in section 5.4.2 of this appendix.

5.4.5 *Comparable single-speed room air conditioner combined energy efficiency ratio at each cooling mode test condition.* Calculate the combined energy efficiency ratio for a comparable single-speed room air conditioner, $CEER_{SS\_m}$, for each test condition, expressed in Btu/Wh.

$$CEER_{SS\_m} = \frac{Capacity_{SS\_m}}{\left(\frac{AEC_{SS\_m} + E_{TSO}}{k \times t}\right)}$$

Where:

$CEER_{SS\_m}$ = comparable single-speed room air conditioner combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1.

$Capacity_{SS\_m}$ = comparable single-speed room air conditioner cooling capacity, in Btu/h, for each test condition in Table 1, in Btu/h, determined in section 5.4.1 of this appendix.

AEC_{SS_m} = comparable single-speed room air conditioner annual energy consumption for each test condition in Table 1, in kWh/year, determined in section 5.4.3 of this appendix.

E_{TSO} = standby mode and off mode annual energy consumption for room air conditioners, in kWh/year, determined in section 5.3 of this appendix.

m as defined in section 5.4.1 of this appendix.

t and k as defined in section 5.4.2 of this appendix.

5.4.6 *Comparable single-speed room air conditioner adjusted combined energy efficiency ratio for each cooling mode test condition.* Calculate the adjusted combined energy efficiency ratio for a comparable single-speed room air conditioner, $CEER_{SS\_m\_adj}$, with cycling losses considered, expressed in Btu/Wh.

$$CEER_{SS\_m\_adj} = CEER_{SS\_m} \times CLF_m$$

Where:

$CEER_{SS\_m\_adj}$ = comparable single-speed room air conditioner adjusted combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1.

$CEER_{SS\_m}$ = comparable single-speed room air conditioner adjusted combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1, determined in section 5.4.5 of this appendix.

CLF_m = cycling loss factor for each cooling mode test condition, 1 for test condition 1, 0.971 for test condition 2, 0.923 for test condition 3, and 0.875 for test condition 4.

m as defined in section 5.4.1 of this appendix.

5.4.7 *Weighted combined energy efficiency ratio.* Calculate the weighted combined energy efficiency ratio for the variable-speed room air conditioner, $CEER_{wt}$, and comparable single-speed room air conditioner, $CEER_{SS\_wt}$, expressed in Btu/Wh.

$$CEER_{wt} = \sum_m CEER_m \times W_m$$

$$CEER_{SS\_wt} = \sum_m CEER_{SS\_m\_adj} \times W_m$$

Where:

$CEER_{wt}$ = variable-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh.

$CEER_{SS\_wt}$ = comparable single-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh.

$CEER_m$ = variable-speed room air conditioner combined energy efficiency ratio, in Btu/Wh, at each test condition in Table 1, determined in section 5.4.4 of this appendix.

$CEER_{SS\_m\_adj}$ = comparable single-speed room air conditioner adjusted combined energy efficiency ratio, in Btu/Wh, at each test condition in Table 1, determined in section 5.4.6 of this appendix.

W_m = weighting factors for each cooling mode test condition, 0.05 for test condition 1, 0.16 for test condition 2, 0.31 for test condition 3, and 0.48 for test condition 4.

m as defined in section 5.4.1 of this appendix.

5.4.8 *Variable-speed room air conditioner performance adjustment factor.* Calculate the variable-speed room air conditioner performance adjustment factor, F_p.

$$F_p = \frac{\left(CEER_{wt} - CEER_{SS\_wt}\right)}{CEER_{SS\_wt}}$$

Where:

F_p = variable-speed room air conditioner performance adjustment factor.

$CEER_{wt}$ = variable-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh, determined in section 5.4.7 of this appendix.

$CEER_{SS\_wt}$ = comparable single-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh, determined in section 5.4.7 of this appendix

5.4.9 *Variable-speed room air conditioner CEER.* For variable-speed room air conditioners, multiply the combined energy efficiency ratio, CEER, expressed in Btu/Wh, determined in §430.23(f) by $(1 + F_p)$ to obtain the final CEER for variable speed room air conditioners.

