083563/EU XXIV. GP
Eingelangt am 04/06/12

COUNCIL OF THE EUROPEAN UNION

Brussels, 4 June 2012 (OR. en)

10193/12

Interinstitutional File: 2012/0048 (NLE)

ENER 181
COTRA 19
OC 276

LEGISLATIVE ACTS AND OTHER INSTRUMENTS

Subject: AGREEMENT between the Government of the United States of America and the European Union on the coordination of energy-efficiency labelling programs for office equipment
COMMON GUIDELINES
Consultation deadline for Croatia: 13.6.2012

AGREEMENT
BETWEEN THE GOVERNMENT OF THE UNITED STATES OF AMERICA
AND THE EUROPEAN UNION
ON THE COORDINATION OF ENERGY-EFFICIENCY LABELLING PROGRAMS
FOR OFFICE EQUIPMENT

The Government of the UNITED STATES OF AMERICA and the EUROPEAN UNION, hereinafter 'the Parties';

DESIRING to maximise energy savings and environmental benefits by stimulating the supply of and demand for energy efficient products;

TAKING INTO ACCOUNT the Agreement between the Government of the United States of America and the European Community on the Coordination of Energy-Efficient Labelling Programs for Office Equipment, done on 20 December 2006, and its annexes, as amended (hereinafter "the 2006 Agreement");

SATISFIED by the progress made under the 2006 Agreement;

CONVINCED that additional benefits will be achieved by continuing mutual efforts on ENERGY STAR;

HAVE AGREED AS FOLLOWS:

ARTICLE I

General Principles

1. A common set of energy-efficiency specifications and a common logo shall be used by the Parties for the purpose of establishing consistent targets for manufacturers, thereby maximising the effect of their individual efforts on the supply of and demand for such product types.

2. The Parties shall use the Common Logo for the purpose of identifying qualified energy-efficient product types listed in Annex C.

3. The Parties shall ensure that common specifications encourage continuing improvement in efficiency, taking into account the most advanced technical practices on the market.

4. The Common Specifications strive to represent not more than the top 25 percent energy efficient models for which data is available at the time the specifications are set while also taking other factors into consideration.

5. The Parties shall endeavour to ensure that consumers have the opportunity to identify efficient products by finding the label in the market.

ARTICLE II

Relation to the 2006 Agreement

This Agreement supersedes in its entirety the 2006 Agreement.

ARTICLE III

Definitions

For the purposes of this Agreement:

(a) 'ENERGY STAR' means the service mark designated in Annex A and owned by the United States Environmental Protection Agency ('U.S. EPA');

(b) 'Common Logo' means the certification mark designated in Annex A and owned by U.S. EPA;

(c) 'ENERGY STAR Marks' means the 'ENERGY STAR' service mark and the Common Logo, as well as any versions of these marks that may be developed or modified by the Management Entities or Program Participants, as herein defined, including the sign or marking contained in Annex A of this Agreement;

(d) 'ENERGY STAR Labelling Program' means a program administered by a Management Entity using common energy efficiency specifications, marks, and guidelines to be applied to designated product types;

(e) 'Program Participants' means manufacturers, vendors, or resale agents that sell designated, energy-efficient products that meet the specifications of and who have chosen to participate in, the ENERGY STAR Labelling Program by registering or entering an agreement with the Management Entity of either Party;

(f) 'Common Specifications' are the energy-efficiency and performance requirements, including testing methods listed in Annex C, used by Management Entities and Program Participants to determine qualification of energy-efficient products for the Common Logo.

(g) 'Third-party certification means a set of procedures under the U.S. ENERGY STAR Program that an independent organization administers to ensure that products meet ENERGY STAR requirements. These procedures include testing in a laboratory that meets international standards for quality and competency. These procedures also include review of documentation to determine ENERGY STAR eligibility and ongoing verification testing to ensure continued compliance.

(h) 'Self-certification' means a set of procedures for qualifying products under the EU ENERGY STAR Program whereby the Program Participant ensures and declares that the registered product complies with all relevant provisions of the applicable Common Specifications.

ARTICLE IV

Management Entities

Each Party hereby designates a management entity responsible for implementation of this Agreement (the 'Management Entities'). The European Union designates the Commission of the European Union ('Commission') as its Management Entity. The United States of America designates the U.S. EPA as its Management Entity.

ARTICLE V

Administration of the ENERGY STAR Labelling Program

1. Each Management Entity shall administer the ENERGY STAR Labelling Program for the energy-efficient product types listed in Annex C, subject to the terms and conditions set forth in this Agreement. Program administration includes registering Program Participants on a voluntary basis, maintaining Program Participant and compliant product lists, and enforcing the terms of the Guidelines for Proper Use of the ENERGY STAR Name and Common Logo set forth in Annex B.

2. The ENERGY STAR Labelling Program shall use the Common Specifications listed in Annex C.

3. To the extent that each Management Entity takes effective measures to educate consumers about the ENERGY STAR Marks, it shall do so in accordance with the Guidelines for Proper Use of the ENERGY STAR Name and Common Logo set forth in Annex B.

4. Each Management Entity shall bear the expenses for all of its activities under this Agreement.

ARTICLE VI

Participation in the ENERGY STAR Labelling Program

1. The Management Entities shall permit any manufacturer, vendor or resale agent to enter the ENERGY STAR Labelling Program by registering as a Program Participant.

2. The Management Entities shall permit Program Participants to use the Common Logo to identify qualified products that have been tested in their own facilities or by an independent test laboratory and that meet the Common Specifications set forth in Annex C. For products placed solely on the EU market, the Management Entity allows Program Participants to self-certify the qualified products. For products placed on the US market the Management Entity requires the Program Participants meet the third party certification requirements laid out in the revised U.S. Partner Commitments.

3. Each Management Entity shall maintain and share with the other lists of all Program Participants and products that qualify for the Common Logo in their respective territory.

4. Notwithstanding the procedures specified in paragraph 2 (self-certification for products placed on the EU market and third-party certification for products placed on the US market), each Management Entity reserves the right to test or otherwise review products that are or have been sold within its territories (in the territories of the European Union Member States in the case of the Commission) to determine whether the products are certified in accordance with the Common Specifications set forth in Annex C. The Management Entities shall communicate and cooperate fully with one another to ensure all products bearing the Common Logo meet the Common Specifications set forth in Annex C.

ARTICLE VII

Program coordination between the Parties

1. The Parties shall establish a Technical Commission to review implementation of this Agreement, composed of representatives of their respective Management Entities.

2. To the extent possible, the Technical Commission shall meet annually and shall consult at the request of one of the Management Entities to review the operation and administration of the ENERGY STAR Labelling Program, the Common Specifications set forth in Annex C, product coverage, and the progress in achieving the objectives of this Agreement.

3. Non-parties (including other governments and industry representatives) may attend meetings of the Technical Commission as observers, unless otherwise agreed by both Management Entities.

ARTICLE VIII

Registration of the ENERGY STAR Marks

1. The U.S. EPA, as owner of the ENERGY STAR marks, has registered the marks in the European Union as Community Trade Marks. The Commission shall not seek or obtain any registration of the ENERGY STAR marks or any variation of the marks in any country.

2. The U.S. EPA undertakes not to consider as an infringement of these marks the use by the Commission, or the authorized use by any Program Participant registered by the Commission, of the ENERGY STAR marks in accordance with the terms of this Agreement.

ARTICLE IX

Enforcement and non-compliance

1. In order to protect the ENERGY STAR marks, each Management Entity shall ensure the proper use of the ENERGY STAR marks within its territory (within the territories of the European Union Member States in the case of the Commission). Each Management Entity shall ensure that the ENERGY STAR marks are used only in the form that appears in Annex A and only on qualifying products. Each Management Entity shall ensure that the ENERGY STAR marks are used solely in the manner specified in the Guidelines for Proper Use of the ENERGY STAR Name and Common Logo set forth in Annex B.

2. Each Management Entity shall ensure that prompt and appropriate action is taken against Program Participants, whenever it has knowledge that a Program Participant has used an infringing mark or has affixed an ENERGY STAR mark to a product that does not comply with the Specifications set forth in Annex C. Such actions shall include, but not be limited to:

(a) informing the Program Participant in writing of its non-compliance with the terms of the ENERGY STAR Labelling Program;

(b) through consultations, developing a plan to reach compliance; and

(c) if compliance cannot be reached, terminating the registration of the Program Participant, as appropriate.

3. Each Management Entity shall ensure that all reasonable actions are taken to end the unauthorised use of the ENERGY STAR marks or use of an infringing mark by an entity that is not a Program Participant. Such actions shall include, but shall not be limited to:

(a) informing the entity using the ENERGY STAR marks of ENERGY STAR Labelling Program requirements and the Guidelines for Proper Use of the ENERGY STAR Name and Common Logo; and

(b) encouraging the entity to become a Program Participant and register qualified products, if appropriate;

4. Each Management Entity shall immediately notify the Management Entity of the other Party of any infringement of the ENERGY STAR marks in the other Party's territory as well as the initial action taken, if any, to end such infringement.

5. If compliance cannot be reached following actions listed under points 2 and 3 above, the EU shall require its Member States to fully cooperate and consult with the Management Entity and take all necessary measures, including legal action, to end any non-complying, and therefore, unauthorized use of the ENERGY STAR marks

ARTICLE X

Procedures for amending the Agreement and for adding new Annexes

1. Either Management Entity may propose an amendment to this Agreement and may propose new annexes to the Agreement.

2. A proposed amendment shall be made in writing and shall be discussed at the next meeting of the Technical Commission, provided that it has been communicated to the other Management Entity at least sixty days in advance of such meeting.

3. Amendments to this Agreement and decisions to add new annexes shall be made by mutual agreement of the Parties. Amendments to Annexes A, B, and C shall be made according to the provisions of Articles XI and XII.

ARTICLE XI

Procedures for amending Annexes A and B

1. A Management Entity seeking to amend Annex A or Annex B shall follow the procedures set forth in paragraphs 1 and 2 of Article X.

2. Amendments to Annexes A and B shall be made by mutual agreement of the Management Entities.

ARTICLE XII

Procedures for amending Annex C

1. A Management Entity seeking to amend Annex C to revise existing Specifications or to add a new product type ('Proposing Management Entity') shall follow the procedures set forth in paragraphs 1 and 2 of Article X, and shall include in its proposal:

(a) a demonstration that significant energy savings would result from revising the Specifications or adding the new product type;

(b) as appropriate, energy consumption requirements for various power consumption modes;

(c) information on the standardised testing protocols to be used in evaluating the product;

(d) evidence of existing non-proprietary technology that would make possible cost-effective energy savings without negatively affecting product performance; information on the estimated number of product models that would meet the proposed specification and approximate market share represented;

(e) information on the views of industry groups potentially affected by the proposed amendment; and

(f) a proposed effective date for the new Specifications, taking into consideration product life cycles and production schedules.

2. Proposed amendments to Annex C that are accepted by both Management Entities shall enter into force on a date mutually agreed by the Management Entities.

3. If, after receipt of a proposal made in accordance with paragraphs 1 and 2 of Article X, the other Management Entity ('Objecting Management Entity') is of the view that the proposal does not meet the requirements specified in paragraph 1 or otherwise objects to the proposal it shall promptly (normally by the next Technical Commission Meeting) notify the Proposing Management Entity in writing of its objection and shall include any available information supporting its objection; for example, information demonstrating that the proposal, if adopted, would likely:

(a) disproportionately and unfairly confer market power on one company or industry group;

(b) undermine overall industry participation in the ENERGY STAR labelling program;

(c) conflict with its laws and regulations; or

(d) impose burdensome technical requirements.

4. The Management Entities shall make best efforts to reach agreement on the proposed amendment at the first meeting of the Technical Commission following the proposal. If the Management Entities are unable to reach agreement on the proposed amendment at this Technical Commission meeting, they shall seek to reach agreement in writing prior to the subsequent Technical Commission meeting.

5. If, by the end of the subsequent Technical Commission meeting, the Parties are unable to reach agreement, the Proposing Management Entity shall withdraw its proposal; and with respect to proposals to revise existing Specifications, the corresponding product type shall be removed from Annex C by the date agreed upon in writing by the Management Entities. All Program Participants shall be informed of this change and of the procedures to be followed to implement this change.

6. When preparing new Common Specifications or revising existing Common Specifications, the Management Entities shall ensure effective coordination and consultation among themselves and with their respective stakeholders, particularly with regard to the content of the working documents and timelines.

ARTICLE XIII

General provisions

1. Other environmental labelling programs are not covered by this Agreement and may be developed and adopted by either of the Parties.

2. All activities undertaken under this Agreement shall be subject to the applicable laws and regulations of each Party and to the availability of appropriated funds and resources.

3. Nothing in this Agreement shall affect the rights and obligations of any Party deriving from a bilateral, regional or multilateral agreement into which it has entered prior to the entry into force of this Agreement.

4. Without prejudice to any other provisions of this Agreement, either Management Entity may run labelling programs, other than ENERGY STAR, with respect to product types not included in Annex C. Notwithstanding any other provisions of this Agreement, neither Party shall hinder the import, export, sale or distribution of product in such a program because it bears the energy-efficiency marks of the Management Entity of the other Party.

ARTICLE XIV

Entry into force and duration

1. This Agreement shall enter into force on the date upon which each Party has notified the other in writing through diplomatic channels that its respective internal procedures necessary for its entry into force have been completed.

2. This Agreement shall remain in force for a period of five years. At least one year prior to the end of this period, the Parties shall meet to discuss renewal of this Agreement.

ARTICLE XV

Termination

1. Either Party may terminate this Agreement at any time by providing three months written notice to the other Party.

2. In the event of termination or non-renewal of this Agreement, the Management Entities shall inform all Program Participants which they have registered of the termination of the joint program. Moreover, Management Entities shall inform the Program Participants which they have registered that each Management Entity may continue the labelling activities under two separate individual programs. In this case, the European Union labelling program will not use the ENERGY STAR marks. The Commission shall ensure that itself, the Member States of the European Union and any Program Participants which it has registered cease using the ENERGY STAR marks by the date agreed upon in writing by the Management Entities. The obligations contained in this Article XV (2) shall survive the termination of this Agreement.

Done at ... this day of ..., in two originals.

Pursuant to EU law, this Agreement shall also be drawn up by the EU in the Bulgarian, Czech, Danish, Dutch, Estonian, Finnish, French, German, Greek, Hungarian, Italian, Latvian, Lithuanian, Maltese, Polish, Portuguese, Romanian, Slovakian, Slovenian, Spanish and Swedish languages.

ANNEX A

ENERGY STAR Name and Common Logo

Name: ENERGY STAR

ANNEX B

GUIDELINES FOR PROPER USE OF THE ENERGY STAR NAME
AND COMMON LOGO

The ENERGY STAR name and Common logo are marks of the U.S. EPA. As such, the name and Common logo may only be used in accordance with the following guidelines and the Partnership Agreement or the European Commission Registration Form signed by Program Participants in the ENERGY STAR labelling program. Please distribute these guidelines to those who will be responsible for preparing ENERGY STAR materials on your behalf.

U.S. EPA, and the European Commission, in the European Union Member States Territory oversee proper use of the ENERGY STAR name and Common logo. This includes monitoring the use of the marks in the marketplace, and directly contacting those organisations that are using them improperly or without authorisation. Consequences of misusing the marks may include the termination of the Program Participant's participation in the ENERGY STAR labelling program, and, for products imported into the U.S. improperly using the marks, the possible seizure by the U.S. Customs Services of those goods.

General Guidelines

The ENERGY STAR Program is a partnership between businesses and organisations on one side and the US Federal government or the European Union on the other side. As part of this partnership, businesses and organisations can use the ENERGY STAR name and Common logo, as part of their energy efficiency and environmental activities.

Organisations must enter into an agreement with a management entity – the Environmental Protection Agency for the US or the European Commission for the EU– to use the marks as provided in this document. Alterations to these marks are not allowed as the alterations would confuse businesses and consumers about the source of the ENERGY STAR program and reduce its value for all.

Organisations using these marks must abide by the following general guidelines:

1. The ENERGY STAR name and Common Logo may never be used in any manner that would imply endorsement of a company, its products, or its services. Neither the Common Logo nor the ENERGY STAR name may be used in any other company name or logo, product name, service name, domain name, or Web site title, nor may the Common Logo, the ENERGY STAR name, or any similar mark be applied for as a trademark, or as part of a trademark by any entity other than the U.S. EPA.

2. The ENERGY STAR name and Common Logo may never be used in a manner that would disparage ENERGY STAR, EPA, the Department of Energy, the European Union, the European Commission, or any other government body.

3. The Common Logo may never be associated with products that do not qualify as ENERGY STAR.

4. Partners and other authorised organisations are responsible for their own use of the ENERGY STAR name and Common Logo, as well as use by their representatives, such as ad agencies and implementation contractors.

Using the ENERGY STAR Name

– The ENERGY STAR name should always appear in capital letters;

– The registration symbol ® must be used with the first time the words 'ENERGY STAR' appear in material for the U.S. market;

And

– The ® symbol should always be in superscript;

– There shall be no space between the words 'ENERGY STAR' and the ® symbol;

– The ® symbol shall be repeated in a document for each chapter title or Web page.

Using the Common Logo

The Common Logo is a mark to be used as a label only on those products that meet or exceed ENERGY STAR performance guidelines.

Uses of the Common Logo include:

– On a qualifying and registered product;

– In product literature for a qualifying product;

– On the Web to identify a qualifying product;

– In advertising where it is used near to or on a qualifying product;

– On Point of Purchase materials;

– On qualifying product packaging.

Appearance of the Common Logo

US EPA created this mark to maximise the visual impression of the mark and for contrast and legibility. The mark includes the ENERGY STAR symbol in a block with the ENERGY STAR name in a block directly below to reinforce the legibility of the symbol. The two blocks are separated by a white rule equal in thickness to the arc within the symbol. The mark also has a white key line around it that is also equal in thickness to the arc within the symbol.

Clear Space

U.S. EPA and the EU Commission require that a clear space of .333 (1/3) the height of the graphic box within the mark surround the mark at all times. No other graphic elements, such as text and images can appear in this area. U.S. EPA and the EU Commission require this clear space since the Common Logo frequently appears on materials using complex imagery such as other marks, graphic devices, and text.

Minimum Size

The mark may be resized, but the proportions must be maintained. For legibility, we recommend that the mark not be reproduced smaller in width than .375 inch (3/8″; 9.5 mm) for print. Lettering legibility inside the mark must be maintained on the Web.

Preferred Colour

The preferred colour for the mark is 100 % Cyan. Alternate versions in black or reversed out to white are allowed. The Web colour equivalent of 100 % Cyan is hex colour #0099FF. If multicolour printing is available for advertising, product literature, or point of purchase materials the mark should be printed in 100 % Cyan. If this colour is not available, then black can be substituted.

Incorrect Uses of the Mark

Please:

– Do not use the mark on non-qualifying products.

– Do not alter the mark by using the ENERGY STAR symbol block without the block containing the name 'ENERGY STAR'.

When reproducing the mark please:

– Do not make the mark an outline.

– Do not use a white mark on a white background.

– Do not change the colours of the mark.

– Do not distort the mark in any way.

– Do not alter the lock up of the mark.

– Do not place the mark on a busy image.

– Do not rotate the mark.

– Do not separate any of the mark's elements.

– Do not substitute any part of the mark.

– Do not use any other typeface to replace part of the mark.

– Do not violate the clear space of the mark.

– Do not skew the mark.

– Do not change the size of the mark lock up.

– Do not replace the approved wording.

– Do not use the Common Logo in an unapproved colour.

– Do not let text run into the mark.

– Do not use the symbol block alone. The ENERGY STAR name must appear as well.

– Do not delete the symbol block from the mark.

Writing and Talking About ENERGY STAR

To maintain and build the value of ENERGY STAR, U.S. EPA and the EU Commission recommend terminology to use when writing and talking about elements of the program.

CORRECT	INCORRECT
ENERGY STAR qualified computer	ENERGY STAR compliant computer ENERGY STAR certified computer ENERGY STAR rated computer
Computer that has earned the ENERGY STAR	
Products that have earned the ENERGY STAR	ENERGY STAR product ENERGY STAR products (referring to a suite of products) ENERGY STAR equipment Endorsed by U.S. EPA Meeting ENERGY STAR standards
PARTNERS/PROGRAM PARTICPANTS	
An ENERGY STAR Partner	An ENERGY STAR company
Company X, an ENERGY STAR Partner	Company X, a company endorsed by U.S. EPA
A company participating in ENERGY STAR	A U.S. EPA approved seller of ENERGY STAR equipment
A company promoting ENERGY STAR	Endorsed by U.S. EPA
ENERGY STAR qualified monitors	ENERGY STAR Monitor Program

CORRECT	INCORRECT
GOVERNMENT SOURCE OF AUTHORITY	
Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. EPA and the EU Commission	
ENERGY STAR and the ENERGY STAR mark are registered U.S. marks	
ENERGY STAR is a registered mark owned by the U.S. government	
PERFORMANCE GUIDELINES	
ENERGY STAR guidelines	ENERGY STAR Standards
ENERGY STAR specifications	U.S. EPA-approved
ENERGY STAR performance levels	U.S. EPA-endorsed
Voluntary programs	Received an endorsement by U.S. EPA

Questions Regarding the Use of the ENERGY STAR Name and Common Logo

ENERGY STAR Hotline

In the U.S. call toll-free:1-888-STAR-YES (1-888-782–7937)

Outside the U.S. Call: 202-775–6650

Fax: 202-775–6680

www.energystar.gov

EUROPEAN COMMISSION

Directorate-General Energy

Phone: +32 2 2972136

www.eu-energystar.org

ANNEX C

COMMON SPECIFICATIONS

I. COMPUTER SPECIFICATIONS

1. DEFINITIONS

A. Computer: A device which performs logical operations and processes data. Computers are composed of, at a minimum: (1) a central processing unit (CPU) to perform operations; (2) user input devices such as a keyboard, mouse, digitizer or game controller; and (3) a computer display screen to output information. For the purposes of this specification, computers include both stationary and portable units, including desktop computers, integrated desktop computers, notebook computers, small-scale servers, thin clients and workstations. Although computers must be capable of using input devices and computer displays, as noted in numbers 2 and 3 above, computer systems do not need to include these devices on shipment to meet this definition.

