



ENERGY STAR® Program Requirements Product Specification for Residential Climate Controls

Test Method – Usability Rev. DRAFT (Nov-2010)

1 OVERVIEW

2 The following test method shall be used for determining product compliance with the Performance-Based
3 Usability Requirements in the ENERGY STAR Eligibility Criteria for Residential Climate Controls.

2 APPLICABILITY

5 This ENERGY STAR Test Method is applicable to Residential Climate Controls subject to Performance-
6 Based Usability Testing, as described in the ENERGY STAR Residential Climate Controls Specification.

3 DEFINITIONS

8 Unless otherwise specified, all terms used in this document are consistent with the definitions contained
9 in the ENERGY STAR Eligibility Criteria for Residential Climate Controls.

- 10 • Panelist: An individual member of the usability test panel.
- 11 • Usability Test Panel: A group of persons, recruited by the test laboratory in accordance with
12 selection criteria included in this test method. Members of this group are responsible for
13 individually performing usability tasks on the UUT in accordance with this test method.
- 14 • UUT: Unit Under Test

4 USABILITY TEST PANEL SELECTION

16 A) Panel size: 21 individuals

17 B) Panel Composition:

18 1) The 21-member usability test panel shall concurrently meet the following three requirements:

- 19 i) Represented Age Group,
- 20 ii) Gender;
- 21 iii) Level of Education, and
- 22 iv) Vision.

23 2) The details for these four requirements include:

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- 25 i) Age Groups
 - 26 ▪ Age 20–34 – 6-individuals
 - 27 ▪ Age 35–49 – 6-individuals
 - 28 ▪ Age 50–64 – 6-individuals
 - 29 ▪ Age 65–79 – 3-individuals

- 30 ii) Gender Composition
 - 31 • 50% each male and female individuals, plus one of either gender.

- 32 iii) Level of Education
 - 33 • Less than High-School Education – 3-individuals
 - 34 • High-School Graduate & Less than Bachelor’s Degree – 12-individuals
 - 35 • Bachelor’s Degree or Higher – 6-individuals

- 36 iv) Vision
 - 37 • No Color Vision Deficiency – 20-individuals
 - 38 • Red-Green Color Vision Deficiency – 1-individual (male)

39 **Note:** In response to stakeholder concerns about the “reference device”, EPA is releasing this draft with a
 40 relatively large panel size designed to provide more reproducible test results. In the long term, we think a
 41 reference device has potential to increase the reproducibility of the tests. EPA sees three options for
 42 adjusting the panel size and providing a reference.

- 43 1) Use the test as described here.
- 44 2) Use a smaller panel and a reference device for each task. The reference device would not be intended
 45 to reflect the best available solution, but rather a common solution. There would be no single device that
 46 can act as a reference for all tests; instead, different devices would be chosen for different tests.
 47 Usability experts that we spoke to felt this was not a good idea, in addition to stakeholder concerns about
 48 possible advantages to some manufacturers arising from the choice of reference.
- 49 3) Use a “virtual reference”, a unit programmed on a small touchscreen device such as an Android phone
 50 or iPhone. The device would provide the user with the apparent functionality of a thermostat. This could
 51 be designed either to be the best available technology or to be a functionally sufficient solution. EPA
 52 believes that in the long term, this is the best option for the test, and intends to pursue it in subsequent
 53 revisions of the test method. Ideally, the virtual reference would be developed by industry. However,
 54 EPA will make contingency plans to develop it.

55 The December 14th meeting will include a targeted discussion of these options.

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 57 The usability test panel composition is designed be representative of U.S. demographics on a National
 58 basis. Age group, Gender and Level of Education percentages are based on 2000 U.S. census data.
 59 Vision percentages are based on National Institute of Health data.

60 The 2000 U.S. census data indicates that 9% Speak English “less than very well.” EPA is considering
 61 adding appropriate representation in the panel for the U.S. population segment where English is not the
 62 primary spoken language at home.

63 Data from the 2010 U.S. census is expected to be released in the December 2010 timeframe. EPA will
 64 evaluate this data and adjust the usability test panel composition, if warranted.

- 65 3) Other Panelist Requirements:
 - 66 i) U.S. resident.
 - 67 ii) No prior experience with the UUT.