Where:

F_p = variable-speed room air conditioner performance adjustment factor, determined in section 5.4.8 of this appendix."

(3) *Representations*. LG may not make representations about the energy efficiency of the basic models identified in paragraph (1) for compliance, marketing, or other purposes unless the basic models have been tested in accordance with the provisions in the alternate test procedure and such representations fairly disclose the results of such testing in accordance with 10 CFR 429.15(a).

(4) This interim waiver shall remain in effect according to the provisions of 10 CFR 430.27.

(5) This interim waiver is issued to LG on the condition that the statements, representations, and information provided by LG are valid. DOE may revoke or modify this waiver at any time if it determines the factual basis underlying the petition for waiver is incorrect, or the results from the alternate test procedure are unrepresentative of the basic models' true energy consumption characteristics. 10 CFR 430.27(k)(1). Likewise, LG may request that DOE rescind or modify the interim waiver if LG discovers an error in the information provided to DOE as part of its petition, determines that the interim waiver is no longer needed, or for other appropriate reasons. 10 CFR 430.27(k)(2).

(6) Granting of this interim waiver does not release LG from the certification requirements set forth at 10 CFR part 429.

DOE makes decisions on waivers and interim waivers for only those basic models specifically set out in the petition, not future models that may be manufactured by the petitioner. LG may submit a new or amended petition for waiver and request for grant of interim waiver, as appropriate, for additional basic models of room air conditioners. Alternatively, if appropriate, LG may request that DOE extend the scope of a waiver or an interim waiver to include additional basic models employing the same technology as the basic models set forth in the original petition consistent with 10 CFR 430.27(g).

V. Request for Comments

DOE is publishing LG's petition for waiver in its entirety, pursuant to 10 CFR 430.27(b)(1)(iv).[5] The petition includes a suggested alternate test procedure, as specified in the petition and summarized in section III of this document, to determine the efficiency of LG's specified room air conditioners. DOE may consider including the alternate procedure specified in the Interim Waiver Order, specified in section IV of this document, in a subsequent Decision and Order.

[5] The petition did not identify any of the information contained therein as confidential business information.

DOE invites all interested parties to submit in writing by [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***], comments and information on all aspects of the petition, including the alternate test procedure. Pursuant to 10 CFR 430.27(d), any person submitting written comments to DOE must also send a copy of such comments to the petitioner. The contact information for the petitioner is Scott Blake Harris, Harris, Wiltshire & Grannis LLP, 1919 M Street, NW, Eighth Floor, Washington, DC 20036.

Submitting comments via *http://www.regulations.gov*. The *http://www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

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DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include (1) a description of the items, (2) whether and why such items are customarily treated as confidential within the industry, (3) whether the information is generally known by or available from other sources, (4) whether the information has previously been made available to others without obligation concerning its confidentiality, (5) an explanation of the competitive injury to the submitting person which would result from public disclosure, (6) when such information might lose its confidential character due to the passage of time, and (7) why disclosure of the information would be contrary to the public interest.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

Signed in Washington, DC, on June 22, 2018.

Kathleen B. Hogan, Ph.D.
Deputy Assistant Secretary for Energy Efficiency
Energy Efficiency and Renewable Energy

BEFORE THE
UNITED STATES DEPARTMENT OF ENERGY
WASHINGTON, D.C. 20585

In the Matter of: Energy Efficiency Program: Test Procedure for Room Air Conditioners

Petition of LG Electronics, Inc. for Waiver and Application for Interim Waiver of Test Procedure for Room Air Conditioners

LG Electronics, Inc. (LG) respectfully submits this Petition for Waiver and Application for Interim Waiver[1] from DOE's test procedure for room air conditioners (RACs). LG seeks a waiver because the current test procedure does not accurately measure the energy consumption of RACs with variable speed compressors (VSCs). LG requests expedited treatment of the Petition and Application.

LG is a manufacturer of room air conditioners and other products sold worldwide, including in the United States. LG's United States affiliate is LG Electronics USA, Inc., with headquarters at 1000 Sylvan Avenue, Englewood Cliffs, NJ 07632 (tel. 201-816-2000). Its worldwide headquarters are located at LG Twin Towers 20, Yoido-dong, Youngdungpo-gu Seoul, Korea 150-721; (tel. 011-82-2-3777-1114); URL: http.www.LGE.com.

