# Draft 3 ENERGY STAR Imaging Equipment Program Requirements (Version 1.0) Supplemental Rationale for EPA Decisions Informed by Manufacturer-submitted Functional-adder Data

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In developing the Eligibility Criteria for products addressed by the Operational Mode (OM) approach in the Draft 3 ENERGY STAR Imaging Equipment Program Requirements (Version 1.0), EPA considered an OM dataset of 242 imaging equipment models. The dataset included the following:

- Currently ENERGY STAR qualified copiers, fax machines, multifunction devices (MFDs), and printers that clearly fall under the OM approach according to Table 2 in Section 2 of the Draft 3 specification for which functional adders have been identified;
- Qualified OM models reported to EPA as available on the market between October 2003 and December 2005 (Large-format models as available starting in January 1996); and
- OM models submitted to EPA specifically for inclusion in the specification revision, which may not be qualified per the current specifications.

This document provides supplemental rationale in support of Section 3.B. of the Draft 3 ENERGY STAR Imaging Equipment Program Requirements (Version 1.0), dated March 17, 2006. It is EPA's intention that this document serve as a reference to aid stakeholders in better understanding how this section of the specification was developed, and in particular, the data that informed the OM specification levels.

Accompanying this rationale document is the masked OM dataset EPA considered in the development of the OM Eligibility Criteria.

## Functional-adder Development

The concept for the functional-adder approach for OM products was first proposed at the October 14, 2005, imaging equipment stakeholder meeting, and subsequently developed in collaboration with stakeholders over a period of months following the meeting. Based in part on discussions with industry experts, EPA proposed a set of functions, or functional adders, and corresponding power allowances in the Draft 2 specification released on December 21, 2005. At the February 14, 2006, stakeholder meeting, EPA discussed the proposed approach and the feedback it has received with stakeholders, including the Draft 2 functional-adder types and allowances, the planned approach for determining the marking-engine Sleep criteria, and EPA's initial findings from analyzing the proposed adders used in conjunction with existing qualified product data. Per the action items resulting from this meeting, several manufacturers provided EPA with additional data, which identified the functional adders present on their products as standard and tested. EPA used this data to help inform its analysis of a dataset of existing qualified product models to observe how the functions contributed to the models' reported Sleep mode values. The findings from this analysis, which included functions not previously included in Draft 2, informed the development of the eligibility criteria presented in OM Tables 1 through 8 in the Draft 3 specification.

The changes to the functional-adder proposal reflected in Draft 3 are highlighted below. Further detail about the initial values proposed in Draft 2 are provided in the February 14th stakeholder meeting discussion guide, which was distributed on February 8, 2006, and is available online at www.energystar.gov/productdevelopment.

Enhanced Display

The Draft 2 functional-adder for products with an enhanced display was omitted from Draft 3, due to the challenge of comprehensively defining such a feature and its contribution to the imaging product's energy consumption while in Sleep. EPA believes the new functional adder that has been added to consider the power supply of a product should sufficiently address this product feature in a more standardized manner than delineating the characteristics of an enhanced display, which may vary from manufacturer to manufacturer.

E. Wired card/camera/storage interface

For this functional adder, which previously had been considered only a Secondary adder, EPA added a Primary functional-adder allowance of 0.5 W. Some products in the market only have this type of interface active while the product is in Sleep mode, thus, it was determined that this Type E adder required a Primary allowance in addition to the Secondary allowance already provided.

G. Infrared

The amount of power allowed for this Secondary type of functional adder was reduced from 0.25 watts to 0.2 watts. EPA made this change to simplify manufacturer-calculations and improve consistency of this allowance with the other allowances, which all maintain one significant digit to the right of the decimal. Stakeholders who feel that the additional 0.05 watts is required for Infrared to function while the imaging product is in Sleep are asked to provide documentation supporting the need for this additional power.

Cordless handset and Ringtone cancellation

Though the OM dataset includes only a few products that have the functionalities to communicate with a cordless handset or cancel incoming fax ringtones sold on the product as standard, EPA found that the rationale for allowing some additional power for these functions was reasonable. Draft 3 allows 0.8 watts for cordless handset functionality and 1 watt for the ability to cancel incoming ringtones.

Memory

While manufacturers who offered data on the amount of memory sold with their current products did not report large amounts of memory for these products, EPA determined that an allowance for product memory merited further investigation. This determination was based on the likelihood that, in line with computer trends, some future imaging products will be designed with large banks of memory. Draft 3 allows 1 watt per each gigabyte (GB) of product memory. In any subsequent drafts of the specification, EPA will consider whether the power allowance provided in Draft 3 should be retained, or whether the specification should consider only certain types of memory, such as those that are capable of an enhanced rate of data transfer.

