Draft Test Procedure for Determining
Idle State Power Use of Personal Computers

September 12, 2005 (Version 1)

The purpose of this test procedure is to provide a standard methodology for measuring the power use of computers in *Idle State*.[1] Computers are normally characterized as operating in one of three *modes: off, sleep*, or *active*.   Within the *active mode* is a state described as *Idle State* in which the computer is on and active, but there is little utilization of the central processing unit (CPU) (See *Idle State* definition below). What follows is the proposed methodology for measuring power use of computers in *Idle State.*

Definitions

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

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

Approved Meter
As described in IEC 62301 Ed 1.0: Measurement of Standby Power, approved meters include the following attributes:

- Power resolution of 1 mW or better;
- An available current crest factor of 3 (or more) at its rated range value;
- Minimum current range of 10mA (or less).

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

---

[1] This draft test procedure was prepared by NRDC and its consultant for consideration by the computer industry, ENERGY STAR, and other stakeholders. It includes collection of additional data about computer hardware and software configurations intended to inform specification-setting processes.. After such policies are adopted, the final test procedure may end up being substantially simpler.

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.

Off Mode

Off mode, also characterized as "*standby*," refers to the condition in which a computer has been switched off by means of the operating system software or a physical switch on the computer itself. Typically, some power consumption is still occurring in this situation, because the off switch is placed "downstream" of the power supply, thus causing some power to flow through the power supply even when the computer itself is off.

Sleep Mode

Sleep mode can correspond to a variety of different processor states, but is generally characterized as a condition under which a computer is not operating, but can rapidly return to normal operation following a wake signal from the keyboard, mouse, or local area network. Power use during sleep mode will often be slightly higher than in *off mode*, corresponding to the operation of circuitry that watches for a wake signal and then restores the computer to the set of operating conditions in which it was engaged prior to going to sleep. This test procedure refers to *sleep mode* by the computer itself, rather than the *sleep mode* experienced by the monitor to which it is attached. Computers can trigger monitors to go to sleep without themselves being asleep. *Sleep mode* can further be subdivided to specify which components are powered down:

ACPI S-States for PCs	Common Terminology	Power Saving Action
S-1	"Standby"	Processor is halted but remains powered.
S-2	*No longer in use*	
S-3	"Suspend to RAM"/ "Sleep"	CPU powered down and contents moved to RAM
S-4	"Suspend to Disk"/ "Hibernate"	CPU powered down along with RAM, contents moved to disk
S-5	"Soft Off"/ "Shut Down"	System is powered down but could supply power to certain devices to trigger wake event, such as start up from LAN or USB device.

Active Mode

Active mode corresponds to a wide range of operating conditions that a computer may experience. At the high end (of both activity and power use), such operating conditions could include full CPU utilization, ongoing changes to information being displayed on the screen, hard drive and optical drive activity, network activity, data input from the keyboard or mouse, etc. More typically, only some of these activities might be occurring simultaneously, so power use would be somewhat lower.

Idle State
This test procedure refers to the lowest end of the active mode as *idle state* – a condition in which:

- The operating system has fully loaded
- No windows are open
- No user input is occurring from the keyboard or mouse
- No hard drive or optical drive activity is occurring and no floppy discs, optical discs, tapes, or flash memory cards are inserted in their respective drives
- The computer is connected to only one mouse, keyboard, and monitor
- No other USB or Firewire peripherals are attached
- No change is occurring to the information displayed on screen (though a monitor is attached)
- No network connection is established via Ethernet, wireless, or modem sources[2]

Measurement Approach
Measurement of ac power consumption of a computer in the idle state should be conducted as follows:

1. Record the manufacturer and model name of the UUT.
2. 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.[3]
3. Record basic information about the video card, including video card name, resolution, amount of onboard memory, and bits per pixel.[4]
4. Ensure that power management settings that power down the hard drive(s) are set to 10 minutes or longer.
5. Make the following initial preparations, depending on computer type:

