

***Computer Memorandum of Understanding (Version 3.0)
between The United States Environmental Protection Agency
and***

I. Common Agreements and Principles

- A. This is a voluntary agreement between _____ ("ENERGY STAR[®] Partner" or "Partner") and the United States Environmental Protection Agency ("EPA"), by which _____ joins the ENERGY STAR Program. The terms of this MOU shall apply to computers and integrated computer systems sold by Partner under its own brand name(s).
- B. ENERGY STAR Partner and EPA agree that the primary purpose of the ENERGY STAR Program is to promote the manufacturing and marketing of energy-efficient equipment, thereby potentially reducing combustion-related pollution.
- C. ENERGY STAR Partner and EPA agree that the use of energy-efficient equipment may also increase profits and competitiveness for businesses.
- D. ENERGY STAR Partner and EPA agree that the ENERGY STAR Program may also improve or enhance equipment's useful lifetime, customer satisfaction, and overall product quality.
- E. ENERGY STAR Partner and EPA agree that publicizing the ENERGY STAR Program is important to demonstrate the following: the concern of Partner for the environment, the vitality of the free enterprise system in reducing costs, and the capability of voluntary programs to achieve environmental goals.
- F. ENERGY STAR Partner and EPA agree that maintaining public confidence in the ENERGY STAR Program is critical to achieving the shared goals of Partner and EPA.
- G. ENERGY STAR Partner and EPA agree that the integrity of the ENERGY STAR Program and the ENERGY STAR logo depend on consumer recognition of the ENERGY STAR logo as a means of identifying products in a particular market that are more energy-efficient than conventional products. Therefore, ENERGY STAR Partner and EPA will work together to revise the technical specifications as necessary. ENERGY STAR Partner agrees that EPA can initiate a review of compliance guidelines at any time, if necessary.
- H. ENERGY STAR Partner and EPA agree that membership in the ENERGY STAR Program is essential to the cooperative effort to achieve the shared goals stated above.

II. Definitions

- A. Computer: For purposes of this MOU, a computer is defined as a desktop, tower or mini-tower, or portable unit, including high-end desktop computers, personal computers, workstations, network computer desktops, X terminal controllers, and computer-based point-of-sale retail terminals. To qualify, the unit must be capable of being powered from a wall

outlet, but this does not preclude units that are capable of being powered from a wall outlet and also from a battery. This definition is intended primarily to cover computers sold for use in businesses or homes. This definition of a computer does not include computers sold or otherwise marketed as “File Server” or “Server”.

- B. Monitor: For purposes of this MOU, a monitor is defined as a cathode-ray tube (CRT), flat panel display (e.g., a liquid crystal display) or other display device and its associated electronics. A monitor may be sold separately or integrated into the computer chassis. This definition is intended primarily to cover standard monitors designed for use with computers. For purposes of this MOU, however, the following may also be considered a monitor: mainframe terminals, and physically separate display units.
- C. Integrated Computer System: For purposes of this MOU, this category covers systems in which the computer and visual display monitor are combined into a single unit. Such systems must meet all of the following criteria: it is not possible to measure the power consumption of the two components separately; and the system is connected to the wall outlet through a single power cable.
- D. Inactivity: For purposes of this MOU, inactivity is defined as a period of time during which a computer does not encounter any user input (e.g., keyboard input or mouse movement.)
- E. Low-Power or “Sleep” Mode: Sleep mode is defined as the reduced power state that the computer enters after a period of inactivity.
- F. Wake Events: For purposes of this MOU, a “wake event” is defined as a user, programmed, or external event or stimulus that causes the computer to transition from its low-power/“sleep” mode to its active mode of operation. Examples of wake events include, but are not limited to, movement of the mouse, keyboard activity or a button press on the chassis, and in the case of external events, stimulus conveyed via a telephone, remote control, network, cable modem, satellite, etc.

