



ENERGY STAR[®] Program Requirements Product Specification for Data Center Storage

**Draft 2 Test Method
March 2013**

1 OVERVIEW

The following test method shall be used for determining compliance with requirements in the ENERGY STAR Product Specification for Data Center Storage, and when acquiring test data for reporting on the ENERGY STAR Power and Performance Data Sheet.

2 APPLICABILITY

The following test method is applicable to all products eligible for qualification under the ENERGY STAR Eligibility Criteria for Data Center Storage.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Data Center Storage.

4 TEST SETUP

A) Input Power: Input power shall be as specified in Table 1 and Table 2. The frequency for input power shall be as specified in Table 3.

B) Ambient Temperature: Ambient temperature shall be no less than 18 °C and no greater than 28 °C over the duration of the test.

C) Relative Humidity: Relative humidity shall be within 15% and 80%.

17 **Table 1: Input Power Requirements for Products with Nameplate Rated Power Less Than or Equal**
 18 **to 1500 W**

Product Type	Supply Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion
Storage Products with Ac-Dc Single-Output PSUs	230 V ac and/or 115 V ac	+/- 1.0 %	2.0 %
Storage Products with Ac-Dc Multi-Output PSUs	230 V ac and/or 115 V ac		
Optional Testing Conditions For Ac-Dc Japanese Market	100 V ac		
Three-phase Storage Products	208 V ac		

19 **Table 2: Input Power Requirements for Products with Nameplate Rated Power Greater Than**
 20 **1500 W**

Product Type	Supply Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion
Storage Products with Ac-Dc Single-Output PSUs	230 V ac and/or 115 V ac	+/- 4.0 %	5.0 %
Storage Products with Ac-Dc Multi-Output PSUs	230 V ac and/or 115 V ac		
Optional Testing Conditions For Ac-Dc Japanese Market	100 V ac		
Three-phase Storage Products	208 V ac		

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Table 3: Input Frequency Requirements for All Products

Supply Voltage	Frequency	Frequency Tolerance
100 V ac	50 or 60 Hz	±1.0%
115 V ac	60 Hz	
230 V ac	50 Hz or 60 Hz	
Three-phase	60 Hz	

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23 **Note:** EPA is proposing to allow three-phase storage products to be tested, as they are supported by the
 24 Version 2.0 SNIA Emerald™ Power Efficiency Measurement Specification. Revisions have been made to
 25 Table 1, Table 2, and Table 3 to harmonize with the three phase voltage and frequency testing
 26 requirements in the Version 2.0 ENERGY STAR Computer Servers test method. EPA welcomes feedback
 27 on the specified three-phase voltage and frequency levels.

28 EPA has removed dc voltage and frequency testing requirements from the same tables, as the Version 2.0
 29 Emerald™ specification does not address them at this time.

30 Finally EPA has made minor revisions to the frequencies in Table 3 based on stakeholder feedback
 31 submitted in response to the Draft 3 Version 1.0 specification that EPA should harmonize with the Version
 32 2.0 ENERGY STAR Computer Servers test method.

33 D) Power Meter: Power Meter(s) shall report true Root Mean Square (RMS) power and at least two
 34 of the following measurement units: voltage, current and power factor. Power Meter(s) shall
 35 possess the following attributes:

36 1) Calibration: The meter shall be calibrated within the past one year of the test date, by a
 37 standard traceable to National Institute of Science and Technology (USA) or a counterpart
 38 national metrology institute in other countries.

39 2) Crest Factor: An available current crest factor of 3 or more at its rated range value. For
 40 analyzers that do not specify the current crest factor, the analyzer must be capable of
 41 measuring an amperage spike of at least 3 times the maximum amperage measured during
 42 any 1 second sample.

43 3) Minimum Frequency Response: 3.0 kHz

44 4) Minimum Resolution:

- 45 i. 0.01 W for measurement values less than 10 W;
- 46 ii. 0.1 W for measurement values from 10 W to 100 W; and
- 47 iii. 1.0 W for measurement values greater than 100 W.

- 48 5) Logging: The reading rate supported by the meter shall be at least 1 set of measurements per
49 second, where set is defined as watts. The data averaging interval of the analyzer shall equal
50 the reading interval. Data averaging interval is defined as the time period over which all
51 samples captured by the high-speed sampling electronics of the analyzer are averaged to
52 provide the measurement set.
- 53 6) Measurement Accuracy: Measurement uncertainty as introduced by the instrument that
54 measures the input power to the product under test, including any external shunts.
- 55 i. Power measurements with a value greater than or equal to 0.5 W shall be made with an
56 uncertainty of less than or equal to 2% at the 95% confidence level.
- 57 ii. Power measurements with a value less than 0.5 W shall be made with an uncertainty of
58 less than or equal to 0.01 W at the 95% confidence level.
- 59 E) Temperature Sensor: The temperature sensor shall possess the following attributes:
- 60 1) Logging: The sensor shall have a minimum reading rate of 4 samples per minute.
- 61 2) Measurement Accuracy: Temperature must be measured no more than 50 mm in front of
62 (upwind of) the main airflow inlet of the UUT and reported by the sensor with an overall
63 accuracy of ± 0.5 °C or better.

