



# ENERGY STAR® Product Specification for Large Network Equipment

## Eligibility Criteria Draft Version 1.1

Following is the Draft Version 1.1 ENERGY STAR product specification for Large Network Equipment. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

### 1 DEFINITIONS

#### A) Product Classifications:

- 1) Network Equipment: A device whose primary function is to pass Internet Protocol traffic among various network interfaces/ports.
- 2) Large Network Equipment (LNE): Network Equipment that is mountable in a Standard Equipment Rack, supports network management protocols (e.g. SNMP) and contains at least one of the following features:
  - a) Contains more than eleven (11) Physical Network Ports.
  - b) Total aggregate port throughput of the product is greater than 12 Gb/s
- 3) Modular Product: An LNE product that accepts Modules, as defined below in 1.(D)(5), modifying the capability of the device.
- 4) Fixed Product: An LNE product that cannot accept Modules that modify the capability of the device.

#### B) Product Types:

- 1) Router: A network device that routes network packets from one logical network to another, along a predefined or dynamically discovered path, based on network layer information embedded in the Network packet header (OSI layer #3).
- 2) Switch: A network device that delivers packet data frames to specific physical ports on the device, based on the destination address of each frame from the Data Link (OSI layer #2), within a logical network.
- 3) Security Appliance: A stand-alone network device whose primary function is to protect the network from unwanted traffic (e.g. secure tunnel and firewall appliances). This includes products whose primary function is to provide virtual private network (VPN) services.
- 4) Access Point Controller: A network device whose primary function is to manage wireless local area network (WLAN) traffic through one or more wireless access point devices.

#### C) Product Characteristics:

- 1) Processor Managed Product: An LNE product whose management is handled through a distinct co-management processor within the product itself that has independent control over the LNE product.
- 2) Network Managed Product: An LNE product that is not Processor Managed, where management of the product is handled through processing power provided by a separate device within the network to which it is connected.
- 3) Stackable Product: A product, which supports the ability to join multiple discrete products of similar type to form a single larger autonomous functioning unit.

D) LNE Components:

- 1) Power Supply Unit (PSU): A device that converts ac or dc input power to one or more dc power outputs for the purpose of powering an LNE product. An LNE product's PSU must be self-contained and physically separable from the motherboard and must connect to the system via a removable or hard-wired electrical connection.
  - A. Ac-Dc Power Supply: A PSU that converts line-voltage ac input power into one or more dc power outputs for the purpose of powering an LNE product.
  - B. Dc-Dc Power Supply: A PSU that converts line-voltage dc input power to one or more dc outputs for the purpose of powering an LNE product. For purposes of this specification, a dc-dc converter (also known as a voltage regulator) that is internal to an LNE product and is used to convert a low voltage dc (e.g., 12 V dc) into other dc power outputs for use by the LNE product's components is not considered a dc-dc power supply.
  - C. Single-output Power Supply: A PSU that is designed to deliver the majority of its rated output power to one primary dc output for the purpose of powering an LNE product. Single-output PSUs may offer one or more standby outputs that remain active whenever connected to an input power source. For purposes of this specification, the total rated power output from any additional PSU outputs that are not primary and standby outputs shall be no greater than 20 watts. PSUs that offer multiple outputs at the same voltage as the primary output are considered single-output PSUs unless those outputs (1) are generated from separate converters or have separate output rectification stages, or (2) have independent current limits.
  - D. Multi-output Power Supply: A PSU that is designed to deliver the majority of its rated output power to more than one primary dc output for the purpose of powering an LNE product. Multi-output PSUs may offer one or more standby outputs that remain active whenever connected to an input power source. For purposes of this specification, the total rated power output from any additional PSU outputs that are not primary and standby outputs is greater than or equal to 20 watts.
- 2) Standard Equipment Rack: An equipment enclosure commonly seen in data centers or managed facilities and intended to house a variety of information technology equipment. Front panel width is typically 19 inches (482.6 mm). Standard equipment racks are defined by EIA-310, IEC 60297, or DIN 41494.
- 3) Modular Chassis: An equipment enclosure used in a modular LNE product that houses all the components of the product together in one place (e.g. PSUs, backplane, modules).
- 4) Backplane: A circuit board within the chassis of a modular LNE product into which line cards or modules are inserted to allow communication between the various connected modules.
- 5) Module: A plug in device, not used alone, which can add/change the type of network connections, increase/decrease the number of ports, and add/remove additional functionality for a product. Modules include but are not limited to line cards, port adapters, and network adapters. Modules do not include pluggable transceivers (e.g. SFP, SFP+, XFP) or modular power supplies.
- 6) Processor: The logic circuitry that responds to and processes the basic instructions that drive an LNE product. For purposes of this specification, a processor is a central processing unit (CPU) which can be used to provide basic function and/or management function.