III. Entry into Force and Duration

- A. Both parties agree that any previously executed MOU between the parties on the subject of ENERGY STAR-compliant computers, integrated computer systems and monitors shall be terminated effective June 30, 1999, except as provided for in Section III.D below.
- B. Both parties agree that as technologies and markets change, it may become desirable to revise the specifications and/or product categories contained in this MOU. ENERGY STAR Partner and EPA agree to work together to revise the specifications and/or product categories in the MOU if and when changes in technology and/or markets make these revisions desirable and necessary. ENERGY STAR Partner and EPA also agree that a reasonable effort should be made to consider the ideas and opinions of all ENERGY STAR Computer Partners and other interested parties when revising the specifications contained in this MOU.
- C. Both parties agree that the terms of this MOU shall become effective on July 1, 1999, although Partner may choose, at its discretion, to implement the terms of this MOU prior to this date.

- D. Both parties agree to the following schedule for phasing in the new specifications contained in this MOU:
1. Computers and integrated computer system models that Partner first ships *before July 1, 1999* may be qualified under Section IV.B of the Computer and Monitor MOU (Version 2.0), as amended. Once such models are qualified as ENERGY STAR-compliant, they may continue to bear the ENERGY STAR logo until the models are phased out of the market (i.e., the new specifications will not apply retroactively to previously qualified products).
 2. Computer and integrated computer system models that Partner first ships *on or after July 1, 1999 and before July 1, 2000* must be qualified under the specifications outlined in Section IV.D.1.i (computers) and Section IV.D.2 (integrated computer systems) of this agreement.
 3. Computer and integrated computer system models that Partner first ships *on or after July 1, 2000* must be qualified under the new specifications outlined in Section IV.D.1.ii (computers) and Section IV.D.2 (integrated computer systems) of this agreement.
- E. Both parties agree that this agreement may be terminated by Partner or EPA at any time, and for any reason, with no penalty. However, the parties agree that termination for noncompliance would occur only in accordance with the procedures set out in Section VII of this agreement.

IV. ENERGY STAR Partner's Responsibilities

A. Reading and Understanding Logo Use Guidelines

ENERGY STAR Partner affirms that it has read, understands, and will abide by the Guidelines for Proper Use of the ENERGY STAR Name and International Logo.

B. Appointment of Liaison

ENERGY STAR Partner agrees to appoint a responsible company representative as liaison with EPA for the ENERGY STAR Program and to notify EPA within one month of any change in liaison responsibility. (Attachment A)

C. Measuring and Testing Equipment

Power consumption of a computer shall be measured and tested from an AC source to the system. Partner must measure a representative sample of the configuration of all the models that it ships to the customer, but the Partner does not need to consider power consumption changes that may result from component additions made by the computer user after sale of product. See EPA's testing procedure guidelines for more information.

Partner is responsible for only applying the ENERGY STAR logo to its system configurations that meet the ENERGY STAR criteria. Partner shall self-certify those products that it determines are compliant. Partner may submit compliant product information to EPA on a voluntary basis using the product information form, if it wishes to have such products included in the ENERGY STAR Product Listing. Product information forms shall include complete information on the features and options installed on tested configurations.

D. Product Qualification for the ENERGY STAR Logo

ENERGY STAR Partner agrees to introduce one or more models of computers and/or integrated computer systems that meet the specifications outlined below.

1. Computers: An ENERGY STAR-compliant computer shall satisfy the following conditions:

i. Tier I: Computer models first shipped on or after July 1, 1999 and before July 1, 2000

- a. The computer shall enter a sleep mode after a period of inactivity.
- b. If the computer is shipped with the capability to be on a network, it shall have the ability to enter a sleep mode while on the network.
- c. If the computer is shipped with the capability to be on a network, it shall retain in sleep mode its ability to respond to wake events directed or targeted to the computer while on a network. If the wake event requires the computer to exit the sleep mode and perform a task, the computer shall re-enter its sleep mode after a period of inactivity following the completion of the task requested. Partner may use any means available to achieve the behavior described in this subsection.
- d. A computer whose power supply has a maximum continuous output power rating¹ less than or equal to 200 watts ($\leq 200\text{W}$) shall automatically enter a low-power/“sleep” state of 30 watts or less after a specified period of inactivity. A computer whose power supply has a maximum continuous output power rating greater than 200 watts ($> 200\text{W}$) shall automatically enter a low-power/“sleep” state of no more than 15 percent (15%) of its maximum continuous output power rating after a specified period of inactivity.

Computers that always maintain a level of power consumption of 30 watts or less comply with the power consumption requirements of Tier I of this agreement, and are not required to incorporate the sleep mode described in Section II.

