ENERGY STAR®
Large Network Equipment:
Framework Document and Draft 1 Test Method Webinar

July 2, 2013

U.S. Environmental Protection Agency

U.S. Department of Energy

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Agenda

1	Introduction
2	Specification Framework Document Overview
3	Draft 1 Test Method Update
4	Next Steps

Meeting Introduction

- EPA and DOE invite all stakeholders to participate in the development of the ENERGY STAR specification for Large Network Equipment
  - Stakeholder participation is critical to the specification development.
  - EPA and DOE look forward to continuing the development of the test method and specification based on stakeholder feedback.
- Note: All slides will be posted to the ENERGY STAR Large Network Equipment website

Webinar Details

- Webinar slides and related materials will be available on the Large Network Equipment Web page:
  - www.energystar.gov/newspecs
  - *Follow link to "Version 1.0 is in Development" under "Large Network Equipment"*

- Audio provided via teleconference:

  Call in: +1 (877) 423-6338 (U.S.)
  +1 (571) 281-2578 (International)
  Code: 436598#

  - Phone lines will remain open during discussion
  - Please mute line unless speaking
  - Press *6 to mute and *6 to un-mute your line

Webbinar Goals

Cover topics in the EPA Framework Document related to:

1. Definitions and Eligible Product Categories
2. Energy Efficiency Criteria and Test Procedures
3. Information and Management Requirements

Cover topics in the DOE Draft 1 Test Method related to:

1. Power over Ethernet (PoE)
2. Half-Port Testing
3. Idle Testing
4. Efficiency Metric
5. Packet Size Statistical Distribution
6. Partial Utilization Load Requirements
7. Energy Efficient Ethernet (EEE)
8. Power Management Features
9. Incremental Throughput Granularity

Written Comments

- In addition to making verbal comments during the meeting, stakeholders are strongly encouraged to submit written comments and helpful information.

- Please send all comments to:

  largenetwork@energystar.gov

Comment Deadline
Friday, July 12

Agenda

1	**Introduction**
2	**Specification Framework Document Overview**
3	**Draft 1 Test Method Update**
4	**Next Steps**

Definitions

- Large Network Equipment (LNE)
  - Network Equipment that is rack-mounted, intended for use in standard equipment racks, or contains more than eleven (11) wired Physical Network Ports.

- Router
  - A network device that determines the optimal path along which network traffic should be forwarded. Routers forward packets from one network to another based on network layer information.

- Switch
  - A network device that filters, forwards, and floods frames based on the destination address of each frame. The switch operates at the data link layer of the OSI model.

Definitions

- Security Appliances
  - A stand-alone network device whose primary function is to protect the network from unwanted traffic.

- 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.

Definitions

- Fixed Network Equipment
  - A network device that consists of hardware which is mostly a single functional unit.

- Modular Network Equipment
  - A chassis which can accept a variety of functional units to enable networking services.

- Managed vs. Unmanaged – Managed must meet the following:
  1. Can be configured with redundant power supplies; and
  2. Includes a dedicated management controller

Eligible Product Categories

- Proposed in scope:
  - Fixed Routers
  - Fixed Switches
  - Modular Switches and Routers
- Proposed out of scope:
  - Security Appliances
  - Access Point Controllers
  - Products whose primary function is to provide wireless connectivity

V1.0 Energy Efficiency Criteria

- Fixed routers and switches:
  - Create energy efficiency criteria
  - May be a single metric, or the creation of limits based on product type, characteristics, and functionality
  - Path forward is dependent on data collected during upcoming data assembly effort

- Modular routers and switches:
  - Require reporting of performance and power, but not set energy efficiency levels for these products in Version 1.0
  - May include PSU efficiency, etc.

Criteria Under Consideration

- Minimum power supply efficiency

- Active State and possibly Idle State power levels

- Collection and display of test results via the product finder tool on the ENERGY STAR website.

- Standard methods for reporting product energy use and system performance over the network

Criteria Under Consideration

- Specific energy efficient features or capabilities, such as:
  - Ability to power down unused ports
  - Remote administration of ports individually
  - Presence of variable speed fans
  - Ability to scale power dynamically with the level of utilization
  - Implementation of Energy Efficient Ethernet (IEEE 802.3az)
  - Ability to perform well at higher operating temperatures

Information and Management Requirements

- Standard Information Reporting
  - Manufacturer reports of specified test data for display in the product finder tool on the ENERGY STAR web site.
  - EPA will consider how industry standardized data reporting may be integrated into the ENERGY STAR web site.

- Data Measurement and Output
  - Ability of devices to provide nearly real-time system performance data to network for use by management systems.

Information and Management Requirements

- Do any existing LNE standards approximate the requirement proposed on the previous slide?

- Do LNE products have the ability to measure and self-report operation characteristics in an open, accessible format?