I. Basic Models for Which a Waiver is Requested

[1] See 10 C.F.R. § 430.27 (petitions for waiver and interim waiver).

The basic models for which a waiver is requested are set forth in the Appendix. They are distributed in commerce under the LG brand name.

II. Need for the Requested Waiver

The LG RACs with VSC technology are advanced, energy efficient products. A VSC (inverter compressor) uses frequency controls constantly to adjust the compressor's rotation speed to maintain the desired temperature in the home without turning the motor on and off. The compressor responds automatically to surrounding conditions to operate in the most efficient possible manner. This results in both dramatic energy savings and faster cooling compared to products without VSCs. RACs with VSCs also have a higher/lower operating range (10Hz to 120Hz) than those without VSC.[2]

Unfortunately, the current DOE test procedure for RACs provides that they be tested only with full-load performance.[3] Thus, the RAC test procedure does not take into account the benefits of VSC, with its part-load performance characteristics. This is unlike the DOE test procedure for central air conditioners, which provides for testing with part-load performance for VSCs.

DOE has recognized this serious shortcoming in its RAC test procedure. It has stated that this test procedure "does not measure the benefits of technologies that improve part-load performance."[4]

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[2] To the best of LG's knowledge, LG is the only manufacturer of RAC basic models distributed in commerce in the United States to incorporate design characteristic(s) similar to those found in the basic models that are the subject of this petition, namely, RAC VSC technology.

[3] 10 C.F.R. Part 430, Subpart B, Appendix F.

[4] 80 Fed. Reg. 34843, 34848 (June 18, 2015).

> The current room AC test procedure measures only the full-load performance at outdoor ambient conditions of 95 °F dry-bulb and 75 °F wet-bulb. Therefore, technologies that improve part-load performance, such as multiple-speed compressors and variable-opening expansion devices, will not improve the rated performance of a room AC under the current test procedure."[5]

Indeed, DOE has correctly stressed that, "[i]n contrast, central ACs and heat pumps are rated using multiple rating points at different conditions."[6] Finally, DOE has said it intends to investigate potential revision of the test procedure "to account for any benefits of technologies that improve part-load performance."[7]

At the moment, however, the DOE test procedure for RACs does not include any provision to account for the benefits of the part-load performance of VSCs. Therefore, the test procedure evaluates the LG models with VSCs in a manner that misrepresents their actual energy consumption. LG urges that a waiver be granted, for the basic models in the Appendix, that will allow use of the alternate test procedure discussed below. The test procedure is designed to take into account the energy savings characteristics of VSCs, and will yield results more representative of the actual energy consumption of these products than the current DOE test procedure. And the rules provide that DOE "will grant a waiver from the test procedure requirements" in these

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5 *Id.*

6 *Id.*

7 *Id.*

circumstances.[8] The waiver should continue until DOE adopts an applicable amended test procedure.

III. PROPOSED ALTERNATE TEST PROCEDURE

LG proposes the following alternate test procedure to evaluate the performance of the basic models listed in the Appendix. The alternate test procedure is the same as the existing test procedure for RACs except that it takes into account VSC part-load characteristics. It does so by providing for tests at a variety of load conditions. Specifically:

LG shall be required to test the performance of the basic models listed in the Appendix hereto according to the test procedure for room air conditioners in 10 C.F.R. Part 430, Subpart B, Appendix F, except as follows:

Add new Sections 1.8 and 1.9 to Appendix F as follows:

"1.8 "Single-speed" means a type of room air conditioner that does not automatically adjust either the compressor or fan speed, or both, based on the detected outdoor conditions.

1.9 "Variable-speed" means a type of room air conditioner that can automatically adjust compressor and fan speed, only compressor speed, or only fan speed, based on the detected outdoor conditions."