Components

B. Computer Display: A display screen and its associated electronics encased in a single housing, or within the computer housing (e.g., notebook or integrated desktop computer), that is capable of displaying output information from a computer via one or more inputs, such as a VGA, DVI, Display Port, and/or IEEE 1394. Examples of computer display technologies are the cathode-ray tube (CRT) and liquid crystal display (LCD).

C. Discrete Graphics Processing Unit (GPU): A graphics processor with a local memory controller interface and a local, graphics-specific memory.

D. External Power Supply: A component contained in a separate physical enclosure external to the computer casing and designed to convert line voltage AC input from the mains to lower DC voltage(s) for the purpose of powering the computer. An external power supply must connect to the computer via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.

E. Internal Power Supply: A component internal to the computer casing and designed to convert AC voltage from the mains to DC voltage(s) for the purpose of powering the computer components. For the purposes of this specification, an internal power supply must be contained within the computer casing but be separate from the main computer board. The power supply must connect to the mains through a single cable with no intermediate circuitry between the power supply and the mains power. In addition, all power connections from the power supply to the computer components, with the exception of a DC connection to a computer display in an Integrated Desktop Computer, must be internal to the computer casing (i.e., no external cables running from the power supply to the computer or individual components). Internal DC-to-DC converters used to convert a single DC voltage from an external power supply into multiple voltages for use by the computer are not considered internal power supplies.

Computer Types

F. Desktop Computer: A computer where the main unit is intended to be located in a permanent location, often on a desk or on the floor. Desktops are not designed for portability and utilise an external computer display, keyboard, and mouse. Desktops are designed for a broad range of home and office applications.

G. Small-Scale Server: A computer that typically uses desktop components in a desktop form factor, but is designed primarily to be a storage host for other computers. A computer must have the following characteristics to be considered a Small-Scale Server:

(a) Designed in a pedestal, tower, or other form factor similar to those of desktop computers such that all data processing, storage, and network interfacing is contained within one box/product;

(b) Intended to be operational 24 hours/day and 7 days/week, and unscheduled downtime is extremely low (in the order of hours/year);

(c) Capable of operating in a simultaneous multi-user environment serving several users through networked client units; and

(d) Designed for an industry-accepted operating system for home or low-end server applications (e.g., Windows Home Server, Mac OS X Server, Linux, UNIX, Solaris).

(e) Small-Scale Servers are designed to perform functions such as providing network infrastructure services (e.g., archiving) and hosting data/media. These products are not designed to process information for other systems or run web servers as a primary function.

(f) This specification does not cover Computer Servers as defined in the ENERGY STAR Version 1.0 Computer Server specification. Small-Scale Servers covered by this specification are limited to computers marketed for non-datacentre operation (e.g. homes, small offices).

H. Integrated Desktop Computer: A desktop system in which the computer and computer display function as a single unit which receives its AC power through a single cable. Integrated desktop computers come in one of two possible forms: (1) a system where the computer display and computer are physically combined into a single unit; or (2) a system packaged as a single system where the computer display is separate but is connected to the main chassis by a DC power cord and both the computer and computer display are powered from a single power supply. As a subset of desktop computers, integrated desktop computers are typically designed to provide similar functionality as desktop systems.

I. Thin Client: An independently-powered computer that relies on a connection to remote computing resources to obtain primary functionality. Main computing (e.g., programme execution, data storage, interaction with other Internet resources, etc.) takes place using the remote computing resources. Thin Clients covered by this specification are limited to devices with no rotational storage media integral to the computer. The main unit of a Thin Client covered by this specification must be intended for location in a permanent location (e.g. on a desk) and not for portability.

J. Notebook Computer: A computer designed specifically for portability and to be operated for extended periods of time either with or without a direct connection to an AC power source. Notebooks must utilise an integrated computer display and be capable of operation off an integrated battery or other portable power source. In addition, most notebooks use an external power supply and have an integrated keyboard and pointing device. Notebook computers are typically designed to provide similar functionality to desktops, including operation of software similar in functionality as that used in desktops. For the purposes of this specification, docking stations are considered accessories and therefore the performance levels associated with notebooks presented in Section 3, below, do not include them. Tablet PCs, which may use touch-sensitive screens along with or instead of other input devices, are considered Notebook Computers in this specification.

K. Workstation: A high-performance, single-user computer typically used for graphics, CAD, software development, financial and scientific applications among other compute-intensive tasks. To qualify as a workstation, a computer must:

(a) Be marketed as a workstation;

(b) Have a mean time between failures (MTBF) of at least 15,000 hours based on either Bellcore TR-NWT-000332, issue 6, 12/97 or field collected data; and

(c) Support error-correcting code (ECC) and/or buffered memory.

(d) In addition, a workstation must meet three of the following six optional characteristics:

(e) Have supplemental power support for high-end graphics (i.e., PCI-E 6-pin 12V supplemental power feed);

(f) The system is wired for greater than x4 PCI-E on the motherboard in addition to the graphics slot(s) and/or PCI-X support;

(g) Does not support Uniform Memory Access (UMA) graphics;

(h) Includes five or more PCI, PCIe or PCI-X slots;

(i) Capable of providing multi-processor support to two or more processors (must support physically separate processor packages/sockets, i.e., not met with support for a single multi-core processor); and/or

(j) Be qualified by at least two Independent Software Vendor (ISV) product certifications; these certifications can be in process, but must be completed within 3 months of qualification.

Operational Modes

L. Off Mode: The power consumption level in the lowest power mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when the appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions. For systems where ACPI standards are applicable, the Off Mode correlates to ACPI System Level S5 state.

M. Sleep Mode: A low power state that the computer is capable of entering automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "awake" in response to network connections or user interface devices with a latency of ≤ 5 seconds from initiation of wake event to the system becoming fully usable, including rendering of display. For systems where ACPI standards are applicable, the Sleep mode most commonly correlates to ACPI System Level S3 (suspend to RAM) state.

N. Idle State: The state in which the operating system and other software have completed loading, a user profile has been created, the machine is not asleep, and activity is limited to those basic applications that the system starts by default.

O. Active State: The state in which the computer is carrying out useful work in response to a) prior or concurrent user input or b) prior or concurrent instruction over the network. This state includes active processing, seeking data from storage, memory, or cache, including idle state time while awaiting further user input and before entering low power modes.

P. Typical Energy Consumption (TEC): A method of testing and comparing the energy performance of computers, which focuses on the typical electricity consumed by a product while in normal operation during a representative period of time. For Desktops and Notebooks, the key criterion of the TEC approach is a value for typical annual electricity use, measured in kilowatt-hours (kWh), using measurements of average operational mode power levels scaled by an assumed typical usage model (duty cycle). For Workstations, requirements are based on a TEC power value calculated from operational mode power levels, maximum power, and an assumed duty cycle.

Networking and Power Management

Q. Network Interface: The components (hardware and software) whose primary function is to make the computer capable of communicating over one or more network technologies. Examples of Network Interfaces are IEEE 802.3 (Ethernet) and IEEE 802.11 (Wi-Fi).

R. Wake Event: A user, scheduled, or external event or stimulus that causes the computer to transition from Sleep or Off to active mode of operation. Examples of wake events include, but are not limited to: movement of the mouse, keyboard activity, controller input, real-time clock event, or a button press on the chassis, and in the case of external events, stimulus conveyed via a remote control, network, modem, etc.

S. Wake On LAN (WOL): Functionality which allows a computer to wake from Sleep or Off when directed by a network request via Ethernet.

T. Full Network Connectivity: The ability of the computer to maintain network presence while in sleep mode and intelligently wake when further processing is required (including occasional processing required to maintain network presence). Maintaining network presence may include obtaining and/or defending an assigned interface or network address, responding to requests from other nodes on the network, or maintaining existing network connections, all while in the sleep state. In this fashion, presence of the computer, its network services and applications, is maintained even though the computer is in sleep mode. From the vantage point of the network, a sleeping computer with full network connectivity is functionally equivalent to an idle computer with respect to common applications and usage models. Full network connectivity in sleep is not limited to a specific set of protocols but can cover applications installed after initial installation.

Marketing and Shipment Channels

U. Enterprise Channels: Sales channels normally used by large and medium-sized business, government organisations, educational institutions, or other organisations purchasing computers used in managed client/server environments.

V. Model Number: A unique marketing name that applies to a specific hardware/software configuration (i.e. operating system, types or processors, memory, GPU, etc.) that is either pre-defined, or a configuration selected by the customer.

W. Model Name: A marketing name that includes reference to both the PC model family number, a short description of the product, or branding references.

X. Product Family: A high-level description referring to a group of computers typically sharing one chassis/motherboard combination that often contains hundreds of possible hardware and software configurations.

2. QUALIFYING PRODUCTS

Computers must meet the computer definition and one of the product type definitions provided in Section 1, above, to qualify as ENERGY STAR. The following table provides a list of the types of computers that are (and are not) eligible for ENERGY STAR.

Products Covered by this Version 5.0 Specification	Products Not Covered by this Version 5.0 Specification
● Desktop Computers ● Integrated Desktop Computers ● Notebook Computers ● Workstations ● Small-Scale Servers ● Thin Clients	● Computer Servers (as defined in Version 1.0 Computer Server specification) ● Handhelds, PDAs, and Smartphones

3. ENERGY-EFFICIENCY AND POWER MANAGEMENT CRITERIA

Computers must meet the requirements below to qualify as ENERGY STAR. The Version 5.0 effective date is covered in Section 5 of this specification.

A. Power supply efficiency requirements

Computers must meet the requirements below to qualify as ENERGY STAR. The Version 5.0 effective date is covered in Section 5 of this specification.

(a) Computers Using an Internal Power Supply: 85% minimum efficiency at 50% of rated output and 82% minimum efficiency at 20% and 100% of rated output, with Power Factor $\geq$ 0.9 at 100% of rated output.

(b) Computers Using an External Power Supply: External Power Supplies sold with ENERGY STAR computers must be ENERGY STAR qualified or meet the no-load and active mode efficiency levels laid down in the ENERGY STAR Program Requirements for Single Voltage External AC-AC and AC-DC Power Supplies, Version 2.0. The ENERGY STAR specification and qualified product list can be found at www.energystar.gov/powersupplies. Note: This performance requirement also applies to multiple voltage output external power supplies as tested in accordance with the Internal Power Supply test method referenced in Section 4, below.

B. Efficiency and performance requirements

(1) Desktop, Integrated Desktop, and Notebook Levels:

Desktop Categories for TEC Criteria:

For the purposes of determining TEC levels, desktops and integrated desktops must qualify under Categories A, B, C, or D as defined below:

(a) Category A: all desktop computers that do not meet the definition of Category B, Category C, or Category D below will be considered under Category A for ENERGY STAR qualification.

(b) Category B: to qualify under Category B, desktops must have:

– equal to two physical cores; and

– two gigabytes (GB) of system memory.

(c) Category C: To qualify under Category C, desktops must have:

– greater than two physical cores.

In addition to the requirement above, models qualifying under Category C must be configured with at least one of the following two characteristics:

- at least two gigabytes (GB) of System Memory, and/or
- a discrete GPU

(d) Category D: to qualify under Category D, desktops must have:

- at least four physical cores

In addition to the requirement above, models qualifying under Category D must be configured with at least one of the following two characteristics:

- at least four gigabytes (GB) of System Memory; and/or
- a discrete GPU with a frame buffer width greater than 128-bit.

Notebook Categories for TEC Criteria:

For the purposes of determining TEC levels, notebooks must qualify under Categories A, B, or C as defined below:

(a) Category A: All notebook computers that do not meet the definition of Category B or Category C below will be considered under Category A for ENERGY STAR qualification.

(b) Category B: To qualify under Category B, notebooks must have:

- A discrete GPU

(c) Category C: To qualify under Category C, notebooks must have:

- greater than or equal to 2 physical cores;
- greater than or equal to 2 gigabytes (GB) of system memory; and
- a discrete GPU with a frame buffer width greater than 128-bit.

TEC (Desktop and Notebook product categories):

The following tables indicate the required TEC levels for the 5.0 Specification. Table 1 below lists TEC requirements for Version 5.0, while Table 2 gives weightings for each operational mode by product type. TEC will be determined using the formula below:

$E_{TEC} = (8760/1000) \cdot (P_{off} \cdot T_{off} + P_{sleep} \cdot T_{sleep} + P_{idle} \cdot T_{idle})$, where all P_x are power values in watts, all T_x are Time values in % of year, and the TEC E_{TEC} is in units of kWh and represents annual energy consumption based on mode weightings in Table 2.

Table 1: E_{TEC} Requirement – Desktops and Notebooks

	Desktops and Integrated Computers (kWh)	Notebook Computers (kWh)
TEC (kWh)	Category A: ≤ 148.0 Category B: ≤ 175.0 Category C: ≤ 209.0 Category D: ≤ 234.0	Category A: ≤ 40.0 Category B: ≤ 53.0 Category C: ≤ 88.5
Capability Adjustments		
Memory	1 kWh (per GB over base) *Base Memory*: Categories A, B and C: 2GB Category D: 4 GB	0.4 kWh (per GB over 4)
Premium Graphics (*for Discrete GPUs with specified Frame Buffer Widths*)	Cat. A, B: 35 kWh (FB Width ≤ 128-bit) 50 kWh (FB Width > 128-bit) Cat. C, D: 50 kWh (FB Width > 128-bit)	Cat. B: 3 kWh (FB Width > 64-bit)
Additional Internal Storage	25 kWh	3 kWh

Table 2: Operational Mode Weighting – Desktops and Notebooks

	Desktop		Notebook	
	Conventional	Proxying*	Conventional	Proxying*
T_{off}	55%	40%	60%	45%
T_{sleep}	5%	30%	10%	30%
T_{idle}	40%	30%	30%	25%

Note: Proxying *refers to a computer that maintains Full Network Connectivity as defined in Section 1 of this specification. For a system to qualify under the proxying weightings above, it must meet a non-proprietary proxying standard that has been approved by the EPA and the European Commission as meeting the goals of ENERGY STAR. Such approval must be in place prior to submittal of product data for qualification. See Section 3.C, "*Qualifying Computers with Power Management Capabilities", *for further information and testing requirements.*

(2) Workstation Levels

P_{TEC} (Workstation product category):

The following tables indicate the required P_{TEC} levels for the 5.0 Specification. Table 3 below lists P_{TEC} requirements for Version 5.0, while Table 4 gives weightings for each operational mode. P_{TEC} will be determined using the formula below:

$P_{TEC} = 0.35 \cdot P_{off} + 0.10 \cdot P_{sleep} + 0.55 \cdot P_{idle}$

where all P_x are power values in watts.

Table 3: P_{TEC} Requirement - Workstations

$P_{TEC} \leq 0.28 \cdot [P_{max} + (\#\ HDD \cdot 5)]$

Table 4: Operational Mode Weighting - Workstations

Toff	35%
Tsleep	10%
Tidle	55%
Note: Weightings are included in the P_{TEC} *formula, above.*	

Multiple Graphics Devices (Workstations):

Workstations that meet ENERGY STAR requirements with a single graphics device may also qualify for a configuration with more than one graphics device, provided the additional hardware configuration is identical with the exception of the additional graphics device(s). The use of multiple graphics includes, but is not limited to, driving multiple displays and ganging for high-performance, multi-GPU configurations (e.g. ATI Crossfire, NVIDIA SLI). In such cases, and until such time as SPECviewperf® supports multiple graphics threads, manufacturers may submit the test data for the workstation with the single graphics device for both configurations without retesting the system.

(3) Small-Scale Server Levels:

For the purposes of determining Idle state levels, Small-Scale Servers must qualify under Categories A or B, as defined below:

(a) Category A: All Small-Scale Servers that do not meet the definition of Category B will be considered under Category A for ENERGY STAR qualification.

(b) Category B: To qualify under Category B Small-Scale Servers must have:

- processor(s) with greater than 1 physical core or greater than 1 discrete processor; and

- a minimum of 1 gigabyte of system memory

Table 6: Small-Scale Server Efficiency Requirements

Small-Scale Server Operational Mode Power Requirements	
Off Mode: ≤ 2.0 W Idle State: Category A: ≤ 50.0 W Category B: ≤ 65.0 W	
Capability	Additional Power Allowance
Wake On LAN (WOL) (Applies only if computer is shipped with WOL enabled)	+ 0.7 W for Off

(4) Thin Client Levels

Thin Client Categories for Idle Criteria: For the purposes of determining Idle levels, Thin Clients must qualify under Categories A or B as defined below:

(a) Category A: All Thin Clients that do not meet the definition of Category B, below, will be considered under Category A for ENERGY STAR qualification.

(b) Category B: To qualify under Category B, Thin Clients must:

– Support local multimedia encode/decode

Table 7: Thin Client Efficiency Requirements

Thin Client Operational Mode Power Requirements	
Off Mode: ≤ 2 W Sleep Mode (*if applicable*): ≤ 2 W Idle State: Category A: ≤ 12.0 W Category B: ≤ 15.0 W	
Capability	Additional Power Allowance
Wake On LAN (WOL) (*Applies only if computer is shipped with WOL enabled*)	+ 0.7 W for Sleep + 0.7 W for Off

C. Power Management Requirements

Products must meet the power management requirements detailed in Table 8, below, and be tested as shipped.

Table 8: Power Management Requirements

Specification Requirement		Applicable to	
Shipment Requirements			
Sleep Mode	Shipped with a Sleep mode which is set to activate within 30 minutes of user inactivity. Computers shall reduce the speed of any active 1 Gb/s Ethernet network links when transitioning to Sleep or Off.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Small-Scale Servers	
		Thin Clients	
Display Sleep Mode	Shipped with the display's Sleep mode set to activate within 15 minutes of user inactivity.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Small-Scale Servers (if computer display is present)	√
		Thin Clients	√

Specification Requirement		Applicable to	
Network Requirements for Power Management			
Wake on LAN (WOL)	Computers with Ethernet capability shall have the ability to enable and disable WOL for Sleep mode.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Small-Scale Servers	√
		Thin Clients (*Only applies if software updates from the centrally managed network are conducted while the unit is in sleep or off mode. Thin Clients whose standard framework for upgrading client software does not require off-hours scheduling are exempt from the requirement.)*	√

<table>
<tr><th>Specification Requirement</th><th></th><th colspan="2">Applicable to</th></tr>
<tr><td colspan="4">Network Requirements for Power Management</td></tr>
<tr><td rowspan="10">Wake on LAN (WOL)</td><td rowspan="10">Applies to computers shipped through Enterprise Channels, only:

Computers with Ethernet capability must meet one of the following requirements:

● be shipped with Wake On LAN (WOL) enabled from the Sleep mode when operating on AC power (i.e. notebooks may automatically disable WOL when disconnected from the mains); or
● provide control to enable WOL that is sufficiently-accessible from both the client operating system user interface and over the network if computer is shipped to enterprise without WOL enabled.</td><td>Desktop Computers</td><td>√</td></tr>
<tr><td>Integrated Desktop Computers</td><td>√</td></tr>
<tr><td>Notebook Computers</td><td>√</td></tr>
<tr><td>Workstations</td><td>√</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Small-Scale Servers</td><td>√</td></tr>
<tr><td>Thin Clients (Only applies if software updates from the centrally managed network are conducted while the unit is in sleep or off mode. Thin Clients whose standard framework for upgrading client software does not require off-hours scheduling are exempt from the requirement.)</td><td>√</td></tr>
<tr><td></td><td></td></tr>
</table>

Specification Requirement		Applicable to	
Wake Management	*Applies to computers shipped through Enterprise Channels, only:* Computers with Ethernet capability shall be capable of both remote (via network) and scheduled wake events from Sleep mode (e.g. Real Time Clock). Manufacturers shall ensure, where the manufacturer has control (i.e., configured through hardware settings rather than software settings), that these settings can be managed centrally, as the client wishes, with tools provided by the manufacturer.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Small-Scale Servers	√
		Thin Clients	√

For all computers with WOL enabled, any directed packet filters shall be enabled and set to an industry standard default configuration. Until one (or more) standards are agreed upon, partners are asked to provide their direct packet filter configurations to the EPA and the European Commission for publication on the website to stimulate discussion and development of standard configurations.

Qualifying Computers with Power Management Capabilities:

(a) Off: Computers shall be tested and reported as shipped for Off. Models that will be shipped with WOL enabled for Off shall be tested with WOL enabled. Likewise, products shipped with WOL disabled for Off shall be tested with WOL disabled.

(b) Sleep: Computers shall be tested and reported as shipped for Sleep. Models sold through enterprise channels, as defined in Section 1, definition V, shall be tested, qualified, and shipped with WOL enabled/disabled based on the requirements in Table 8. Products going directly to consumers through normal retail channels only are not required to be shipped with WOL enabled from Sleep, and may be tested, qualified, and shipped with WOL either enabled or disabled.

(c) Proxying: Desktop, Integrated Desktop, and Notebook Computers shall be tested and reported for Idle, Sleep, and Off with proxying features enabled or disabled as shipped. For a system to qualify using TEC weightings for proxying, it must meet a proxying standard that has been approved by the EPA and the European Commission as meeting the goals of ENERGY STAR. Such approval must be in place prior to submittal of product data for qualification.

Customer software and management service pre-Provisioning:

The Partner will remain responsible for testing products and qualifying them as they ship them. If the product meets and is qualified as ENERGY STAR at this point, it can be labelled as such.

If the Partner is hired by a customer to load a custom image, the Partner must take the following steps:

- The Partner must let the customer know that their product may not meet ENERGY STAR with the custom image loaded (a sample letter is available for use from the ENERGY STAR website that can be shared with customers).

- The Partner must encourage their customer to test the product for ENERGY STAR compliance.

User Information Requirement:

In order to ensure that purchasers/users are properly informed on the benefits of power management, the manufacturer will include with each computer, one of the following:

- Information on ENERGY STAR and the benefits of power management in either a hard copy or electronic copy of the user manual. This information should be near the front of the user guide; or

- A package or box insert on ENERGY STAR and the benefits of power management.

Either option must at least include the following information:

- Notice that the computer as shipped has been enabled for power management and what the time settings are (either the default settings for the system or a note stating that the default settings for the computer comply with the ENERGY STAR requirements of less than 15 minutes of user inactivity for the display and less than 30 minutes of inactivity for the computer, recommended by the ENERGY STAR program for optimal energy savings); and

- How to properly wake the computer from Sleep mode.