- 68 iii) No association or prior involvement with the HVAC or related industries, including family
- 69 members associated with the company providing the UUT.
- 70 iv) No financial interest associated with the UUT or its manufacture, including stocks, bonds or
- 71 other investments.
- 72 v) No other conflicts of interest that could unfairly influence test results.

73 **Note:** Panelist requirements are designed to help ensure that the panel is impartial and representative of
 74 the U.S. market.

75 **Discussion Point:** Are there additional panelist restrictions or requirements that should be considered?

76 5 PERFORMANCE-BASED USABILITY REQUIREMENTS

77 Usability test requirements, to be used with this test method, are detailed in Section 3 of the ENERGY
 78 STAR Program Requirements for Residential Climate Controls – Eligibility Criteria, including the usability
 79 metric and compliance criteria.

80 6 TEST PROCEDURE

81 A) Test Equipment

82 **Table 1: Test Equipment**

Test Equipment	Measurement / units	Measurement Accuracy (minimum)
Humidistat	Relative Humidity / %	± 5%
Thermometer	Ambient Temperature / °F	± 0.5°F
Sound Level Meter	Ambient Noise / dB SPL	± 2dB SPL
Stopwatch	Test Interval / s	± 0.5s

83 **Note:** Specified measurement accuracy is intended to permit suitable measurements to be performed
 84 with low-cost test instrumentation.

85 B) Test Administration:

- 86 1) Usability testing shall be conducted by test administrator(s) who shall:
 - 87 i) Configure UUT
 - 88 ii) Ensure test environment is orderly, quiet and comfortable
 - 89 iii) Provide verbal instructions to each panelist in accordance with the Residential Climate
 - 90 Controls Test Administrator Script, included as Annex A
 - 91 iv) Observe task performance
 - 92 v) Assess and record task success
 - 93 vi) Measure and record time to complete

94 2) Test administrators shall not offer additional guidance or assistance beyond the Residential
95 Climate Controls Test Administrator Script.

96 **Note:** EPA intends for test administrator(s) to explain required the tasks, time to complete limits and data
97 collection process to the panelists. Test administrator(s) are required to observe task performance in
98 order to assess task success. The administrator should help to provide a comfortable orderly environment
99 so that panelists may focus on task completion. The administrator is not allowed to offer guidance or
100 coaching, and should not add stress, for example, by closely peering over the panelist's shoulder while
101 observing.

102 **Note:** The Residential Climate Controls Test Administrator Script is under development and will be added
103 to a subsequent draft. With the goal of enhanced repeatability across multiple usability panels and test
104 laboratories, EPA believes that a standardized test administrator script is of high importance.

105 **Discussion Points:** Are there additional administrator requirements that should be added? Can wording
106 be improved to better achieve the above goals?

107 C) UUT Configuration: The test sample shall be configured for operation prior to the start of each day of
108 usability testing. Configuration shall be verified to be correct prior to each test iteration. UUT
109 configuration shall be accurately documented and shall include the following steps:

- 110 1) Ensure that UUT configuration is "as shipped"; reset configuration to "as shipped" if required.
- 111 2) Perform minimal configuration so that UUT functionality is representative of a typical installation.
- 112 3) Configure the UUT with *incorrect* values for the month, date, year, and time. If the UUT date and
113 time is automatically configured, this step may not be possible. If this is the case, document and
114 skip this step.

115 **Note:** UUT configuration has been minimized in order to simplify test administration and minimize
116 expense.

117 **Discussion Points:** Are additional instructions required? Should EPA require the configuration of
118 additional settings such as type of HVAC, number of stages, etc. before testing may be performed?

119 D) Test Setup:

- 120 1) **UUT Mounting** shall be representative of typical home installations. The UUT shall be affixed to a
121 wall in its normal orientation, with the center of the device 5 feet above the floor. Use of alternate
122 test heights are permitted in cases where a 5-foot height is problematic for the panelist. As an
123 example, a mounting height of 3 ½ feet above the floor will better suit a panelist confined to a
124 wheel chair.