¹ The maximum continuous output power rating of a power supply is the value defined by the power supply manufacturer in the operating instructions provided with the product.

ii. Tier II: Computer models first shipped on or after July 1, 2000

There are two guidelines - A & B - under which a computer can be qualified as ENERGY STAR-compliant. The two guidelines have been developed to provide Partners with the freedom to approach power management and energy efficiency in different ways.

The following types of computers must be qualified under Guideline A:

- **Computers that are shipped with the capability to be on networks such that they can remain in their low-power/sleep mode while their network interface adapter retains the ability to respond to network queries.**
- **Computers that are not shipped with a network interface capability.**
- **Computers shipped to a non-networked environment.**

EPA expects computers sold or otherwise marketed as personal computers to be qualified under Guideline A only.

Computers that are shipped with the capability to be on networks that currently require the computer's processor and/or memory to be involved in maintaining its network connection while in sleep mode can be qualified under Guideline B. Computers qualifying under Guideline B are expected to maintain identical network functionality in and out of sleep mode.

Guideline A

- a. The computer shall enter a sleep mode after a period of inactivity.
- b. If the computer is shipped with the capability to be on a network, it shall have the ability to enter a sleep mode while on the network.
- c. If the computer is shipped with the capability to be on a network, it shall retain in sleep mode its ability to respond to wake events directed or targeted to the computer while on a network. If the wake event requires the computer to exit the sleep mode and perform a task, the computer shall re-enter its sleep mode after a period of inactivity following the completion of the task requested. Partner may use any means available to achieve the behavior described in this subsection.
- d. The computer shall consume power in the sleep mode according to Table A.

TABLE A

Maximum Continuous Power Rating of Power Supply¹	Watts in sleep mode
≤ 200W	≤ 15W
> 200W ≤ 300W	≤ 20W
> 300W ≤ 350W	≤ 25W
> 350W ≤ 400W	≤ 30W
> 400W	10% of the maximum continuous output rating

Computers that always maintain a level of power consumption of 15 watts or less comply with the power consumption requirements of Tier II of this agreement, and are not required to incorporate the sleep mode described in Section II.

Guideline B

- a. The computer shall enter a sleep mode after a period of inactivity.
 - b. If the computer is shipped with the capability to be on a network, it shall have the ability to enter a sleep mode irrespective of the network technology.
 - c. The computer shall retain in sleep mode its ability to respond to all types of network requests. There shall be no loss in network functionality available to the user (e.g., the network functionality available to the user during the sleep mode shall be the same as that was available before the computer entered the sleep mode).
 - d. The computer shall consume in the sleep mode, no more than 15% of the maximum continuous power rating of its power supply.
2. Integrated Computer Systems: An ENERGY STAR-compliant integrated computer system shall satisfy the following conditions:
- a. The integrated computer system shall enter a sleep mode after a period of inactivity.
 - b. If the integrated computer system is shipped with the capability to be on a network, it shall have the ability to enter a sleep mode while on the network.
 - c. If the integrated computer system is shipped with the capability to be on a network, it shall retain in sleep mode its ability to respond to wake events directed or targeted to the computer while on a network. If the wake event requires the computer to exit the sleep mode and perform a task, the integrated computer system shall re-enter its sleep mode after a period of inactivity after the completion of the task requested. Partner may use any means available to achieve the behavior described in this subsection.

¹ The maximum continuous output power rating of a power supply is the value defined by the power supply manufacturer in the operating instructions provided with the product.

- d. **Tier I:** An integrated computer system, first shipped **before July 1, 2000**, shall consume no more than 45 watts in the sleep mode. Integrated computer systems that always maintain a level of power consumption less than or equal to 45 watts comply with the power consumption requirements of this agreement and are not required to incorporate the sleep mode described in Section II.

Tier II: An integrated computer system, first shipped **on or after July 1, 2000** shall consume no more than 35 watts in the sleep mode. Integrated computer systems that always maintain a level of power consumption less than or equal to 35 watts comply with the power consumption requirements of this agreement and are not required to incorporate the sleep mode described in Section II.