D. Voluntary Requirements

User Interface

Although not mandatory, manufacturers are strongly recommended to design products in accordance with the Power Control User Interface Standard — IEEE 1621 (formally known as "Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments"). Compliance with IEEE 1621 will make power controls more consistent and intuitive across all electronic devices. For more information on the standard see http://eetd.LBL.gov/Controls.

4. TEST PROCEDURES

Manufacturers are required to perform tests and self-certify those models that meet the ENERGY STAR guidelines.

– In performing these tests, the partner agrees to use the test procedures provided in Table 9, below.

– The test results must be reported to the EPA or the European Commission, as appropriate.

Additional testing and reporting requirements are provided below.

1. Number of Units Required for TEC or Idle Testing:

Manufacturers may initially test a single unit for qualification. If the initial unit tested is less than or equal to the applicable requirement for TEC or Idle but falls within 10% of that level, one additional unit of the same model with an identical configuration must also be tested. Manufacturers shall report test values for both units. To qualify as ENERGY STAR, both units must meet the maximum TEC or Idle level for that product and that product category.

Note: This additional testing is only required for TEC qualification (Desktops, Integrated Desktops, Notebooks, Workstations) and Idle qualification (Small-Scale Servers, Thin Clients) – only one unit is required to be tested for Sleep and Off if such requirements apply. The following examples further illustrate this approach:

Example 1 – Category A Desktop must meet a TEC level of 148.0 kWh or less, making 133.2 kWh the 10% threshold for additional testing.

– If the first unit is measured at 130 kWh, no more testing is needed and the model qualifies (130 kWh is 12% more efficient than the specification and is therefore "outside" the 10% threshold).

– If the first unit is measured at 133.2 kWh, no more testing is needed and the model qualifies (133.2 kWh is exactly 10% more efficient than the specification).

– If the first unit is measured at 135 kWh, then an additional unit must be tested to determine qualification (135 kWh is only 9% more efficient than the specification and is "within" the 10% threshold).

– If the two units are then tested at 135 and 151 kWh, the model does not qualify as ENERGY STAR—even though the average is 143 kWh — because one of the values exceeds the ENERGY STAR specification.

– If the two units are then tested at 135 and 147 kWh, the model does qualify as ENERGY STAR because both values meet the ENERGY STAR specification of 148.0 kWh.

Example 2 – A Category A Small-Scale Server must meet an Idle level of 50 watts or less, making 45 Watts the 10% threshold for additional testing. The following scenarios could then occur when testing a model for qualification:

– If the first unit is measured at 44 watts, no more testing is needed and the model qualifies (44 watts is 12% more efficient than the specification and is therefore "outside" the 10% threshold).

– If the first unit is measured at 45 watts, no more testing is needed and the model qualifies (45 watts is exactly 10% more efficient than the specification).

– If the first unit is measured at 47 watts, then an additional unit must be tested to determine qualification (47 Watts is only 6% more efficient than the specification and is "within" the 10% threshold).

– If the two units are then tested at 47 and 51 watts, the model does not qualify as ENERGY STAR—even though the average is 49 watts— because one of the values (51) exceeds the ENERGY STAR specification.

– If the two units are then tested at 47 and 49 watts, the model does qualify as ENERGY STAR because both values meet the ENERGY STAR specification of 50 watts.

2. Models Capable of Operating at Multiple Voltage/Frequency Combinations:

Manufacturers shall test their products based on the market(s) in which the models will be sold and promoted as ENERGY STAR qualified.

For products that are sold as ENERGY STAR in multiple international markets and, therefore, rated at multiple input voltages, the manufacturer must test at and report the required measured power consumption and efficiency values at all relevant voltage/frequency combinations. For example, a manufacturer that ships the same model to the United States and Europe must measure, meet the specification, and report test values at both 115 Volts/60 Hz and 230 Volts/50 Hz in order to qualify the model as ENERGY STAR in both markets. If a model qualifies as ENERGY STAR at only one voltage/frequency combination (e.g., 115 Volts/60 Hz), then it may only be qualified and promoted as ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g. North America and Taiwan).

Table 9: Test Procedures

Product Category	Specification Requirement	Test Protocol	Source
All Computers	Power Supply Efficiency	*IPS: Generalised Internal Power Supply Efficiency Test Protocol Rev. 6.4.2* EPS: ENERGY STAR Test Method for External Power Supplies *Note: Should any information/procedures in addition to those described by the Internal Power Supply Efficiency Protocol be required in order to test an Internal Power Supply, partners must make available to EPA or the European Commission, as appropriate, upon request the test setup used to acquire IPS data used in a product submittal.*	IPS: www.efficientpowersupplies.org EPS: www.energystar.gov/powersupplies

Product Category	Specification Requirement	Test Protocol	Source
Desktop, Integrated, and Notebook Computers	E_{TEC} (from measurements of Off Mode, Sleep Mode, and Idle State)	ENERGY STAR Computer Test Method (Version 5.0), Annex I, Section III	Appendix A
Workstations	P_{TEC} (from measurements of Off Mode, Sleep Mode, Idle State, and Maximum Power)	ENERGY STAR Computer Test Method (Version 5.0), Annex I, Section III-IV	
Small-Scale Servers	Off Mode and Idle State	ENERGY STAR Computer Test Method (Version 5.0) , Annex I, Section III	
Thin Clients	Off Mode, Sleep Mode, and Idle State	ENERGY STAR Computer Test Method (Version 5.0) , Annex I, Section III	

3. Qualifying families of Products

Models that are unchanged or that differ only in finish from those sold in a previous year may remain qualified without the submission of new test data assuming the specification remains unchanged. If a product model is placed on the market in multiple configurations or styles, as a product "family" or series, the partner may report and qualify the product under a single model number, as long as all of the models within that family or series meet either of the following requirements:

– Computers that are built on the same platform and are identical in every respect except for housing and colour may be qualified through submission of test data for a single, representative model.

– If a product model is placed on the market in multiple configurations, the partner may report and qualify the product under a single unique model identifier number that represents the highest power configuration available in the family, rather than reporting each and every individual model in the family; there must not be higher consuming configurations of the same product model than the representative configuration. In this case, the highest configuration would consist of: the highest power processor, the maximum memory configuration, the highest power GPU, etc. For systems which meet the definition for multiple categories (as defined in Section 3.B) depending on the specific configuration, manufacturers will have to submit the highest power configuration for each category under which they would like the system to qualify. For example, a system that could be configured either as a Category A or a Category B desktop would require a submission of the highest power configuration for both categories in order to qualify as ENERGY STAR. If a product could be configured to meet all three categories, it would then have to submit data for the highest power configuration in all categories. Manufacturers will be held accountable for any efficiency claims made about all other models in the family, including those not tested or for which data was not reported.

All units/configurations associated with a product model designation, for which a Partner is seeking ENERGY STAR qualification, must meet the ENERGY STAR requirements. If a Partner wishes to qualify configurations of a model for which non-qualifying alternative configurations exist, the Partner must assign the qualifying configurations an identifier using the model name/number that is unique to ENERGY STAR Qualified configurations. This identifier must be used consistently in association with the qualifying configurations in marketing/sales materials and on the ENERGY STAR list of qualified products (e.g. model A1234 for baseline configurations and A1234-ES for ENERGY STAR qualifying configurations).

5. EFFECTIVE DATE

The date that manufacturers may begin to qualify products as ENERGY STAR will be defined as the effective date of the agreement.

Desktop, Integrated Desktop, Notebook, Workstation, Small-Scale Server:

The ENERGY STAR Version 5.0 effective date for *Desktop, Integrated Desktop, Notebook, Workstation, Small-Scale Server and Thin Client* is July 1, 2009. All products, including models originally qualified under Version 4.0, with a date of manufacture on or after July 1, 2009 must meet this Version 5.0 requirements in order to qualify for ENERGY STAR. Game Consoles with a date of manufacture on or after July 1, 2010 must meet this Version 5.0 requirements in order to qualify for ENERGY STAR. Any previously executed agreement on the subject of ENERGY STAR qualified computers shall be terminated with effect from June 30, 2009.

6. Future Specification Revisions

The EPA and the European Commission reserve the right to revise the specification should technological and/or market changes affect its usefulness to consumers or industry or its impact on the environment. In keeping with current policy, revisions to the specification will be discussed with stakeholders. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model. To qualify as ENERGY STAR, a product model must meet the ENERGY STAR specification in effect on the model's date of manufacture.

Appendix A

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

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

Computers must be tested with configuration and settings as shipped, unless otherwise specified in the test procedure in this Appendix A. Steps requiring alternative setup are marked with an asterisk (" * ").

I. Definitions

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

1. UUT: UUT is an acronym for "unit under test," which in this case refers to the computer being tested.

2. UPS: UPS is an acronym for "Uninterruptible Power Supply," which refers to a combination of converters, switches and energy storage means, for example batteries, constituting a power supply for maintaining continuity of load power in case of input power failure.

II. Testing Requirements

1. Approved Meter:

Approved meters will include the following attributes[1]:

– Power resolution of 1 mW or better;

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

– An available current crest factor of 3 or more at its rated range value; and

– Lower bound on the current range of 10mA or less.

The following attributes in addition to those above are suggested:

– Frequency response of at least 3 kHz; and

– Calibration with a standard that is traceable to the U.S. National Institute of Standards and Technology (NIST).

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

2. Accuracy

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

- 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.

3. Test Conditions

Supply Voltage:	North America/Taiwan: Europe/Australia/New Zealand: Japan:	115 (± 1%) Volts AC, 60 Hz (± 1%) 230 (± 1%) Volts AC, 50 Hz (± 1%) 100 (± 1%) Volts AC, 50 Hz (± 1%)/60 Hz (± 1%) *Note:* For products rated for > 1.5 kW maximum power, the voltage range is ± 4%
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 4.2, 4.3, 4.4)

4. Test Configuration

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

If the UUT supports Ethernet, it 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 Computer Products

The AC power consumption of a computer should be measured as follows:

UUT Preparation

1. Record the manufacturer and model name of the UUT.

2. Ensure that the UUT is connected to network resources as detailed below, and that the UUT maintains this live connection for the duration of testing, disregarding brief lapses when transitioning between link speeds.

   (a) Desktops, Integrated Desktops, and Notebooks shall be connected to a live Ethernet (IEEE 802.3) network switch as specified in Section II., "Test Configuration," above. The computer must maintain this live connection to the switch for the duration of testing, disregarding brief lapses when transitioning between link speeds. Computers without Ethernet capability must maintain a live wireless connection to a wireless router or network access point for the duration of testing.

   (b) Small-Scale Servers shall be connected to a live Ethernet (IEEE 802.3) network switch as specified in Section II., "Test Configuration," above, and that the connection is live.

(c) Thin Clients shall be connected to a live server via a live Ethernet (IEEE 802.3) network switch and shall run intended terminal/remote connection software.

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 the test to be valid the meter should remain in place until all Off, Sleep, and Idle power data is recorded.

5. Record the ac voltage and frequency.

6. Boot the computer and wait until the operating system has fully loaded. If necessary, run the initial operating system setup and allow all preliminary file indexing and other one-time/periodic processes to complete.

7. Record basic information about the computer's configuration – computer type, operating system name and version, processor type and speed, and total and available physical memory, etc.

8. Record basic information about the video card or graphics chipset (if applicable) - video card/chipset name, frame buffer width, resolution, amount of onboard memory, and bits per pixel.

9. * Ensure that the UUT is configured as shipped including all accessories, WOL enabling, and software shipped by default. UUT should also be configured using the following requirements for all tests:

   (a) Desktop systems shipped without accessories should be configured with a standard mouse, keyboard and external computer display.

   (b) Notebooks 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.

   (c) Notebooks 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 this configuration is reported in the test results.

(d) Small-Scale Servers and Thin Clients shipped without accessories should be configured with a standard mouse, keyboard and external computer display (if server has display output functionality).

(e) For Computers with Ethernet capability, power to wireless radios should be turned off for all tests. This applies to wireless network adapters (e.g. 802.11) or device-to-device wireless protocols. For Computers without Ethernet capability, power to a wireless LAN radio (e.g. IEEE 802.11) should remain on during testing and must maintain a live wireless connection to a wireless router or network access point, which supports the highest and lowest data speeds of the client radio, for the duration of testing.

(f) Primary hard drives may not be power managed ("spun-down") during Idle testing unless they contain non-volatile cache integral to the drive (e.g. "hybrid" hard drives). If more than one internal hard drive is installed as shipped, the non-primary, internal hard drive(s) may be tested with hard drive power management enabled as shipped. If these additional drives are not power managed when shipped to customers, they must be tested without such features implemented.

10. The following guidelines should be followed to configure power settings for computer displays (adjusting no other power management settings):

    (a) For computers with external computer displays (most desktops): use the computer display power management settings to prevent the display from powering down to ensure it stays on for the full length of the Idle test as described below.

    (b) For computers with integrated computer displays (notebooks and integrated systems): use the power management settings to set the display to power down after one minute.

11. Shut down the UUT

Off Mode Testing

12. With the UUT shut down and in Off, set the meter to begin accumulating true power values at an interval of less than or equal to one reading per second. Accumulate power values for five additional minutes and record the average (arithmetic mean) value observed during that five minute period.[1]

[1] 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.

Idle Mode Testing

13. Switch on the computer and begin recording elapsed time, starting either when the computer is initially switched on, or immediately after completing any log in activity necessary to fully boot the system. Once logged in with the operating system fully loaded and ready, close any open windows so that the standard operational desktop screen or equivalent ready screen is displayed. Between five and 15 minutes after the initial boot or log in, set the meter to begin accumulating true power values at an interval of at least one reading per second. Accumulate power values for five additional minutes and record the average (arithmetic mean) value observed during that five minute period.

Sleep Mode Testing

14. After completing the Idle measurements, place the computer in Sleep mode. Reset the meter (if necessary) and begin accumulating true power values at an interval of at least one reading per second. Accumulate power values for five additional minutes and record the average (arithmetic mean) value observed during that five minute period.

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

Reporting Test Results

16. The test results must be reported to the EPA or the European Commission, as appropriate, taking care to ensure that all required information has been included, including modal power values and eligible capability adjustments for Desktops, Integrated Desktops, and Notebooks.

IV. Maximum Power Test for Workstations

The maximum power for workstations is found by the simultaneous operation of two industry standard benchmarks: Linpack to stress the core system (e.g., processor, memory, etc.) and SPECviewperf® (latest available version for the UUT) to stress the system's GPU. Additional information on these benchmarks, including free downloads, can be found at the URLs found below:

Linpack	http://www.netlib.org/linpack/
SPECviewperf®	http://www.spec.org/benchmarks.html#gpc

This test must be repeated three times on the same UUT, and all three measurements must fall within a ± 2% tolerance relative to the average of the three measured maximum power values.

Measurement of the maximum AC power consumption of a workstation should be conducted as follows:

UUT Preparation

1. 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. The meter should be able to store and output the maximum power measurement reached during the test or be capable of another method of determining maximum power.

2. 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.

3. Record the AC voltage.

4. * Boot the computer and, if not already installed, install Linpack and SPECviewperf as indicated on the above Websites.

5. Set Linpack with all the defaults for the given architecture of the UUT and set the appropriate array size "n" for maximising power draw during the test.

6. Ensure all guidelines set by the SPEC organisation for running SPECviewperf are being met.

Maximum Power Testing

7. Set the meter to begin accumulating true power values at an interval no more than one reading per second, and begin taking measurements. Run SPECviewperf and as many simultaneous instances of Linpack as needed to fully stress the system.

8. Accumulate power values until SPECviewperf and all instances have completed running. Record the maximum power value attained during the test.

Reporting Test Results

9. The test results must be reported to the EPA or the European Commission, as appropriate, taking care to include all required information.

10. Upon submittal of data, manufacturers must also include the following data:

    a. Value of the n (the array size) used for Linpack,

    b. Number of simultaneous copies of Linpack run during the test,

    c. Version of SPECviewperf run for test,

    d. All compiler optimisations used in compiling Linpack and SPECviewperf, and

    e. A precompiled binary for end users to download and run both SPECviewperf and Linpack. These can be distributed either through a centralised standards body such as SPEC, by the OEM or by a related third party.

V. Continuing Verification

This testing procedure 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 comply with ENERGY STAR.

Appendix B

SAMPLE CALCULATIONS

I. Desktop, Integrated Desktop, Notebook Computers: Below is a sample TEC calculation intended to show how compliance levels are determined based on functional adders and operational mode measurements, for an example E_{TEC} evaluation for a Category A Notebook Computer (integrated GPU, 8 GB Memory Installed, 1 HDD)

1. Measure values using the Appendix A test procedure:

   – Off = 1 W

   – Sleep = 1.7 W

   – Idle = 10 W

2. Determine which Capability Adjustments apply:

   – Integrated Graphics? Does not apply for Premium Graphics.

– 8GB Memory installed. Does meet memory adjustment level: 8 yields a 1.6 kWh adjustment (4 · 0.4kWh).

3. Apply Weightings based on Table 2 to calculate TEC:

– *Table 2 (for conventional notebook):*

Toff	60%
Tsleep	10%
Tidle	30%

– $E_{TEC} = (8760/1000) \cdot (P_{off} \cdot T_{off} + P_{sleep} \cdot T_{sleep} + P_{idle} \cdot T_{idle})$

– $= (8760/1000) \cdot (P_{off} \cdot 0.60 + P_{sleep} \cdot 0.10 + P_{idle} \cdot 0.30)$

– $= (8760/1000) \cdot (1 \cdot 0.60 + 1.7 \cdot 0.10 + 10 \cdot 0.30)$

– $= 33.03\ kWh$

4. Determine TEC Requirement for the computer by adding any capability adjustments (step 2) to the Base TEC requirement (Table1).

– *Table 1 (for notebooks):*

Notebook Computers (kWh)	
Category A	40
Category B	53
Category C	88.5

– *ENERGY STAR TEC Requirement = 40 kWh + 1.6 kWh = 41.6 kWh*

5. Compare ETEC to the ENERGY STAR TEC Requirement (step 4) to ascertain whether the model qualifies.

– *Category A TEC requirement: 41.6 kWh*

– E_{TEC}*: 33.03 kWh*

– *33.03 kWh < 41.6 kWh*

Notebook meets the ENERGY STAR requirements.

II. Workstations: Below is a sample PTEC calculation for a Workstation with two hard drives.

1. Measure values using the Appendix A test procedure.

– *Off = 2 W*

– *Sleep = 4 W*

– *Idle = 80 W*

– *Max Power = 180 W*

2. Note number of Hard Drives installed.

– *Two hard drives installed during test.*

3. Apply Weightings based on Table 4 to calculate P_{TEC}:

– *Table 4:*

Toff	35%
Tsleep	10%
Tidle	55%

– $P_{TEC} = (0.35 \cdot P_{off} + 0.10 \cdot P_{sleep} + 0.55 \cdot P_{idle})$

– $= (0.35 \cdot 2 + 0.10 \cdot 4 + 0.55 \cdot 80)$

– $= 45.10\ W$

4. Calculate the PTEC requirement using the formula in Table 3.

– $P_{TEC} = 0.28 \cdot [P_{max} + (\#\,HDD \cdot 5)]$

– $P_{TEC} = 0.28 \cdot [180 + 2 \cdot 5)]$

– $P_{TEC} = 53.2$

5. Compare the adjusted P_{TEC} to the ENERGY STAR levels to determine if the model qualifies.

– 45.10 < 53.2

Workstation meets the ENERGY STAR requirements.

II. DISPLAY SPECIFICATIONS

1. DEFINITIONS

A. Electronic Display (also referred to as "Display"): A commercially-available product with a display screen and associated electronics, often encased in a single housing, that as its primary function displays visual information from (i) a computer, workstation or server via one or more inputs, such as VGA, DVI, HDMI, or IEEE 1394, or (ii) a USB flash drive, a memory card, or wireless Internet connection. Common display technologies include liquid crystal display (LCD), light emitting diode (LED), cathode-ray tube (CRT), and plasma display panel (PDP).

B. External Power Supply: A component contained in a separate physical enclosure external to the display casing and designed to convert line voltage AC input from the mains to lower DC voltage(s) for the purpose of powering the display. An external power supply (EPS) must connect to the display via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.

C. On Mode: The operational mode of a display that is (i) connected to a power source, (ii) has all mechanical (hard) power switches turned on, and (iii) is performing its primary function of producing an image.

D. Sleep Mode: The operational mode of a display that is (i) connected to a power source, (ii) has all mechanical (hard) power switches turned on, and (iii) has been placed into a low-power mode by receiving a signal from a connected device (e.g. computer, game console, or set-top box) or by cause of an internal function such as a sleep timer or occupancy sensor. Sleep Mode is considered a "soft" low-power condition, in that the display can be brought out of Sleep Mode by receiving a signal from a connected device or by cause of an internal function.

E. Off Mode: The operational mode of a display that is (i) connected to a power source, (ii) engaged by a power switch, and (iii) not providing any function. The user must actuate a mechanical switch to bring the device out of Off Mode. If there is more than one such switch, the tester shall use the most readily available switch.

F. Luminance: The photometric measure of the luminous intensity per unit area of light travelling in a given direction. It describes the amount of light that passes through or is emitted from a particular area, and falls within a given solid angle. The standard unit for luminance is candela per square meter (cd/m2).

G. Automatic Brightness Control: For displays, automatic brightness controls is the self-acting mechanism which controls brightness of the display as a function of ambient light.

2. QUALIFYING PRODUCTS:

To qualify for ENERGY STAR, the display must satisfy the following criteria:

A. Maximum viewable diagonal screen size: The display must have a viewable diagonal screen size of less than or equal to (≤) 60 inches.

B. Power Source: The display must be powered by a separate AC wall outlet, a battery unit that is sold with an AC adapter, or a data or network connection.

C. Television Tuners: If the display has an integrated television tuner, it may qualify for ENERGY STAR under this specification as long as it is primarily marketed and sold to consumers as a display or as a dual-function display and television. Any display with a television tuner that is marketed and sold exclusively as a television is not eligible to qualify under this specification. Under Tier 2 of this specification, only those displays without tuners may qualify; displays with tuners may qualify under Tier 2 of the Version 3.0 ENERGY STAR TV specification.

D. Automatic Brightness Control (ABC): To qualify for ENERGY STAR using the Automatic Brightness Control On Mode power equation, the display must ship with ABC enabled by default.