Power supply (PS) size

In general, according to the ENERGY STAR definition included in Draft 3, a functional adder is meant to address the energy consumption required by a product to maintain a particular function while the imaging product is in Sleep. However, stakeholders have pointed out that some functions require no energy during Sleep but considerable power while in Active, and all else being equal, a larger power supply will have a no/low-load loss that is higher than a smaller one. Power-supply size is also an indirect indication of product speed and/or monthly capacity.

For a given level of power-supply efficiency, the impact of a larger power supply on specific low-load levels can be computed precisely. EPA believes that this effect can be reasonably approximated by a linear allowance, but seeks comment on the constant of 10 watts and slope value of 5% proposed in Draft 3 for this allowance. EPA recognizes that an allowance for power-supply size effectively may duplicate part or all of other allowances, since manufacturers choose power-supply size to accommodate the designed functionality of a product. If subsequent drafts of the specification maintain the power-supply allowance, then it may be appropriate for EPA to reduce some of the other allowances accordingly. EPA appreciates stakeholder feedback regarding this potential double-counting.

## Marking-Engine Criteria Development

As explained in the February 14th meeting discussion guide, development of the marking-engine eligibility criteria depended heavily on the final allowance values for each functional adder, and the presence of these functional adders in the existing OM dataset. As the functional-adder power allowances increase in value, the net power allowance for the marking engine drops.

To obtain the marking-engine criteria, the functional-adder allowances for each model are subtracted from the model's Sleep value, leaving the "marking engine" value in watts. Through collaboration with industry stakeholders, EPA was able to determine the functional adders present on most of the products in the original dataset. The resulting marking-engine values underwent a top 25% analysis to determine the Sleep specification lines for OM Tables 1 through 8.

The following are the specific steps taken to derive the marking-engine Sleep criteria values for OM Tables 1 through 8 in Draft 3:

**1. Determine the Functional Adders and associated power allowances.** Beginning in October, 2005, EPA received stakeholder proposals on functions that merit additional energy in Sleep and specific power requirements for these functions. EPA used these proposals to arrive at the Draft 2 functional-adder set. Stakeholder input before and after the Draft 2 proposal identified other functions that might merit power allowances in addition to those proposed in Draft 2.

**2. Obtain the Sleep Power and Functional Adder presence for existing products.** As part of the Draft 2 development, to gain a better understanding of the effect of various functions on the energy consumption of a product while in Sleep, EPA collected information on the availability of various functions on currently ENERGY STAR qualified product models using the information provided on manufacturer Web sites and specification sheets. Expanding on this effort for Draft 3, between February 24th and March 7th, ten manufacturers assisted EPA by providing details on the presence of the various functions in their existing qualified and, in some cases, unqualified products. In general, manufacturers indicated the presence or absence of specific functions, but in some cases, provided the number of functions offered in a particular category. In some instances, manufacturers provided specific values, such as the amount of on-board memory or the dc output rating of the product's power supply.

**3. Subtract allowances from each product to determine the base marking-engine Sleep value.** Using the OM dataset, the Draft 2 functional-adder allowances were subtracted from each product's Sleep-power value where these adders where confirmed present by manufacturers. This resulted in a marking-engine power value in Sleep for each product in the dataset.

For example, an Ink Jet printer with a Type B data interface as Primary and two Type E Secondary interfaces that consumes 3.2 W in Sleep would receive 0.5 + 0.1 + 0.1 = 0.7 watts of adder allowances, leaving 2.5 watts for the product's marking engine. Within each OM Table, the marking-engine values were then sorted from lowest to highest.

**4. Identify the 25% marking-engine Sleep specification-level.** When determining the top 25% specification criteria for each OM table, EPA considered the impact of the Standby requirements proposed in Table D and the external-power-adapter requirement proposed at the beginning of Section 3 on the number of models that would meet the specification. A considerable number of products in the OM dataset failed the external-power-adapter and/or Standby criteria, and thus, higher Sleep marking-engine criteria were used to ensure that 25% of products met all three criteria. In terms of power alone, this resulted in well over 25% of the models in the dataset meeting the Sleep marking-engine criteria.

**5. Consider alternative adders and power levels.** In many cases, industry stakeholders proposed power allowances for the functional adders that greatly exceeded the allowances put forward in Draft 2. When a set of adders based on these higher manufacturer-proposed levels was applied to the OM dataset, about half of the products in OM Table 2 resulted in negative marking-engine power values. EPA saw this as evidence that this aggregate set of functional adders was not a reasonable choice.