- E. In order to ensure that the maximum number of users take advantage of the low-power/"sleep" state, Partner shall ship its computers and/or integrated computer systems with the power-management feature enabled. The default time for all products shall be preset for less than 30 minutes. (EPA recommends that the preset time be set between 15 and 30 minutes.) The user shall have the ability to change the time settings or disable the low-power/sleep mode.
- F. Operating Systems: The proper activation of a computer's low-power/"sleep" mode is typically contingent upon the installation and use of a particular version of an operating system. If a computer is shipped from the Partner with one or more operating systems, the computer shall be capable of entering and fully recovering from the low-power/"sleep" mode while running in at least one of those operating systems. If the computer is not shipped with operating system software, the Partner shall clearly specify which mechanism will render the computer ENERGY STAR-compliant. In addition, if any special software, hardware drivers, or utilities are necessary for the proper activation and recovery of the sleep mode, they must be installed in the computer. The Partner shall include this information in product literature (e.g., user's manual or data sheets) and/or on its Internet Web site. Brochures and advertisements shall be worded to avoid misleading statements. **See Guidelines for Proper Use of the ENERGY STAR® Name and International Logo.**
- G. Monitor Control: The computer shall include one or more mechanisms through which it can activate the low-power modes of an ENERGY STAR-compliant monitor. Partner shall clearly specify in product literature the manner in which its computer can control ENERGY STAR-compliant monitors, and any special circumstances that must exist in order for monitor power management to be accomplished. Partner shall set the computer's default to activate the monitor's first low-power or sleep mode within 30 minutes of user inactivity. Partner shall also set the default time for the next level of power management such that the monitor enters the second low-power or "deep sleep" mode within 60 minutes of inactivity. The combined total of the default times for both low-power modes shall not exceed 60 minutes. Partner can choose to set the computer to activate the monitor to enter the second low-power or "deep sleep" mode directly within 30 minutes of inactivity (i.e., the computer can activate the monitor to bypass the first sleep mode and enter the second deep sleep mode).

The user shall have the ability to change the time settings or disable the low-power modes for the monitor control. This monitor control requirement does not apply to integrated computer systems. However, integrated computer systems that are marketed and sold as part of a docking system shall have the capability to automatically control the power of an externally connected monitor.

H. Customer Education

1. Identification of Qualifying Products in the Marketplace

ENERGY STAR Partner must ensure that consumers have a quick and easy method of determining which of its products are ENERGY STAR compliant. To achieve this goal, EPA recommends that Partner place the ENERGY STAR logo on all qualified computers and integrated computer systems, their packaging, and product-related materials such as brochures, manuals, and advertisements. EPA also recommends that Partner place the ENERGY STAR logo on all product-related material published on Partner's Web site(s).

2. Product Literature

It is important that consumers understand the power-management feature of their equipment. Accordingly, Partner shall provide general information to users regarding the ENERGY STAR features of the computer or integrated computer system. This information might include the following: a description of the method for changing the power-management settings or default times, a description of the ENERGY STAR Program, and a discussion of the savings associated with using the power-management feature. Partner may determine the best manner through which to disseminate this general information to users. Examples of acceptable approaches include user's manual, on-line tutorial or Internet Web site, and special brochures included in the shipping box. Brochures and advertisements shall be worded to avoid misleading statements. **See Guidelines for Proper Use of the ENERGY STAR[®] Name and International Logo.**

I. Employee Education

Partner agrees to make available general information about the ENERGY STAR Program to all of its employees whose jobs are relevant to the development, marketing, sales, and service of ENERGY STAR-compliant computers and integrated computer systems.

J. Information Sharing

At EPA's request, Partner will attempt to locate customers who have profited from the program and are willing to share information about performance and savings, as well as employees who have contributed in its success. This customer- or employee-supplied information is to be without reference or endorsement of specific Partner, specific products, or other supply sources.

K. Endorsement

ENERGY STAR Partner agrees that it will not construe, claim, or imply that its participation in the Program constitutes EPA approval, acceptance, or endorsement of anything other than Partner's commitment to the Program. ENERGY STAR Partner understands that participation in the ENERGY STAR Program does not constitute EPA endorsement of ENERGY STAR Partner or its products. In addition, since the EPA will not officially approve any individual test reports submitted by Partner, Partner may not include misleading statements in product literature or sales presentations that imply a product is approved or certified by the EPA, e.g., Partner shall not make claims such as "This computer is EPA-approved," "This computer is EPA-certified," or any similar statement intended to convey an EPA endorsement.