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Review of Draft 1 Test Method

- Draft 1 contains **nine** modifications, based on stakeholder feedback, regarding:
    1. Power over Ethernet (PoE);
    2. Half-Port Testing;
    3. Idle Test;
    4. Efficiency Metric;
    5. Packet Size Statistical Distribution;
    6. Partial Utilization Load Requirements;
    7. Energy Efficient Ethernet (EEE);
    8. Power Management Features; and
    9. Incremental Throughput Granularity.

Revision #1 – PoE Load Testing

Preliminary Approach Proposal

No PoE test performed

Draft 1 Proposal

Products that are capable of supplying PoE shall perform a separate PoE Load test

Rationale:
- PoE capability affects a product's power usage
- Collecting data allows DOE to analyze efficiency of PoE delivery

Revision #1 – PoE Load Testing

PoE Testing Proposed in Draft 1

1. All PoE-capable ports are connected to a PoE load

2. Max PoE-load is specified by the manufacturer and/or the relevant IEEE 802.3 standard

3. PoE load is distributed evenly between all PoE-capable ports

4. No traffic is sent to the UUT during PoE load testing

Revision #2 – Half-Port Testing

Preliminary Approach Proposal

Products perform the data throughput test with all ports connected.

Rationale:

- The Preliminary Approach Test Method was based on ATIS-0600015.03.2013, which requires all ports to be active and ready to pass traffic.

Revision #2 – Half-Port Testing

Draft 1 Proposal

Products perform the data throughput test with all ports connected, and again with half of the ports connected.

Rationale:

- Many products do not have all ports active during normal operation.
- DOE and EPA would like to collect data to analyze how the number of active ports affects product power and performance.

Revision #2 – Half-Port Testing

Half-Port Testing Proposed in Draft 1

1. Conducted same as full-port testing, but with half of the data ports connected

2. Round up to the nearest integer if there are an odd number of ports

3. If more than one type of data port exists (e.g., uplink, downlink, etc.), then half of each type of data ports is connected

4. The connected ports shall be chosen at random

Revision #3 – Idle Test

Preliminary Approach Proposal

The Idle test is run using a 0% utilization

Draft 1 Proposal

The Idle test is run using a 0.01% utilization, and is called a Very Low Utilization (VLU) test

Rationale:
- DOE believes that testing at 0.01% represents a more realistic scenario, and will ensure that all products are capable of handling traffic when operating at idle.

Revision #4 – Efficiency Metric

Preliminary Approach Proposal

TEER metric used to calculate efficiency

Draft 1 Proposal

Power and throughput values are reported, but efficiency is not calculated

Rationale:

- DOE & EPA are currently interested in analyzing measured power and throughput for a future data assembly effort.
- Energy efficiency criteria will be included at a later date.

Revision #5 – Packet Size Statistical Distribution

Preliminary Approach Proposal

Accurate IMIX is used during testing

Draft 1 Proposal

Simple IMIX is used during testing

Rationale:

- The use of Simple IMIX reduces the test burden relative to Accurate IMIX and delivers similar efficiency results.

Revision #6 – Partial Utilization Levels

Preliminary Approach Proposal

Test at **either** 10% **or** 30%, **depending** on product type.

Draft 1 Proposal

Test at **both** 10% **and** 30%, **regardless** of product type.

Rationale:
- There is some ambiguity in how ATIS defines each product type (e.g. edge, access, core, etc)
- DOE would like to analyze how each utilization levels affects power consumption

Revision #7 – EEE Testing

Preliminary Approach Proposal

No requirements included for testing products that are EEE-compatible.

Draft 1 Proposal

Products that are EEE-compatible are tested with equipment that is EEE-compatible.

Rationale:
- EEE has the potential to reduce the overall power consumption of products which use copper-based Ethernet.