E. External Power Supply: If the display is shipped with an EPS, the EPS must be ENERGY STAR qualified or meet the no-load and active mode efficiency levels provided in the ENERGY STAR Program Requirements for Single Voltage AC-AC and AC-DC External Power Supplies. The ENERGY STAR specification and qualified product list can be found at www.energystar.gov/powersupplies.

F. Power Management Requirements: The display must have at least one mechanism enabled by default that allows the display to automatically enter Sleep or Off Mode. For instance, data or network connections must support powering down the display according to standard mechanisms, such as Display Power Management Signalling. Displays generating their own content must have a sensor or timer enabled by default to automatically engage Sleep or Off Mode.

3. ENERGY-EFFICIENCY CRITERIA

A. On Mode Requirements

1. Tier 1

To qualify as ENERGY STAR, the display must not exceed the maximum On Mode power consumption (PO or PO1) as calculated from the equations below. The maximum On Mode power consumption is expressed in watts and rounded to the nearest tenth of a watt.

Table 1: Tier 1 On Mode Power Consumption Requirements

Display Category	Maximum On Mode Power Consumption (W)
Diagonal Screen Size < 30 inches Screen Resolution ≤ 1.1 MP	PO = 6*(MP) + 0.05*(A) + 3
Diagonal Screen Size < 30 inches Screen Resolution > 1.1 MP	PO = 9*(MP) + 0.05*(A) + 3
Diagonal Screen Size 30 - 60 inches All Screen Resolutions	PO = 0.27*(A) + 8

Where:

MP = Display Resolution (megapixels)
A = Viewable Screen Area (square inches)

EXAMPLE: The maximum On Mode power consumption for a display with 1440 x 900 resolution, or 1,296,000 pixels, a 19 inch viewable diagonal screen size and a viewable screen area of 162 square inches, would be: ((9 x 1.296) + (0.05 x 162)) + 3 = 22.8 watts when rounded to the nearest tenth of a watt.

Table 2: Sample Tier 1 On Mode Maximum Power Consumption Requirements[1]

Diagonal Screen Size (inches)	Resolution	Megapixels	Screen Dimensions (inches)	Screen Area (sq. in.)	Maximum On Mode Power Consumption (watts)
7	800 x 480	0.384	5.9 x 3.5	21	6.4
19	1440 x 900	1.296	16.07 x 10.05	162	22.8
26	1920 x 1200	2.304	21.7 x 13.5	293	38.4
42	1360 x 768	1.044	36 x 20	720	202.4
50	1920 x 1080	2.074	44 x 24	1056	293.1

2. Tier 2

To qualify as ENERGY STAR, the display must not exceed the following maximum On Mode consumption equations: TBD.

[1] For displays between 30 and 60 inches, resolution must be reported when submitting a product for qualification; however, resolution is not considered when calculating the On Mode power consumption of these displays.

3. Displays with Automatic Brightness Control (ABC)

For Displays shipped with ABC features enabled by default an alternate calculation is used to calculate maximum On Mode power consumption

$PO1 = (0.8 * Ph) + (0.2 * Pl)$

where PO1 is the average On Mode power consumption in watts, rounded to the nearest tenth of a watt, Ph is the On Mode power consumption in high ambient lighting conditions, and Pl is the On Mode power consumption in low ambient lighting conditions. The formula assumes the display will be in low ambient lighting conditions 20% of the time.

B. Sleep and Off Mode Requirements:

1. Tiers 1 and 2

To qualify as ENERGY STAR, the display must not exceed the maximum power consumption levels for Sleep and Off Modes provided in Table 3, below. Displays capable of multiple Sleep Modes (i.e., Sleep and Deep Sleep) must meet Sleep Mode requirements in all sleep modes.

EXAMPLE: A display test result of 3 watts in Sleep and 2 watts in Deep Sleep would not qualify because power consumption in one of the Sleep Modes exceeded the 2 watt Tier 1 limit.

Table 3: Sleep and Off Mode Power Consumption Requirements for all Displays

Mode	Tier 1	Tier 2
Maximum Sleep Mode Power Consumption (W)	≤ 2	≤ 1
Maximum Off Mode Power Consumption (W)	≤ 1	≤ 1

4. TEST REQUIREMENTS

How to Use this Section

EPA and the European Commission utilise, where possible, widely-accepted industry practices for measuring product performance and power consumption under typical operating conditions. The test methods in this specification are based on standards from the Video Electronics Standards Association (VESA) Display Metrology Committee and the International Electrotechnical Commission (IEC). In cases where the VESA and IEC standards were insufficient for the needs of the ENERGY STAR program, additional testing and measurement methods were developed in cooperation with industry stakeholders.

To ensure a consistent means for measuring the power consumption of electronics products such that the test results may be reproduced, and that outside factors do not adversely affect the test results, the following protocol must be followed. It has four main components:

– Test Conditions and Instrumentation

– Setup

– Test Method

– Documentation

Note: Test Method is located in Appendices 1 and 2. Appendix 1 describes the test procedure for displays with a viewable diagonal screen size measuring less than (<) 30 inches. Appendix 2 describes the test procedure for displays with a viewable diagonal screen size measuring from 30 to 60 inches, inclusive.

Partners may elect to use an in-house or independent laboratory to provide the test results.

Facility Quality Control

Partners are required to perform tests and certify those product models that meet the ENERGY STAR guidelines. In order to conduct testing in support of qualification for ENERGY STAR, the product must be tested in a facility that has quality control procedures for monitoring the validity of tests and calibrations. ENERGY STAR recommends conducting these tests in a facility that follows the general requirements for the competence of testing and calibration laboratories as described in the International Standard ISO/IEC 17025.

Test Conditions and Instrumentation

A. Power Measurement Protocols

The average true power consumption of the display shall be measured during On Mode, Sleep Mode, and Off Mode. When performing measurements to self-certify a product model, the Unit Under Test (UUT) must initially be in the same condition (e.g., configuration and settings) as when shipped to the customer, unless adjustments need to be made pursuant to the instructions below.

1. Power measurements shall be taken from a point between the outlet or power source and the UUT.

2. If a product's electrical power comes from Mains, USB, IEEE1394, Power-over-Ethernet, telephone system, or any other means or combinations of means, the net AC electrical power consumed by the product (taking into account AC-to-DC conversion losses) must be used for qualification.

3. Products powered by a standard low voltage DC supply (e.g., USB, USB PlusPower, IEEE 1394, and Power Over Ethernet) shall utilize a suitable AC-powered source of the DC power. This AC-powered source's energy consumption shall be measured and recorded as the UUT's power consumption.

4. For a display powered by USB, a powered hub serving only the display being tested shall be used. For a display powered by Power Over Ethernet or USB PlusPower, it is acceptable to measure the power distribution device with and without the display connected, and record the difference between the two readings as the display's power consumption. The tester should confirm that this reasonably reflects the unit's DC consumption plus some allowance for power supply and distribution inefficiency.

5. Any product capable of being powered from both AC and standard low-voltage DC sources shall be tested while operating on AC power.

B. Input AC Power Requirements

Supply Voltage:	North America/Taiwan: Europe/Australia/New Zealand: Japan:	115 (± 1%) Volts AC, 60 Hz (± 1%) 230 (± 1%) Volts AC, 50 Hz (± 1%) 100 (± 1%) Volts AC, 50 Hz (± 1%)/60 Hz (± 1%) Note: For products rated for > 1.5 kW maximum power, the voltage range is ± 4%
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 Ed 1.0: Household Electrical Appliances – Measurement of Standby Power, Sections 4.2, 4.3)

C. Approved Meter

Approved meters will include the following attributes.[1]

– An available current crest factor of 3 or more at its rated range value; and

– Lower bound on the current range of 10mA or less.

The power measurement instrument shall have a resolution of:

– 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.

The following attributes in addition to those above are suggested:

– Frequency response of at least 3 kHz; and

[1] Characteristics of approved meters taken from IEC 62301 Ed 1.0: Household Electrical Appliances – Measurement of Standby Power.

– Calibration with a standard that is traceable to the U.S. National Institute of Standards and Technology (NIST).

It is also desirable for instruments to be able to measure average power over any user-selected time interval (the most accurate devices perform an internal calculation to divide accumulated energy by elapsed time). As an alternative, the measurement instrument would have to be capable of integrating energy over any user-selected time interval with an energy resolution of less than or equal to 0.1 mWh and integrating time displayed with a resolution of 1 second or less.

D. Accuracy

Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level. Measurements of power of less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W at the 95% confidence level.[1]

All measurements should be recorded in watts and rounded to the nearest tenth of a watt.

[1] Ibid.

E. Dark Room Conditions

All luminance testing shall be performed in dark room conditions. The display screen illuminance measurement (E) in Off Mode must be less than or equal to 1.0 lux. Measurements should be taken perpendicular to the centre of the display screen using a Light Measuring Device (LMD) with the display in Off Mode (Reference VESA FPDM Standard 2.0, Section 301-2F).

F. Light Measurement Protocols

When light measurements, such as illuminance and luminance, need to be made, an LMD shall be used with the display located in dark room conditions. The LMD shall be used to take measurements at the centre of and perpendicular to the display screen (Reference VESA FPDM Standard 2.0, Appendix A115). The screen surface area to be measured shall cover at least 500 pixels, unless this exceeds the equivalent of a rectangular area with sides of length equal to 10% of the visible screen height and width (in which case this latter limit applies). However, in no case may the illuminated area be smaller than the area the LMD is measuring (Reference VESA FPDM Standard 2.0, Section 301-2H).

Setup

A. Peripherals

No external devices shall be connected to Universal Serial Bus (USB) hubs or ports. Any built-in speakers, TV tuners, etc. may be placed in their minimum power configuration, as adjustable by the user, to minimize power consumption not associated with the display itself.

B. Modifications

Device modifications such as circuit removal, or other actions not available to a typical user, are not permitted.

C. Analogue vs. Digital Interface

Partners are required to test their displays using the analogue interface, except in those cases where one is not provided (i.e., digital interface displays, which for the purposes of this test method are defined as having only a digital interface). For digital interface displays, please see Footnote 1 in Appendix 1 for voltage information, and follow the test method in Appendix 1 and/or 2, depending on the viewable diagonal screen size of the UUT, using a digital signal generator.

D. Models Capable of Operating at Multiple Voltage/Frequency Combinations

Partners shall test, qualify, and document conditions applicable to each market in which their products shall be sold as ENERGY STAR qualified.

EXAMPLE: For a product to earn the ENERGY STAR label in both the United States and Europe, it must qualify at both 115V/60Hz and 230V/50Hz. If the product qualifies as ENERGY STAR at only one voltage/frequency combination (e.g., 115 Volts/60 Hz), then it may only be qualified and promoted as ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g., North America and Taiwan).

E. External Power Supply

For displays shipped with an external power supply, the supplied EPS must be used for all testing. An alternate power supply may not be substituted.

F. Colour Controls

All colour controls (hue, saturation, gamma, etc.) shall be set to factory default settings.

G. Resolution and Refresh Rate

Resolution and refresh rate vary by technology, as follows:

(1) For LCDs and other fixed pixel technologies, pixel format shall be set to the native level. LCD refresh rate shall be set to 60 Hz, unless a different refresh rate is specifically recommended by the Partner, in which case that rate shall be used.

(2) CRT pixel format shall be set at the preferred pixel format with the highest resolution that is intended to be driven at a 75 Hz refresh rate. A VESA Discrete Monitor Timing (DMT) or newer industry standard pixel format timing must be used for the test. The CRT display must be capable of meeting all its Partner-stated quality specifications in the tested format.

H. Warm-up

UUT must be warmed up for a minimum of 20 minutes before any test measurements are taken (Reference VESA FPDM Standard 2.0, Section 301-2D or 305-3 for warm-up test).

I. Stability

All power consumption measurements shall be recorded after instrument readings are stable to within 1% over a three-minute period (Reference IEC 4.3.1).

Test Method

In performing these tests, the partner agrees to use the applicable test procedures provided in Appendices 1 and/or 2, depending on the viewable diagonal screen size of the UUT, as follows:

For displays with a viewable diagonal screen size measuring less than (<) 30 inches, use Appendix 1.

For displays with a viewable diagonal screen size measuring from 30 to 60 inches, use Appendix 2.

Documentation

A. Submittal of Qualified Product Data to EPA or the European Commission, as applicable

Partners are required to self-certify those product models that meet the ENERGY STAR guidelines and report information to EPA through the Online Product Submittal tool, or to the European Commission, as applicable. ENERGY STAR qualifying product data, including information about new models, must be provided on an annual basis, or more frequently if desired by the Partner.

B. Qualifying Family of Products

Families of display models that are built on the same chassis and are identical in every respect but housing and color may be qualified through submission of test data for a single, representative model. Likewise, models that are unchanged or that differ only in finish from those sold in a previous year may remain qualified without the submission of new test data.

C. Number of Units Required for Testing

Borrowing from European Norm 50301 (Reference BSI 03-2001, BS EN 50301:2001, Methods of Measurement for the Power Consumption of Audio, Video, and Related Equipment, Annex A), EPA and the European Commission have established a test procedure where the number of units required for test depends on the test results for the first unit:

(1) If the steady-state power consumption of the UUT is greater than 85% of the ENERGY STAR qualification limit in any of the three operating modes, two additional units of the same model shall be tested.

(2) The power consumption data for each of the three test units shall be reported to EPA via the Online Product Submittal tool, or to the European Commission, as applicable, along with the average On, Sleep, and Off Mode power consumption data from the three tests.

(3) Testing of additional units is not required if the steady-state power consumption of the first test unit is less than or equal to 85% of the ENERGY STAR qualification limit in all of the three operating modes.

(4) None of the test values for any of the units tested may exceed the ENERGY STAR specification for the model to be ENERGY STAR qualified.

(5) The following example further illustrates this approach:

EXAMPLE: FOR SIMPLICITY, ASSUME THE SPECIFICATION IS 100 watts or less and only applies to one operational mode. 85 watts would represent the 15% threshold…

- If the first unit is measured at 80 watts, no more testing is needed and the model qualifies (80 watts is not greater than 85% of the ENERGY STAR qualification limit).

- If the first unit is measured at 85 watts, no more testing is needed and the model qualifies (85 watts is exactly 85% of the ENERGY STAR qualification limit).

- If the first unit is measured at 85.1 watts, then two more units shall be tested to determine qualification (85.1 watts is greater than 85% of the ENERGY STAR qualification limit).

- If three units are tested at 90, 98, and 105 watts, the model does not qualify as ENERGY STAR—even though the average is 98 watts— because one of the values (105) exceeds the ENERGY STAR specification.

5. USER INTERFACE

Partners are strongly recommended to design products in accordance with the user interface standard IEEE P1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments. The Power Management Controls project developed this standard to make power controls more consistent and intuitive across all electronic devices. For details, see http://eetd.LBL.gov/Controls.

6. EFFECTIVE DATE

The date that Partners may begin to qualify products as ENERGY STAR, under the Version 5.0 specification, will be defined as the effective date of the agreement. Any previously executed agreement on the subject of ENERGY STAR qualified displays shall be terminated effective October 29, 2009 for displays with a viewable diagonal screen size under 30 inches, or on January 29, 2010 for displays with a viewable diagonal screen size from 30 to 60 inches, inclusive.

A. Qualifying Products Under Tier 1 of the Version 5.0 Specification

The date upon which Tier 1 of the Version 5.0 specification shall go into effect is contingent upon the size of the display, and is outlined in the table below. All products, including models originally qualified under Version 4.1, with a date of manufacture on or after that date must meet the new Version 5.0 requirements in order to qualify for ENERGY STAR (including additional shipments of models originally qualified under Version 4.1). The date of manufacture is specific to each unit and is the date (e.g., month and year) of which a unit is considered to be completely assembled.

Display Category	Tier 1 Effective Date
Diagonal Screen Size < 30 inches	October 30, 2009
Diagonal Screen Size 30 - 60 inches	January 30, 2010

B. Qualifying Products Under Tier 2 of the Version 5.0 Specification

The second phase of this specification, Tier 2, shall take effect on October 30, 2011, and apply to products with a date of manufacture on or after October 30, 2011. For example, a unit with a date of manufacture of October 30, 2011 must meet the Tier 2 specification in order to qualify as ENERGY STAR.

C. Elimination of Grandfathering

EPA and the European Commission will not allow grandfathering under this Version 5.0 ENERGY STAR specification. ENERGY STAR qualification under Version 4.1 is not automatically granted for the life of the product model. Therefore, any product sold, marketed, or identified by the manufacturing partner as ENERGY STAR must meet the current specification in effect at the time of manufacture of the product.

7. FUTURE SPECIFICATION REVISIONS

EPA and the European Commission reserve the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through stakeholder discussions.

EPA and the European Commission will periodically assess the market in terms of energy efficiency and new technologies. As always, stakeholders will have an opportunity to share their data, submit proposals, and voice any concerns. EPA and the European Commission will strive to ensure that the Tier 1 and 2 specifications recognize the most energy-efficient models in the marketplace and reward those Partners who have made efforts to further improve energy efficiency.

APPENDIX 1

Test Procedures for Displays with a viewable diagonal screen size less than (<) 30 inches

When to use this document

This document describes the test procedures for displays with a viewable screen area measuring less than (<) 30 inches diagonal for the ENERGY STAR Program Requirements for Displays Version 5.0. The procedures are to be used to determine the On, Sleep, and Off Mode power consumption of the unit under test (UUT). Note this appendix includes separate procedures for the following product types:

– CRT displays;

– Fixed pixel displays without Automatic Brightness Control (ABC) enabled by default; and,

– Fixed pixel displays with ABC enabled by default.

1. TEST METHOD FOR CRT DISPLAYS

A. Testing conditions, instrumentation, and setup

Before testing the UUT, ensure the proper testing conditions, instrumentation, and setup are in place as outlined in the Product Test Conditions and Instrumentation, and Product Test Setup sections of the Displays specification.

B. On Mode

(1) Connect the test sample to the outlet or power source and test equipment.

(2) Power on all test equipment and properly adjust power source voltage and frequency.

(3) Check for normal operation of the test unit and leave all customer adjustments set to factory default settings.

(4) Bring the test unit into On Mode either by using the remote control device or by using the ON/OFF switch on the test unit cabinet.

(5) Allow the UUT to reach operating temperature (approximately 20 minutes).

(6) Set the proper display mode. (Refer to Product Test Setup, Section G, Resolution and Refresh Rate.)

(7) Provide dark room conditions. (Refer to Product Test Conditions and Instrumentation, Section F, Light Measurement Protocols, and Section E, Dark Room Conditions.)

(8) Set size and luminance as follows:

(a) Initiate the AT01P (Alignment Target 01 Positive Mode) pattern (VESA FPDM Standard 2.0, A112-2F, AT01P) for screen size and use it to set the display to the Partner's recommended image size, which is typically slightly smaller than maximum viewable screen size.

(b) Then, test pattern (VESA FPDM Standard 2.0, A112-2F, SET01K) shall be displayed that provides eight shades of gray from full black (0 volts) to full white (0.7 volts).[1] Input signal levels shall conform to VESA Video Signal Standard (VSIS), Version 1.0, Rev. 2.0, December 2002.

(c) Adjust (where feasible) the display brightness control downward from its maximum until the lowest black bar luminance level is just slightly visible (VESA FPDM Standard 2.0, Section 301-3K).

[1] Corresponding voltage values for digital only interface displays that correspond to the brightness of the image (0 to 0.7 volts) are: 0 volts (black) = a setting of 0, 0.1 volts (darkest shade of gray analog) = 36 digital gray, 0.7 volts (full white analog) = 255 digital gray; please note that future digital interface specifications may widen this range, but in all cases, 0 volts shall correspond to black and the maximum value shall correspond to white, with 0.1 volts corresponding to one-seventh of the maximum value.

(d) Display a test pattern (VESA FPDM Standard 2.0, A112-2H, L80) that provides a full white (0.7 volts) box that occupies 80% of the image.

(e) Adjust the contrast control until the white area of the screen is set at the following luminance: 100 cd/m2

(f) measured according to VESA FPDM Standard 2.0, Section 302-1. (If the display's maximum luminance is less than the prescribed luminance, above, the technician shall use the maximum luminance and report the value to EPA or the European Commission, as applicable, with other required testing documentation. Similarly, if the display's minimum luminance is greater than the prescribed luminance, the technician shall use the minimum luminance and report the value to EPA or the European Commission, as applicable.)

(g) The luminance value shall be reported to EPA or the European Commission, as applicable, with other required testing documentation.

(9) Once luminance is set, dark room conditions are no longer needed.

(10) Set the power meter current range. The full-scale value selected multiplied by the crest factor rating (Ipeak/Irms) of the meter must be greater than the peak current reading from the oscilloscope.

(11) Allow the readings on the power meter to stabilize and then take the true power reading in watts from the power meter. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. (Refer to Product Test Setup, Section I, Stability.)

(12) Record power consumption and total pixel format (horizontal x vertical pixels displayed), to calculate pixels/watt.

C. Sleep Mode (Power Switch On, No Video Signal)

(1) At the conclusion of the On Mode test, initiate the display's Sleep Mode. The method of adjustment shall be documented along with the sequence of events required to reach the Sleep Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Sleep Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the unit in Sleep Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power). If the device has different Sleep Modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive of those modes. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

D. Off Mode (Power Switch Off)

(1) At the conclusion of the Sleep Mode test, initiate the display's Off Mode using the power switch that is most easily accessed by the user. The method of adjustment shall be documented along with the sequence of events required to reach the Off Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Off Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the model in Off Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power).

E. Reporting results

Upon completion of this test procedure, please refer to the Product Test Documentation section of the specification for guidance on how to report your test results to EPA or the European Commission, as applicable.

2. TEST METHOD FOR FIXED PIXEL DISPLAYS *WITHOUT* ABC ENABLED BY DEFAULT:

A. Testing conditions, instrumentation, and setup

Before testing the UUT, ensure the proper testing conditions, instrumentation, and setup are in place as outlined in the Product Test Conditions and Instrumentation, and Product Test Setup sections of the Displays specification.

B. On Mode

(1) Connect the test sample to the outlet or power source and test equipment.

(2) Power on all test equipment and properly adjust power source voltage and frequency.

(3) Check for normal operation of the test unit and leave all customer adjustments set to factory default settings.

(4) Bring the test unit into On Mode either by using the remote control device or by using the ON/OFF switch on the test unit cabinet.