L. Voluntary Actions

ENERGY STAR Partner agrees that the activities it undertakes connected with this MOU are not intended to provide services to the federal government and that Partner will not submit a claim for compensation to any federal agency.

V. **EPA's Responsibilities**

A. Appointment of Liaison

EPA agrees to designate a single liaison point for the ENERGY STAR Program, and to notify Partner within one month of any change in liaison responsibilities. Please send signed MOU and other correspondence to this person. (Attachment A)

B. Product Testing

EPA agrees to accept the product certification by the Partner when qualifying ENERGY STAR-compliant products. This certification may be self-determined by the Partner or determined by an independent third party. While this is a self-certifying process, EPA reserves the right to conduct tests on products bearing the ENERGY STAR logo from either the open market or other available sources. EPA may request Partner to voluntarily provide products to be tested by EPA.

C. Consumer Acceptance

EPA agrees to make an effort to encourage consumer acceptance of products introduced under this agreement and bearing the ENERGY STAR logo.

D. Public Recognition

EPA agrees to provide Partner with recognition for its public service in protecting the environment by performing analyses about the pollution prevented by corporate participants, and providing this and other program information to appropriate news media sources for publication.

E. Consumer Education

EPA agrees to promote energy-efficient equipment, and to inform consumers about the ENERGY STAR Program and ENERGY STAR logo by writing articles and/or cooperating with the news media by sharing information, where appropriate.

F. Public Service Advertisements

EPA agrees to work with Partner independently and/or in conjunction with other Partners to coordinate the placement of advertisements to promote energy-efficient equipment, educate consumers about the ENERGY STAR Program and logo, and provide Partner with due recognition for its public service in protecting the environment.

VI. **Use of the ENERGY STAR Logo and Name**

A. Associating Logo with Qualifying Models

It is the responsibility of the Partner to associate EPA, the ENERGY STAR logo and name, and the ENERGY STAR Program only with those specific models that qualify under the terms and conditions of this MOU. **See Guidelines for Proper Use of the ENERGY STAR[®] Name and International Logo.**

B. ENERGY STAR Materials

EPA agrees to loan Partner, at no charge, materials from which Partner can reproduce the ENERGY STAR logo.

C. Referring to the ENERGY STAR Logo

When the ENERGY STAR logo is used, Partner agrees that it shall be accompanied by the following statement: “As an ENERGY STAR[®] Partner, [Company] has determined that this product meets the ENERGY STAR guidelines for energy efficiency.” When the ENERGY STAR logo is applied directly to the product or product packaging, Partner may place this statement in the user’s manual. **See Guidelines for Proper Use of the ENERGY STAR Name and International Logo.**

D. Registered Marks

ENERGY STAR Partner understands that the ENERGY STAR[®] name and the ENERGY STAR logo are registered marks of the United States Environmental Protection Agency, and are subject to the provisions of Title 15, Chapter 22, United States Code, the various state laws applicable to trademarks, and this Memorandum of Understanding. As such, the Partner shall note this registered status, as appropriate. This includes: (a) expressing the ENERGY STAR name in all capital letters (It is also appropriate to use a slightly larger point size for the first letter of each word, e.g., twelve point for the E and S, and ten point for the other letters.), and (b) including the registered symbol,[®] *each time* the ENERGY STAR name or logo appears in a brochure, poster, advertisement, or other document (i.e., ENERGY STAR[®]). The registered mark statement “ENERGY STAR is a U.S. registered mark” may also be used *in addition* to the registered symbol to indicate the registered status of the mark. **See Guidelines for Proper Use of the ENERGY STAR[®] Name and International Logo.**

E. Endorsement

Under no circumstances shall the ENERGY STAR name or logo be used in a manner that would imply EPA endorsement of the Partner, its products, or its services.

F. Altering Logo

ENERGY STAR Partner agrees not to alter the ENERGY STAR logo except in the ways described in the Guidelines for Proper Use of the ENERGY STAR[®] Name and International Logo.