Add the following at the end of Section 2.1 of Appendix F:

"For a variable-speed room air conditioner, the cooling mode test shall be repeated 3 additional times with alternate outdoor test conditions, as described in section 3.1 of this appendix. For a variable-speed room air conditioner, a psychrometric chamber may alternatively be used in

[8] 10 C.F.R. § 430.27(f)(2).

place of a calorimeter chamber, in accordance with ANSI/ASHRAE Standard 37-2009 (incorporated by reference; see §430.3). If using the psychrometric chamber approach, set-up and instrument the variable-speed room air conditioner in accordance with Section 5 and Section 6 of ANSI/ASHRAE Standard 37-2009, measure the indoor cooling capacity in accordance with Section 7.3 of ANSI/ASHRAE Standard 37-2009, and measure the average electrical input power in Watts at the nameplate voltage for each of the rating test condition."

Add the following at the end of Section 3.1 of Appendix F:

", except, for variable-speed room air conditioners, the set of four cooling mode tests shall be conducted with the following test conditions, presented in Table 1 of this appendix.

Table 1: Indoor and Outdoor Inlet Air Test Conditions – Variable-Speed Room Air Conditioners

Test Condition	Evaporator Inlet Air, °*F*		Condenser Inlet Air, °*F*		Compressor Speed
	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb	
Test Condition 1	80	67	95	75	Maximum
Test Condition 2	80	67	92	72.5	Maximum
Test Condition 3	80	67	87	69	Intermediate
Test Condition 4	80	67	82	65	Minimum

"

Add the following at the end of Section 4.1 of Appendix F:

"If using the psychrometric chamber approach for a variable-speed room air conditioner, measure the indoor cooling capacity in accordance with Section 7.3 of ANSI/ASHRAE Standard 37-2009 and measured power input in cooling mode in accordance with Section 5.4 of

ANSI/ASHRAE Standard 37-2009."

Add the following at the end of Section 5.1 of Appendix F:

"For variable-speed room air conditioners, determine cooling capacity, $Capacity_m$, for each of the four cooling mode rating test conditions. The cooling capacity used in §430.23(f) and reported in §429.15(b)(2) shall be the cooling capacity determined for test condition 1 in Table 1 of this appendix.

Add the following at the end of Section 5.2 of Appendix F:

"For variable-speed room air conditioners, determine electrical power input, P_m, for each of the four cooling mode rating test conditions, and the electrical power input used in §430.23(f) shall be the value measured for test condition 1 in Table 1 of this appendix."

Add the following after Section 5.3 of Appendix F:

"5.4 *Variable-speed room air conditioner combined energy efficiency ratio.* Calculate the combined energy efficiency ratio for variable-speed room air conditioners as follows, which shall be the combined energy efficiency ratio reported in §429.15(b)(2) for variable-speed room air conditioners.

5.4.1 *Comparable single-speed room air conditioner*. Calculate the cooling capacity, expressed in British thermal units per hour (Btu/h), and electrical power input, expressed in watts, for a comparable single-speed room air conditioner at all cooling mode test conditions.

$$Capacity_{SS\_m} = Capacity_{95} \times (1 + (M_c \times (T_{95} - T_m)))$$

$$P_{SS\_m} = P_{95} \times (1 - (M_p \times (T_{95} - T_m)))$$

Where:

$Capacity_{SS\_m}$ = comparable single-speed room air conditioner cooling capacity, in Btu/h, calculated for each of the cooling mode test conditions in Table 1.

$Capacity_{95}$ = variable-speed room air conditioner cooling capacity, in Btu/h, determined in section 5.1 of this appendix for test condition 1 in Table 1.

P_{SS_m} = comparable single-speed room air conditioner electrical power input, in watts, calculated for each of the cooling mode test conditions in Table 1.

P_{95} = variable-speed room air conditioner electrical power input, in watts, determined in section 5.2 of this appendix for test condition 1 in Table 1.

M_c = adjustment factor to determine the increased capacity at lower outdoor test conditions, 0.0099.

M_p = adjustment factor to determine the reduced electrical power input at lower outdoor test conditions, 0.0076.

T_{95} = outdoor dry-bulb temperature for test condition 1 in Table 1, 95 °F.

T_m = outdoor dry-bulb temperature for each of the test conditions in Table 1.

m represents the cooling mode test condition (“95” test condition 1 (95 °F), “92” test condition 2 (92 °F), “87” test condition 3 (87 °F), and “82” test condition 4 (82 °F)).