64 5 TEST CONDUCT

65 5.1 Guidance for Implementation of SNIA Emerald™ Power Efficiency Measurement 66 Specification Version 2.0, Rev 1

67 **Note:** EPA is proposing to use the SNIA Emerald™ Power Efficiency Measurement Specification, Version
68 2.0, Rev 1 (6 October 2013) in place of the previous SNIA Version 1.0 Emerald™ specification. The
69 Version 2.0 Emerald™ specification incorporates a new hot band workload which more accurately
70 addresses systems with caching ability, as well as mixed drive configurations that make use of auto-tiering
71 functionality. Additional details on the Hot Band workload can be found in the Version 2.0 Emerald™
72 specification.

- 73 A) Online 2 Data Center Storage products must include a RAID capable controller during all testing.
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75 **Note.** EPA has removed the requirement in the previous test method that the Ready Idle Test shall be
76 conducted over a 24 hour period. EPA has held several discussions with stakeholders and agrees that the
77 Version 2.0 Emerald™ specification approach to measuring idle state power is sufficient, and that
78 maintaining the 24 hour idle state measurement as proposed in the previous draft of this test method
79 creates additional unnecessary testing burden. EPA welcomes stakeholder feedback on this revision.

- 80 B) Storage products shipped with COMs must disable all COMs that are capable of being disabled
81 during the following tests:
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83 **Note.** EPA has clarified that all COMs that are capable of being disabled during testing must be disabled
84 during testing in Sections 6.1 through Section 6.4.

- 85 1) SUT Pre-fill Test (6.1)

86 **Note:** EPA has added the SUT Pre-fill Test to this list to harmonize with the revised requirements in the
87 SNIA Emerald™ Power Efficiency Measurement Specification Version 2.0 Online testing Section 7.4.

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- 89 2) SUT Conditioning Test (6.2)
- 90 3) Active State Test (6.3)
- 91 4) Ready State Idle Test (6.4)
- 92 5) Following the completion of the Ready Idle State Test, COMs shipped with the storage
93 product shall be enabled and COM Validation Testing (6.4) shall be performed for all COMs
94 present in the product.
- 95 C) Network Attached Storage products that ship with Block I/O capability shall be tested under the
96 following additional requirements:
- 97 1) All usable Storage Devices shall be allocated to Block I/O for all testing with the exception of:
- 98 i. Storage Devices needed to enable a minimal NAS capability in the system;
- 99 ii. Limitations imposed by the system for maximum allowable Block I/O capacity.
- 100 D) NAS functionality shall be enabled during all testing.
- 101 E) No external NAS storage requests shall be presented to a system during testing. (NAS
102 functionality shall be in a Ready-Idle state).

103 6 TEST PROCEDURES FOR ALL PRODUCTS

104 6.1 SUT Pre-fill Test

105 The SUT pre-fill test shall be performed according to the SNIA Emerald™ Power Efficiency Measurement
106 Specification Version 2.0: Section 7.4.1: Online SUT Pre-fill Test.

107 **Note:** EPA has added the SUT Pre-fill Test guidance to harmonize with the revised requirements in the
108 SNIA Emerald™ Power Efficiency Measurement Specification Version 2.0 Online testing Section 7.4.

109 6.2 SUT Conditioning Test

110 The SUT conditioning shall be performed according to the SNIA Emerald™ Power Efficiency
111 Measurement Specification Version 2.0: *Section 7.4.2: Online SUT Conditioning Test.*

112 6.3 Active State Test

113 The Active state performance shall be measured according to the SNIA Emerald™ Power Efficiency
114 Measurement Specification Version 2.0: *Section 7.4.3: Online Active Test;* with the additional guidance in
115 Section 5 of this document.

116 6.4 Ready Idle State Test

117 The Ready Idle state performance shall be measured according to the SNIA Emerald™ Power Efficiency
118 Measurement Specification Version 2.0: *Section 7.4.4: Online Ready Idle Test;* with the additional
119 guidance in Section 5 of this document.

120 **6.5 COM Validation Test**

121 The validation of COM functionality shall be recorded according to the SNIA Emerald™ Power Efficiency
122 Measurement Specification Version 2.0: *Section 7.4.5: Online Capacity Optimization Test*, with the
123 additional guidance in Section 5 of this document.

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125 A) Verification testing of COM features specified by the storage product shall be executed at least
126 once using storage devices of the vender's choice. Once verified there is no requirement to re-
127 execute the verification testing procedure with different storage devices.

128 **Note:** EPA has clarified that COM validation testing is only required to be performed once per series of
129 configuration tests for a product family.

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