E) Other Enterprise and Datacenter Information Technology Equipment:

- 1) Small Network Equipment (SNE): Network Equipment that is intended to serve users in either small networks or a subset of a large network. SNE includes a) all Network Equipment with integral wireless capability and b) other Network Equipment meeting all of the following criteria:
  - i) Designed for stationary operation

- ii) Contains no more than eleven (11) wired Physical Network Ports; and
  - iii) Primary configuration for operation outside of standard equipment racks.
- 2) Computer Server: A computer that provides services and manages networked resources for client devices (e.g., desktop computers, notebook computers, thin clients, wireless devices, PDAs, IP telephones, other computer servers and other network devices). A computer server is sold through enterprise channels for use in data centers and office/corporate environments. A computer server is primarily accessed via network connections, versus directly-connected user input devices such as a keyboard or mouse. For purposes of this specification, a product must meet all of the following criteria to be considered a computer server:
- i) is marketed and sold as a Computer Server;
  - ii) is designed for and listed as supporting computer server operating systems (OS) and/or hypervisors;
  - iii) is targeted to run user-installed applications typically, but not exclusively, enterprise in nature;
  - iv) provides support for error-correcting code (ECC) and/or buffered memory (including both buffered DIMMs and buffered on board (BOB) configurations)
  - v) is packaged and sold with one or more ac-dc or dc-dc power supplies; and
  - vi) is designed such that all processors have access to shared system memory and are visible to a single OS or hypervisor.
- 3) Storage Product: A fully-functional storage system that supplies data storage services to clients and devices attached directly or through a network. Components and subsystems that are an integral part of the storage product architecture (e.g., to provide internal communications between controllers and disks) are considered to be part of the storage product. In contrast, components that are normally associated with a storage environment at the data center level (e.g., devices required for operation of an external SAN) are not considered to be part of the storage product. A storage product may be composed of integrated storage controllers, storage devices, embedded network elements, software, and other devices. For purposes of this specification, a storage product is a unique configuration of one or more SKUs, sold and marketed to the end user as a Storage Product.
- 4) Storage Networking Products: Products whose primary purpose is the transfer of data between computers systems and storage products. This includes products that use typical storage networking protocols (e.g. Fibre Channel), as well as those that support IP based storage traffic such as iSCSI capable networking products.
- 5) Uninterruptible Power Supply (UPS): Combination of convertors, switches, and energy storage devices (such as batteries) constituting a power system for maintaining continuity of load power in case of input power failure.
- 6) Digital Subscriber Line Access Multiplexer (DSLAM): A network device that connects multiple digital subscriber line (DSL) interfaces to a backbone network that in turn connects to a larger service provider network.
- 7) Cable Modem Termination System (CMTS): A network device that connects multiple cable television (CATV) interfaces to a backbone network that in turn connects to a larger service provider network. Note that CATV connections are often also used to transfer IP traffic.
- 8) Network Caching Device: A network device connected to a network that caches content from a remote source that allows connected devices on the downstream network faster subsequent access by later serving the cached content to the downstream devices rather than content accessed directly from the original source.
- 9) Load Balancing Device: A network device connected to a network that distributes network traffic across several downstream devices. These products allow increased capacity and

reliability of data transfer over the network.

F) Operational Power States:

- 1) Active State: The operating state where the product is carrying out work in response to prior or concurrent external requests.
- 2) Idle State: The operating state where the product is capable of carrying out work, but is not actively transferring data.

G) Additional Terms:

- 1) Physical Network Port: An integrated physical connection point primarily intended to accept IP or similar traffic via a cable. Fiber-optic connections are considered Physical Network Ports for the purposes of this specification.
  - a) Uplink Port: A port designated for transferring consolidated data traffic from multiple devices or downstream networks attached to the downlink ports to an upstream network or device.
  - b) Downlink Port: A port designated for distributing data from the consolidated uplink port to a single device or downstream network.
- 2) Energy Efficient Ethernet (EEE): A technology which enables reduced power consumption of Ethernet interfaces during times of low data throughput. Defined in Clause 78 of IEEE 802.3 (originally specified in IEEE 802.3az).
- 3) Power over Ethernet (PoE): A technology that enables transfer of electrical power, along with data, to network end point devices through an Ethernet cable. PoE is defined in Clause 33 of IEEE 802.3 (originally specified in IEEE 802.3af and IEEE 802.3at). The PoE specification defines two types of equipment:
  - a) Type 1: Powered devices up to 13.0 watts
  - b) Type 2: Powered devices up to 25.5 watts

H) Product Family: A group of models/configurations that share a set of common attributes that are variations on a basic design.