125 **Note:** Climate Control (thermostat) mounting height is not specified by the National Electrical Code and is
126 often loosely specified in installation instructions. "Approximately 5 feet from the floor" is a rule of thumb
127 for installation height and thus, a 5-foot height has been specified for this test method. EPA considers it
128 important that the UUT installation and panelist interaction be representative of typical installations; for
129 example, with the UUT mounted on a wall and the panelist standing during all interactions with the
130 device.

- 131 2) **Written User Documentation** (included in "as shipped" product) shall be readily available to the
132 panelists during testing. User documentation shall be placed on a small shelf, wall-mounted
133 document bin, table or other similar, readily-accessible location.

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Note: A test administrator will indicate to each panelist the availability of user documentation. The test script will include associated verbiage such as "...should you desire to consult it, user documentation is available for your use" to signal that use of this documentation is optional.

- 3) **Current Date and Time** shall be clearly posted. Date shall be in MMM DD, YYYY format (e.g. "JAN 18, 2012"). Time shall be indicated with a digital clock and shall be in HH:MM 12-hour format (e.g., "12:30 PM").
- 4) **Test Environment** shall be quiet and dedicated to usability testing. Examples of suitable spaces include a meeting room, vacant office, or similar work space. The following environmental parameters shall be maintained during usability testing:
 - i) Ambient Temperature (heating season): $70 \pm 2^{\circ}\text{F}$
 - ii) Ambient Temperature (cooling season): $78 \pm 2^{\circ}\text{F}$
 - iii) Relative Humidity: 20 – 60%
 - iv) Ambient Noise: ≤ 45 dB SPL
- E) **Usability Tasks:** Each panelist shall perform each of the following usability tasks, in sequence, one time only.
 - 1) **Task 1:** Set Date & Time – The product shall be provided in HVAC Heat mode with the default program schedule active and the default or home screen displayed. The product shall be provided with an incorrect date & time – user shall be provided with the current date in the MM DD, YYYY format and a digital clock displaying current time. User shall be instructed to set the current date and time in the product.
 - 2) **Task 2:** Turn on Heat – The product shall be provided in HVAC Off mode with the default or home screen displayed – user shall be instructed to set the product to HVAC Heat mode at an active setpoint of 68°F .
 - 3) **Task 3:** Identify Room Temperature and Setpoint – The product shall be provided in HVAC Heat mode with the default or home screen displayed – user shall be instructed to identify and read aloud the current room temperature and active setpoint.
 - 4) **Task 4:** Activate/Cancel Away Mode – The product shall be provided in HVAC Cool mode with the default program schedule active and the default or home screen displayed – user shall be instructed to verbally announce, "Away mode activated," after setting the product to a mode that will immediately initiate a constant energy saving Cool setpoint and maintain it until cancelled. After activation of Away mode, the user shall be instructed to verbally announce, "Away mode cancelled," after returning the product to follow the default program schedule in HVAC Cool mode.
 - 5) **Task 5:** Modify Program Schedule – The product shall be provided in HVAC Heat mode with the default ENERGY STAR program schedule active and the default or home screen displayed – user shall be instructed to configure and save the following changes to the default Climate Control schedule; and to set the product to follow the modified schedule in HVAC Heat mode:

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Table 2: Residential Climate Control – Program Modifications

Day	Time	Setpoint (Heat)	Setpoint (Cool)
Monday	5 a.m.	68°F	80°F
	7 a.m.	60°F	87°F
	4:30 p.m.	68°F	80°F
	10 p.m.	65°F	80°F
Saturday	9 a.m.	68°F	80°F
	11 p.m.	65°F	80°F

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- 6) **Task 6:** Identify Energy Rate Tier – The product shall be configured to display Time of Use pricing information; it shall be provided in HVAC Heat mode with the default or home screen displayed – user shall be instructed to identify and read aloud the current energy rate tier or energy price as applicable.

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Note: Tasks are ordered from simpler to more complex. In some, but not all, cases usability tasks may relate to prescriptive path requirements. In order to avert a larger comprehensive set of tasks required to ensure a 1:1 mapping between prescriptive requirements and performance-based testing, a smaller, representative sampling of usability tasks was selected.

