



# ENERGY STAR<sup>®</sup> Program Requirements Product Specification for Data Center Storage

Draft Test Method  
June 2012

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## 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 Product Specification 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	+/- 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		
Dc Storage Products	+/- 53 V dc	+/- 1.0 V	

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	+/- 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		
Dc Storage Products	+/- 53 V dc	+/- 1.0 V	

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**Table 3: Input Frequency Requirements for All Products**

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

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

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

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

33 3) Minimum Frequency Response: 3.0 kHz

34 4) Minimum Resolution:

- 35 i. 0.01 W for measurement values less than 10 W;
- 36 ii. 0.1 W for measurement values from 10 W to 100 W; and
- 37 iii. 1.0 W for measurement values greater than 100 W.

38 5) Logging: The reading rate supported by the meter shall be at least 1 set of measurements per  
39 second, where set is defined as watts. The data averaging interval of the analyzer shall equal the  
40 reading interval. Data averaging interval is defined as the time period over which all samples  
41 captured by the high-speed sampling electronics of the analyzer are averaged to provide the  
42 measurement set.

43 6) Measurement Accuracy: Measurement uncertainty as introduced by the instrument that measures  
44 the input power to the product under test, including any external shunts.

- 45 i. Power measurements with a value greater than or equal to 0.5 W shall be made with an  
46 uncertainty of less than or equal to 2% at the 95% confidence level.
- 47 ii. Power measurements with a value less than 0.5 W shall be made with an uncertainty of  
48 less than or equal to 0.01 W at the 95% confidence level.

49 B) Temperature Sensor: The temperature sensor shall possess the following attributes:

50 1) Logging: The sensor shall have a minimum reading rate of 4 samples per minute.

51 2) Measurement Accuracy: Temperature must be measured no more than 50 mm in front of (upwind  
52 of) the main airflow inlet of the UUT and reported by the sensor with an overall accuracy of ± 0.5  
53 °C or better.

54 **5 TEST CONDUCT**

55 **5.1 Guidance for Implementation of SNIA Emerald™ Power Efficiency Measurement**  
56 **Specification Version 1.0**

57 **Note:** EPA is aware of the development of a revised version of the SNIA Emerald specification that  
58 incorporates mixed workloads and testing for systems with caching abilities. EPA will follow this effort to  
59 evaluate inclusion of these additions into the test method prior to the finalization.

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61 A) Online 2 Data Center Storage products must include a RAID capable controller during all testing.

62 **Note:** EPA is requiring that Online 2 systems submitted for ENERGY STAR qualification must contain an  
63 integrated RAID capable storage controller. Because this differs from the SNIA taxonomy in the Emerald  
64 Specification, which states that Online 2 storage products are not required to contain a RAID capable  
65 controller, EPA has included the guidance above

66 B) The Ready Idle Test (6.3) shall be conducted over a period of 24 hours, with AVERAGE POWER<sup>1</sup>  
67 submitted over the entire 24 hour period.

68 **Note.** EPA is replacing the approach in the SNIA Emerald specification, section 7.4.3.4, with a 24 hour  
69 test to capture common background processes.

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71 C) Storage products shipped with COMs must have all COMs disabled during the following tests:

72 1) SUT Conditioning Test (6.1)

73 2) Active State Test (6.2)

74 3) Ready State Idle Test (6.3)

75 4) Following the completion of the Ready Idle State Test, COMs shipped with the storage product  
76 shall be enabled and COM Validation Testing (6.4) shall be performed for all COMs present in the  
77 product.

78 **Note:** EPA is requiring that all COM functionality should be turned off during the SUT Conditioning Test,  
79 Active State Test and Ready Idle State Test. This will create an even comparison of products at their base  
80 functionality, prior to the addition of extra cost capacity optimization method options which provide varying  
81 levels of improved performance based on the usage of the product.

82 D) Network Attached Storage products that ship with Block I/O capability shall be tested under the  
83 following additional requirements:

84 i. All usable Storage Devices shall be allocated to Block I/O for all testing with the exception of:

85 (a) Storage Devices needed to enable a minimal NAS capability in the system;

86 (b) Limitations imposed by the system for maximum allowable Block I/O capacity.

87 ii. NAS functionality shall be enabled during all testing.

<sup>1</sup> The calculation of AVERAGE POWER is defined in Equation 7-3 of the SNIA Emerald™ Power Efficiency Measurement Specification Version 1.0

88           iii. No external NAS storage requests shall be presented to a system during testing. (NAS  
89           functionality shall be in a Ready-Idle state).

90           **Note:** EPA has provided special guidance on testing NAS systems with Block I/O capability for  
91           qualification in Version 1.0.

## 92           **6 TEST PROCEDURES FOR ALL PRODUCTS**

### 93           **6.1 SUT Conditioning Test**

94           SUT conditioning shall be performed according to SNIA Emerald™ Power Efficiency Measurement  
95           Specification Version 1.0: *Section 7.4.1: Online SUT Conditioning Test.*

### 96           **6.2 Active State Test**

97           Active state performance shall be measured according to SNIA Emerald™ Power Efficiency Measurement  
98           Specification Version 1.0: *Section 7.4.2: Online Active Test;* with the additional guidance in Section 5 of  
99           this document.

### 100          **6.3 Ready Idle State Test**

101          Ready Idle state performance shall be measured according to SNIA Emerald™ Power Efficiency  
102          Measurement Specification Version 1.0: *Section 7.4.3: Online Ready Idle Test;* with the additional  
103          guidance in Section 5 of this document.

### 104          **6.4 COM Validation Test**

105          Validation of COM functionality shall be recorded according to SNIA Emerald™ Power Efficiency  
106          Measurement Specification Version 1.0: *Section 7.4.4: Online Capacity Optimization Test;* with the  
107          additional guidance in Section 5 of this document.

108          **Note:** EPA would like to clarify that the COM validation testing is designed to validate existence and  
109          activation of COMs that are present in the SUT. This test is not designed to measure the effectiveness of  
110          COMs in the storage product for various workloads.

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