- 1) Common Product Family Attributes for Modular Products: A set of features common to all models/configurations within a modular product family. All models/configurations within a modular product family must share the following:
  - a) Be from the same model line or machine type; and
  - b) Share the same mechanical and electrical designs in the chassis with only superficial mechanical differences to enable a design to support a variety of module options.
- 2) Product Family Tested Product Configurations:
  - a) Minimum Power Configuration: The product configuration that includes the combination of components including modules, power supplies, and other associated processing and power support hardware that generates the least possible energy consumption within a product family.
  - b) Maximum Power Configuration: The product configuration that includes the combination of components including modules, power supplies, and other associated processing and power support hardware that generates the greatest possible energy consumption within a product family.
  - c) Typical Configuration: A product configuration that lies between the minimum and maximum configurations that is representative of a product with high volumes sales. Product families containing a single product shall be represented by that configuration.

## 2 SCOPE

### 2.1 Included Products

- 2.1.1 Products that meet the definition of Large Network Equipment in Section 1 of this document are eligible for ENERGY STAR certification under this specification. Products explicitly excluded from Version 1.1 are identified in Section 2.2.

### 2.2 Excluded Products

- 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for certification under this specification. The list of specifications currently in effect can be found at [www.energystar.gov/specifications](http://www.energystar.gov/specifications).
- 2.2.2 Products that contain greater than four Physical Network Ports that have 100 Gb/s or higher link rate capability.

**Note:** EPA received recent partner feedback indicating an interest in amending the ENERGY STAR Large Network specification criteria to capture more modern products, which utilize faster Physical Network Port speeds.

As such, EPA discussed the approach above with several partners and has determined that the proposed change accommodates the natural evolution of increased throughput in more recent products while still limiting the scope of the specification to non-telcom equipment.

EPA welcomes feedback on this proposal to accommodate products with up to four 100 Gb/s or higher physical network ports. The Agency does not believe that this change requires changes to any other elements of the specification or test method.

- 2.2.3 The following products are not eligible for certification under this specification:
- i. Small Network Equipment;
  - ii. Computer Servers, including blade switches sold within a Blade Server configuration;
  - iii. Storage Products, including Blade Storage;
  - iv. Storage Networking Products;
  - v. Security Appliances;
  - vi. Access Point Controllers;
  - vii. DSLAM/CMTS equipment;
  - viii. Network Caching Devices; and
  - ix. Load Balancing Devices.

## 3 CERTIFICATION CRITERIA

### 3.1 Significant Digits and Rounding

- 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.
- 3.1.2 Unless otherwise specified in this specification, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.

- 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

### 3.2 Power Supply Requirements

- 3.2.1 Power supply test data and test reports from testing entities recognized by EPA to perform power supply testing shall be accepted for the purpose of certifying the ENERGY STAR product.
- 3.2.2 Power Supply Efficiency Criteria: Power Supplies used in products eligible under this specification must meet the following requirements when tested using the Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.7 (available at [www.efficientpowersupplies.org](http://www.efficientpowersupplies.org)). Power Supply data generated using Rev. 6.4.2, 6.4.3, 6.5, or 6.6 are acceptable provided the test was conducted prior to the effective date of Version 1.1 of this specification.
  - i. Fixed LNE Products: To certify for ENERGY STAR, a fixed LNE product must be configured with **only** PSUs that meet or exceed the applicable efficiency requirements specified in Table 2 **prior to shipment**.
  - ii. Modular LNE Products: To certify for ENERGY STAR, a modular LNE product shipped with a chassis must be configured such that **all** PSUs supplying power to the chassis meet or exceed the applicable efficiency requirements specified in Table 2 **prior to shipment**.

**Table 2: Efficiency Requirements for PSUs**

| Power Supply Type | Rated Output Power | 10% Load | 20% Load | 50% Load | 100% Load |
|-------------------|--------------------|----------|----------|----------|-----------|
| Multi-output      | All Output Levels  | N/A      | 85%      | 88%      | 85%       |
| Single-output     | All Output Levels  | 80%      | 88%      | 92%      | 88%       |