G. Termination of Agreement

If either EPA or Partner terminates this Agreement, Partner will no longer be entitled to apply the ENERGY STAR logo to newly manufactured products, and will no longer make reference to the ENERGY STAR Program so as to construe continuing involvement in the program. Any products bearing the logo that have been shipped by the Partner prior to program termination, and are no longer in the Partner’s possession (e.g., products on display or inventoried by retail stores or distributors), may continue to bear the logo.

VII. Conflict Resolution

A. Good Faith Principle

Each party agrees to exercise good faith as a general principle for resolving conflicts under the ENERGY STAR Office Equipment Program.

B. Notification of Problems

Both parties agree to informally notify each other if any problems or issues arise under the ENERGY STAR Office Equipment Program and to work together to provide maximum public confidence in the program.

C. Procedure for Addressing Non-compliant Products

1. If EPA receives information that one or more computer or integrated computer system models claimed by Partner as ENERGY STAR-compliant may not meet all of the terms of this MOU, or if EPA believes Partner is using the ENERGY STAR logo improperly, then EPA will immediately notify Partner and attempt to address and resolve the problem informally.
2. If these informal discussions do not produce a mutually agreeable resolution, EPA shall notify Partner in writing that Partner shall be terminated from the ENERGY STAR Program unless it undertakes the specific corrective actions sought by EPA. Partner agrees to reply to EPA in writing within 20 business days of receiving EPA's letter. At that time, Partner shall agree to do one of the following: (a) undertake in a timely and effective manner, the corrective actions sought by EPA; or (b) voluntarily terminate this agreement. If Partner does not respond to EPA's letter within 20 business days, or responds but does not agree to either (a) or (b), then this agreement is terminated.

D. Notification in Writing

If Partner believes that EPA is not meeting all of its commitments, Partner agrees to formally notify EPA in writing. EPA agrees to respond in writing within 20 business days of receiving Partner's letter. At that time, EPA will do one of the following: (a) undertake the corrective actions sought by Partner, or (b) explain why such corrective actions cannot be undertaken.

VIII. Freedom of Information Act and Confidential Business Information

Both parties understand that information provided by Partner to EPA will be treated pursuant to EPA's public information regulations under 40 Code of Federal Regulations, Part Two.

* * * * *

The undersigned hereby execute this Memorandum of Understanding on behalf of their respective parties. The signer of this agreement affirms that he/she has the authority to commit Partner to participation in the ENERGY STAR Office Equipment Program.

For the U.S. Environmental Protection Agency (EPA):

Signature: _____ Date: _____

Name: Kathleen Hogan
Title: Director, Climate Protection Partnerships Division

For

Signature: _____ Date: _____

Name: _____

Title: _____

ATTACHMENT A

Please complete and return with the signed Memorandum of Understanding.

EPA Contact:

Mailing Address:

Craig Hershberg
Manager, ENERGY STAR Office Equipment
US EPA
Ariel Rios Bldg.
1200 Pennsylvania Ave., NW
(Mail Code 6202 J)
Washington, DC 20460

Overnight Delivery Address:

Craig Hershberg
Manager, ENERGY STAR Office Equipment
US EPA
1310 L Street, NW
Washington, DC 20005
(202) 343-9120

Partner's Contacts:

Primary Contact (to receive all program administrative materials):

Name:
Title:
Address:
City, State, ZIP:
Telephone Number:
Fax Number:
E-mail Address:
Location of US Headquarters (if applicable):

Marketing/PR Contact (to receive marketing and communications materials):

Name:
Title:
Address:
City, State, ZIP:
Telephone Number:
Fax Number:
E-mail Address:

Customer Service Contact (to be given to the public for further information on products):

Telephone number:
Fax Number:
Web Site:

ATTACHMENT B

TEST CONDITIONS FOR ENERGY STAR® COMPLIANCE MEASUREMENT FOR COMPUTERS

In order to reduce confusion and increase consistency, the following protocol should be followed when measuring power consumption levels of computers for compliance with the ENERGY STAR Computer Memorandum Of Understanding (MOU).

Outlined below are the minimum test conditions that should be established when performing the power measurement. These are necessary in order to ensure that ENERGY STAR compliance is based on common characteristics of computers.

A description of the test conditions and a discussion of testing equipment can also be found below.

