

Comments received for the Generalized Internal Power Supply Test Protocol Version 6.4.2

A) *Energy Star Stakeholders Comments:*

C1. The Test Protocol defines that efficiency measurements be taken at 20%, 50%, and 100% Load. In light of attention to "Green" initiatives the variation of efficiency with load, particularly at light load, has increasing importance. XXXX would like to see efficiency measured in 10% increments of loading from 10% to 100% of rated power. Note that the Appendix A example even reports efficiency at 10% Load. Substantially all suppliers and many users have ATE equipment to make the efficiency measurements so the added burden of extra data points is small. ARTG will be characterizing vendor power supply efficiencies at these 10 Load points plus measured No Load Input power (if appropriate).

The DC-DC power supply module pictured in the lower left of page 28 is a board mount module that is normally soldered in place. Does this type of power supply meet the scope of the protocol for "easily accessible inputs and outputs, and can be separated from the appliance without causing damage to other components and circuits"? Are similar encapsulated DC-DC modules also included in the procedure?

C2. Should there be an exclusion for standby rails at the same voltage as the main output? The purpose of a standby output on a single output power supply at the same voltage is to have zero load on the standby output while the server is operating. This is done to save power, so it seems unnecessary to load these types of standby outputs while testing the efficiency. Has this been considered?

C3. In figure 1, they account for voltage drops across input line 1 and the positive output, but they do not account for losses in input line 2 and output return. Not accounting for these can alter efficiency measurements.

C4. I did not see any specification that test equipment actually be properly calibrated.

C5. They specify that power meters need to have a resolution of at least 1W and less than 2% uncertainty at a 95% confidence interval. 2% seems very high when we are talking about certifications. The 1/2 watt you lose with the 1W resolution is also a significant amount of power at many of the 20% load points.

C6. On the non-technical front, they did not capitalize most of the acronyms used throughout the document.

C7. I have a question on the input conditions for AC-DC Supplies. You are including 230V 60Hz for single-output power supplies and 115V 60Hz for multi-output supplies and wanted to know if this sufficient for ENERGY STAR testing. Is 230V 60 Hz spec looking forward to the future when EU/Australia/India might adopt this spec? If so should 100V, 50Hz input (for Japan) be included in the testing as well?

C8. Some of the typical nominal electricity supply details for some regions are documented in IEC 62301 "Household Electrical Appliances: Measurement of standby power," which is referenced in the below draft. For US, testing at 48 V dc and 115 V, 60 Hz and 230 V, 60 Hz should be sufficient but for Europe and other countries, 60 V dc, and 50 Hz should be considered. (Many of the dc/dc power supplies that UL evaluates are rated 48/60 V dc, 48-60 Vdc, 36-72 V dc, etc to cover tolerances).

C9. The 48VDC (+ or minus), is an effective limitation if the technology is considering busing of DC voltages outside of a chassis (greater than 18" or so). However many blade manufactures

use 12V systems, composed of rectifiers (AC to DC front ends) + DC-DC internal power supplies. I am not sure why there is a need to limit the testing document and certification to one voltage (48 VDC), as the techniques are the same for all voltage choices (12V, 24V, 48V, and up). The range should likely be 6V to 600VDC. We do not use 12VDC or 24VDC dc-dc computer power supply systems at this time, focusing our offerings at 48VDC (isolated, so either + or -). However, we are reviewing 12VDC for dense rack/blade like offerings as well the use of higher voltages if and when the agency issues are resolved. The short answer is it covers everything we use today, but will restrict others and our future designers in their early adoption.

C10. I feel that all power supplies that are listed as multi-ranging or broad range at their input voltage, should be required to meet the testing at representative voltages. A power supply may meet energy star at 230vac, but not quite make it at 115vac. Perhaps there should be allowance for that fact. Today the majority of both single output and multi-output supplies used in servers, are used at either 208 vac or at 230vac, depending on the country of use. Only a small fraction are still used at 115vac. A supply should not be denied the rating by simply having 5 outputs vs. one, or by extending the input range from high line only (185vac to 245 vac) to low line (90vac to 189vac) + high line. Ideally, all power supplies would be required to meet the efficiency requirements at both high line and low line conditions. There is no basis to allow a single output supply to only operate at high line, while penalizing a multi-output supply.