- 3.2.3 Power Supply Power Factor Criteria: Ac-Dc Power Supplies used in products eligible under this specification must meet the following requirements when tested using the Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.6 (available at [www.efficientpowersupplies.org](http://www.efficientpowersupplies.org)). Power Supply data generated using Rev. 6.4.2, 6.4.3, or 6.5 are acceptable provided the test was conducted prior to the effective date of Version 1.1.
  - i. Fixed LNE Products: To certify for ENERGY STAR, a fixed LNE product must be configured so that **all Ac-Dc** PSUs within the product meet or exceed the applicable power factor requirements specified in Table 3 **prior to shipment**, under all loading conditions for which output power is greater than or equal to 75 watts. Partners are required to measure and report PSU power factor under loading conditions of less than 75 watts, though no minimum power factor requirements apply.
  - ii. Modular LNE Products: To certify for ENERGY STAR, a modular LNE product shipped with a chassis must be configured such that **all Ac-Dc** PSUs supplying power to the chassis meet or exceed the applicable power factor requirements specified in Table 3 **prior to shipment**, under all loading conditions for which output power is greater than or equal to 75 watts. Partners are required to measure and report PSU power factor under loading conditions of less than 75 watts, though no minimum power factor requirements apply.

**Table 3: Power Factor Requirements for Ac-Dc PSUs**

| Power Supply Type | Rated Output Power                                      | 10% Load | 20% Load | 50% Load | 100% Load |
|-------------------|---|----------|----------|----------|-----------|
| Multi-output      | All Output Ratings                                      | N/A      | 0.80     | 0.90     | 0.95      |
| Single-output     | Output Rating ≤ 500 W                                   | N/A      | 0.80     | 0.90     | 0.95      |
|                   | Output Rating > 500 W<br>and<br>Output Rating ≤ 1,000 W | 0.65     | 0.80     | 0.90     | 0.95      |
|                   | Output Rating > 1,000 watts                             | 0.80     | 0.90     | 0.90     | 0.95      |

### 3.3 Energy Efficiency Feature Requirements

- 3.3.1 To certify for ENERGY STAR, an LNE product must have the following features enabled in its as-shipped configuration, implemented as specified:
- i. Remote Port Administration: An LNE product must provide the end-user with the ability to conduct remote administration of individual physical network ports.
  - ii. Adaptive Active Cooling: Primary components of an LNE product must utilize adaptive cooling technologies that reduce the energy consumed by the cooling technology in proportion to the current cooling needs of the LNE product. (e.g., reduction of variable speed fan or blower speeds at lower ambient air temperature). This requirement is not applicable to devices that employ passive cooling.
  - iii. Energy Efficient Ethernet: All copper-based physical network ports in an LNE product must be compliant with IEEE 802.3 Clause 78.

### 3.4 Active State Efficiency Criteria for all LNE Products

- 3.4.1 EPA is pursuing this approach to active state evaluation to encourage further testing of the energy efficiency of LNE products. EPA will evaluate this data when considering active state efficiency levels in Version 2.0 of the specification. Efficiency data will be measured and disclosed in a consistent manner and is provided along with the hardware and software characteristics of each system. Thus, this reporting approach will assist manufacturers in differentiating the efficiency of their products and purchasers interested in buying efficient products.
- 3.4.2 Active State Data Reporting: To certify for ENERGY STAR, an LNE product or LNE Product Family must be submitted for certification with the following information disclosed in full and in the context of the complete Active State efficiency rating test report:
- i. Full power and performance shall be measured and reported, both in certification materials and as required in Section 4 for each applicable configuration within the product family as defined in Section 1.H)2) above.

- 3.4.3 The testing of modular Large Network Equipment for compliance with Section 3.4.1 shall be carried out with the following additional considerations:
- i. Power and performance values shall be measured and reported using a fully-populated chassis
  - ii. Heterogeneous module configurations are permitted.

## 4 STANDARD INFORMATION REPORTING REQUIREMENTS

### 4.1 Data Reporting Requirements

- 4.1.1 All required data fields in the ENERGY STAR Version 1.1 LNE Qualified Product Exchange form shall be submitted to EPA for each ENERGY STAR certified LNE product or LNE Product Family.
- 4.1.2 The following data will be displayed on the ENERGY STAR website through the product finder tool:
- i. model name and number, identifying SKU and/or configuration ID;
  - ii. product characteristics (utilization type, modular vs. fixed, power specifications, etc.);
  - iii. product type (management scheme, stackable, etc.);
  - iv. tested system configuration(s), including port counts, port speeds, number of modules supported, types of ports supported, etc.;
  - v. energy consumption and performance data from required Active State Efficiency Criteria testing;
  - vi. PoE capability (number of PoE ports supported, maximum PoE class supported, maximum total PoE power supported, etc.);
  - vii. available and enabled user configurable power management features of the system;
  - viii. for product family certifications, a list of certified configurations with qualified SKUs or configuration IDs; and
  - ix. for a modular LNE products, a list of compatible chassis that meet ENERGY STAR qualification criteria.
- 4.1.3 EPA may periodically revise this list, as necessary, and will notify and invite stakeholder engagement in such a revision process.

