ENERGY STAR® Program Requirements for Consumer Audio and DVD Products

Eligibility Criteria

Below is the product specification for ENERGY STAR qualified consumer audio and DVD products. A product must meet all of the identified criteria if it is to be labeled as ENERGY STAR by its manufacturer.

1) Definitions: Below are brief descriptions of consumer audio and DVD products and their common operational modes as relevant to ENERGY STAR. The ENERGY STAR specification focuses on reducing energy consumption while the product is in the Standby Mode.

   A. Consumer Audio and DVD Products: To qualify, these products must draw current from a building's AC power electrical outlet via a power cord or via an AC power adapter that is shipped with the product. Also eligible are those products that have a power switch to interrupt the current flow from the power line and perform no operating functions except in active mode. This agreement does not cover professional, automotive, or solely battery-powered products. For a list of eligible consumer audio and DVD product categories, refer to Section 2, Qualifying Products.

      1. Consumer Audio Product: A commercially available electronic product encased in a single housing whose intended purpose, other than providing non-video status displays, is the production or recording of signals in the audio domain as reproduced by headphones, loudspeakers, or other transducers.

      2. Digital Versatile Disc (DVD) Product: A commercially available electronic product encased in a single housing whose intended purpose is the production or recording of digitized video signals on a spinning reflective disc media.

   B. Standby Mode: The mode in which the product is connected to the power source, is possibly producing status information or time readout, is waiting to be switched to the active mode, and produces/records no video or audio signal (either directly audible, or audible as reproduced by headphones, loudspeakers, or other transducers). The product may exit the standby mode through an automatic timer activation, direct activation by the user, or a remote control command from the user. In standby mode, the product is substantially shut down but may continue to perform some functions (e.g., remote control sensing and clock).

   C. Active Mode: The mode in which the product is connected to a power source and is producing or recording signals in the video domain and/or audio domain as reproduced by headphones, loudspeakers, or other transducers. The power requirement in this mode is typically greater than the power requirement in standby mode.

   D. Disconnect: The mode in which the product is disconnected from all external power sources.

2) Qualifying Products: For the purposes of this agreement, ENERGY STAR Partner agrees that consumer audio and DVD products include the following: cassette decks, CD players/changers, CD recorders/burners, clock radios, DVD products, equalizers, laserdisc players, mini- and midi-systems, minidisc players, powered speakers, rack systems, stereo amplifiers/pre-amplifiers, stereo receivers, table radios, and tuners.

3) Energy-Efficiency Specifications for Qualifying Products: Only those products listed in Section 2 that meet the criteria below may qualify as ENERGY STAR (Version 1.0).

Product	Phase I Standby Mode	Phase II Standby Mode
Consumer Audio Products	≤ 2.0 Watts	≤ 1.0 Watt
DVD Products	≤ 3.0 Watts	≤ 1.0 Watt

4) Power Measurement: Manufacturers are required to perform tests and self-certify those product models that meet the ENERGY STAR guidelines. The power requirement shall be measured from the outlet or power supply source to the product under test. The Partner shall measure the average true power (in watts) of the product. When performing measurements to self-certify a product model, the products under test must be in the condition (e.g., configuration and settings) shipped to the customer.

5) Test Criteria: To ensure consistency in measuring the power requirements for electronics products, this protocol should be followed. Outlined in Section A are the ambient test conditions that should be respected when performing power measurements. These conditions ensure that outside factors do not affect the test results and that the test results can be reproduced. Sections B and C describe the specifications for testing equipment and the test method, respectively. Section D reviews responsibilities, while Section E covers continuing verification.

A. Test Conditions

***General Criteria**:*

Total Harmonic Distortion (Voltage):	< 3% THD
Ambient Temperature:	22°C ± 4°C

Terminations: External speaker terminals terminated per 3.6.2.2 (IEC 107-1)

Market-Specific Criteria:

Market:	United States	Europe and Australia	Japan
Voltage:	115 V RMS ± 3 V RMS	230 V RMS ± 10 V RMS	100 V RMS ± 5 V RMS & 200 V RMS ± 10 V RMS
Frequency:	60 Hz ± 3 Hz	50 Hz ± 3 Hz	50 Hz ± 3 Hz & 60 Hz ± 3 Hz

Note: Testing needs to be done only at a voltage and frequency in the above range. It is not necessary to test all combinations of high voltage/low frequency, high voltage/high frequency, etc.