(5) Allow the UUT to reach operating temperature (approximately 20 minutes).

(6) Set the proper display mode (Refer to Product Test Setup, Section G, Resolution and Refresh Rate).

(7) Provide dark room conditions (Refer to Product Test Conditions and Instrumentation, Section F, Light Measurement Protocols, and Section E, Dark Room Conditions).

(8) Set size and luminance as follows:

(a) Test pattern (VESA FPDM Standard 2.0, A112-2F, SET01K) shall be displayed that provides eight shades of gray from full black (0 volts) to full white (0.7 volts).1 Input signal levels shall conform to VESA Video Signal Standard (VSIS), Version 1.0, Rev. 2.0, December 2002.

(b) With the brightness and contrast controls at maximum, the technician shall check that, at a minimum, the white and near white gray levels can be distinguished. If white and near white gray levels cannot be distinguished, then contrast shall be adjusted until they can be distinguished.

(c) The technician shall next display a test pattern (VESA FPDM Standard 2.0, A112-2H, L80) that provides a full white (0.7 volts) box that occupies 80% of the image.

(d) The technician shall then adjust the brightness until the white area of the screen is set at the following luminance:

Product	Cd/m2
Less than or equal to 1.1 MP resolution	175
Greater than 1.1 MP resolution	200

measured according to VESA FPDM Standard 2.0, Section 302-1. (If the display's maximum luminance is less than the prescribed luminance in the table above, the technician shall use the maximum luminance and report the value to EPA or the European Commission, as applicable, with other required testing documentation. Similarly, if the display's minimum luminance is greater than the prescribed luminance, the technician shall use the minimum luminance and report the value to EPA or the European Commission, as applicable.)

(e) The luminance value shall be reported to EPA or the European Commission, as applicable, with other required testing documentation.

(9) Once luminance is set, dark room conditions are no longer needed.

(10) Set the power meter current range. The full-scale value selected multiplied by the crest factor rating (Ipeak/Irms) of the meter must be greater than the peak current reading from the oscilloscope.

(11) Allow the readings on the power meter to stabilize and then take the true power reading in watts from the power meter. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. (Refer to Product Test Setup, Section I, Stability.)

(12) Record power consumption and total pixel format (horizontal x vertical pixels displayed), to calculate pixels/watt.

C. Sleep Mode (Power Switch On, No Video Signal)

(1) At the conclusion of the On Mode test, initiate the display's Sleep Mode. The method of adjustment shall be documented along with the sequence of events required to reach the Sleep Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Sleep Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the unit in Sleep Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power). If the device has different Sleep Modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive of those modes. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

D. Off Mode (Power Switch Off)

(1) At the conclusion of the Sleep Mode test, initiate the display's Off Mode using the power switch that is most easily accessed by the user. The method of adjustment shall be documented along with the sequence of events required to reach the Off Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Off Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the model in Off Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power).

E. Reporting results

Upon completion of this test procedure, please refer to the Product Test Documentation section of the specification for guidance on how to report your test results to EPA or the European Commission, as applicable.

3. TEST METHOD FOR FIXED PIXEL DISPLAYS WITH ABC ENABLED BY DEFAULT:

A. Testing conditions, instrumentation, and setup

Before testing the UUT, ensure the proper testing conditions, instrumentation, and setup are in place as outlined in the Product Test Conditions and Instrumentation, and Product Test Setup sections of the Displays specification.

B. On Mode

(1) Connect the test sample to the outlet or power source and test equipment.

(2) Power on all test equipment and properly adjust power source voltage and frequency.

(3) Check for normal operation of the test unit and leave all customer adjustments set to factory default settings.

(4) Bring the test unit into On Mode either by using the remote control device or by using the ON/OFF switch on the test unit cabinet.

(5) Allow the UUT to reach operating temperature (approximately 20 minutes).

(6) Set the proper display mode (Refer to Product Test Setup, Section G, Resolution and Refresh Rate).

(7) Set the power meter current range. The full-scale value selected multiplied by the crest factor rating (Ipeak/Irms) of the meter must be greater than the peak current reading from the oscilloscope.

(8) The following alternate test procedure is used to calculate maximum On Mode power consumption for displays shipped with Automatic Brightness Control enabled by default. For this test procedure, high ambient lighting is to be set at 300 lux, while low ambient lighting is to be set at 0 lux, as follows:

(a) Set the ambient light level to 300 lux as measured at the face of an ambient light sensor.

(b) Allow the readings on the power meter to stabilize, and then take the high ambient lighting true power reading, Ph, in watts from the power meter. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. (Refer to Product Test Setup, Section I, Stability.)

(c) Set the ambient light level to 0 lux as measured at the face of an ambient light sensor.

(d) Allow the readings on the power meter to stabilize, and then take the low ambient lighting true power reading, Pl, in watts from the power meter.

(e) Calculate average On Mode power consumption using the equation in section 3.A.3., Displays with Automatic Brightness Control, on page 7 of the specification.

(9) Record power consumption and total pixel format (horizontal x vertical pixels displayed), to calculate pixels/watt.

C. Sleep Mode (Power Switch On, No Video Signal)

(1) At the conclusion of the On Mode test, initiate the display's Sleep Mode. The method of adjustment shall be documented along with the sequence of events required to reach the Sleep Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Sleep Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the unit in Sleep Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power). If the device has different Sleep Modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive of those modes. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

D. Off Mode (Power Switch Off)

(1) At the conclusion of the Sleep Mode test, initiate the display's Off Mode using the power switch that is most easily accessed by the user. The method of adjustment shall be documented along with the sequence of events required to reach the Off Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Off Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the model in Off Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power).

E. Reporting results

Upon completion of this test procedure, please refer to the Product Test Documentation section of the specification for guidance on how to report your test results to EPA or the European Commission, as applicable.

APPENDIX 2

Test Procedures for Displays with a viewable diagonal screen size
from 30 to 60 inches, inclusive

When to use this document

This document describes the test procedures for displays with a viewable diagonal screen size from 30 to 60 inches, inclusive ("large displays"), for the ENERGY STAR Program Requirements for Displays Version 5.0. The procedures are to be used to determine the On, Sleep, and Off Mode power consumption of the unit under test (UUT).

Table 1: Test Procedure for Measuring Operational Modes

Specification Requirement	Test Protocol	Source
On Mode	IEC 62087, Ed 2.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment, Section 11, "Measuring conditions of television sets for On (average) mode."	www.iec.ch

1. TESTING CONDITIONS, INSTRUMENTATION, AND SETUP

Before testing the UUT, ensure the proper testing conditions, instrumentation, and setup are in place as outlined in the Product Test Conditions and Instrumentation, and Product Test Setup sections of the Displays specification.

2. MEASURING POWER IN ON, SLEEP, AND OFF MODE

A. On Mode (Guidance on Implementation of IEC 62087)

Below, guidance is provided on using IEC 62087, Ed. 2.0 for measuring large displays' On Mode power. For purposes of determining ENERGY STAR qualification of a product, the below exceptions and clarifications apply.

(1) Accuracy of Input Signal Levels: Section 11.4.12, "Accuracy of input signal levels," reminds testers that video inputs used for testing should be within ± 2% of reference white and black levels. Section B.2 of Annex B, "Considerations for On (average) mode television set power measurements" describes the importance of input signal accuracy in further detail. EPA and the European Commission would like to emphasize the importance of using accurate/calibrated video inputs during On Mode testing and encourages testers to use HDMI inputs wherever possible.

(2) True Power Factor: Due to increased awareness of the importance of power quality, Partners shall indicate the true power factor of their displays during On Mode measurement.

(3) Use of Test Materials for Testing: To measure average On Mode power consumption, Partners should measure 'Po_broadcast' as described in section 11.6.1, "On mode (average) testing with dynamic broadcast-content video signal."

(4) Testing at Factory Default Settings: In measuring the On Mode power consumption of large displays, EPA and the European Commission are interested in capturing first and foremost the power consumption of products as they are shipped from the factory. Picture level adjustments that need to be made prior to testing On Mode power consumption should be made per section 11.4.8, "Picture level adjustments," if applicable.

Section 11.4.8 reads: "The contrast and brightness of the television set and the backlight level, if it exists, shall be set as originally adjusted by the manufacturer to the end user. In the case that a setting mode must be chosen on initial activation, the 'standard mode' or equivalent shall be chosen. In the case that no 'standard mode' or equivalent exists, the first mode listed in the on-screen menus shall be selected. The mode used during the test shall be described in the report. 'Standard mode' is defined as 'recommended by the manufacturer for normal home use.'"

For products shipped with a forced menu where the customer must select upon initial start up the mode in which the product will operate, section 11.4.8 states that testing must be conducted in "standard mode."

Information relaying that the product qualifies for ENERGY STAR in a specific setting and that this is the setting in which power savings will be achieved will be included with the product in its packaging and posted on the Partner's Web site, where information about the model is listed.

(5) Testing of displays with Automatic Brightness Control: For this test procedure, high ambient lighting is to be set at 300 lux, while low ambient lighting is to be set at 0 lux, as follows:

(a) Set the ambient light level to 300 lux as measured at the face of an ambient light sensor.

(b) Measure the high ambient lighting On Mode power consumption, Ph, as described in section 11.6.1, "On mode (average) testing with dynamic broadcast-content video signal."

(c) Set the ambient light level to 0 lux as measured at the face of an ambient light sensor.

(d) Measure the low ambient lighting On Mode power consumption, Pl, as described in section 11.6.1, "On mode (average) testing with dynamic broadcast-content video signal."

(e) Calculate average On Mode power consumption using the equation in section 3.A.3., Displays with Automatic Brightness Control, on page 7 of the specification.

B. Sleep Mode (Power Switch On, No Video Signal)

(1) At the conclusion of the On Mode test, initiate the display's Sleep Mode. The method of adjustment shall be documented along with the sequence of events required to reach the Sleep Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Sleep Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the unit in Sleep Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power). If the device has different Sleep Modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive of those modes. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

C. Off Mode (Power Switch Off)

(1) At the conclusion of the Sleep Mode test, initiate the display's Off Mode using the power switch that is most easily accessed by the user. The method of adjustment shall be documented along with the sequence of events required to reach the Off Mode. Power on all test equipment and properly adjust operation range.

(2) Allow the display to remain in Off Mode until stable power readings are measured. Measurements are considered stable once the wattage reading does not vary more than 1% over a three-minute period. Tester shall ignore the input sync signal check cycle when metering the model in Off Mode.

(3) Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value (i.e., not peak or instantaneous power).

(4) Reporting results: Upon completion of this test procedure, please refer to the Product Test Documentation section of the specification for guidance on how to report your test results to EPA or the European Commission, as applicable.

3. MEASURING LUMINANCE

After the IEC test clip has run and the power consumption has been recorded, the technician shall measure the product's luminance using the methodology described below. Note, the technician shall not alter the product's settings from how they were set during the power consumption test.

(1) Using the three bar video signal (Lt) static test image referenced in section 11.5 of IEC 62087, measure the center point, axial luminance of the display per the Video Electronics Standards Association (VESA) Flat Panel Display Measurements Standard (FPDM) Version 2.0, section 301-2H.

(2) Report in OPS the measured luminance value in candelas per square meter (cd/m2), rounded to the nearest whole number.

(3) All luminance measurements should be performed in accordance with the test conditions outlined above for large displays. Specifically, measuring the luminance must be conducted with the display's settings as they are shipped from the factory. For products with a forced menu, measurements shall be conducted in standard, or home mode.

III. IMAGING EQUIPMENT SPECIFICATIONS

A. DEFINITIONS

Products

1. Copier — A commercially available imaging product whose sole function is the production of hard-copy duplicates from graphic hard-copy originals. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as copiers or upgradeable digital copiers (UDCs).

2. Digital Duplicator — A commercially available imaging product that is sold in the market as a fully automated duplicator system through the method of stencil duplicating with digital reproduction functionality. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as digital duplicators.

3. Facsimile Machine (Fax Machine) — A commercially available imaging product whose primary functions are scanning hard-copy originals for electronic transmission to remote units and receiving similar electronic transmissions to produce hard-copy output. Electronic transmission is primarily over a public telephone system, but also may be via a computer network or the Internet. The product also may be capable of producing hard-copy duplicates. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as fax machines.

4. Mailing Machine — A commercially available imaging product that serves to print postage onto mail pieces. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as mailing machines.

5. Multifunction Device (MFD) — A commercially available imaging product which is a physically integrated device or a combination of functionally integrated components that performs two or more of the core functions of copying, printing, scanning, or faxing. The copy functionality as addressed in this definition is considered to be distinct from single-sheet convenience copying offered by fax machines. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as MFDs or multifunction products (MFPs).

Note: If the MFD is not a single integrated unit but a set of functionally integrated components, then the manufacturer must certify that when installed correctly in the field, the sum of all energy or power use for all MFD components comprising the base unit will achieve the energy or power levels provided in section C to qualify as an ENERGY STAR MFD.

6. Printer — A commercially available imaging product that serves as a hard-copy output device, and is capable of receiving information from single-user or networked computers, or other input devices (e.g. digital cameras). The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as printers, including printers that can be upgraded to MFDs in the field.

7. Scanner — A commercially available imaging product that functions as an electro-optical device for converting information into electronic images that can be stored, edited, converted, or transmitted, primarily in a personal computing environment. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as scanners.

Marking Technologies

8. Direct Thermal (DT) — A marking technology that transfers an image by burning dots onto a coated medium as it passes over a heated print head. DT products do not use ribbons.

9. Dye Sublimation (DS) — A marking technology where images are formed by depositing (subliming) dye onto the print media based upon the amount of energy delivered by the heating elements.

10. Electrophotography (EP) — A marking technology characterised by illumination of a photoconductor in a pattern representing the desired hard-copy image via a light source, development of the image with particles of toner using the latent image on the photoconductor to define the presence or absence of toner at a given location, transfer of the toner to the final hard-copy medium, and fusing to cause the desired hard copy to become durable. Types of EP include Laser, LED, and LCD. Colour EP is distinguished from monochrome EP in that toners of at least three different colours are available in a given product at one time. Two types of colour EP technology are defined below:

11. Parallel Colour EP — A marking technology that uses multiple light sources and multiple photoconductors to increase the maximum colour printing speed.

12. Serial Colour EP — A marking technology that uses a single photoconductor in a serial fashion and one or multiple light sources to achieve the multi-colour hard-copy output.

13. Impact — A marking technology characterised by the formation of the desired hard-copy image by transferring colorant from a 'ribbon' to the media via an impact process. Two types of impact technology are Dot Formed Impact and Fully Formed Impact.

14. Ink Jet (IJ) — A marking technology where images are formed by depositing colorant in small drops directly onto the print media in a matrix manner. Colour IJ is distinguished from monochrome IJ in that more than one colorant is available in a product at any one time. Typical types of IJ include Piezo-electric (PE) IJ, IJ Sublimation, and Thermal IJ.

15. High Performance IJ — An IJ marking technology in high-performance business applications that usually employ electrophotographic marking technology. High Performance IJ differs from conventional IJ in that it has nozzle arrays that span the width of a page and/or the ability to dry the ink on the media through additional media-heating mechanisms.

16. Solid Ink (SI) — A marking technology where the ink is solid at room temperature and liquid when heated to the jetting temperature. Transfer to the media can be direct, but is most often made to an intermediate drum or belt and then offset-printed to the media.

17. Stencil — A marking technology that transfers images onto the print media from a stencil that is fitted around an inked drum.

18. Thermal Transfer (TT) — A marking technology where the desired hard-copy image is formed by depositing small drops of solid colorant (usually coloured waxes) in a melted/fluid state directly onto the print media in a matrix manner. TT is distinguished from IJ in that the ink is solid at room temperature and is made fluid by heat.

Operational Modes, Activities, and Power States

19. Active — The power state in which the product is connected to a power source and is actively producing output, as well as performing any of its other primary functions.

20. Automatic Duplexing — The capability of a copier, fax machine, MFD, or printer to automatically place images on both sides of an output sheet, without manual manipulation of output as an intermediate step. Examples of this are one-sided to two-sided copying and two-sided to two-sided copying. A product is considered to have automatic duplexing capability only if the model includes all accessories needed to satisfy the above conditions.

21. Default Delay Time — The time set by the manufacturer prior to shipping that determines when the product will enter a lower-power mode (e.g. Sleep, Off) following completion of its primary function.

22. Off — The power state that the product enters when it has been manually or automatically switched off but is still plugged in and connected to the mains. This mode is exited when stimulated by an input, such as a manual power switch or clock timer, to bring the unit into Ready mode. When this state is the result of manual intervention by a user, it is often referred to as Manual Off, and when it is the result of automatic or predetermined stimuli (e.g. a delay time or clock), it is often referred to as Auto Off.

23. Ready — The condition that exists when the product is not producing output, has reached operating conditions, has not yet entered into any lower-power modes, and can enter Active mode with minimal delay. All product features can be enabled in this mode, and the product must be able to return to Active mode by responding to any potential input options designed into the product. Potential inputs include external electrical stimulus (e.g. network stimulus, fax call, or remote control) and direct physical intervention (e.g. activating a physical switch or button).

24. Sleep — The reduced power state that the product enters automatically after a period of inactivity. In addition to entering Sleep automatically, the product may also enter this mode 1) at a user-set time-of-day, 2) immediately in response to manual action by the user, without actually turning off, or 3) through other, automatically achieved ways that are related to user behaviour. All product features can be enabled in this mode and the product must be able to enter Active mode by responding to any potential input options designed into the product; however, there may be a delay. Potential inputs include external electrical stimulus (e.g. network stimulus, fax call, remote control) and direct physical intervention (e.g. activating a physical switch or button). The product must maintain network connectivity while in Sleep, waking up only as necessary.

    Note: When reporting data and qualifying products that can enter Sleep mode in multiple ways, partners should reference a Sleep level that can be reached automatically. If the product is capable of automatically entering multiple, successive Sleep levels, it is at the manufacturer's discretion which of these levels is used for qualification purposes; however, the default delay time provided must correspond with whichever level is used.

25. Standby — The lowest power consumption mode that cannot be switched off (influenced) by the user and which may persist for an indefinite time when the product is connected to the main electricity supply and used in accordance with the manufacturer's instructions[1]. Standby is the product's minimum power mode.

    Note: For imaging equipment products addressed by these specifications, the Standby power level, or the minimum power mode, usually occurs in Off mode, but can occur in Ready or Sleep. A product cannot exit Standby and reach a lower power state unless it is physically disconnected from the main electricity supply as a result of manual manipulation.

Product Size Formats

26. Large Format — Products categorised as Large Format include those designed for A2 media and larger, including those designed to accommodate continuous-form media at a width of 406 millimetres (mm) or wider. Large-format products may also be capable of printing on standard-size or small-format media.

27. Small Format — Products categorised as Small Format include those designed for media sizes smaller than those defined as Standard (e.g. A6, 4″ x 6″, microfilm), including those designed to accommodate continuous-form media at widths smaller than 210 mm.

[1] IEC 62301 — Household electrical appliances — Measurement of standby power. 2005.

28. Standard — Products categorised as Standard include those designed for standard-sized media (e.g. Letter, Legal, Ledger, A3, A4, and B4), including those designed to accommodate continuous-form media at widths between 210 mm and 406 mm. Standard-size products may also be capable of printing on small-format media.

Additional Terms

29. Accessory — An optional piece of peripheral equipment that is not necessary for the operation of the base unit, but that may be added before or after shipment in order to add functionality. An accessory may be sold separately under its own model number, or sold with a base unit as part of a package or configuration.

30. Base Product — A base product is the standard model shipped by the manufacturer. When product models are offered in different configurations, the base product is the most fundamental configuration of the model, which possesses the minimum number of functional adders available. Functional components or accessories offered as optional, rather than standard, are not considered part of the base product.

31. Continuous Form — Products categorised as Continuous Form include those which do not use a cut-sheet media size, and are designed for key applications such as printing of bar codes, labels, receipts, waybills, invoices, airline tickets, or retail tags.

32. Digital Front-end (DFE) — A functionally integrated server that hosts other computers and applications and acts as an interface to imaging equipment. A DFE provides greater functionality to the imaging product. A DFE is defined as either:

Type 1 DFE: A DFE that draws its DC power from its own AC power supply (internal or external), which is separate from the power supply that powers the imaging equipment. This DFE may draw its AC power directly from a wall outlet, or it may draw it from the AC power associated with the imaging product's internal power supply.

Type 2 DFE: A DFE that draws its DC power from the same power supply as the imaging equipment with which it operates. Type 2 DFEs must have a board or assembly with a separate processing unit that is capable of initiating activity over the network and can be physically removed, isolated, or disabled using common engineering practices to allow power measurements to be made.

A DFE also offers at least three of the following advanced features:

(a) Network connectivity in various environments;

(b) Mailbox functionality;

(c) Job queue management;

(d) Machine management (e.g. waking the imaging equipment from a reduced power state);

(e) Advanced graphical user-interface (UI);

(f) Ability to initiate communication with other host servers and client computers (e.g. scanning to email, polling remote mailboxes for jobs); or

(g) Ability to post-process pages (e.g. reformatting pages prior to printing).

33. Functional Adder — A functional adder is a standard product feature that adds functionality to the base marking engine of an imaging equipment product. The Operational Mode portion of these specifications contains additional power allowances for certain functional adders. Examples of functional adders include wireless interfaces and scanning capability.

34. Operational Mode (OM) Approach — A method of testing and comparing the energy performance of imaging equipment products which focuses on product energy consumption in various low-power modes. The key criteria used by the OM approach are values for low-power modes, measured in watts (W). Detailed information can be found in the 'ENERGY STAR Qualified Imaging Equipment Operational Mode Test Procedure' available at www.energystar.gov/products.

35. Marking Engine — The very basic engine of an imaging product, which drives the image production of that product. Without additional functional components, a marking engine cannot acquire image data to process and is, therefore, non-functional. A marking engine is reliant on functional adders for communication ability and image processing.

36. Model — An imaging equipment product that is sold or marketed under a unique model number or marketing name. A model may comprise a base unit or a base unit and accessories.

37. Product Speed — In general, for Standard-size products, a single A4 or 8.5″ x 11″ sheet printed/copied/scanned on one side in a minute is equal to one image-per-minute (ipm). If the maximum claimed speeds differ when producing images on A4 or 8.5″ x 11″ paper, the higher of the two is used.

