

1 **ENERGY STAR Test Procedure for Determining the**
2 **Power Use of Computers in Off, Sleep, and Idle**
3

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

12 **I. Definitions**
13

14 Unless otherwise specified, all terms used in this document are consistent with the definitions
15 contained in the Version 5.0 ENERGY STAR Eligibility Criteria for Computers.
16

17 **UUT**

18 UUT is an acronym for “unit under test,” which in this case refers to the computer being tested.
19

20 **UPS**

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

26 **II. Testing Requirements**
27

28 **Approved Meter**

29 Approved meters will include the following attributes¹:
30

- 31 • Power resolution of 1 mW or better;
- 32 • An available current crest factor of 3 or more at its rated range value; and
- 33 • Lower bound on the current range of 10mA or less.
34

35 The following attributes in addition to those above are suggested:
36

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

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

48 **Accuracy**

49 Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to
50 2% at the 95% confidence level. Measurements of power of less than 0.5 W shall be made with an
51 uncertainty of less than or equal to 0.01 W at the 95% confidence level. The power measurement
52 instrument shall have a resolution of:

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

53
54
55
56
57
58
59
60
61
62

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

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

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)

63
64
65
66
67
68
69
70
71
72

Test Configuration

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

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

III. Test Procedure for Off, Sleep and Idle for All Products

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89

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

UUT Preparation

1. Record the manufacturer and model name of the UUT.
2. Ensure that the UUT is connected to a live Ethernet (IEEE 802.3) network switch as specified in Section II., “Test Configuration,” above, and that the connection is live. The computer must maintain this live connection to the switch for the duration of testing, disregarding brief lapses when transitioning between link speeds.
3. Connect an approved meter capable of measuring true power to an ac line voltage source set to the appropriate voltage/frequency combination for the test.
4. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units should be connected between the meter and the UUT. For a valid test to take place the meter should remain in place until all Off, Sleep, and Idle power data is recorded.
5. Record the ac voltage.
6. Boot computer and wait until the operating system has fully loaded.
7. If necessary, run the initial operating system setup and allow all preliminary file indexing and other one-time/periodic processes to complete.

- 90 8. Record basic information about the computer's configuration – computer type, operating system
91 name and version, processor type and speed, and total and available physical memory, etc.²
92 9. Record basic information about the video card - video card name, resolution, amount of onboard
93 memory, and bits per pixel.³
94 10. Ensure that the UUT is configured as shipped including all accessories, power management
95 settings, WOL enabling and software shipped by default. UUT should also be configured using
96 the following requirements for all tests:
97 a. Desktop systems shipped without accessories should be configured with a standard
98 mouse, keyboard and external monitor.
99 b. Notebooks and tablets should include all accessories shipped with the system, and need
100 not include a separate keyboard or mouse when equipped with an integrated pointing
101 device or digitizer.
102 c. Notebooks and tablets should have the battery pack(s) removed for all tests. For systems
103 where operation without a battery pack is not a supported configuration, the test may be
104 performed with fully charged battery pack(s) installed, making sure to report this
105 configuration in the test results.
106 d. Power to wireless radios should be turned off for all tests. This applies to wireless
107 network adapters (e.g., 802.11) or device-to-device wireless protocols.
108 11. The following guidelines should be followed to configure power settings for displays (adjusting no
109 other power management settings):
110 a. For computers with external displays (most desktops): use the monitor power
111 management settings to prevent the monitor from powering down to ensure it stays on for
112 the full length of the Idle test as described below.
113 b. For computers with integrated monitors (notebooks, tablets and integrated systems): use
114 the power management settings to set the monitor to power down after 1 minute.
115 12. Shut down the UUT.

116 **Off Mode Testing**

- 117 13. With the UUT shut down and in Off, set the meter to begin accumulating true power values at an
118 interval of 1 reading per second. Accumulate power values for 5 additional minutes and record
119 the average (arithmetic mean) value observed during that 5 minute period.⁴
120
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 Exactly 15 minutes after the initial boot or log in, set the meter to begin accumulating true power
128 values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes
129 and record the average (arithmetic mean) value observed during that 5 minute period.
130

131 **Sleep Mode Testing**

- 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.

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.

136 16. If testing both WOL enabled and WOL disabled for Sleep, wake the computer and change the
137 WOL from Sleep setting through the operating system settings or by other means. Place the
138 computer back in Sleep mode and repeat step 15, recording Sleep power necessary for this
139 alternate configuration.

140
141 **Reporting Test Results**

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

144
145 **IV. Continuing Verification**

146
147 This testing procedure describes the method by which a single unit may be tested for compliance. An
148 ongoing testing process is highly recommended to ensure that products from different production runs
149 are in compliance with ENERGY STAR.

150