B. Test Equipment: Manufacturers should measure and report the true standby power[1] requirements of the product. Doing so necessitates the use of a true power watt meter. Because there are many watt meters from which to choose, manufacturers need to exercise care in selecting an appropriate model. The following items should be considered when procuring equipment and performing the test:

1. AC Power Source (with sufficient output current for the test unit that meets the requirement for AC line voltage, frequency stability, and THD).
2. True Power Meter (with sufficient accuracy, resolution, crest factor rating, and bandwidth).
3. Oscilloscope with Current Probe (to monitor AC line current waveform, amplitude, and frequency. Optional but recommended).
4. True RMS Volt Meter (to verify voltage at the input of test unit. Optional if AC source output is sufficiently accurate).
5. Frequency Counter (to verify frequency at the input of test unit. Optional if AC source output is sufficiently accurate).

Crest Factor: Electronics equipment may draw current that is not sinusoidal.[2] While virtually any watt meter can measure a standard current waveform, it is more difficult to select a watt meter when irregular current waveforms are involved.

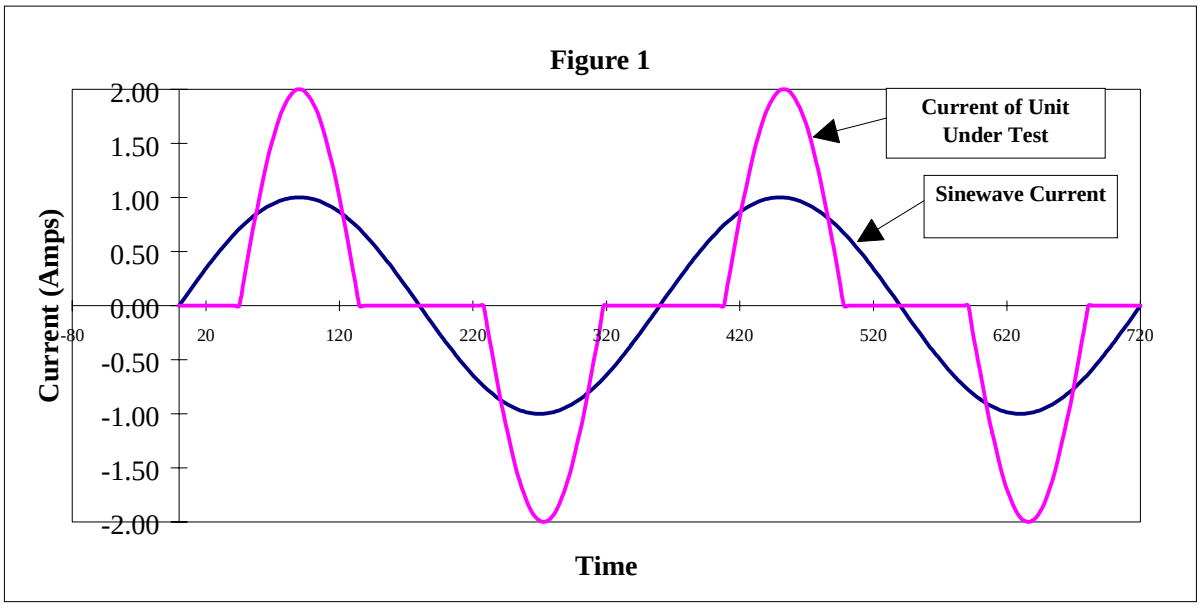
It is critical that the watt meter selected be capable of reading the current drawn by the product without causing internal peak distortion (i.e., clipping off the top of the current wave). This requires a review of the meter's crest factor rating and the current ranges available on the meter. Better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

To determine the crest factor rating requirement of the meter and the proper current range settings, the peak current (amps) draw of the product under test in standby mode must first be measured. This can be accomplished using an oscilloscope with a current probe.