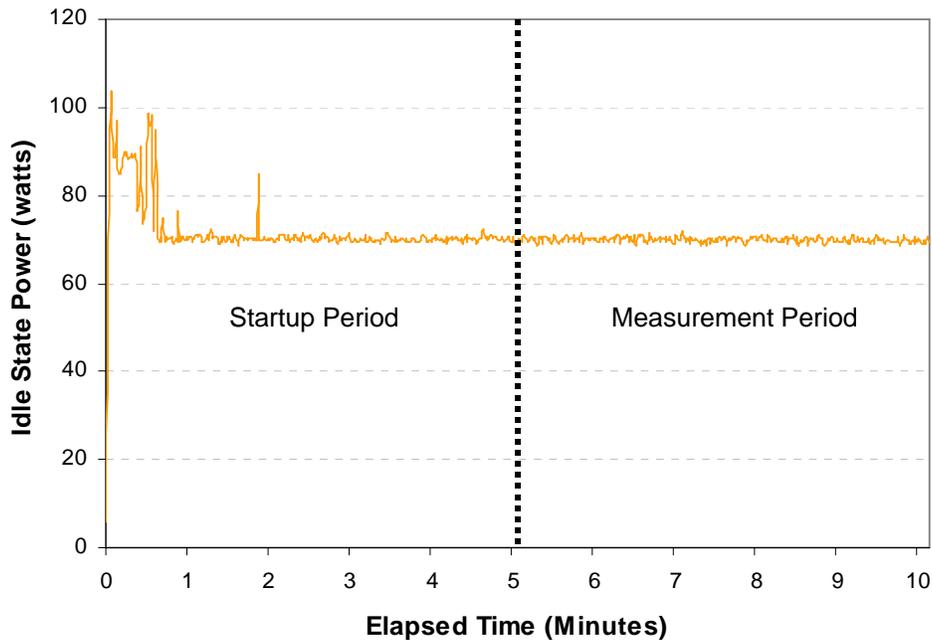| Computer Type	Actions
Laptop	1. Switch off the computer 2. Remove the laptop from its docking station (if applicable) 3. Remove the battery or ensure the battery is fully charged 4. Switch on the computer 5. Use power management settings to set screen to full brightness (adjust no other power management settings) and complete test below 6. Using power management settings, set the monitor to power down after 1 minute (adjust no other power management settings) and repeat test below

---

[2] Testing by Ecos Consulting and Lawrence Berkeley Laboratories has confirmed that network connections can contribute varying loads to idle state, depending on interface type, connection speed, and degree of activity. Removing active network connections entirely represents the most straightforward way to ensure repeatable, accurate results.

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

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

Integrated Desktop[5]	1. Use power management settings to set screen to full brightness (adjust no other power management settings) and complete test below 2. Using power management settings, set the monitor to power down after 1 minute (adjust no other power management settings) and repeat test below
Conventional Desktop	No preparations needed
Desktop Derived Server	No preparations needed

Idle State Power After Start Up

6. Connect an approved meter[6] capable of measuring true power to an ac line voltage source set at 120 volts, 60 Hz. 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. Record the ac voltage. Switch on the computer and begin recording elapsed time. After the operating system has fully loaded, close any windows that may be open. Exactly 5 minutes after the computer was switched on, set meter to begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute

---

[5] An integrated desktop is a computer whose monitor has no separate ac power source. The computer's power cord also draws power to operate its integrated monitor.
[6] Recently calibrated, laboratory grade metering equipment from Yokogawa, Voltech, etc. will tend to yield the highest precision, especially with readings of less than 5 watts. These meters can integrate over user-selected intervals to determine average power use for readings that are changing rapidly. However, any of the various low cost plug load meters (Watts Up Pro, Kill-A-Watt, Power Angel, etc.) may be sufficiently precise for collecting large amounts of preliminary data on idle power, where typical readings for desktop computers are 25 watts or more, and may be stable within 1 to 2 watts.

period.[7] The data-recording period should not be more than 5 minutes so as to prevent potential data collection after power management settings have taken effect.

7. Record date, location of test, and testing organization, as well as name of technician conducting the test. If multiple computers of the same model are being tested, record serial number or other unique identifying information.

All data shall be entered into a standardized form in the attached spreadsheet to facilitate analysis and ensure comparable results.

---

[7] 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.