5.4.2 *Variable-speed annual energy consumption for cooling mode at each cooling mode test condition.* Calculate the annual energy consumption for cooling mode under each test condition, AEC_m, expressed in kilowatt-hours per year (kWh/year).

$$AEC_m = P_m \times t \times k$$

Where:

AEC_m = variable-speed room air conditioner annual energy consumption, in kWh/year, in cooling mode for each test condition in Table 1.

P_m = electrical power input, in watts, in cooling mode for each test condition in Table 1.

m as defined in section 5.4.1 of this appendix.

t = number of annual operating hours in cooling mode, 750.

k = 0.001 kWh/Wh conversion factor from watt-hours to kilowatt-hours.

5.4.3 *Comparable single-speed room air conditioner annual energy consumption for cooling mode at each cooling mode test condition.* Calculate the annual energy consumption for a comparable single-speed room air conditioner for cooling mode under each test condition, AEC_{SS_m}, expressed in kWh/year.

$$AEC_{SS\_m} = P_{SS\_m} \times t \times k$$

Where:

AEC_{SS_m} = comparable single-speed room air conditioner annual energy consumption, in kWh/year, in cooling mode for each test condition in Table 1.

P_{SS_m} = comparable single-speed room air conditioner electrical power input, in watts, in cooling mode for each test condition in Table 1, determined in section 5.4.1 of this appendix.

m as defined in section 5.4.1 of this appendix.

t and k as defined in section 5.4.2 of this appendix.

5.4.4 *Variable-speed room air conditioner combined energy efficiency ratio at each cooling mode test condition.* Calculate the variable-speed room air conditioner combined energy efficiency ratio, $CEER_m$, for each test condition, expressed in Btu/Wh.

$$CEER_m = \frac{Capacity_m}{\left(\frac{AEC_m + E_{TSO}}{k \times t}\right)}$$

Where:

$CEER_m$ = variable-speed room air conditioner combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1.

$Capacity_m$ = variable-speed room air conditioner cooling capacity, in Btu/h, for each test condition in Table 1, determined in section 5.1 of this appendix.

AEC_m = variable-speed room air conditioner annual energy consumption, in kWh/yr, in cooling mode for each test condition in Table 1, determined in section 5.4.2 of this appendix.

E_{TSO} = standby mode and off mode annual energy consumption for room air conditioners, in kWh/year, determined in section 5.3 of this appendix.

m as defined in section 5.4.1 of this appendix.

t and k as defined in section 5.4.2 of this appendix.

5.4.5 *Comparable single-speed room air conditioner combined energy efficiency ratio at each cooling mode test condition.* Calculate the combined energy efficiency ratio for a comparable single-speed room air conditioner, $CEER_{SS\_m}$, for each test condition, expressed in Btu/Wh.

$$CEER_{SS\_m} = \frac{Capacity_{SS\_m}}{\left(\frac{AEC_{SS\_m} + E_{TSO}}{k \times t}\right)}$$

Where:

$CEER_{SS\_m}$ = comparable single-speed room air conditioner combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1.

$Capacity_{SS\_m}$ = comparable single-speed room air conditioner cooling capacity, in Btu/h, for each test condition in Table 1, in Btu/h, determined in section 5.4.1 of this appendix.

AEC_{SS_m} = comparable single-speed room air conditioner annual energy consumption for each test condition in Table 1, in kWh/year, determined in section 5.4.3 of this appendix.

E_{TSO} = standby mode and off mode annual energy consumption for room air conditioners, in kWh/year, determined in section 5.3 of this appendix.

m as defined in section 5.4.1 of this appendix.

t and k as defined in section 5.4.2 of this appendix.

5.4.6 *Comparable single-speed room air conditioner adjusted* c*ombined energy efficiency ratio for each cooling mode test condition.* Calculate the adjusted combined energy efficiency ratio for a comparable single-speed room air conditioner, $CEER_{SS\_m\_adj}$, with cycling losses considered, expressed in Btu/Wh.

$$CEER_{SS\_m\_adj} = CEER_{SS\_m} \times CLF_m$$

Where:

$CEER_{SS\_m\_adj}$ = comparable single-speed room air conditioner adjusted combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1.