Based on this analysis and on stakeholder input, EPA made several changes to the Draft 2 functional-adder set to arrive at the Draft 3 functional-adders. New adders that were included in the Draft 3 specification address the following:

- Ability to communicate with a cordless handset;
- Ability to cancel the ringtone of an incoming fax;

- Installed memory; and
- Power-supply (PS) size, based on PS output rating (OR).

Generally, any increase in the functional-adder allowances will reduce the overall base marking-engine level for each table. Manufacturers and ENERGY STAR are best served by functional-adder allowances that are as close to the actual required consumption of these functions as possible.

The functional-adders provided in Draft 3 are reproduced below for reference:

**OM Functional Adders**

| Type | Details | Functional Adder Allowances (W) | |
|---|---|---|---|
| | | **Primary** | **Secondary** |
| Interfaces | A. Wired < 20 MHz, e.g. USB 1.x, IEEE488, RS232 | 0.3 | 0.2 |
| | B. Wired < 500 MHz, e.g. USB 2.x, IEEE 1394/FireWire, 100Mb Ethernet | 0.5 | 0.2 |
| | C. Wired > 500 MHz, e.g. 1G Ethernet | 1.5 | 0.5 |
| | D. Wireless, e.g. Bluetooth, 802.12 | - | 0.7 |
| | E. Wired card/camera/storage, e.g. memory card / smart card readers, camera interfaces | 0.5 | 0.1 |
| | F. Fax | 0.4 | 0.2 |
| | G. Infrared | - | 0.2 |
| Other | Storage (e.g. disk drives, DVD drives) | - | 0.2 |
| | Scanners with CCFL lamps | - | 2.0 |
| | Scanners with non-CCFL lamps | - | 0.5 |
| | PC-based system (cannot print/copy without being connected to a PC) | - | -0.5 |
| | Cordless handset | - | 0.8 |
| | Ringtone cancellation | - | 1.0 |
| | Memory | - | 1.0 W per 1 GB |
| | Power-supply (PS) size, based on PS output rating (OR) **[Note: this adder does not apply to scanners]** | - | For PSOR > 10 W, 0.05 x (PSOR – 10 W) |

**6. Identify the 25% specification-level with the revised functional-adder set.** The changes to the functional-adder allowances proposed in Draft 3 as compared to Draft 2 had only a modest effect on the 25% marking-engine level.

## Difficulties Encountered

While preparing the Draft 3 functional-adder proposal, EPA encountered the difficulties highlighted below:

- As noted earlier in this rationale, the OM dataset taken from the ENERGY STAR products database included all qualified models marked as available on the market between October 2003 and December 2005 (Large-format models as available starting in January 1996). Because many products in the database do not have a specific marking engine identified, EPA had to limit this dataset to only those models that had a specific marking-engine that clearly fell under the OM approach, according to Table 2 in Section 2 of the Draft 3 specification. Models in the database that did not have a specific marking-engine identified were excluded from the dataset. Because

partners were encouraged to ensure that data in the database was fully up-to-date and correct as early as the distribution of the First OM Test Procedure on May 17, 2005, EPA assumed the data in the system was accurate and distributed individual spreadsheets to partners with models clearly defined under OM approach. Some partners included additional models in the spreadsheets they returned to EPA, which supplemented this dataset.

- The OM dataset included no mailing machines, and very few Small-format printers. In both cases, EPA judged that the Sleep performance for these product types should closely resemble that of products addressed in Table 2 (i.e., Standard-size Ink Jet products) based on the prevalent use of Ink Jet technology in mailing machines and Small Format printers currently in the market. Thus, the OM Table 2 marking-engine levels were adopted for mailing machines in OM Table 4 and Small-format printers in OM Table 5.
- For many OM Table 2 products, manufacturers did not specify whether any particular interface was active during the original testing to meter Sleep power consumption. The existing test procedures included in the Memoranda of Understanding (MOUs) for each of these products do not require an active interface, but the new test procedure (as presented in the final draft OM test procedure, distributed on August 31, 2005) does require **at least one** active interface. A product that has no active interface during testing can drop to a lower power-level than one that has one. EPA initially was concerned that a large number of products tested with no active connection might unreasonably bias the marking-engine level downward, and just over half of the Table 2 products lacked such a designation. However, there was little difference between the 25% level from the entire dataset and the level from the subset with identified primary interfaces, thus, EPA found that no such bias manifest in the data.