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F) Usability Task Parameters

Table 3-2: Residential Climate Control – Usability Task Parameters

Task Number	Max Time to Complete (s)	Target Time to Complete (s)	k_i
1 – Set Date & Time	300	120	$k_1 = 194$
2 – Turn On Heat	60	10	$k_2 = 16$
3 – Identify Room Temperature and Setpoint	30	5	$k_3 = 8.0$
4 – Activate/Cancel Away Mode	90	15	$k_4 = 24$
5 – Modify Program Schedule	600	180	$k_5 = 291$
6 – Identify Energy Rate Tier	30	5	$k_6 = 8.0$

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G) Data Collection:

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- 1) Ambient temperature, relative humidity, and ambient noise shall be measured and recorded prior to the start of each day of usability testing.

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- 2) Usability test data shall be recorded for each of the 21 test iterations for each task, as follows:

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i) Test Date

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ii) Start Time

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iii) Task success

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- s=0, task completed incorrectly or not-within allotted time, or

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- s=1, task completed correctly within allotted time

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iv) Time to complete, if s=1

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The format and method for data collection and recording shall be determined by the test laboratory. Sample data sheets are included in Annex B, for guidance. Excel 2003 based electronic versions shall also available on the ENERGY STAR website.

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197 **ANNEX A: RESIDENTIAL CLIMATE CONTROLS TEST**
198 **ADMINISTRATOR SCRIPT**

199 *Climate control test administrator script is currently under development.*

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207 **ANNEX B: SAMPLE DATA SHEETS**

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209 The following pages include sample data sheets for recording data from each of the six tasks that
210 comprise the ENERGY STAR Residential Climate Controls Test Method for Usability.

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212 Electronic versions of these documents will also be made available on the ENERGY STAR website in
213 their final form.

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ENERGY STAR Usability Data Sheet - Task 1
Set Date & Time

Test Laboratory: _____	Ambient Temperature: _____
Test Date(s): _____	Relative Humidity: _____
DUT Manufacturer: _____	Ambient Noise: _____
DUT Model: _____	
DUT s/n: _____	
DUT Rev: _____	
DUT Firmware ID: _____	

If $t_1 \geq 300$ s, or task is completed erroneously; enter $s = 0$

Usability Panelist No.	Test Date (MM/DD/YYYY)	Start Time (HH:MM AM/PM)	s (0 or 1)	t_2 (s)	M_2 (0 - 100)
1	11/11/2010	8:00AM	1	100	74.8
2	11/11/2010	8:00AM	1	55	85.9
3	11/11/2010	8:00AM	1	90	77.2
4	11/11/2010	8:00AM	1	89	77.5
5	11/11/2010	8:00AM	1	140	65.4
6	11/11/2010	8:30AM	1	130	67.7
7	11/11/2010	8:30AM	1	55	85.9
8	11/11/2010	8:30AM	1	67	82.9
9	11/11/2010	8:30AM	1	59	84.9
10	11/11/2010	9:00AM	1	120	70.0
11	11/11/2010	8:30AM	1	100	74.8
12	11/11/2010	8:30AM	1	69	82.4
13	11/11/2010	8:30AM	1	70	82.2
14	11/11/2010	9:00AM	1	120	70.0
15	11/11/2010	9:00AM	0		0.0
16	11/11/2010	8:30AM	0		0.0
17	11/11/2010	8:30AM	0		0.0
18	11/11/2010	9:00AM	1	120	70.0
19	11/11/2010	9:00AM	0		0.0
20	11/11/2010	9:00AM	1	45	88.5
21	11/11/2010	9:00AM	1	50	87.2

$$M_i = \frac{200s}{1 + e^{x_i}}$$

$$M_i(\text{avg}) = \frac{M_i(\text{user 1}) + M_i(\text{user 2}) + \dots + M_i(\text{user 21})}{21}$$

where $x_i = t_i/k_i$
 t_i = time to complete task i (seconds)
 k_i = constant for task i
 $k_1 = 194$ for task 1

$s = 0$ if task is completed erroneously or not completed within allotted time
 $s = 1$ if task is completed correctly, within allotted time

$M_1(\text{avg}) = 63.2$
Task Compliance: PASS

ENERGY STAR Usability Data Sheet - Task 2
Turn on Heat

Test Laboratory: _____	Ambient Temperature: _____
Test Date(s): _____	Relative Humidity: _____
DUT Manufacturer: _____	Ambient Noise: _____
DUT Model: _____	
DUT s/n: _____	
DUT Rev: _____	
DUT Firmware ID: _____	