These facts lead me to a few points.

- It is easier to deliver all of the power at a single rail, so the requirement for energy star should be slightly higher for a single output supply, with the assumption that the other conversion stages are still needed elsewhere on the load side.
- It is easier to achieve high efficiency with a higher input voltage/lower input current, so the requirement at 115vac (or 90vac) should be slightly lower, say 2% lower requirement than for high line.
- Combing these two thoughts, results in a power supply that is likely 5% less efficient at five outputs running at 115vac than an equal one running 12v only at 230vac. In fact, if the 5 output supply was only loaded on the 12v rail, powered at 230vac, most would perform almost equally to the single output supply.
- I am assuming the requirement for energy star will be a bit higher for DC-DC (2%), as it is a bit easier to achieve, than for ac-dc, and there is an assumption that the AC-DC conversion stage still needs to happen on the supply side somewhere?

C11. I am curious about the rationale for choosing 230V-in for single-output supplies and 115V-in for multiple-output supplies. Many of the devices I support at our data center come with auto ranging supplies that overlap across two or more standard utilization voltages. I don't disagree with the point made in Section 4.2.1, sensible design suggests using the highest standard voltage available—but not all facilities use the same standard voltages. The power supply in Appendix A ranges from 100V to 240V, which means it might be connected at 115V, 208V or 230V. Ideally the efficiencies at each standard voltage would be reported. Certainly in larger facilities 208V is far more common than 230V, as most distribution would be nominally 208Y/120V. I don't know how much difference there would be between 208V and 230V (power supplies not being my area of expertise), but even a 0.5% difference in efficiency multiplied by several million units would add up to quite a few watts. Especially when you factor in the facilities overhead for powering and cooling higher-end devices, which itself ranges between 0.6x and 2.0x (average about 1.0x) of the device load. I know this last factor doesn't apply to the test itself, but that is the supply's "leverage" against the utility grid.

In the case of desktop device supplies (which I believe the 115V-in multiple outlet supply represents) the only applicable standard voltage would be 115V so only that set of efficiency data could be reported.

B) Climate Savers Computing Initiative (CSCI) Stakeholders Comments:

(Note: The section numbers and the comments relevant to that section are given below)

3.6 integrated fans not included for single output PSUs

4.2.1 230VAC / 60Hz is not a common voltage; 230VAC / 50Hz is common

4.3/5.7 Is 15minute a long enough stability time? +/-1% change in efficiency for stability seems too large. +/-0.2% seems better to determine thermal stability.

5.2 Why AC source needs to be 10x the input rating?

5.4 Figure 1: does not include return losses in output and input connections.

State that voltage measurement are made as close to the PSU output as possible on the system side of the output connector and as close to the PSU input as possible on the cord side of the input connector.

5.5 Measurements equipment requirements;

NIST calibration needs to be required.

Power meter accuracy of 2% is not good enough. Better than 1% accuracy at any measurement point.

DC power sensing accuracy requirements not included. Better than 0.5% accuracy.

1W resolution is too high. Can we remove the resolution requirements and just state the accuracy requirements of the meters?

Averaging duration of power meter not stated. Input power measurements should be taken over no less than a 1 second average.

7 Do we really need to record barometric pressure??

Record additional information; range selection of all meters at each load point, accuracy at each measurement each load point on voltage, currents, power, & PF.

Average AC power; not RMS power

DC power, current, and voltage should always be an average, not RMS

Record measurement points for voltage; note locations in report.