I. TEST CONFIGURATION

Power consumption of a computer shall be measured and tested from an AC source to the system. Partner must measure a representative sample of the configuration that it ships to the customer, but the Partner does not need to consider power consumption changes that may result from component additions made by the computer user after sale of product. As described in the MOU, there are two guidelines under which a Partner can qualify a computer as ENERGY STAR-compliant. Partners can choose either Guideline A OR Guideline B for testing compliance.

II. TEST CONDITIONS

Line Impedance: < 0.25 ohm
Total Harmonic Distortion: < 5%
Input AC Voltage¹: 115 VAC RMS +/- 5V RMS
Input AC Frequency¹: 60 Hz +/- 3 Hz
Ambient Temperature: 25 deg. C +/- 3 deg. C

III. TESTING EQUIPMENT

The goal is to accurately measure the true power consumption² of the computer. This necessitates the use of a true RMS wattmeter. There are many models to choose from, but Partners will need to exercise care in selecting an appropriate model. The following factors should be considered when purchasing a meter and setting up the actual test.

¹ If products will be sold in Europe or Asia, testing should also be performed at the appropriate machine-rated voltage and frequency. For example, products destined for European markets might be tested at 230 V and 50 Hz.

² True power is defined as the product of the voltage, current and the power factor (volts x amps x power factor), and is typically reported as Watts. Apparent Power is defined as the product of voltage and current (volts x amps) and is usually expressed in terms of VA or volt-amps. The power factor for equipment with switching power supplies is always less than 1.0, so true power is always less than apparent power.

Crest Factor³

Computers that contain switching power supplies draw current in a waveform different from typical sinusoidal current. While virtually any wattmeter can measure a standard current waveform, it is more difficult to select a wattmeter when irregular current waveforms are involved.

It is critical that the wattmeter selected be capable of reading the current drawn by the computer without causing internal peak distortion (i.e., clipping off the top of the current wave). This requires a review of the meter's crest factor⁴ and of the current ranges available on the meter. Better meters will have higher crest factors, and more choices of current ranges.

When preparing the test, the first step should be to determine the peak current (amps) associated with the computer being measured. This can be accomplished using an oscilloscope. Then a current range must be selected that will enable the meter to register the peak current. Specifically, the full scale value of the current range selected multiplied by the crest factor of the meter (for current) must be greater than the peak current reading from the oscilloscope.

For example, if a wattmeter has a crest factor of 4, and the current range is set on 3 amps, the meter can register current spikes of up to 12 amps. If measured peak current is only 6 amps; the meter would be satisfactory. The other concern to be aware of is that if the current range is set too high in order to register peak current, it may lose accuracy in measuring the non-peak current. Again, with more current range choices and higher crest factors, manufacturer will get better results.

Frequency Response

Another issue to consider when selecting a wattmeter is the frequency response rating of the meter. Electronic equipment that contains switching power supplies causes harmonics (odd harmonics typically up to the 21st). These harmonics must be accounted for in power measurement, or the power consumption data will be inaccurate. Accordingly, EPA recommends that Partners purchase wattmeters that have a frequency response of at least 3 kHz. This will account for harmonics up to the 50th, and is recommended by IEC 555.

Resolution

Partners should choose a meter that can provide resolution of 0.1 W.

Accuracy

Catalogues and specification sheets for wattmeters typically provide information on the accuracy of power readings that can be achieved at different range settings.

³ The crest factor for a sinusoidal 60 Hz current waveform is always 1.4. The crest factor for a current waveform associated with a computer containing a switching power supply will always be greater than 1.4 (though typically no higher than 8). The crest factor of a current waveform is defined as the ratio of the peak current (amps) to the RMS current (amps).

⁴ The crest factor of a wattmeter is often provided for both current and voltage. For current, it is the ratio of the peak current to the RMS current in a specific current range. When only one crest factor is given, it is usually for current. An average true RMS wattmeter has a crest factor in the range of 2:1 to 6:1.

Calibration

To maintain their accuracy, wattmeters should be calibrated with a standard that is traceable to the U.S. National Bureau of Standards (NBS).

Continuing Verification

This testing procedure (protocol) describes the method by which a single unit may be tested for compliance. An ongoing testing process is highly recommended to ensure that products from different production runs are in compliance with the MOU. A model may qualify as ENERGY STAR-compliant if testing indicates that 95 percent of the units sold under this model name/number will meet the specifications contained within the MOU.