

1 ENERGY STAR® Program Requirements
2 for Computers
3

4 APPENDIX A
5 ENERGY STAR Test Procedure for Determining the
6 Power Use of Computers in Off, Sleep, and Idle,
7

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8 The following protocol should be followed when measuring power consumption levels of computers for
9 compliance with the Off, Sleep, and Idle levels provided in the ENERGY STAR Version 5.0 Computer
10 Specification. Partners must measure a representative sample of the configuration as shipped to the
11 customer. However, the Partner does not need to consider power consumption changes that may result
12 from component additions, BIOS and/or software settings made by the computer user after sale of
13 product. *This procedure is intended to be followed in order and the mode being tested is labeled where
14 appropriate.*
15

16 I. Definitions

17 Unless otherwise specified, all terms used in this document are consistent with the definitions
18 contained in the Version 5.0 ENERGY STAR Eligibility Criteria for Computers.
19

20 UUT

21 UUT is an acronym for “unit under test,” which in this case refers to the computer being tested.
22

23 UPS

24 UPS is an acronym for “Uninterruptible Power Supply,” which refers to a combination of converters,
25 switches and energy storage means, for example batteries, constituting a power supply for
26 maintaining continuity of load power in case of input power failure.
27
28
29

30 II. Testing Requirements

31 Approved Meter

32 Approved meters will include the following attributes¹:
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- 34
- 35 • Power resolution of 1 mW or better;
 - 36 • An available current crest factor of 3 or more at its rated range value; and
 - 37 • Lower bound on the current range of 10mA or less.
- 38

39 The following attributes in addition to those above are suggested:

- 40
- 41 • Frequency response of at least 3 kHz; and
 - 42 • Calibration with a standard that is traceable to the U.S. National Institute of Standards and
43 Technology (NIST).
- 44

45 It is also desirable for measurement instruments to be able to average power accurately over any user
46 selected time interval (this is usually done with an internal math’s calculation dividing accumulated
47 energy by time within the meter, which is the most accurate approach). As an alternative, the
48 measurement instrument would have to be capable of integrating energy over any user selected time
49 interval with an energy resolution of less than or equal to 0.1 mWh and integrating time displayed with
50 a resolution of 1 second or less.
51

¹ Characteristics of approved meters taken from IEC 62301 Ed 1.0: Measurement of Standby Power

52 **Accuracy**
 53 Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to
 54 2% at the 95% confidence level. Measurements of power of less than 0.5 W shall be made with an
 55 uncertainty of less than or equal to 0.01 W at the 95% confidence level. The power measurement
 56 instrument shall have a resolution of:

- 57
- 58 • 0.01 W or better for power measurements of 10 W or less;
- 59 • 0.1 W or better for power measurements of greater than 10 W up to 100 W; and
- 60 • 1 W or better for power measurements of greater than 100 W.

61
 62 All power figures should be in watts and rounded to the second decimal place. For loads greater than
 63 or equal to 10 W, three significant figures shall be reported.

64 **Test Conditions**

Supply Voltage:	North America/Taiwan:	115 (± 1%) Volts AC, 60 Hz (± 1%)
	Europe/Australia/New Zealand:	230 (± 1%) Volts AC, 50 Hz (± 1%)
	Japan:	100 (± 1%) Volts AC, 50 Hz (± 1%)/60 Hz (± 1%)
<i>Note: For products rated for > 1.5 kW maximum power, the voltage range is ± 4%</i>		
Total Harmonic Distortion (THD) (Voltage):	< 2% THD (< 5% for products which are rated for > 1.5 kW maximum power)	
Ambient Temperature:	23°C ± 5°C	
Relative Humidity:	10 – 80 %	

(Reference IEC 62301: Household Electrical Appliances – Measurement of Standby Power, Sections 3.2, 3.3)

67 **Test Configuration**

68 Power consumption of a computer shall be measured and tested from an ac source to the UUT.

69
 70
 71 The UUT must be connected to an Ethernet network switch capable of the UUT's highest and lowest
 72 network speeds. The network connection must be live during all tests.

73
 74
 75
 76 **III. Test Procedure for Off, Sleep and Idle for Small-Scale Servers and Thin Clients**

Deleted: All Products

77 Measurement of ac power consumption of a computer should be conducted as follows:

78 **UUT Preparation**

- 79 1. Record the manufacturer and model name of the UUT.
- 80 2. Ensure that the UUT is connected to network resources as appropriate and that the UUT
 81 maintains this live connection for the duration of testing, disregarding brief lapses when
 82 transitioning between link speeds.
 - 83 a. Small-Scale Servers shall be connected to a live Ethernet (IEEE 802.3) network switch as
 84 specified in Section II., "Test Configuration," above, and that the connection is live.
 - 85 b. Thin Clients shall be connected to a live server via a live Ethernet (IEEE 802.3) network
 86 switch and running intended terminal/remote connection software.
- 87 3. Connect an approved meter capable of measuring true power to an ac line voltage source set to
 88 the appropriate voltage/frequency combination for the test.
 89

