ENERGY STAR® Specification Framework Document for Digital-to-Analog Converter Boxes

ENERGY STAR Background

ENERGY STAR is a government-backed program that is helping businesses and consumers protect the environment through superior energy efficiency. Products that earn the ENERGY STAR use less energy, with no sacrifice in performance, and prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency (EPA) and the Department of Energy. Today, nationwide consumer recognition of the ENERGY STAR mark exceeds 60%. In 2005, ENERGY STAR saved U.S. consumers over 150 billion kWh of electricity, or $12 billion in energy costs. Greenhouse gases equivalent to taking 23 million cars off the road were prevented from entering the atmosphere as a result of the ENERGY STAR program.

There are currently more than 50 different product categories that are eligible to earn the ENERGY STAR. These include products within the broad categories of consumer electronics, office equipment, appliances, heating and cooling equipment, and more. Over 1,500 manufacturing companies have joined ENERGY STAR as partners, labeling more than 35,000 product models. The program also has over 800 retail partners, with more than 21,000 storefronts. Many companies have benefited by participating in this program because ENERGY STAR allows for another point of competition and differentiation in the market.

ENERGY STAR and Digital-to-Analog Converter Boxes (DTAs)

The U.S. will be shifting to digital only TV broadcasts on February 18, 2009. As of that date, older analog TVs will require a digital-to-analog converter box, or DTA, in order for users to continue receiving broadcast channels. The EPA is in the process of developing an ENERGY STAR specification for DTAs. Unlike other more established product categories in the ENERGY STAR portfolio, DTAs are not yet on the market in the U.S. Therefore, EPA's specification setting process will involve some forecasting of where the market can go from an energy efficiency perspective. With this ENERGY STAR specification, EPA intends to create an incentive for the more efficient design of these devices not likely to be sold until shortly before the transition in early 2009.

The National Telecommunications and Information Administration (NTIA) has been charged by Congress with implementing and administering a program to provide $40 coupons to those consumers who will need to purchase a DTA to continue receiving OTA broadcasts following the transition to all-digital broadcasting.

According to estimates provided by various parties, approximately 22 million DTAs could be purchased leading up to and immediately following the transition to all-digital broadcasting. Based on the power consumption of DTAs currently available in international markets, the American Council for an Energy Efficient Economy (ACEEE) has estimated that if left unchecked, On Mode power consumption could be as much as 17 watts and Standby Mode as much as 8 watts for DTAs introduced to the U.S. market.

Estimates show that the typical U.S. consumer watches broadcast TV for a daily average of anywhere from four to six hours. As one or more viewers can watch a single TV at the same time, and there are an average of 2.73[1] TVs per household, the average daily time that a single set is used for viewing broadcast TV is closer to 3 hours.[2] Thus a DTA will only be needed on average for 3 hours per day, per TV. However, the converter box may not necessarily be turned off during the remaining 21 hours. Depending on consumer behavior and product design, the DTA may be left on the entire day and only enter a low power mode if the user physically turns it off by pushing a button on the front of the product or using a remote control. Unlike a TV where it is easy to recognize if the product is on or off, this distinction will not be as apparent with a DTA, furthering the likelihood that these devices will be unknowingly left on continuously. Assuming DTAs are left on all the time, the estimated annual power consumption of a DTA with On Mode power consumption of 17 watts and Standby power consumption of 8 watts would be 149 kWh/year. This means consumers would have to spend approximately $15 per year to power their DTAs,

[1] Nielsen Media Research
[2] Nielsen: Market Research, Television Audience 2005

or $75 over the anticipated five-year lifetime of the product. With an expected 22 million DTAs entering U.S. homes, these products would consume approximately 3.29 billion kWh/year and cost $330 million per year to operate.

The anticipated large scale manufacture and sale of these products presents a unique opportunity to take steps to ensure these new devices are as energy-efficient as possible. EPA is, therefore, developing an ENERGY STAR specification for DTAs, which will provide manufacturers the opportunity to display the ENERGY STAR mark on qualifying models, providing a way for consumers to identify the more efficient models in the marketplace. The ENERGY STAR specification will also provide an easy way for interested retailers to ask their suppliers for energy-efficient DTAs to sell to their customers.

Definitions

Auto Power Down: A feature that operates similarly to power management features in computers, and would require the DTA to enter Standby Passive Mode after a certain pre-set number of hours of user inactivity (e.g., no channel changes being made).

Digital Television Adapter (DTA): Receives terrestrial, (over the air) digital signals and converts them to an analog output suitable for analog TVs. Does not provide digital signal output, and thus does not work with a digital TV. The DTA category does not include converters that work with satellite or cable digital signals, nor does it cover devices with multi-functionality such as a DVD player with digital to analog conversion capability.

On Mode: The appliance is connected to a power source and fulfils its main function, e.g., receiving and converting a digital TV signal and repacking it in standard definition analog NTSC format.

Standby Active Mode: The appliance is connected to a power source, does not fulfill the main function but can be switched into another mode with the remote control unit or an internal signal A DTA in this mode can also be switched into another mode with an external signal, and can be exchanging/receiving data with/from an external source. For DTAs, this operational mode would most typically include program guide updates.

Standby Passive Mode: The appliance is connected to a power source, does not fulfill the main function but can be switched into another mode with the remote control unit or an internal signal. This mode is typically the lowest power consuming mode that a DTA has while plugged in.

Note: Once NTIA finalizes its ruling on the definition of a DTA eligible for the $40 coupon, EPA intends to mirror that definition in its ENERGY STAR specification for DTAs. Definitions for On, Standby Passive, and Standby Active Mode are consistent with IEC 62087: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment. (The definition for Standby Passive mode is consistent with the 'Sleep' Mode definition in CEA-2013-A.)