If $t_2 \geq 60$ s, or task is completed erroneously; enter $s = 0$

Usability Panelist No.	Test Date (MM/DD/YYYY)	Start Time (HH:MM AM/PM)	s (0 or 1)	t_2 (s)	M_2 (0 - 100)
1	11/11/2010	8:30AM	1	5	84.5
2	11/11/2010	8:30AM	1	5	84.5
3	11/11/2010	8:30AM	1	4	87.6
4	11/11/2010	8:30AM	1	6	81.5
5	11/11/2010	8:30AM	1	6	81.5
6	11/11/2010	9:00AM	1	4	87.6
7	11/11/2010	9:00AM	1	3	90.7
8	11/11/2010	8:30AM	1	6	81.5
9	11/11/2010	8:30AM	1	6	81.5
10	11/11/2010	9:00AM	1	4	87.6
11	11/11/2010	9:30AM	1	6	81.5
12	11/11/2010	9:30AM	0		0.0
13	11/11/2010	9:30AM	1	12	64.2
14	11/11/2010	8:30AM	0		0.0
15	11/11/2010	8:30AM	0		0.0
16	11/11/2010	8:30AM	1	6	81.5
17	11/11/2010	8:30AM	1	6	81.5
18	11/11/2010	9:00AM	1	4	87.6
19	11/11/2010	9:00AM	0		0.0
20	11/11/2010	9:00AM	0		0.0
21	11/11/2010	9:30AM	1	10	69.7

$$M_i = \frac{200s}{1 + e^{x_i}}$$

$$M_i(\text{avg}) = \frac{M_i(\text{user 1}) + M_i(\text{user 2}) + \dots + M_i(\text{user 21})}{21}$$

where:

i = task number

$x_i = t_i / k_i$

t_i = time to complete task i (seconds)

k_i = constant for task i

$k_2 = 16$ for task 2

$s = 0$ if task is completed erroneously or not completed within allotted time

$s = 1$ if task is completed correctly, within allotted time

$M_2(\text{avg}) = 62.6$
Task Compliance: PASS

ENERGY STAR Usability Data Sheet - Task 3
Identify Room Temp & Setpoint

Test Laboratory: _____	Ambient Temperature: _____
Test Date(s): _____	Relative Humidity: _____
DUT Manufacturer: _____	Ambient Noise: _____
DUT Model: _____	
DUT s/n: _____	
DUT Rev: _____	
DUT Firmware ID: _____	

If $t_3 \geq 30$ s, or task is completed erroneously; enter s = 0

Usability Panelist No.	Test Date (MM/DD/YYYY)	Start Time (HH:MM AM/PM)	s (0 or 1)	t_2 (s)	M_2 (0 - 100)
1	11/11/2010	9:00AM	1	5	69.7
2	11/11/2010	9:00AM	1	2	87.6
3	11/11/2010	9:00AM	1	3	81.5
4	11/11/2010	9:00AM	1	6	64.2
5	11/11/2010	9:00AM	1	6	64.2
6	11/11/2010	9:30AM	1	4	75.5
7	11/11/2010	9:30AM	1	2	87.6
8	11/11/2010	9:30AM	1	2	87.6
9	11/11/2010	9:30AM	1	3	81.5
10	11/11/2010	9:30AM	1	3	81.5
11	11/11/2010	10:00AM	1	6	64.2
12	11/11/2010	10:00AM	1	3	81.5
13	11/11/2010	9:00AM	1	2	87.6
14	11/11/2010	9:00AM	1	3	81.5
15	11/11/2010	9:00AM	1	6	64.2
16	11/11/2010	9:00AM	1	6	64.2
17	11/11/2010	9:30AM	1	4	75.5
18	11/11/2010	9:30AM	1	2	87.6
19	11/11/2010	9:30AM	1	2	87.6
20	11/11/2010	9:30AM	1	3	81.5
21	11/11/2010	10:00AM	1	5	69.7

$$M_i = \frac{200s}{1 + e^{x_i}}$$

$$M_i(\text{avg}) = \frac{M_i(\text{user 1}) + M_i(\text{user 2}) + \dots + M_i(\text{user 21})}{21}$$