    - For mailing machines, one piece of mail processed in a minute is equal to one mail-piece-per-minute (mppm).

    - For Small-format products, a single A6 or 4″ x 6″ sheet printed/copied/scanned on one side in a minute is equal to 0.25 ipm.

    - For Large-format products, a single A2 sheet is equivalent to 4 ipm and one A0 sheet is equivalent to 16 ipm.

- For continuous-form products categorised as Small-format, Large-format, or Standard-size, print speed in ipm should be obtained from the product's maximum marketed imaging speed in metres per minute according to the conversion below:

X ipm = 16 x [Maximum media width (metres) x Maximum imaging speed (length-metres/minute)]

In all cases, the converted speed in ipm should be rounded to the nearest integer (e.g. 14.4 ipm rounds to 14.0 ipm; 14.5 ipm rounds to 15 ipm).

For qualification purposes, manufacturers should report the speed of the product according to the prioritisation of functions outlined below:

- Print Speed, unless the product cannot perform the print function, in which case,

- Copy Speed, unless the product cannot perform the print or copy functions, in which case,

- Scan Speed.

38. Typical Electricity Consumption (TEC) Approach — A method of testing and comparing the energy performance of imaging equipment products which focuses on the typical electricity consumed by a product while in normal operation during a representative period of time. The key criterion of the TEC approach for imaging equipment is a value for typical weekly electricity consumption, measured in kilowatt-hours (kWh). Detailed information can be found in the Typical Electricity Consumption Test Procedure in section D.2.

B. QUALIFYING PRODUCTS

These ENERGY STAR specifications are intended to cover personal, business, and commercial imaging equipment products but not industrial products (e.g. products directly connected to three-phase power). Units must be capable of being powered from a wall outlet or from a data or network connection, using the international standard nominal voltage supplies listed in section D.4. In order to qualify as ENERGY STAR, an imaging equipment product must be defined in section A and meet one of the product descriptions in Table 1 or 2 below.

Table 1				
Qualifying Products — TEC Approach				
Product Area	Marking Technology	Size Format	Colour Capability	TEC Table
Copiers	Direct Thermal	Standard	Monochrome	TEC 1
	Dye Sublimation	Standard	Colour	TEC 2
	Dye Sublimation	Standard	Monochrome	TEC 1
	EP	Standard	Monochrome	TEC 1
	EP	Standard	Colour	TEC 2
	Solid Ink	Standard	Colour	TEC 2
	Thermal Transfer	Standard	Colour	TEC 2
	Thermal Transfer	Standard	Monochrome	TEC 1
Digital Duplicators	Stencil	Standard	Colour	TEC 2
	Stencil	Standard	Monochrome	TEC 1
Fax Machines	Direct Thermal	Standard	Monochrome	TEC 1
	Dye Sublimation	Standard	Monochrome	TEC 1
	EP	Standard	Monochrome	TEC 1
	EP	Standard	Colour	TEC 2
	Solid Ink	Standard	Colour	TEC 2
	Thermal Transfer	Standard	Colour	TEC 2
	Thermal Transfer	Standard	Monochrome	TEC 1

Table 1				
Qualifying Products — TEC Approach				
Product Area	Marking Technology	Size Format	Colour Capability	TEC Table
Multifunction Devices (MFDs)	High Performance IJ	Standard	Monochrome	TEC 3
	High Performance IJ	Standard	Colour	TEC 4
	Direct Thermal	Standard	Monochrome	TEC 3
	Dye Sublimation	Standard	Colour	TEC 4
	Dye Sublimation	Standard	Monochrome	TEC 3
	EP	Standard	Monochrome	TEC 3
	EP	Standard	Colour	TEC 4
	Solid Ink	Standard	Colour	TEC 4
	Thermal Transfer	Standard	Colour	TEC 4
	Thermal Transfer	Standard	Monochrome	TEC 3

Table 1				
Qualifying Products — TEC Approach				
Product Area	Marking Technology	Size Format	Colour Capability	TEC Table
Printers	High Performance IJ	Standard	Monochrome	TEC 1
	High Performance IJ	Standard	Colour	TEC 2
	Direct Thermal	Standard	Monochrome	TEC 1
	Dye Sublimation	Standard	Colour	TEC 2
	Dye Sublimation	Standard	Monochrome	TEC 1
	EP	Standard	Monochrome	TEC 1
	EP	Standard	Colour	TEC 2
	Solid Ink	Standard	Colour	TEC 2
	Thermal Transfer	Standard	Colour	TEC 2
	Thermal Transfer	Standard	Monochrome	TEC 1

Table 2				
Qualifying Products — Operational Mode Approach				
Product Area	Marking Technology	Size Format	Colour Capability	OM Table
Copiers	Direct Thermal	Large	Monochrome	OM 1
	Dye Sublimation	Large	Colour & Monochrome	OM 1
	EP	Large	Colour & Monochrome	OM 1
	Solid Ink	Large	Colour	OM 1
	Thermal Transfer	Large	Colour & Monochrome	OM 1
Fax Machines	Ink Jet	Standard	Colour & Monochrome	OM 2
Mailing Machines	Direct Thermal	N/A	Monochrome	OM 4
	EP	N/A	Monochrome	OM 4
	Ink Jet	N/A	Monochrome	OM 4
	Thermal Transfer	N/A	Monochrome	OM 4
Multifunction Devices (MFDs)	Direct Thermal	Large	Monochrome	OM 1
	Dye Sublimation	Large	Colour & Monochrome	OM 1
	EP	Large	Colour & Monochrome	OM 1
	Ink Jet	Standard	Colour & Monochrome	OM 2
	Ink Jet	Large	Colour & Monochrome	OM 3
	Solid Ink	Large	Colour	OM 1
	Thermal Transfer	Large	Colour & Monochrome	OM 1

Table 2				
Qualifying Products — Operational Mode Approach				
Product Area	Marking Technology	Size Format	Colour Capability	OM Table
Printers	Direct Thermal	Large	Monochrome	OM 8
	Direct Thermal	Small	Monochrome	OM 5
	Dye Sublimation	Large	Colour & Monochrome	OM 8
	Dye Sublimation	Small	Colour & Monochrome	OM 5
	EP	Large	Colour & Monochrome	OM 8
	EP	Small	Colour	OM 5
	Impact	Large	Colour & Monochrome	OM 8
	Impact	Small	Colour & Monochrome	OM 5
	Impact	Standard	Colour & Monochrome	OM 6
	Ink Jet	Large	Colour & Monochrome	OM 3
	Ink Jet	Small	Colour & Monochrome	OM 5
	Ink Jet	Standard	Colour & Monochrome	OM 2
	Solid Ink	Large	Colour	OM 8
	Solid Ink	Small	Colour	OM 5
	Thermal Transfer	Large	Colour & Monochrome	OM 8
	Thermal Transfer	Small	Colour & Monochrome	OM 5
Scanners	N/A	Large, Small & Standard	N/A	OM 7

C. ENERGY-EFFICIENCY SPECIFICATIONS FOR QUALIFYING PRODUCTS

Only those products listed in section B above that meet the following criteria may qualify as ENERGY STAR. Effective dates are provided in section F.

Products Sold with an External Power Supply: To qualify as ENERGY STAR under the present Imaging Equipment Version 1.1 specifications, imaging equipment products manufactured on or after 1 July 2009 using a single-voltage external AC-AC or AC-DC power supply must use an ENERGY STAR-qualified external power supply, or one that meets the ENERGY STAR External Power Supply (EPS) Version 2.0 requirements when tested by the ENERGY STAR test method. The ENERGY STAR specification and test method for single-voltage external AC-AC and AC-DC power supplies may be found at www.energystar.gov/products.

Products Designated to Operate with a Type 1 DFE: To qualify as ENERGY STAR under the present Imaging Equipment Version 1.1 specifications, an imaging equipment product manufactured on or after 1 July 2009 that is sold with a Type 1 DFE must use a DFE that meets the ENERGY STAR Imaging Equipment Digital Front End Power Supply Efficiency Requirements listed in section C.3.

Products Designated to Operate with a Type 2 DFE: For an imaging equipment product sold with a Type 2 DFE and manufactured on or after 1 July 2009 to qualify as ENERGY STAR under the present Imaging Equipment Version 1.1 specifications, manufacturers should subtract the DFE's energy consumption in Ready mode for TEC products or exclude it when measuring Sleep and Standby for OM products. Section C.1 provides further detail on adjusting TEC values for DFEs for TEC products and section C.2 provides further detail for excluding DFEs from OM Sleep and Standby levels.

It is the intent of EPA and the European Commission that, whenever possible, the power associated with the DFE (Type 1 or Type 2) should be excluded or subtracted from the TEC energy and OM power measurements.

Products Sold with an Additional Cordless Handset: To qualify, fax machines or MFDs with fax capability manufactured on or after 1 July 2009 that are sold with additional cordless handsets must use an ENERGY STAR-qualified handset, or one that meets the ENERGY STAR Telephony specification when tested to the ENERGY STAR test method on the date the imaging product is qualified as ENERGY STAR. The ENERGY STAR specification and test method for telephony products may be found at www.energystar.gov/products.

Duplexing: Standard-size copiers, MFDs, and printers that use EP, SI, and High Performance IJ marking technologies addressed by the TEC approach in section C.1 must meet the following duplexing requirements, based on monochrome product speed:

Colour Copiers, MFDs, and Printers	
Monochrome Product Speed	Duplexing Requirement
≤ 19 ipm	N/A
20 – 39 ipm	Automatic duplexing must be offered as a standard feature or optional accessory at the time of purchase.
≥ 40 ipm	Automatic duplexing is required as a standard feature at the time of purchase.

Monochrome Copiers, MFDs, and Printers	
Monochrome Product Speed	Duplexing Requirement
≤ 24 ipm	N/A
25 – 44 ipm	Automatic duplexing must be offered as a standard feature or optional accessory at the time of purchase.
≥ 45 ipm	Automatic duplexing is required as a standard feature at the time of purchase.

1. ENERGY STAR Eligibility Criteria — TEC

To qualify as ENERGY STAR, the TEC value obtained for imaging equipment listed in section B, Table 1, above must not exceed the corresponding limits below.

For imaging products with a Type 2 DFE, the energy consumption of the DFE, calculated as in the example below, should be excluded when comparing the product's measured TEC value with the limits listed below. The DFE must not interfere with the ability of the imaging product to enter or exit its lower-power modes. In order to be excluded, the DFE must meet the definition in section A.32 and be a separate processing unit that is capable of initiating activity over the network.

Example: A printer's total TEC result is 24.5 kWh/week and its internal DFE consumes 50W in Ready mode. 50W × 168 hours/week = 8.4 kWh/week, which is then subtracted from the tested TEC value: 24.5 kWh/week — 8.4 kWh/week = 16.1 kWh/week. 16.1 kWh/week is then compared to the following limits.

Note: In all of the following equations, x = Monochrome Product Speed (ipm).

TEC Table 1	
Product(s): Copiers, Digital Duplicators, Fax Machines, Printers	
Size Format(s): Standard-size	
Marking Technologies: DT, Mono DS, Mono EP, Mono Stencil, Mono TT, Mono High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 15	1.0 kWh
15 < x ≤ 40	(0.10 kWh/ipm)x – 0.5 kWh
40 < x ≤ 82	(0.35 kWh/ipm)x – 10.3 kWh
> 82	(0.70 kWh/ipm)x – 39.0 kWh

TEC Table 2	
Product(s): Copiers, Digital Duplicators, Fax Machines, Printers	
Size Format(s): Standard-size	
Marking Technologies: Colour DS, Colour Stencil, Colour TT, Colour EP, SI, Colour High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 32	(0.10 kWh/ipm)x + 2.8 kWh
32 < x ≤ 58	(0.35 kWh/ipm)x – 5.2 kWh
> 58	(0.70 kWh/ipm)x – 26.0 kWh

TEC Table 3	
Product(s): MFDs	
Size Format(s): Standard-size	
Marking Technologies: DT, Mono DS, Mono EP, Mono TT, Mono High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 10	1.5 kWh
10 < x ≤ 26	(0.10 kWh/ipm)x + 0.5 kWh
26 < x ≤ 68	(0.35 kWh/ipm)x – 6.0 kWh
> 68	(0.70 kWh/ipm)x – 30.0 kWh

TEC Table 4	
Product(s): MFDs	
Size Format(s): Standard-size	
Marking Technologies: Colour DS, Colour TT, Colour EP, SI, Colour High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 26	(0.10 kWh/ipm)x + 3.5 kWh
26 < x ≤ 62	(0.35 kWh/ipm)x – 3.0 kWh
> 62	(0.70 kWh/ipm)x – 25.0 kWh

2. ENERGY STAR Eligibility Criteria — OM

To qualify as ENERGY STAR, the power consumption values for imaging equipment listed in section C, Table 2, above must not exceed the corresponding limits below. For products that meet the Sleep-mode power requirement in Ready mode, no further automatic power reductions are required to meet the Sleep limit. Additionally, for products that meet the standby-power requirements in Ready or Sleep mode, no further automatic power reductions are required to qualify as ENERGY STAR.

For imaging products with a functionally integrated DFE that relies on the imaging product for its power, the power consumption of the DFE should be excluded when comparing the product's measured Sleep with the combined marking-engine and functional-adder limits below and when comparing the measured Standby level with the Standby limits below. The DFE must not interfere with the ability of the imaging product to enter or exit its lower-power modes. In order to be excluded, the DFE must meet the definition in section A.32 and be a separate processing unit that is capable of initiating activity over the network.

Default Delay Time Requirements: To qualify for ENERGY STAR, OM products must meet the default delay time settings in Tables A through C below for each product type, enabled upon product shipment. In addition, all OM products must be shipped with a maximum machine delay time not in excess of four hours, which is adjustable only by the manufacturer. This maximum machine delay time cannot be influenced by the user and typically cannot be modified without internal, invasive product manipulation. The default delay time settings in Tables A through C may be user-adjustable.

Table A				
Maximum Default Delay Times to Sleep for Small-format and Standard-size OM Products, Excluding Mailing Machines, in Minutes				
Monochrome Product Speed (ipm)	Fax Machines	MFDs	Printers	Scanners
0 – 10	5	15	5	15
11 – 20	5	30	15	15
21 – 30	5	60	30	15
31 – 50	5	60	60	15
51 +	5	60	60	15

Table B				
Maximum Default Delay Times to Sleep for Large-format OM Products, Excluding Mailing Machines, in Minutes				
Monochrome Product Speed (ipm)	Copiers	MFDs	Printers	Scanners
0 – 10	30	30	30	15
11 – 20	30	30	30	15
21 – 30	30	30	30	15
31 – 50	60	60	60	15
51 +	60	60	60	15

Table C	
Maximum Default Delay Times to Sleep for Mailing Machines in Minutes	
Product Speed (mppm)	Mailing Machines
0 – 50	20
51 – 100	30
101 – 150	40
151 +	60

Standby Requirements: To qualify for ENERGY STAR, OM products must meet the Standby power limit in Table D below for each product type.

Table D	
Maximum Standby Power Level for OM Products in Watts	
Product Type	Standby (W)
All OM Products	1

The eligibility criteria in OM Tables 1 through 8 further below address the marking engine of the product. Since products are expected to be shipped with one or more functions beyond a basic marking engine, the corresponding allowances below should be added to the marking engine criteria for Sleep. The total value for the base product plus the functional adders should be used to determine eligibility. Manufacturers may apply no more than three primary functional adders to each product model, but may apply as many secondary adders as are present (with primary adders in excess of three included as secondary adders). An example of this approach is provided below:

Example: Consider a Standard-size IJ printer with a USB 2.0 connection and a memory card connection. Assuming the USB connection is the primary interface used during the test, the printer model would receive a functional-adder allowance of 0.5 W for USB and 0.1 for the memory card reader, for a total of 0.6 W in functional-adder allowances. Since OM Table 2 sets a Sleep mode marking-engine limit of 1.4 W, to determine qualification under ENERGY STAR, the manufacturer would add together the Sleep mode marking-engine limit and the applicable functional-adder allowances to determine the maximum power consumption permitted for qualification of the base product: 1.4 W + 0.6 W. If the power consumption of the printer in Sleep mode is measured at or below 2.0 W, then the printer would meet the ENERGY STAR Sleep limit.

Table 3			
Qualifying Products — OM Functional Adders			
Type	Details	Functional Adder Allowances (W)	
		Primary	Secondary
Interfaces	A. Wired < 20 MHz	0.3	0.2
	A physical data- or network-connection port present on the imaging product that is capable of a transfer rate < 20 MHz. Includes USB 1.x, IEEE488, IEEE 1284/Parallel/Centronics, RS232, and/or fax modem.		
	B. Wired ≥ 20 MHz and < 500 MHz	0.5	0.2
	A physical data- or network-connection port present on the imaging product that is capable of a transfer rate ≥ 20 MHz and < 500 MHz. Includes USB 2.x, IEEE 1394/FireWire/i.LINK, and 100Mb Ethernet.		
	C. Wired ≥ 500 MHz	1.5	0.5
	A physical data- or network-connection port present on the imaging product that is capable of a transfer rate ≥ 500 MHz. Includes 1G Ethernet.		
	D. Wireless	3.0	0.7
	A data- or network-connection interface present on the imaging product that is designed to transfer data via radio-frequency wireless means. Includes Bluetooth and 802.11.		
	E. Wired card/camera/storage	0.5	0.1
	A physical data- or network-connection port present on the imaging product that is designed to allow the connection of an external device, such as flash memory-card/smart-card readers and camera interfaces (including PictBridge).		
	G. Infrared	0.2	0.2
	A data- or network-connection interface present on the imaging product that is designed to transfer data via infrared technology. Includes IrDA.		

Table 3			
Qualifying Products — OM Functional Adders			
Type	Details	Functional Adder Allowances (W)	
		Primary	Secondary
Other	Storage	-	0.2
	Internal storage drives present on the imaging product. Includes internal drives only (e.g. disk drives, DVD drives, Zip drives), and applies to each separate drive. This adder does not cover interfaces to external drives (e.g. SCSI) or internal memory.		
	Scanners with CCFL lamps or non-CCFL lamps	-	0.5
	The presence of a scanner that uses Cold Cathode Fluorescent Lamp (CCFL) technology or a technology other than CCFL, such as Light-Emitting Diode (LED), Halogen, Hot-Cathode Fluorescent Tube (HCFT), Xenon, or Tubular Fluorescent (TL) technologies. This adder is applied only once, regardless of the lamp size or the number of lamps/bulbs employed.		
	PC-based system (cannot print/copy/scan without use of significant PC resources)	-	-0.5
	This adder applies to imaging products that rely on an external computer for significant resources, such as memory and data processing, to perform basic functions commonly performed by imaging products independently, such as page rendering. This adder does not apply to products that simply use a computer as a source or destination for image data.		
	Cordless handset	-	0.8
	The capability of the imaging product to communicate with a cordless handset. This adder is applied only once, regardless of the number of cordless handsets the product is designed to handle. This adder does not address the power requirements of the cordless handset itself.		
	Memory	-	1.0 W per 1 GB

Table 3			
Qualifying Products — OM Functional Adders			
Type	Details	Functional Adder Allowances (W)	
		Primary	Secondary
	The internal capacity available in the imaging product for storing data. This adder applies to all volumes of internal memory and should be scaled accordingly. For example, a unit with 2.5 GB of memory would receive an allowance of 2.5 W while a unit with 0.5 GB would receive an allowance of 0.5 W.		
	Power-supply (PS) size, based on PS output rating (OR) Note: This adder ONLY applies to products which fall under OM Tables 2 and 6.	-	For PSOR > 10 W, 0.02 x (PSOR — 10 W)
	This adder applies to only those imaging products which fall under OM Tables 2 and 6. The allowance is calculated from the internal or external power supply's rated DC output as specified by the power supply manufacturer. (It is not a measured quantity). For example, a unit that is rated to provide up to 3 A at 12 V has a PSOR of 36 W and would receive a power supply allowance of 0.02 x (36-10) = 0.02 x 26 = 0.52 W. For supplies that provide more than one voltage, the sum of power from all voltages is used unless the specifications note that there is a rated limit lower than this. For example, a supply which can supply 3A of 24 V and 1.5 A of 5 V output has a total PSOR of (3 x 24) + (1.5 x 5) = 79.5 W, and an allowance of 1.39 W.		

For the adder allowances shown in Table 3 above, distinctions are made between 'primary' and 'secondary' types of adders. These designations refer to the state in which the interface is required to remain while the imaging product is in Sleep. Connections that remain active during the OM test procedure while the imaging product is in Sleep are defined as primary, while connections that can be inactive while the imaging product is in Sleep are defined as secondary. Most functional adders typically are secondary types.

Manufacturers should consider only the adder types that are available on a product in its as-shipped configuration. Options available to the consumer after the product is shipped or interfaces that are present on the product's externally powered digital front-end (DFE) should not be considered when applying allowances to the imaging product.

For products with multiple interfaces, these interfaces should be considered as unique and separate. However, interfaces that perform multiple functions should only be considered once. For example, a USB connection that operates as both 1.x and 2.x may be counted only once and given a single allowance. When a particular interface may fall under more than one interface type according to Table 3 above, the manufacturer should choose the function that the interface is primarily designed to perform when determining the appropriate adder allowance. For example, a USB connection on the front of the imaging product that is marketed as a PictBridge or 'camera interface' in the product literature should be considered a type E interface rather than a Type B interface. Similarly, a memory-card-reader slot that supports multiple formats may only be counted once. Further, a system that supports more than one type of 802.11 may count as only one wireless interface.