Proposed Energy-Efficiency Specifications

Note: EPA is proposing two alternative approaches to an ENERGY STAR specification for DTAs. Stakeholders are asked to provide feedback on their preferred approach.

Modal Approach: The first approach is a modal approach, where manufacturers will have to ensure DTAs meet prescribed power levels in *both* On Mode and Standby Passive Mode, *and* incorporate a complying auto power down feature to earn the ENERGY STAR. (Standby Active Mode power levels will not be prescribed in the ENERGY STAR specification for DTAs due to the small percentage of time a DTA will operate in this mode, if at all.)

Duty-Cycle Approach: The second approach is a duty-cycle approach, which encourages more efficient product design on an overall *energy used per year* basis instead of a modal approach. A duty-cycle approach would result in a performance-based specification, allowing manufacturers to use any combination of efficient components, advanced integrated circuitry, and/or power management (auto power down) to achieve the specified kWh/year target to earn the ENERGY STAR. This would require that EPA and interested stakeholders develop an accepted typical duty cycle to apply during testing.

Below is a strawman for both approaches. Levels will be determined with stakeholder input, once a preferred approach is decided.

Modal Approach

- DTA shall consume no more than 'X' watts (exact level TBD) of ac power while in On Mode.
- DTA shall consume no more than 'X' watts (exact level TBD) of ac power while in Standby Passive Mode.

DTA must incorporate an auto power down feature that enables the DTA to automatically enter Standby Passive Mode after four hours or less of user inactivity, (e.g., no channel changes being made). The DTA must be shipped with the auto power down feature enabled. Users should have the option to override this feature by (i) means of a warning message being displayed on the television stating that the DTA will enter standby mode in 'X' minutes if no user action is taken, or (ii) turning it off temporarily if the user wants to set a program to record automatically at some point in the future.

Note: EPA has not yet determined maximum allowable power consumption levels for DTAs in On Mode and Standby Passive Mode. If feedback provided by stakeholders indicates a preference for a modal approach, EPA will conduct additional research to determine levels which are both achievable and cost-effective, yet ensure maximum energy and monetary savings for the consumer. To this end, EPA seeks input from stakeholders on wattage levels that are achievable cost-effectively. Any reports on proto-type devices that form the basis for this input would also be very useful as EPA works with stakeholders to develop power consumption levels.

As briefly described in the Introduction, many users may never power down DTAs after watching broadcast TV and thus many DTAs may never enter Standby Mode. One way to address this issue is to include an auto power down feature as part of the efficiency requirements for DTAs, and mandate that ENERGY STAR qualified products be shipped with the feature enabled. The projected annual energy consumption of a DTA with the above-referenced base case On Mode (17 watts) and Standby Passive Mode (8 watts) power consumption levels, which is left on all the time by a user but incorporates auto power down after four hours of user inactivity, ranges from 93 to 100 kWh/yr. (This assumes between 15 and 17 hours in Standby Passive Mode per day.) This is a dramatic reduction from the estimated 149 kWh/year if efficiency is left unchecked. Lower On Mode and Standby Passive Mode power consumption levels would reduce this energy consumption even further. For example, a unit using 8 watts in On Mode and 1 watt in Standby Passive Mode would consume between 27 and 32 kWh/yr.

EPA recognizes that a certain percentage of users, 50% by some estimates, will turn off their DTAs when turning off their TVs. EPA seeks input from stakeholders on whether 50% is an accurate percentage and if not, what would be a better estimate. Data to support suggested estimates would be most useful.

Duty-Cycle Approach

- DTA shall consume no more than TBD kWh/year, as determined when using the duty cycle for a DTA as specified below. (This is an example for discussion only. Parameters will be set following input from stakeholders.)

Auto Power Down Setting	On Mode (hours/day)	Standby Passive Mode (hours/day)[3]
None	13.5	10.5
1 hr	4	20
2 hrs	5.5	18.5
4 hrs	7	17
8 hrs	9.5	14.5

Maximum allowable energy use (kWh/yr) standard = (365/1000) [On (hours/day)* reference On Mode power (watts) + standby (hours/day) *reference Standby Passive Mode power (watts)]

Example: If a reference auto power down period of 4 hours and reference wattages of 8 watts for On and 1 watt for Standby Passive Mode are established, the maximum allowable energy use would be:

Maximum allowable energy use (kWh/yr) standard = (365/1000) [7* 8 + 17 * 1] = 26.6 kWh/yr

Note: EPA has not yet determined the maximum allowable kWh/year power consumption level that DTAs would need to meet under the duty-cycle approach to earn the ENERGY STAR. If stakeholders indicate that they would prefer EPA to move forward with a duty-cycle approach, EPA will continue to conduct research towards determining the appropriate level. As part of their feedback, stakeholders are encouraged to provide any information they have available regarding typical American TV viewing-patterns. This will aid in forming the most accurate and appropriate power consumption target under a duty-cycle approach. The values shown in the table above for discussion are based on a review of Nielsen profiles of TV tuning over an average day, assuming each tuning segment is one-hour in duration, and assuming 50% of users turn off their DTAs when turning off their TVs.

Test Procedure

Note: EPA is considering various test procedures to adopt in the ENERGY STAR specification for DTAs. One alternative for determining On Mode and Standby Passive Mode power consumption is IEC 62087: Methods of Measurement for the Power Consumption of Audio, Video, and Related Equipment. However, EPA believes that this test procedure may fail to address certain aspects of power consumption related to DTAs and is investigating other possible alternatives. The Consumer Electronics Association is currently developing a test procedure for DTAs. If this test procedure meets the needs of this specification, EPA will adopt this test procedure instead.

[3] This includes periods of standby initiated by a user turning the unit off when turning a TV off.