A current range on the meter must be selected that is sufficient to register the peak current. Specifically, the full scale value of the current range selected multiplied by the crest factor of the meter (for current) must be greater than the peak current reading from the oscilloscope by at least 15 percent to compensate for any measurement error. (Note: It is difficult to measure within 5 percent using an analog oscilloscope.) For example, if a watt meter has a crest factor of 4 and the current range is set on 3 amps, the meter can register current spikes of up to 12 amps. If measured peak current is only 6 amps, the meter would be satisfactory. If, however, the current range is set too high, the meter may lose accuracy in measuring non-peak current. Therefore, some delicate balancing is necessary. Make sure that the crest factor is given for the current level that you desire for the meter that you are considering.

[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; therefore, true power is always less than apparent power.

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



Frequency Response: Another issue to consider when selecting a watt meter is the frequency response rating of the meter. Electronic equipment may cause harmonic waveforms that can lead to inaccuracies in the power measurements. For example, electronics equipment powered by switching power supplies typically produces odd harmonics up to the 21st. To ensure that the harmonics are properly addressed, ENERGY STAR recommends the use of a watt meter with frequency response of at least 3 kHz. This will account for harmonics up to the 50th, which is recommended by IEC 555.

Resolution: Manufacturers should choose a watt meter that can provide resolution of 0.1 W.

Accuracy: Catalogues and specification sheets for watt meters typically provide information on the accuracy of power readings that can be achieved at different range settings. If the power measurement is very close to the energy-efficiency guideline specified in these Program Requirements (Eligibility Criteria), a test procedure with greater accuracy will be necessary. For example, if the ENERGY STAR specification is 1.0 watt or less *and* the resulting accuracy of the watt meter at the test settings is ± 0.1 watts, then a power measurement of less than 0.9 watts will ensure that the product qualifies for ENERGY STAR.

Calibration: To maintain their accuracy, watt meters should be calibrated every year with a standard that is traceable to the U.S. National Bureau of Standards (NBS).

C. Test Method: Following are the test steps for measuring the true power requirements of the test unit in standby mode:

1. Power on all test equipment and properly adjust operation range.
2. Connect the test equipment and unit under test.
3. Check for normal operation of the test unit and leave all customer adjustment to factory default settings.
4. Bring the test unit into standby mode (not off mode) either by using the remote control device or by using the ON/OFF switch on the test unit cabinet.
5. Either verify that the wall outlet power is within specifications or adjust the AC power source output as described in Section A (e.g., 115Vrms ± 3Vrms, 60Hz ± 3Hz).

6. 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.
7. After the unit under test reaches operating temperature and the readings on the power meter stabilize (approximately 90 minutes), take the true power reading in watts from the power meter.
8. Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value to within a +10% - 0% error. If the device has different standby modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive mode. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

D. Responsibilities: ENERGY STAR's test criteria are not mandatory, but they will be distributed to outside parties such as buyers and the press. Following the test criteria and producing accurate test results will assist manufacturers in qualifying and labeling products as ENERGY STAR. Companies may determine the appropriate level of stringency and accuracy for their own testing based on their specific products.

E. Continuing Verification: This testing procedure (protocol) describes the method by which a single unit may be tested and qualify as an ENERGY STAR labeled product. An ongoing testing process is highly recommended to ensure that products from different production runs qualify for ENERGY STAR. A model may qualify as ENERGY STAR if testing indicates that 95 percent of the units sold under this model name/number will meet the specifications contained in these Program Requirements (Eligibility Criteria).

6) Effective Date: The date that manufacturers may begin to qualify products as ENERGY STAR will be defined as the *effective date* of the agreement.

A. Phase I: The first phase of this program, Phase I, shall commence immediately and conclude on December 31, 2002. Upon signing this agreement, the Partner may begin to use the ENERGY STAR logo on product models, packaging, or other product-related materials that meet Phase I specifications.

B. Phase II: The second phase of this program, Phase II, shall commence on January 1, 2003. Specifications for Phase II shall apply to products that the Partner begins to ship after December 31, 2002. However, once an individual product model is qualified by the Partner as ENERGY STAR, the model, packaging, or other product-related materials may continue to bear the ENERGY STAR logo until the model is phased out of the market (i.e., the Phase II specifications will not apply retroactively to models previously qualified under Phase I specifications).

7) Future Specification Revisions: ENERGY STAR reserves 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 industry discussions.