OM Table 1	
Product(s): Copiers, MFDs	
Size Format(s): Large Format	
Marking Technologies: Colour DS, Colour TT, DT, Mono DS, Mono EP, Mono TT, Colour EP, SI	
	Sleep (W)
Marking Engine	30

OM Table 2	
Product(s): Fax Machines, MFDs, Printers	
Size Format(s): Standard-size	
Marking Technologies: Colour IJ, Mono IJ	
	Sleep (W)
Marking Engine	1.4

OM Table 3	
Product(s): MFDs, Printers	
Size Format(s): Large Format	
Marking Technologies: Colour IJ, Mono IJ	
	Sleep (W)
Marking Engine	15

OM Table 4	
Product(s): Mailing Machines	
Size Format(s): N/A	
Marking Technologies: DT, Mono EP, Mono IJ, Mono TT	
	Sleep (W)
Marking Engine	7

OM Table 5	
Product(s): Printers	
Size Format(s): Small Format	
Marking Technologies: Colour DS, DT, Colour IJ, Colour Impact, Colour TT, Mono DS, Mono EP, Mono IJ, Mono Impact, Mono TT, Colour EP, SI	
	Sleep (W)
Marking Engine	9

OM Table 6	
Product(s): Printers	
Size Format(s): Standard-size	
Marking Technologies: Colour Impact, Mono Impact	
	Sleep (W)
Marking Engine	4.6

OM Table 7	
Product(s): Scanners	
Size Format(s): Large Format, Small Format, Standard-size	
Marking Technologies: N/A	
	Sleep (W)
Scanning Engine	4.3

OM Table 8	
Product(s): Printers	
Size Format(s): Large Format	
Marking Technologies: Colour DS, Colour Impact, Colour TT, DT, Mono DS, Mono EP, Mono Impact, Mono TT, Colour EP, SI	
	Sleep (W)
Marking Engine	14

3. DFE Efficiency Requirements

The following efficiency requirements are for Digital Front End equipment as defined in section A of these specifications.

Power Supply Efficiency Requirements

Type 1 DFE Using an Internal AC-DC Power Supply: A DFE that gets its DC power from its own internal AC-DC power source must meet the following power supply efficiency requirement: 80% minimum efficiency at 20%, 50%, and 100% of rated output and Power Factor ≥ 0.9 at 100% of rated output.

Type 1 DFE Using an External Power Supply: A DFE that gets its DC power from its own external power supply (as defined by the ENERGY STAR V2.0 Programme Requirements for Single Voltage AC-AC and AC-DC External Power Supplies) must be ENERGY STAR-qualified or meet the no-load and active-mode efficiency levels specified in the ENERGY STAR V2.0 Programme Requirements for Single Voltage AC-AC and AC-DC External Power Supplies. The ENERGY STAR specification and qualified product list can be found at: www.energystar.gov/powersupplies.

Test Procedures

Manufacturers are required to perform tests and self-certify those models that meet the ENERGY STAR guidelines.

- In performing these tests, the partner agrees to use the applicable test procedures provided in Table 4 below.

- The test results for qualifying products must be reported to EPA or the European Commission, as appropriate.

Additional testing and reporting requirements are provided below.

Models Capable of Operating at Multiple Voltage/Frequency Combinations: Manufacturers must test their products based on the market(s) in which the models will be sold and promoted as ENERGY STAR-qualified. EPA and its ENERGY STAR Country Partners have agreed upon a table with three voltage/frequency combinations for testing purposes. Please refer to section D.4 for details regarding international voltage/frequency combinations for each market.

For products that are sold as ENERGY STAR in multiple international markets, and are therefore rated at multiple input voltages, the manufacturer must test and report the required power consumption or efficiency values at all relevant voltage/frequency combinations. For example, a manufacturer that ships the same model to the United States and Europe must carry out measurements, meet the specification, and report test values at both 115 Volts/60 Hz and 230 Volts/50 Hz in order to qualify the model as ENERGY STAR in both markets. If a model qualifies as ENERGY STAR at only one voltage/frequency combination (e.g. 115 Volts/60 Hz), then it may only be qualified and promoted as ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g. North America and Taiwan).

Table 4		
Type 1 DFE Test Procedures		
Specification Requirement	Test Protocol	Source
Power Supply Efficiency	Internal Power Supply (IPS)	IPS: http://efficientpowersupplies.epri.com/
	External Power Supply (EPS) ENERGY STAR Test	EPS: www.energystar.gov/powersupplies/

D. TESTING GUIDELINES

The specific instructions for testing the energy efficiency of imaging equipment products are given in three separate sections below, entitled:

– Typical Electricity Consumption Test Procedure;

– Operational Mode Test Procedure;

and

– Test Conditions and Equipment for ENERGY STAR Imaging Equipment Products.

The test results produced by these procedures will be used as the primary basis for determining ENERGY STAR qualification.

Manufacturers are required to perform tests and self-certify those product models that meet the ENERGY STAR guidelines. Families of imaging equipment models that are built on the same chassis and are identical in every respect except for housing and colour may be qualified through the submission of test data for a single, representative model. Likewise, models that are unchanged or differ only in finish from those sold in a previous year may remain qualified without the submission of new test data, assuming the specification remains unchanged.

If a product model is offered in the market in multiple configurations as a product family or series, the partner may test and report the highest configuration available in the family, rather than each and every individual model. When submitting model families, manufacturers continue to be held accountable for any efficiency claims made about their imaging products, including those not tested or for which data were not reported.

Example: Models A and B are identical, with the exception that model A is shipped with a wired interface > 500 MHz, and model B is shipped with a wired interface < 500 MHz. If model A is tested and meets the ENERGY STAR specification, then the partner may report the test data solely for model A, to represent both models A and B.

If a product's electrical power comes from the mains, USB, IEEE1394, Power-over-Ethernet, the telephone system, or any other means or combinations of means, the net AC electrical power consumed by the product (taking into account AC-to-DC conversion losses, as specified in the OM test procedure) must be used for qualification.

1. Additional testing and reporting requirements are provided below.

Number of Units Required for Test

Testing will be conducted by the manufacturer or its authorised representative on a single unit of a model.

(a) For products listed in section B, Table 1, of these specifications, if the initial unit tested has TEC test results that meet the eligibility criteria but are within 10% of the limit, one additional unit of the same model must also be tested. Manufacturers must report values for both units. To qualify as ENERGY STAR, both units must meet the ENERGY STAR specification.

(b) For products listed in section B, Table 2, of these specifications, if the initial unit tested has OM test results that meet the eligibility criteria but are within 15% of the limits in any of the specified operating modes for that product type, then two more units must be tested. To qualify as ENERGY STAR, all three units must meet the ENERGY STAR specification.

Submission of Qualified Product Data to EPA or the European Commission, as appropriate

Partners are required to self-certify those product models that meet the ENERGY STAR guidelines and report information to EPA or the European Commission, as appropriate. The information to be reported for products will be outlined shortly following publication of the final specifications. In addition, partners must submit to EPA or the European Commission, as appropriate, excerpts from product literature that explain to consumers the recommended default delay times for power management settings. The intention of this requirement is to show that products are being tested as shipped and recommended for use.

Models Capable of Operating at Multiple Voltage/Frequency Combinations

Manufacturers must test their products based on the market(s) in which the models will be sold and promoted as ENERGY STAR-qualified. EPA, the European Commission and their ENERGY STAR Country Partners have agreed upon a table with three voltage/frequency combinations for testing purposes. Please refer to the Imaging Equipment Test Conditions for details regarding international voltage/frequency and paper sizes for each market.

For products that are sold as ENERGY STAR in multiple international markets, and are therefore rated at multiple input voltages, the manufacturer must test and report the required power consumption or efficiency values at all relevant voltage/frequency combinations. For example, a manufacturer that ships the same model to the United States and Europe must carry out measurements, meet the specification, and report test values at both 115 Volts/60 Hz and 230 Volts/50 Hz in order to qualify the model as ENERGY STAR in both markets. If a model qualifies as ENERGY STAR at only one voltage/frequency combination (e.g. 115 Volts/60 Hz), then it may only be qualified and promoted as ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g. North America and Taiwan).

2. Typical Electricity Consumption (TEC) Test Procedure

(a) Types of Products Covered: The TEC test procedure is for the measurement of Standard-size products as defined in section B, Table 1.

(b) Test Parameters

This section describes the test parameters to use when measuring a product under the TEC test procedure. This section does not cover test conditions, which are outlined in section D.4 below.

Testing in Simplex

Products will be tested in simplex mode. Originals for copying must be simplex images.

Test Image

The test image is Test Pattern A from ISO/IEC standard 10561:1999. It must be rendered in 10 point size in a fixed-width Courier font (or nearest equivalent); German-specific characters need not be reproduced if the product is incapable of doing so. The image must be rendered on an 8.5″ × 11″ or A4 sheet of paper, as appropriate for the intended market. For printers and MFDs that can interpret a page description language (PDL) (e.g. PCL, Postscript), images must be sent to the product in a PDL.

Testing in Monochrome

Colour-capable products must be tested making monochrome images unless incapable of doing so.

Auto-off and Network Enabling

The product must be configured as-shipped and recommended for use, particularly for key parameters such as power-management default delay times and resolution (except as specified below). All information from the manufacturer about recommended delay times must be consistent with the as-shipped configuration, including those in operating manuals, on Web sites, and that provided by installation personnel. If a printer, digital duplicator or MFD with print capability, or fax machine has an Auto-off capability and it is enabled as shipped, it must be disabled prior to the test. Printers and MFDs that are capable of being network-connected as-shipped[1] must be connected to a network. The type of network connection (or other data connection if the product is not capable of being networked) is at the discretion of the manufacturer, and the type used must be reported. Print jobs for the test may be sent over non-network connections (e.g. USB), even on those units that are network-connected.

Product Configuration

Paper source and finishing hardware must be present and configured as-shipped and recommended for use; however, their use in the test is at the manufacturer's discretion (e.g. any paper source may be used). Anti-humidity features may be turned off if user-controllable. Any hardware that is part of the model and intended to be installed or attached by the user (e.g. a paper feature) must be installed prior to this test.

[1] The type of network connection must be reported. Common types are Ethernet, 802.11, and Bluetooth. Common non-network data connection types are USB, Serial, and Parallel.

Digital Duplicators

Digital duplicators should be set up and used in accordance with their design and capabilities. For example, each job should include only one original image. Digital duplicators must be tested at maximum claimed speed, which is also the speed that should be used to determine the job size for performing the test, not at the default speed as-shipped, if different. Digital duplicators will otherwise be treated as printers, copiers, or MFDs, depending on their capabilities as shipped.

(c) Job Structure

This section describes how to determine the number of *images per job* to use when measuring a product under the TEC test procedure, and *jobs per day* for the TEC calculation.

For purposes of this test procedure, the product speed used to determine the job size for the test is the manufacturer's reported maximum claimed simplex speed for making monochrome images on standard-sized paper (8.5″ × 11″ or A4), rounded to the nearest integer. This speed will also be used for reporting purposes as the Product Speed of the model. The default output speed of the product, which is to be used in the actual testing, is not measured and may differ from the maximum claimed speed due to factors such as settings for resolution, image quality, printing modes, document scan time, job size and structure, and paper size and weight.

Fax machines should always be tested with one image per job. The number of images per job to be used for all other IE products is to be computed according to the following three steps. For convenience, Table 8 provides the resultant images per job computation for each integral Product Speed up through 100 images per minute (ipm).

(i) Calculate the number of *jobs per day*. The number of jobs per day varies with Product Speed:

For units with a speed of eight ipm or less, use eight jobs per day.

For units with a speed between eight and 32 ipm, the number of jobs per day is equal to the speed. For example, a 14 ipm unit uses 14 jobs per day.

For units with a speed of 32 ipm and above, use 32 jobs per day.

(ii) Calculate the nominal amount of *images per day*[1] from Table 5. For example, a 14 ipm unit uses 0.50×14^2, or 98 images per day.

Table 5		
Imaging Equipment Job Table		
Product type	Rating to use	Formula (images per day)
Monochrome (except fax)	monochrome speed	$0.50 \times ipm^2$
Colour (except fax)	monochrome speed	$0.50 \times ipm^2$

[1] Interim Images/Day in Table 37.

(iii) Calculate the number of images per job by dividing the number of images per day by the number of jobs per day. Round down (truncate) to the nearest integer. For example, a figure of 15.8 should be reported as 15 images per job, rather than rounding to 16 images per job.

For copiers below 20 ipm, there should be one original per required image. For jobs with large numbers of images, such as those for machines greater than 20 ipm, it may not be possible to match the number of required images, particularly with limits on the capacity of document feeders. Therefore, copiers 20 ipm and above may make multiple copies of each original as long as the number of originals is at least ten. This may result in more images being made than required. As an example, for a 50 ipm unit that requires 39 images per job, the test may be done with four copies of ten originals or three copies of 13 originals.

(d) Measurement Procedures

To measure time, an ordinary stopwatch and timing to a resolution of one second is sufficient. All energy figures are to be recorded as watt-hours (Wh). All time is to be recorded in seconds or minutes. 'Zero meter' references are to the 'Wh' readout of the meter. Tables 6 and 7 outline the steps of the TEC procedure.

Service/maintenance modes (including colour calibration) should generally not be included in TEC measurements. Any such modes that occur during the test are to be noted. If a service mode occurs during a job other than the first, that job may be dropped and a substitute job added to the test. If a substitute job is needed, do not record the energy values for the dropped job and add the substitute job immediately after Job 4. The 15-minute job interval is to be maintained at all times, including for the job that is dropped.

MFDs without print capability are to be treated as copiers for all purposes of this test procedure.

(i) Procedure for Printers, Digital Duplicators and MFDs with Print Capability, and Fax Machines

Table 6				
TEC Test Procedure — Printers, Digital Duplicators and MFDs with Print Capability, and Fax Machines				
Step	Initial State	Action	Record (at end of step)	Possible States Measured
1	Off	Plug the unit into meter. Zero the meter; wait test period (five minutes or more).	Off energy Testing Interval time	Off
2	Off	Turn on unit. Wait until unit indicates it is in Ready mode.	—	—
3	Ready	Print a job of at least one output image but no more than a single job per Job Table. Record time to first sheet exiting unit. Wait until the meter shows that the unit has entered its final Sleep mode.	Active0 time	—
4	Sleep	Zero meter; wait one hour.	Sleep energy	Sleep

Table 6				
TEC Test Procedure — Printers, Digital Duplicators and MFDs with Print Capability, and Fax Machines				
Step	Initial State	Action	Record (at end of step)	Possible States Measured
5	Sleep	Zero meter and timer. Print one job per Job Table. Record time to first sheet exiting unit. Wait until timer shows that 15 minutes have elapsed.	Job1 energy	Recovery, Active, Ready, Sleep
			Active1 time	
6	Ready	Repeat Step 5.	Job2 energy	Same as above
			Active2 time	
7	Ready	Repeat Step 5 (without Active time measurement).	Job3 energy	Same as above
8	Ready	Repeat Step 5 (without Active time measurement).	Job4 energy	Same as above
9	Ready	Zero meter and timer. Wait until meter and/or unit shows that unit has entered its final Sleep mode.	Final time	Ready, Sleep
			Final energy	—

Notes:

Before beginning the test, it is helpful to check the power-management default delay times to ensure they are as-shipped, and to confirm that there is plenty of paper in the device.

The 'Zero meter' instruction may be carried out by recording the accumulated energy consumption at that time rather than literally zeroing the meter.

Step 1 — The Off measurement period can be longer if desired, to reduce measurement error. Note that the Off power is not used in the calculations.

Step 2 — If the unit has no Ready indicator, use the time at which the power consumption level stabilises to the Ready level.

Step 3 — After recording the Active0 time, the remainder of this job can be cancelled.

Step 5 — The period of 15 minutes is from job initiation. The unit must show increased energy consumption within five seconds of zeroing the meter and timer; it may be necessary to initiate printing before zeroing to assure this.

Step 6 — A unit that is shipped with short default delay times might begin Steps 6-8 from Sleep.

Step 9 — Units may have multiple Sleep modes so that all but the last Sleep mode are included in the Final period.

Each image is to be sent separately; they may all be part of the same document, but should not be specified in the document as multiple copies of a single original image (unless the product is a digital duplicator, as specified in section D.2(b)).

For fax machines that only use one image per job, the page is to be fed into the unit's document feeder for convenience copying, and may be placed in the document feeder before the test begins. The unit need not be connected to a telephone line unless the telephone line is necessary for performing the test. For example, if the fax machine lacks convenience copying capability, then the job performed in Step 2 should be sent via phone line. On fax machines without a document feeder, the page should be placed on the platen.

(ii) Procedure for Copiers, Digital Duplicators and MFDs without Print Capability

Table 7				
TEC Test Procedure — Copiers, Digital Duplicators and MFDs without Print Capability				
Step	Initial State	Action	Record (at end of step)	Possible States Measured
1	Off	Plug the unit into meter. Zero the meter; wait test period (five minutes or more).	Off energy Testing Interval time	Off
2	Off	Turn on unit. Wait until unit indicates it is in Ready mode.	—	—
3	Ready	Copy a job of at least one image but no more than a single job per Job Table. Record time to first sheet exiting unit. Wait until the meter shows that the unit has entered its final Sleep mode.	Active0 time	—
4	Sleep	Zero meter; wait one hour. If unit turns Off in less than one hour, record time and energy in Sleep, but wait full hour before moving to Step 5.	Sleep energy Testing Interval time	Sleep

Table 7				
TEC Test Procedure — Copiers, Digital Duplicators and MFDs without Print Capability				
Step	Initial State	Action	Record (at end of step)	Possible States Measured
5	Sleep	Zero meter and timer. Copy one job per Job Table. Record time to first sheet exiting unit. Wait until timer shows that 15 minutes have elapsed.	Job1 energy Active1 time	Recovery, Active, Ready, Sleep, Auto-off
6	Ready	Repeat Step 5.	Job2 energy Active2 time	Same as above
7	Ready	Repeat Step 5 (without Active time measurement).	Job3 energy	Same as above
8	Ready	Repeat Step 5 (without Active time measurement).	Job4 energy	Same as above
9	Ready	Zero meter and timer. Wait until meter and/or unit shows that unit has entered its Auto-off mode.	Final energy Final time	Ready, Sleep
10	Auto-off	Zero the meter; wait test period (five minutes or more).	Auto-off energy	Auto-off

Notes:

- Before beginning the test, it is helpful to check the power-management default delay times to ensure they are as-shipped, and to confirm that there is plenty of paper in the device.

- The 'Zero meter' instruction may be carried out by recording the accumulated energy consumption at that time rather than literally zeroing the meter.

- Step 1 — The Off measurement period can be longer if desired, to reduce measurement error. Note that the Off power is not used in the calculations.

- Step 2 — If the unit has no Ready indicator, use the time at which the power consumption level stabilises to the Ready level.

- Step 3 — After recording the Active0 time, the remainder of this job can be cancelled.

- Step 4 — If the unit turns off within this hour, record the Sleep energy and time at that point in time, but wait until a full hour has elapsed since the final Sleep mode was initiated before beginning Step 5. Note that the Sleep power measurement is not used within the calculation, and the unit may enter Auto-off within the full hour.

– Step 5 — The period of 15 minutes is from job initiation. In order to be evaluated by this test procedure, products must be able to complete the required job per the Job Table within the 15-minute job interval.

– Step 6 — A unit that is shipped with short default delay times might begin Steps 6-8 from Sleep or Auto-off.

– Step 9 — If the unit has already entered Auto-off before the start of Step 9, then the values for final energy and final time are zero.

– Step 10 — The Auto-off testing interval may be longer to improve accuracy.

Originals may be placed in the document feeder before the test begins. Products without a document feeder may make all images from a single original placed on the platen.

(iii) Additional Measurement for Products with a Digital Front End (DFE)

This step applies only to products that have a DFE as defined in section A.32.

If the DFE has a separate mains power cord, regardless of whether the cord and controller are internal or external to the imaging product, a five-minute energy measurement of the DFE alone is to be made while the main product is in Ready mode. The unit must be connected to a network if network-capable as shipped.

If the DFE does not have a separate mains power cord, the manufacturer must document the AC power required for the DFE when the unit as a whole is in a Ready mode. This will most commonly be accomplished by taking an instantaneous power measurement of the DC input to the DFE and increasing this power level to account for losses in the power supply.

(e) Calculation Methods

The TEC value reflects assumptions about how many hours a day the product is in general use, the pattern of use during those hours, and the default delay times that the product uses to transition to lower power modes. All electricity measurements are made as accumulated energy over time, and then converted to power by dividing by the length of the time period.

The calculations are based on imaging jobs comprising two clusters each day with the unit going into its lowest power mode in between (as during a lunch break), as illustrated in Figure 2 further below. It is assumed that weekends have no usage, and no manual switching-off is done.

Final Time is the period of time from the last job being initiated to the start of the lowest power mode (Auto-off for copiers, digital duplicators and MFDs without print capability; and Sleep for printers, digital duplicators and MFDs with print capability, and fax machines) minus the 15-minute job interval time.

The following two equations are used for all product types:

Average Job Energy = (Job2 + Job3 + Job4) / 3

Daily Job Energy = (Job1 × 2) + [(Jobs per Day — 2) × Average Job Energy)]

The calculation method for *printers, digital duplicators and MFDs with print capability*, *and fax machines* also uses the following three equations:

Daily Sleep Energy = [24 hours — ((Jobs per day / 4) + (Final Time × 2))] × Sleep Power

Daily Energy = Daily Job Energy + (2 × Final Energy) + Daily Sleep Energy

TEC = (Daily Energy × 5) + (Sleep Power × 48)

The calculation method for copiers, digital duplicators and MFDs without print capability also uses the following three equations:

Daily Auto-off Energy = [24 hours — ((Jobs per day / 4) + (Final Time × 2))] × Auto-off Power

Daily Energy = Daily Job Energy + (2 × Final Energy) + Daily Auto-off Energy

TEC = (Daily Energy × 5) + (Auto-off Power × 48)

The specifications of the metering equipment and ranges used in each measurement must be reported. Measurements must be conducted so as to result in a total potential error in the TEC value of no more than 5%. Accuracy does not need to be reported for cases where the potential error is below 5%. When the potential measurement error is close to 5%, manufacturers should take measures to confirm that it complies with the 5% limit.

(f) References

ISO/IEC 10561:1999. Information technology — Office equipment — Printing devices — Method for measuring throughput — Class 1 and Class 2 printers.