$M_3(\text{avg}) = 77.4$
Task Compliance: PASS

where: i = task number
 $x_i = t_i / k_i$
 t_i = time to complete task i (seconds)
 k_i = constant for task i
 $k_3 = 8.0$ for task 3

$s = 0$ if task is completed erroneously or not completed within allotted time
 $s = 1$ if task is completed correctly, within allotted time

**ENERGY STAR Usability Data Sheet - Task 4
Activate & Cancel Away Mode**

Test Laboratory: _____	Ambient Temperature: _____
Test Date(s): _____	Relative Humidity: _____
DUT Manufacturer: _____	Ambient Noise: _____
DUT Model: _____	
DUT s/n: _____	
DUT Rev: _____	
DUT Firmware ID: _____	

If $t_4 \geq 90$ s, or task is completed erroneously; enter $s = 0$

Usability Panelist No.	Test Date (MM/DD/YYYY)	Start Time (HH:MM AM/PM)	s (0 or 1)	t_2 (s)	M_2 (0 - 100)
1	11/11/2010	9:30AM	1	10	79.5
2	11/11/2010	9:30AM	1	11	77.5
3	11/11/2010	9:30AM	1	20	60.6
4	11/11/2010	9:30AM	1	5	89.6
5	11/11/2010	9:30AM	0		0.0
6	11/11/2010	10:00AM	1	12	75.5
7	11/11/2010	10:00AM	1	14	71.6
8	11/11/2010	10:00AM	1	15	69.7
9	11/11/2010	10:00AM	1	8	83.5
10	11/11/2010	9:30AM	1	20	60.6
11	11/11/2010	9:30AM	1	5	89.6
12	11/11/2010	9:30AM	0		0.0
13	11/11/2010	10:00AM	1	12	75.5
14	11/11/2010	10:00AM	1	14	71.6
15	11/11/2010	10:00AM	1	15	69.7
16	11/11/2010	10:00AM	1	8	83.5
17	11/11/2010	10:00AM	1	8	83.5
18	11/11/2010	10:30AM	1	7	85.5
19	11/11/2010	10:30AM	1	6	87.6
20	11/11/2010	10:30AM	1	8	83.5
21	11/11/2010	10:30AM	1	9	81.5

$$M_i = \frac{200s}{1 + e^{x_i}}$$

$$M_i(\text{avg}) = \frac{M_i(\text{user 1}) + M_i(\text{user 2}) + \dots + M_i(\text{user 21})}{21}$$

where: i = task number

$x_i = t_i / k_i$

t_i = time to complete task i (seconds)

k_i = constant for task i

$k_4 = 24$ for task 4

$s = 0$ if task is completed erroneously or not completed within allotted time

$s = 1$ if task is completed correctly, within allotted time

**$M_4(\text{avg}) = 70.5$
Task Compliance: PASS**

ENERGY STAR Usability Data Sheet - Task 5
Modify Program Schedule

Test Laboratory: _____	Ambient Temperature: _____
Test Date(s): _____	Relative Humidity: _____
DUT Manufacturer: _____	Ambient Noise: _____
DUT Model: _____	
DUT s/n: _____	
DUT Rev: _____	
DUT Firmware ID: _____	

If $t_5 \geq 360$ s, or task is completed erroneously; enter $s = 0$

Usability Panelist No.	Test Date (MM/DD/YYYY)	Start Time (HH:MM AM/PM)	s (0 or 1)	t_2 (s)	M_2 (0 - 100)
1	11/11/2010	10:00AM	1	140	76.4
2	11/11/2010	10:00AM	1	120	79.7
3	11/11/2010	10:00AM	1	210	65.4
4	11/11/2010	10:00AM	1	190	68.5
5	11/11/2010	10:00AM	1	50	91.4
6	11/11/2010	10:30AM	1	100	83.0
7	11/11/2010	10:30AM	1	340	47.4
8	11/11/2010	10:30AM	1	130	78.0
9	11/11/2010	10:30AM	1	100	83.0
10	11/11/2010	10:30AM	1	87	85.2
11	11/11/2010	10:00AM	1	190	68.5
12	11/11/2010	10:00AM	1	57	90.2
13	11/11/2010	10:30AM	1	100	83.0
14	11/11/2010	10:30AM	1	340	47.4
15	11/11/2010	10:30AM	1	130	78.0
16	11/11/2010	10:30AM	1	100	83.0
17	11/11/2010	10:30AM	1	87	85.2
18	11/11/2010	11:00AM	1	99	83.2
19	11/11/2010	11:00AM	1	110	81.3
20	11/11/2010	11:00AM	1	130	78.0
21	11/11/2010	11:00AM	1	125	78.8