## 5 STANDARD PERFORMANCE DATA MEASUREMENT AND OUTPUT REQUIREMENTS

### 5.1 Data Elements

- 5.1.1 Data Elements: LNE products with a nameplate power rating greater than 250 watts shall be capable of measuring and reporting the following data elements at the LNE product level:
- i. Input Power, in watts. Input power measurements must be reported with accuracy within  $\pm 5\%$  of the actual value for measurements greater than 200 W, through the full range of operation. For measurements less than or equal to 200 W, the accuracy must be less than or equal to 10 W multiplied by the number of installed PSUs; and

- ii. Inlet Air Temperature, in degrees Celsius, with accuracy of  $\pm 2^{\circ}\text{C}$ .

#### 5.1.2 Reporting Implementation:

- i. Data shall be made available in a published or user-accessible format that is readable by third-party, non-proprietary management systems;
- ii. Data shall be made available to end users and third-party management systems over a standard network connection;
- iii. Data shall be made available via embedded components or add-in devices that are packaged with the LNE product (e.g., a service processor, embedded power or thermal meter or other out-of-band technology, iPDU, or pre-installed OS);

#### 5.1.3 Sampling Requirements:

- i. *Input power:* Input power measurements must be sampled internally to the LNE product at a rate of greater than or equal to 1 measurement per contiguous 10-second period.
- ii. *Inlet air temperature (optional):* Inlet air temperature measurements must be sampled internally to the LNE product at a rate of greater than or equal to 1 measurement every 10 seconds.
- iii. *Timestamping:* Systems that implement time stamping of environmental data shall sample internally to the LNE product data at a rate of greater than or equal to 1 measurement every 30 seconds.
- iv. *Management Software:* All sampled measurements shall be made available to external management software either via an on-demand pull method, or via a coordinated push method. In either case the system's management software is responsible for establishing the data delivery time scale while the LNE product is responsible to assuring data delivered meets the above sampling and currency requirements.

#### 5.1.4 Documentation Requirements: The following information shall be included in the data submission:

- i. Guaranteed accuracy levels for power and temperature measurements, and
- ii. The time period used for data averaging (if present).

#### 5.1.5 Use of iPDUs: Section 5.1 may be satisfied using iPDUs. In order to satisfy the Data Elements requirement, an iPDU must:

- i. Meet all requirements for accuracy, sampling, and data reporting;
- ii. Be made available for sale and delivery with certified ENERGY STAR LNE products by appearing on the manufacturer's website and/or in marketing material where information on the LNE product is displayed.

## 6 TESTING

### 6.1 Test Methods

- 6.1.1 Manufacturers may select whether to test product with a half-port **or** full-port configuration for ENERGY STAR certification purposes. The testing configuration used for certification purposes will be noted in the Qualified Product Exchange form and displayed on the ENERGY STAR website.

**Table 1: Test Methods for ENERGY STAR Certification**

| Product Type | Test Method  |
|--------------|--|
| All          | ENERGY STAR Test Method for Large Network Equipment (Rev. December-2015) |

## 6.2 Number of Units Required for Testing

- 6.2.1 Representative Models shall be selected for testing per the following requirements:
- i. For certification of an individual product configuration, the unique configuration that is intended to be marketed and labeled as ENERGY STAR is considered the Representative Model.
  - ii. For certification of a product family of all product types, one product configuration for each of the required configurations defined in Section 1.H)2) within the family are considered Representative Models. All such representative models shall have the same Common Product Family Attributes as defined in 1.H).

## 6.3 International Market Certification

- 6.3.1 Products shall be tested for certification at the relevant input voltage/frequency combination for each market in which they will be sold and promoted as ENERGY STAR.

## 7 EFFECTIVE DATE

- 7.1.1 Effective Date: The Version 1.1 ENERGY STAR Large Network Equipment specification shall take effect on **March 1, 2016**. To certify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.
- 7.1.2 Future Specification Revisions: EPA reserves the right to change this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through stakeholder discussions. In the event of a specification revision, please note that the ENERGY STAR certification is not automatically granted for the life of a product model.

## 8 CONSIDERATIONS FOR FUTURE REVISIONS

- 8.1.1 Product Scope: EPA will investigate expanding the scope to include additional product types that are not covered in Version 1.1, as appropriate.
- 8.1.2 Active State Efficiency Criteria: EPA will investigate the product data generated through Version 1.1 certification to support setting active levels in Version 2.0 of this specification wherever possible.