Table 8					
Job Table Calculated					
Speed	Jobs/Day	Interim Images/Day	Interim Images/Job	Images/Job	Images/Day
1	8	1	0.06	1	8
2	8	2	0.25	1	8
3	8	5	0.56	1	8
4	8	8	1.00	1	8
5	8	13	1.56	1	8
6	8	18	2.25	2	16
7	8	25	3.06	3	24
8	8	32	4.00	4	32
9	9	41	4.50	4	36
10	10	50	5.00	5	50
11	11	61	5.50	5	55
12	12	72	6.00	6	72
13	13	85	6.50	6	78
14	14	98	7.00	7	98
15	15	113	7.50	7	105
16	16	128	8.00	8	128
17	17	145	8.50	8	136
18	18	162	9.00	9	162
19	19	181	9.50	9	171
20	20	200	10.00	10	200
21	21	221	10.50	10	210
22	22	242	11.00	11	242
23	23	265	11.50	11	253
24	24	288	12.00	12	288
25	25	313	12.50	12	300
26	26	338	13.00	13	338
27	27	365	13.50	13	351
28	28	392	14.00	14	392
29	29	421	14.50	14	406
30	30	450	15.00	15	450
31	31	481	15.50	15	465
32	32	512	16.00	16	512
33	32	545	17.02	17	544
34	32	578	18.06	18	576
35	32	613	19.14	19	608

Table 8					
Job Table Calculated					
Speed	Jobs/Day	Interim Images/Day	Interim Images/Job	Images/Job	Images/Day
36	32	648	20.25	20	640
37	32	685	21.39	21	672
38	32	722	22.56	22	704
39	32	761	23.77	23	736
40	32	800	25.00	25	800
41	32	841	26.27	26	832
42	32	882	27.56	27	864
43	32	925	28.89	28	896
44	32	968	30.25	30	960
45	32	1013	31.64	31	992
46	32	1058	33.06	33	1056
47	32	1105	34.52	34	1088
48	32	1152	36.00	36	1152
49	32	1201	37.52	37	1184
50	32	1250	39.06	39	1248
51	32	1301	40.64	40	1280
52	32	1352	42.25	42	1344
53	32	1405	43.89	43	1376
54	32	1458	45.56	45	1440
55	32	1513	47.27	47	1504
56	32	1568	49.00	49	1568
57	32	1625	50.77	50	1600
58	32	1682	52.56	52	1664
59	32	1741	54.39	54	1728
60	32	1800	56.25	56	1792
61	32	1861	58.14	58	1856
62	32	1922	60.06	60	1920
63	32	1985	62.02	62	1984
64	32	2048	64.00	64	2048
65	32	2113	66.02	66	2112
66	32	2178	68.06	68	2176
67	32	2245	70.14	70	2240
68	32	2312	72.25	72	2304
69	32	2381	74.39	74	2368

Table 8					
Job Table Calculated					
Speed	Jobs/Day	Interim Images/Day	Interim Images/Job	Images/Job	Images/Day
70	32	2450	76.56	76	2432
71	32	2521	78.77	78	2496
72	32	2592	81.00	81	2592
73	32	2665	83.27	83	2656
74	32	2738	85.56	85	2720
75	32	2813	87.89	87	2784
76	32	2888	90.25	90	2880
77	32	2965	92.64	92	2944
78	32	3042	95.06	95	3040
79	32	3121	97.52	97	3104
80	32	3200	100.00	100	3200
81	32	3281	102.52	102	3264
82	32	3362	105.06	105	3360
83	32	3445	107.64	107	3424
84	32	3528	110.25	110	3520
85	32	3613	112.89	112	3584
86	32	3698	115.56	115	3680
87	32	3785	118.27	118	3776
88	32	3872	121.00	121	3872
89	32	3961	123.77	123	3936
90	32	4050	126.56	126	4032
91	32	4141	129.39	129	4128
92	32	4232	132.25	132	4224
93	32	4325	135.14	135	4320
94	32	4418	138.06	138	4416
95	32	4513	141.02	141	4512
96	32	4608	144.00	144	4608
97	32	4705	147.02	157	4704
98	32	4802	150.06	150	4800
99	32	4901	153.14	153	4896
100	32	5000	156.25	156	4992

Figure 2

TEC Measurement Procedure

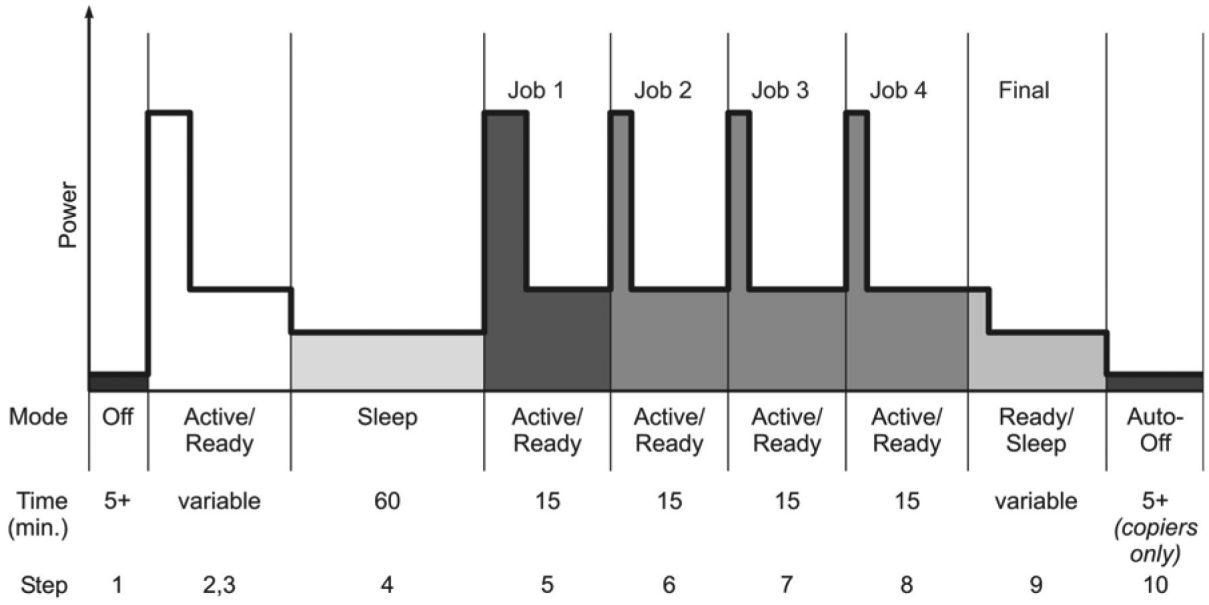

Figure 2 shows the measurement procedure in graphic form. Note that products with short default delay times may include periods of Sleep within the four job measurements, or Auto-off within the Sleep measurement in Step 4. Also, print-capable products with just one Sleep mode will not have a Sleep mode in the final period. Step 10 only applies to copiers, digital duplicators and MFDs without print capability.

Figure 3

A Typical Day

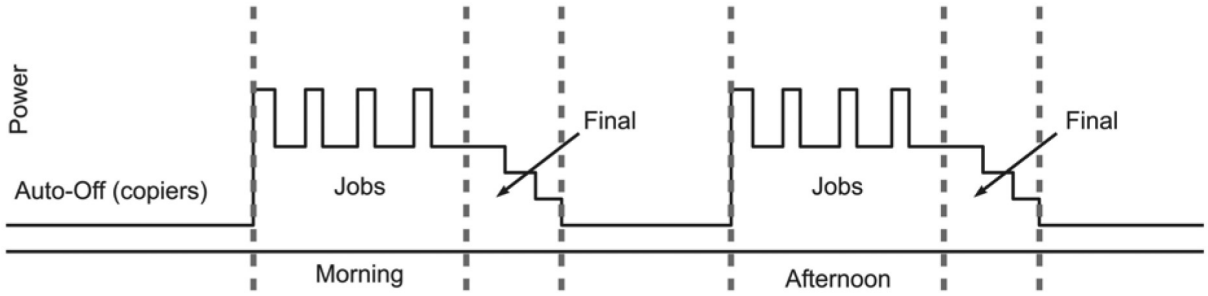

Figure 3 shows a schematic example of an eight-ipm copier that performs four jobs in the morning and four jobs in the afternoon, has two 'final' periods and an Auto-off mode for the remainder of the workday and all of the weekend. An assumed 'lunchtime' period is implied but not explicit. The figure is *not* drawn to scale. As shown, jobs are always 15 minutes apart and in two clusters. There are always two full 'final' periods regardless of the length of these periods. Printers, digital duplicators and MFDs with print capability, and fax machines use Sleep rather than Auto-off as the base mode but are otherwise treated the same as copiers.

3. Operational Mode (OM) Test Procedure

(a) Types of Products Covered: The OM Test Procedure is for the measurement of products defined in section B, Table 2.

(b) Test Parameters

This section describes the test parameters to use when measuring a product's power consumption under the OM Test Procedure.

Network Connectivity

Products that are capable of being network-connected as-shipped[1] must be connected to at least one network during the test procedure. The type of network connection that is active is at the discretion of the manufacturer, and the type used must be reported.

The product should not receive operating power over the network connection (e.g. via Power over Ethernet, USB, USB PlusPower, or IEEE 1394) unless that is the only source of power for the product (i.e. no AC power source is present).

[1] The type of network connection must be reported. Common network types are Ethernet, WiFi (802.11), and Bluetooth. Common data (non-network) connection types are USB, Serial, and Parallel.

Product Configuration

The product must be configured as shipped and recommended for use, particularly for key parameters such as power-management default delay times, print quality, and resolution.
In addition:

Paper source and finishing hardware must be present and configured as shipped; however, use of these features in the test is at the manufacturer's discretion (e.g. any paper source may be used). Any hardware that is part of the model and intended to be installed or attached by the user (e.g. a paper feature) must be installed prior to this test.

Anti-humidity features may be turned off if they are user-controllable.

For fax machines, a page should be fed into the unit's document feeder for convenience copying, and may be placed in the document feeder before the test begins. The unit need not be connected to a telephone line unless the telephone line is necessary for performing the test. For example, if the fax machine lacks convenience copying capability, then the job performed in Step 2 should be sent via phone line. On fax machines without a document feeder, the page should be placed on the platen.

If a product has an Auto-off mode enabled as shipped, it must be enabled prior to performing the test.

Speed

When conducting power measurements under this test procedure, the product should produce images at the speed resulting from its default settings as shipped. However, the manufacturer's reported maximum claimed simplex speed for making monochrome images on standard-sized paper is to be used for reporting purposes.

(c) Power Measurement Method

All power measurements are to be made in accordance with IEC 62301 with the following exceptions:

To determine the voltage/frequency combinations to be used during testing, see the Test Conditions and Equipment for ENERGY STAR Imaging Equipment Products in section D.4.

The harmonics requirement used during testing is more stringent than that required by IEC 62301. The accuracy requirement for this OM test procedure is 2% for all measurements except for Ready power. The accuracy requirement for measuring Ready power is 5%, as provided in section D.4. The 2% figure is consistent with IEC 62301, although the IEC standard expresses it as a confidence level.

For products designed to operate using batteries when not connected to the mains, the battery is to be left in place for the test; however, the measurement should not reflect active battery charging beyond maintenance charging (i.e. the battery should be fully charged before beginning the test).

Products with external power supplies are to be tested with the product connected to the external power supply.

Products powered by a standard low voltage dc supply (e.g. USB, USB PlusPower, IEEE 1394, and Power Over Ethernet) must utilise a suitable AC-powered source for the DC power. This AC-powered source's energy consumption is to be measured and reported for the imaging equipment product under test. For imaging equipment powered by USB, a powered hub serving only the imaging equipment being tested is to be used. For imaging equipment powered by Power Over Ethernet or USB PlusPower, it is acceptable to measure the power distribution device with and without the imaging product connected, and use this difference as the imaging product's consumption. The manufacturer should confirm that this reasonably reflects the unit's DC consumption plus some allowance for power supply and distribution inefficiency.

(d) Measurement Procedure

To measure time, an ordinary stopwatch and timing to a resolution of one second is sufficient. All power figures are to be recorded in watts (W). Table 9 outlines the steps of the OM test procedure. Service/maintenance modes (including colour calibration) generally should not be included in measurements. Any adaptation of the procedure needed to exclude such modes that occur during the test must be noted.

As stated above, all power measurements are to be made in accordance with IEC 62301. Depending on the nature of the mode, IEC 62301 provides for instantaneous power measurements, five-minute accumulated energy measurements, or accumulated energy measurements over periods long enough to properly assess cyclical consumption patterns. Regardless of the method, only power values should be reported.

Table 9			
OM Test Procedure			
Step	Initial State	Action	Record
1	Off	Plug the unit into meter. Turn on unit. Wait until unit indicates it is in Ready mode.	—
2	Ready	Print, copy, or scan a single image.	—
3	Ready	Measure Ready power.	Ready *power*
4	Ready	Wait default delay time to Sleep.	Sleep default delay *time*
5	Sleep	Measure Sleep power.	Sleep *power*
6	Sleep	Wait default delay time to Auto-off.	Auto-off default delay *time*
7	Auto-off	Measure Auto-off power.	Auto-off *power*
8	Off	Manually turn device off. Wait until unit is off.	—
9	Off	Measure Off power.	Off *power*

Notes:

- Before beginning the test, it is helpful to check the power-management default delay times to ensure they are as shipped.

- Step 1 — If the unit has no Ready indicator, use the time at which the power consumption level stabilises to the Ready level, and note this detail when reporting the product test data.

- Steps 4 and 5 — For products with more than one Sleep level, repeat these steps as many times as necessary to capture all successive Sleep levels and report these data. Two Sleep levels are typically used in large-format copiers and MFDs that use high-heat marking technologies. For products lacking this mode, disregard Steps 4 and 5.

- Steps 4 and 6 — Default delay time measurements are to be made in parallel, cumulative from the start of Step 4. For example, a product set to enter a Sleep level in 15 minutes and enter a second Sleep level 30 minutes after entering the first Sleep level will have a 15-minute default delay time to the first level and a 45-minute default delay time to the second level.

- Steps 6 and 7 — Most OM products do not have a distinct Auto-off mode. For products lacking this mode, disregard Steps 6 and 7.

– Step 8 — If the unit has no power switch, wait until it enters its lowest power mode and note this detail when reporting the product test data.

(i) Additional Measurement for Products with a Digital Front End (DFE)

This step applies only to products that have a DFE as defined in section A.32.
If the DFE has a separate mains power cord, regardless of whether the cord and controller are internal or external to the imaging product, a five-minute energy measurement of the DFE alone is to be made while the main product is in Ready mode. The unit must be connected to a network if network-capable as shipped.

If the DFE does not have a separate mains power cord, the manufacturer must document the AC power required for the DFE when the unit as a whole is in a Ready mode. This will most commonly be accomplished by taking an instantaneous power measurement of the DC input to the DFE and increasing this power level to account for losses in the power supply.

(e) References

IEC 62301:2005. Household Electrical Appliances — Measurement of Standby Power

4. Test Conditions and Equipment for ENERGY STAR Imaging Equipment Products

The following test conditions apply to the OM and TEC Test Procedures. These cover copiers, digital duplicators, fax machines, mailing machines, multifunction devices, printers, and scanners.

Below are the ambient test conditions that must be established when performing the energy or power measurements. These are necessary to ensure that variance in ambient conditions does not affect the test results, and that test results are reproducible. Specifications for test equipment follow the test conditions.

(a) Test Conditions

General Criteria:

Supply Voltage[1]:	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%)
		Note: For products rated for > 1.5 kW maximum power, the voltage range is ±4%
Total Harmonic Distortion (THD) (Voltage):	< 2% THD (< 5% for products 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)

[1] Supply Voltage: Manufacturers must test their products based on the market in which the partner intends to sell the products as ENERGY STAR-qualified. For equipment sold in multiple international markets and therefore rated at multiple input voltages, the manufacturer must test at and report all relevant voltages and power consumption levels. For example, a manufacturer that ships the same printer model to the United States and Europe must measure and report the TEC or OM values at both 115 Volts/60 Hz and 230 Volts/50 Hz. If a product is designed to operate at a voltage/frequency combination in a specific market that is different from the voltage/frequency combination for that market (e.g. 230 Volts, 60 Hz in North America), the manufacturer should test the product at the regional combination that most closely matches the product's design capabilities and note this fact on the test reporting sheet.

Paper Specifications:

For all TEC tests and for OM tests that require the use of paper, the paper size and basis weight must be appropriate to the intended market, per the following table.

Paper Size and Weight		
Market	Size	Basis Weight
North America/Taiwan:	8.5″ × 11″	75 g/m^2
Europe/Australia/New Zealand:	A4	80 g/m^2
Japan:	A4	64 g/m^2

(b) Test Equipment

The goal of the test procedures is to accurately measure the TRUE power consumption[1] of the product. This necessitates the use of a True RMS power or energy meter. There are many such meters available, and manufacturers need to exercise care in selecting an appropriate model. The following factors must be considered when selecting a meter and conducting the test.

[1] True power is defined as (volts)x(amps)x(power factor), and is typically reported as Watts. Apparent power is defined as (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. Accumulated energy measurements sums power measurements over a period of time and so also need to be based on measurements of true power.

Frequency Response: Electronic equipment that contains switching power supplies introduces harmonics (odd harmonics typically up to the 21st). If these harmonics are not accounted for in power measurement, the result will be inaccurate. EPA recommends that manufacturers use meters 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: For direct power measurements, the resolution of metering equipment must be consistent with the following requirements of IEC 62301:

'The power measurement instrument shall have a resolution of:

– 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

– 1 W or better for power measurements of greater than 100 W.'[1]

[1] IEC 62301 — Household Electrical Appliances — Measurement of Standby Power 2005.

In addition, the measurement instrument must have a resolution of 10 W or better for power measurements greater than 1.5 kW. Measurements of accumulated energy should have resolutions which are generally consistent with these values when converted to average power. For accumulated energy measurements, the figure of merit for determining the required accuracy is the maximum power value during the measurement period, not the average, since it is the maximum that determines the metering equipment and setup.

Accuracy

Measurements made with these procedures must in all cases have an accuracy of 5% or better, though manufacturers will usually achieve better than this. Test procedures may specify greater accuracy than 5% for some measurements. With knowledge of the power levels of current imaging products and the meters available, manufacturers can calculate the maximum error based on the reading and the range utilised for the reading. For measurements of 0.50 W or less, the required accuracy is 0.02 W.

Calibration

Meters must have been calibrated within the last 12 months to ensure accuracy.

E. USER INTERFACE

Manufacturers are strongly recommended to design products in accordance with IEEE 1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments. This standard was developed to make power controls more consistent and intuitive across all electronic devices. For details on the development of this standard, see http://eetd.lbl.gov/controls.

F. EFFECTIVE DATE

The date that manufacturers may begin to qualify products as ENERGY STAR under the present Version 1.1 specifications will be defined as the effective date of the agreement. Any previously executed agreement on the subject of ENERGY STAR-qualified imaging equipment will be terminated as of 30 June 2009.

Qualifying and Labelling Products under this Version 1.1: the Version 1.1 specifications will commence on 1 July 2009. All products, including models originally qualified under previous imaging equipment specifications, with a date of manufacture on or after 1 July 2009, must meet the new Version 1.1 requirements in order to qualify for ENERGY STAR (including additional manufacturing runs of models originally qualified under previous specifications). The date of manufacture is specific to each unit and is the date (e.g. month and year) on which a unit is considered to be completely assembled.

Elimination of Grandfathering: EPA and the European Commission will not allow grandfathering under the present Version 1.1 ENERGY STAR specifications. ENERGY STAR qualification under previous Versions is not automatically granted for the life of the product model. Therefore, any product sold, marketed, or identified by the manufacturing partner as ENERGY STAR must meet the current specifications in effect at the time of manufacture of the product.

G. FUTURE SPECIFICATION REVISIONS

EPA and the European Commission reserve the right to change the specifications should technological and/or market changes affect their usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specifications are arrived at through stakeholder discussions and are expected to occur approximately 2 – 3 years from the effective date of Version 1.1. EPA and the European Commission will periodically assess the market in terms of energy efficiency and new technologies. As always, stakeholders will have an opportunity to share their data, submit proposals, and voice any concerns. EPA and the European Commission will strive to ensure that the specifications recognise the most energy-efficient models in the marketplace and reward those manufacturers who have made efforts to further improve energy efficiency. Some of the issues to consider addressing in the next specifications include:

(a) Colour Testing: Based on submitted test data, future consumer preferences, and engineering advancements, EPA and the European Commission may modify the specifications at some point in the future to include colour imaging in the test method.

(b) Recovery Time: EPA and the European Commission will closely monitor incremental and absolute recovery times as reported by partners testing to the TEC method, as well as partner-submitted documentation regarding recommended default delay settings. EPA and the European Commission will consider modification of the specifications to address recovery time should it become apparent that manufacturer practices are resulting in user disabling of power management modes.

(c) Addressing OM Products Under TEC: Based on submitted test data, opportunities for greater energy savings, and engineering advancements, EPA and the European Commission may modify the specifications at some point in the future to address products that are currently treated by the OM approach under the TEC approach, including Large-format and Small-format products, as well as products that employ IJ technology.

(d) Additional Energy Impacts: EPA and the European Commission are interested in providing consumers with choices that significantly reduce greenhouse gas emissions compared to typical alternative choices. EPA and the European Commission will be seeking input from stakeholders on methods to document and quantify the environmental impacts under which manufacturing, transportation, product design or the use of consumables can lead to a product with the same or even better overall greenhouse gas impact as products earning the ENERGY STAR based on greenhouse gas emission from energy use alone. We are exploring ways to effectively address these issues and may amend these specifications as warranted based on sufficient supporting information. EPA and the European Commission will work closely with stakeholders on any revisions and ensure revisions are aligned with ENERGY STAR programme guiding principles.

(e) Reporting Data at 230V: EPA and the European Commission may consider that for those products marketed in different markets, one of which includes a 230V market, data from testing at the 230V level should be acceptable as sufficient for the multiple markets. This suggestion is based on the observation that if a product meets the 230V specifications, it will meet the standards at the lower voltage levels.

(f) Expanding Duplexing Requirements: EPA and the European Commission may re-assess the presence of duplexing on the current range of products, and consider how the optional requirements could be made more stringent. Revisiting the duplexing requirements to ensure greater coverage of duplexing would potentially result in reduced paper usage, which has been found to be the largest life-cycle impact of a printer.

(g) Revising TEC Test Procedure: EPA and the European Commission may revisit the TEC test methodology to make usage assumptions more transparent or add requirements to the specification that power consumption be measured and reported in some distinct modes that would allow for values relevant to actual usage patterns.

(h) Power States: EPA and the European Commission may consider revising the definition of certain power terms (e.g. Standby) or adding new power management approaches (e.g. weekend Sleep) in order to maintain consistency with international criteria and to obtain the highest achievable energy savings for imaging equipment.