$$M_i = \frac{200s}{1 + e^{-x_i}}$$

$$M_i(\text{avg}) = \frac{M_i(\text{user 1}) + M_i(\text{user 2}) + \dots + M_i(\text{user 21})}{21}$$

where i = task number
 $x_i = t_i/k_i$
 t_i = time to complete task i (seconds)
 k_i = constant for task i
 $k_5 = 291$ for task 5

$s = 0$ if task is completed erroneously or not completed within allotted time
 $s = 1$ if task is completed correctly, within allotted time

$M_5(\text{avg}) = 76.9$
Task Compliance: PASS

ENERGY STAR Usability Data Sheet - Task 6 Identify Energy Rate Tier

Test Laboratory: _____	Ambient Temperature: _____
Test Date(s): _____	Relative Humidity: _____
DUT Manufacturer: _____	Ambient Noise: _____
DUT Model: _____	
DUT s/n: _____	
DUT Rev: _____	
DUT Firmware ID: _____	

If $t_5 \geq 30$ s, or task is completed erroneously; enter s = 0

Usability Panelist No.	Test Date (MM/DD/YYYY)	Start Time (HH:MM AM/PM)	s (0 or 1)	t_2 (s)	M_2 (0 - 100)
1	11/11/2010	10:30AM	1	5	69.7
2	11/11/2010	10:30AM	1	4	75.5
3	11/11/2010	10:30AM	1	3	81.5
4	11/11/2010	10:30AM	1	3	81.5
5	11/11/2010	10:30AM	1	3	81.5
6	11/11/2010	11:00AM	1	6	64.2
7	11/11/2010	11:00AM	1	6	64.2
8	11/11/2010	11:00AM	1	4	75.5
9	11/11/2010	11:00AM	1	5	69.7
10	11/11/2010	10:30AM	1	4	75.5
11	11/11/2010	10:30AM	1	3	81.5
12	11/11/2010	10:30AM	1	3	81.5
13	11/11/2010	10:30AM	1	4	75.5
14	11/11/2010	11:00AM	1	6	64.2
15	11/11/2010	11:00AM	1	23	10.7
16	11/11/2010	11:00AM	1	4	75.5
17	11/11/2010	11:00AM	1	6	64.2
18	11/11/2010	11:30AM	1	4	75.5
19	11/11/2010	11:30AM	1	8	53.8
20	11/11/2010	11:30AM	1	2	87.6
21	11/11/2010	11:30AM	1	3	81.5

$$M_i = \frac{200s}{1 + e^{x_i}}$$

$$M_i(\text{avg}) = \frac{M_i(\text{user 1}) + M_i(\text{user 2}) + \dots + M_i(\text{user 21})}{21}$$

$M_6(\text{avg}) = 71.0$
Task Compliance: PASS

where i = task number
 $x_i = t_i / k_i$
 t_i = time to complete task i (seconds)
 k_i = constant for task i
 $k_6 = 8.0$ for task 6

$s = 0$ if task is completed erroneously or not completed within allotted time
 $s = 1$ if task is completed correctly, within allotted time

ENERGY STAR Usability Data Sheet - Composite Results

Test Laboratory: _____
Test Date(s): _____
DUT Manufacturer: _____
DUT Model: _____
DUT s/n: _____
DUT Rev: _____
DUT Firmware ID: _____

Task No	$M_i(\text{avg})$
1	63.2
2	62.6
3	77.4
4	70.5
5	76.9
6	71.0

$$M_c = 70.3$$

Usability Compliance: PASS

$$M_c = (M_1(\text{avg}) + M_2(\text{avg}) + M_3(\text{avg}) + M_4(\text{avg}) + M_5(\text{avg}) + M_6(\text{avg}))/6$$

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