$CEER_{SS\_m}$ = comparable single-speed room air conditioner adjusted combined energy efficiency ratio, in Btu/Wh, for each test condition in Table 1, determined in section 5.4.5 of this appendix.

CLF_m = cycling loss factor for each cooling mode test condition, 1 for test condition 1, 0.971 for test condition 2, 0.923 for test condition 3, and 0.875 for test condition 4.

m as defined in section 5.4.1 of this appendix.

5.4.7 *Weighted combined energy efficiency ratio.* Calculate the weighted combined energy efficiency ratio for the variable-speed room air conditioner, $CEER_{wt}$, and comparable single-speed room air conditioner, $CEER_{SS\_wt}$, expressed in Btu/Wh.

$$CEER_{wt} = \sum_m CEER_m \times W_m$$

$$CEER_{SS\_wt} = \sum_m CEER_{SS\_m\_adj} \times W_m$$

Where:

$CEER_{wt}$ = variable-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh.

$CEER_{SS\_wt}$ = comparable single-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh.

$CEER_m$ = variable-speed room air conditioner combined energy efficiency ratio, in Btu/Wh, at each test condition in Table 1, determined in section 5.4.4 of this appendix.

$CEER_{SS\_m\_adj}$ = comparable single-speed room air conditioner adjusted combined energy efficiency ratio, in Btu/Wh, at each test condition in Table 1, determined in section 5.4.6 of this appendix.

W_m = weighting factors for each cooling mode test condition, 0.05 for test condition 1, 0.16 for test condition 2, 0.31 for test condition 3, and 0.48 for test condition 4.

m as defined in section 5.4.1 of this appendix.

5.4.8 *Variable-speed room air conditioner performance adjustment factor.* Calculate the variable-speed room air conditioner performance adjustment factor, F_p.

$$F_p = \frac{\left(CEER_{wt} - CEER_{SS\_wt}\right)}{CEER_{SS\_wt}}$$

Where:

F_p = variable-speed room air conditioner performance adjustment factor.

$CEER_{wt}$ = variable-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh, determined in section 5.4.7 of this appendix.

$CEER_{SS\_wt}$ = comparable single-speed room air conditioner weighted combined energy efficiency ratio, in Btu/Wh, determined in section 5.4.7 of this appendix

5.4.9 *Variable-speed room air conditioner CEER.* For variable-speed room air conditioners, multiply the combined energy efficiency ratio, CEER, expressed in Btu/Wh, determined in §430.23(f) by $(1 + F_p)$ to obtain the final CEER for variable speed room air conditioners.

Where:

F_p = variable-speed room air conditioner performance adjustment factor, determined in section 5.4.8 of this appendix."

IV. APPLICATION FOR INTERIM WAIVER

LG also hereby applies for an interim waiver of the applicable test procedure requirements for the LG basic models set forth in the Appendix. LG meets the criteria for an interim waiver.

LG's Petition for Waiver is likely to be granted because the test method contained in 10 C.F.R. Part 430, Subpart B, Appendix F clearly does not address the VSC characteristics of these LG basic models. Thus, the test procedure does not accurately measure their energy consumption. Without waiver relief, LG would be subject to requirements that are inapplicable to these products. Additionally, LG will suffer economic hardship and be at a competitive disadvantage if it must wait to rate these basic models pending a determination on the petition for waiver.

DOE approval of LG's interim waiver application is also supported by sound public policy. These LG products employ advanced technology that increases efficiency and reduces energy consumption, while offering a new level of affordable comfort to consumers.

V. CONCLUSION

LG respectfully requests that DOE grant its Petition for Waiver of the applicable test procedure for specified basic models, and also grant its Application for Interim Waiver.

LG requests expedited treatment of the Petition and Application.

Respectfully submitted,

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Counsel to LG Electronics USA, Inc.

April 6, 2018

APPENDIX

The waiver and interim waiver requested herein should apply to testing and rating of the following basic models that are manufactured by LG:

LW2217IVSM

LW1817IVSM

LW1517IVSM