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- 90 4. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units
 91 should be connected between the meter and the UUT. For a valid test to take place the meter
 92 should remain in place until all Off, Sleep, and Idle power data is recorded.
 93 5. Record the ac voltage.
 94 6. Boot UUT and wait until the operating system has fully loaded.
 95 7. If necessary, run the initial operating system setup and allow all preliminary file indexing and other
 96 one-time/periodic processes to complete.
 97 8. Record basic information about the computer's configuration – computer type, operating system
 98 name and version, processor type and speed, and total and available physical memory, etc.²
 99 9. Record basic information about the video card or graphics chipset (if applicable) - video
 100 card/chipset name, resolution, amount of onboard memory, and bits per pixel.³
 101 10. Ensure that the UUT is configured as shipped including all accessories, power management
 102 settings, WOL enabling and software shipped by default. UUT should also be configured using
 103 the following requirements for all tests:
 104 a. Small-Scale Servers and thin clients shipped without accessories should be configured
 105 with a standard mouse, keyboard and external monitor (if server has display output
 106 functionality).
 107 b. Power to wireless radios should be turned off for all tests. This applies to wireless
 108 network adapters (e.g., 802.11) or device-to-device wireless protocols.
 109 11. The following guidelines should be followed to configure power settings for displays (adjusting no
 110 other power management settings):
 111 a. For computers with external displays: use the monitor power management settings to
 112 prevent the monitor from powering down to ensure it stays on for the full length of the Idle
 113 test as described below.
 114 b. For computers with integrated monitors: use the power management settings to set the
 115 monitor to power down after 1 minute.
 116 12. Shut down the UUT.
- 117 **Off Mode Testing**
 118 13. With the UUT shut down and in Off, set the meter to begin accumulating true power values at an
 119 interval of 1 reading per second. Accumulate power values for 5 additional minutes and record
 120 the average (arithmetic mean) value observed during that 5 minute period.⁴
 121
 122 **Idle Mode Testing**
 123 14. Switch on the computer and begin recording elapsed time, starting either when the computer is
 124 initially switched on, or immediately after completing any log in activity necessary to fully boot the
 125 system. Once logged in with the operating system fully loaded and ready, close any open
 126 windows so that the standard operational desktop screen or equivalent ready screen is displayed.
 127 Between 5 and 15 minutes after the initial boot or log in, set the meter to begin accumulating true
 128 power values at an interval of 1 reading per second. Accumulate power values for 5 additional
 129 minutes and record the average (arithmetic mean) value observed during that 5 minute period.
 130
 131 **Sleep Mode Testing (Thin Clients, only)**
 132 15. After completing the Idle measurements, place the computer in Sleep mode. Reset the meter (if
 133 necessary) and begin accumulating true power values at an interval of 1 reading per second.
 134 Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value
 135 observed during that 5 minute period.
 136

Deleted: Desktop systems

Deleted: (including workstations)

Deleted: desktop-derived servers) and

Deleted: <#>Notebooks and tablets should include all accessories shipped with the system, and need not include a separate keyboard or mouse when equipped with an integrated pointing device or digitizer. ¶ <#>Notebooks and tablets should have the battery pack(s) removed for all tests. For systems where operation without a battery pack is not a supported configuration, the test may be performed with fully charged battery pack(s) installed, making sure to report this configuration in the test results. ¶

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Deleted: (most desktops)

Deleted: (notebooks, tablets and integrated systems)

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² On Windows-based machines, much of this information can be found by selecting the following window: Start / Programs / Accessories / System Tools / System Information.

³ On Windows-based machines, this can be found by selecting the following window: Start / Programs / Accessories / System Tools / Components / Display.

⁴ Laboratory-grade, full-function meters can integrate values over time and report the average value automatically. Other meters would require the user to capture a series of changing values every 5 seconds for a five minute period and then compute the average manually.

137 16. If testing both WOL enabled and WOL disabled for Sleep, wake the computer and change the
138 WOL from Sleep setting through the operating system settings or by other means. Place the
139 computer back in Sleep mode and repeat step 14, recording Sleep power necessary for this
140 alternate configuration.
141

142 **Reporting Test Results**

143 17. The test results must be reported to EPA or the European Commission, as appropriate, taking
144 care to ensure that all required information has been included.
145

146 **IV. Continuing Verification**

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148 This testing procedure describes the method by which a single unit may be tested for compliance. An
149 ongoing testing process is highly recommended to ensure that products from different production runs
150 are in compliance with ENERGY STAR.
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