Define the significant digits for measurements; voltage (4 digits), current (4 digits), power (4 digits), Efficiency (3 digits), PF (2 digits), THD (2 digits)

In report; state whether fan power is included or excluded from the power supply measurements

1 Why are *industry standard connectors* significant here? If a power supply has proprietary connectors, isn't it still valid to use this protocol? What constitutes an industry-standard connector? Will lugs (dual-hole or single-hole) meet this criteria?

You may want to make an allowance for power supplies attached to the main circuit board to be allowed under this protocol if they can be easily isolated from the other functions of the product. For example, the Artesyn power brick shown in Appendix B could be considered to be integrated into the main circuit board, but these connections are well-enough defined that the output from the power brick can be easily and definitively isolated from the other parts of the circuit board.

2 Please add the following: ATIS-0600315.2007, Voltage Levels for DC-Powered Equipment Used in the Telecommunications Environment, December, 2007.
<https://www.atis.org/docstore/product.aspx?id=22782>

Please add the following: ETSI EN 300 132-2 V2.0.0, Environment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc), (2001-12). <http://www.etsi.org/>

4.2.2

Suggest replacing all the text above the note with the following text:

As defined in ATIS-0600315.2007 and ETSI EN 300 132-2, typical -48VDC equipment is expected to operate in a range from approximately -40VDC to -57VDC to handle a variety of on-battery and charging conditions. However, as outlined in the ATIS spec, -48VDC systems spend the vast majority of their time around -53VDC. Systems connected to flooded (wet cell) batteries typically have a float voltage of -52VDC, while systems connected to VRLA (valve-regulated lead acid) batteries typically have a float voltage of -54VDC. The dc-dc power supplies will be tested at -53VDC \pm 1VDC at the input. [Note: could choose to test twice, once at -52VDC and once at -54VDC.]

5.2

If memory serves (I don't have a copy), IEC 62018, Power consumption of information technology equipment – Measurement methods (2003-06) only requires the AC supply to be 3x the nameplate power, not 10x the nameplate power like the older IEEE spec requires. May want to consider lowering this limit to 3x the nameplate power.

"at least 10 times" --> "at least 10 times (for AC) and at least 1.5 times (for DC)"; this is based on consultation with DC power experts within the ATIS committee and is the proposed minimum value for the ATIS energy efficiency metrics--there's nothing wrong with having a stronger power supply, but it's not necessary for DC systems" \pm 48Vdc" --> "-53Vdc \pm 1Vdc" (see above)

5.4 Either add "(AC Systems)" to the captions for Figures 1 & 2, or: change "Vac" in Figures 1 & 2 to "Vac or Vdc-in" and change "Aac" in Figure 2 to "Aac or Adc-in"

6.1.2 What if a standby voltage rail is something other than 5V? What if there are multiple standby voltages?

C) Editorial Comments:

§2.10: all URLs should have the http:// prefix (or other protocol prefix as appropriate) so that they show up as hyperlinks. This would make it consistent with the hyperlink in the succeeding reference.

§3.1 and throughout: for each acronym, select a capitalization style and use it that way consistently. For example, don't abbreviate alternating current as "ac" but then call it "Ac" when it's at the beginning of a sentence. I would prefer "AC", "DC", "RMS", etc., but it's disconcerting to see the same document have different capitalization for the same acronym in different places. (Compare §3.4 to §3.25 for another example, or look within §3.11.)

§6.1.1 and successive siblings within §6.1 should be promoted to be peers of §6.1.

§6.1.1: "multiple and single output" --> "multiple- and single-output" (add hyphens)

§9: It appears that description b is in the middle of the 4 pictures--is this intuitive? Should it be below the four power supplies or should they be grouped differently?

§9: May want to check and see if the Astec Power and Artesyn Technologies folks (now both part of Emerson) should be referred to as Emerson Network Power or under the older sub-brands.

§10: The power supply identified as 1U looks to be taller than 1U--is it correct? Also, are there some cleaner diagrams from our manuals (or other pictures) that we could provide for Figure C-2? These pictures are not the cleanest, and the cables obscure the view of the power supplies. **N**