Revision #7 – EEE Testing

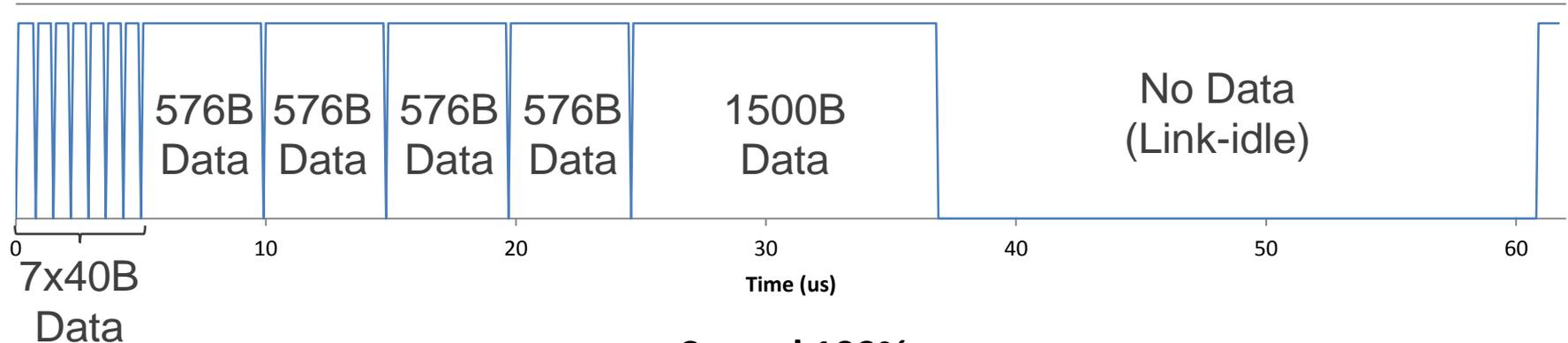## Possible EEE Testing Configurations in Draft 1
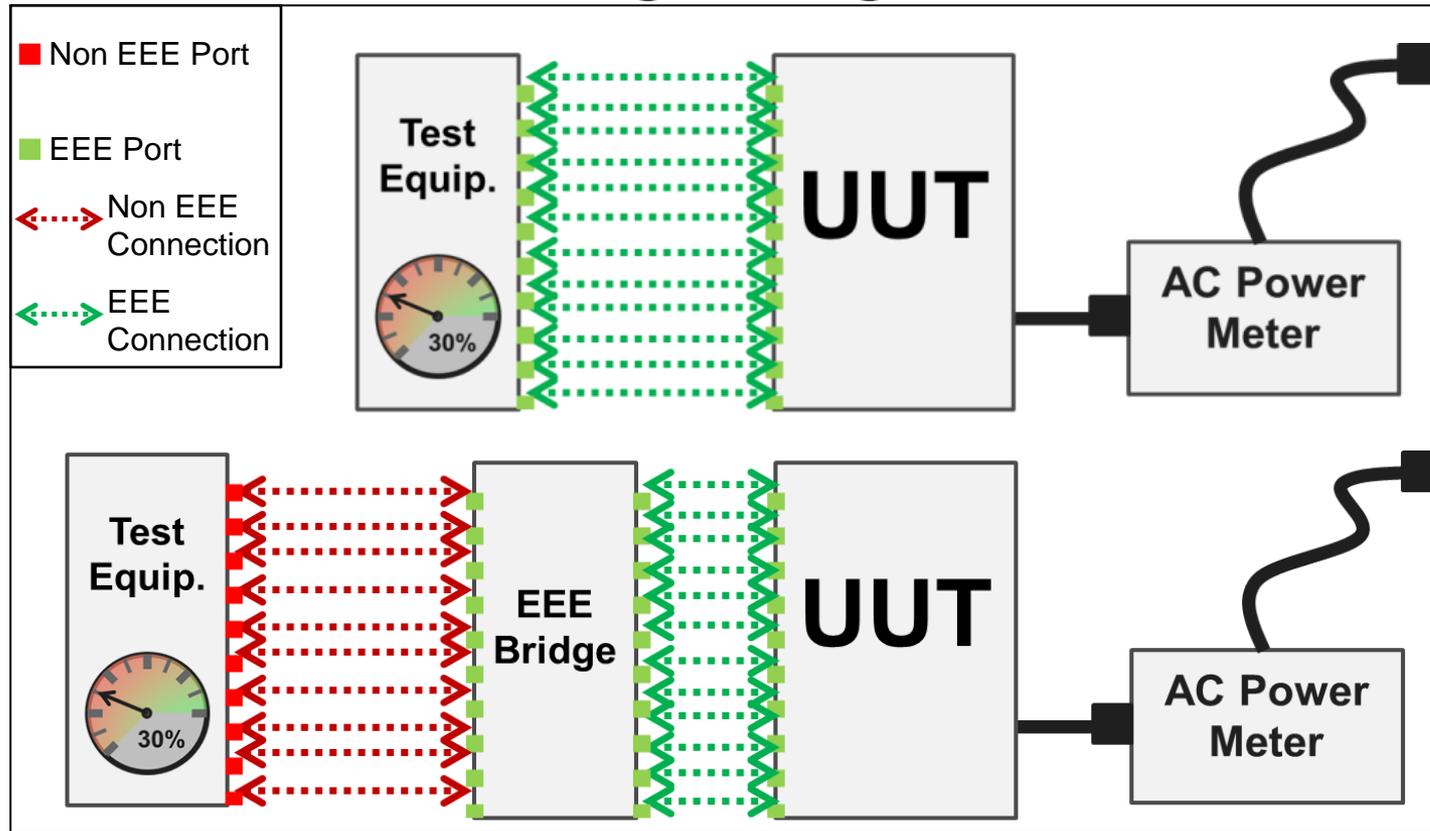
Link-idle Distribution

- There are many ways to generate data to satisfy a given "per-second" throughput requirement.
- The two extremes are
  - Lumped: Long continuous periods of idle separate each lumped set of frames.
  - Spread: Short periods of idle separate each transmitted frame.
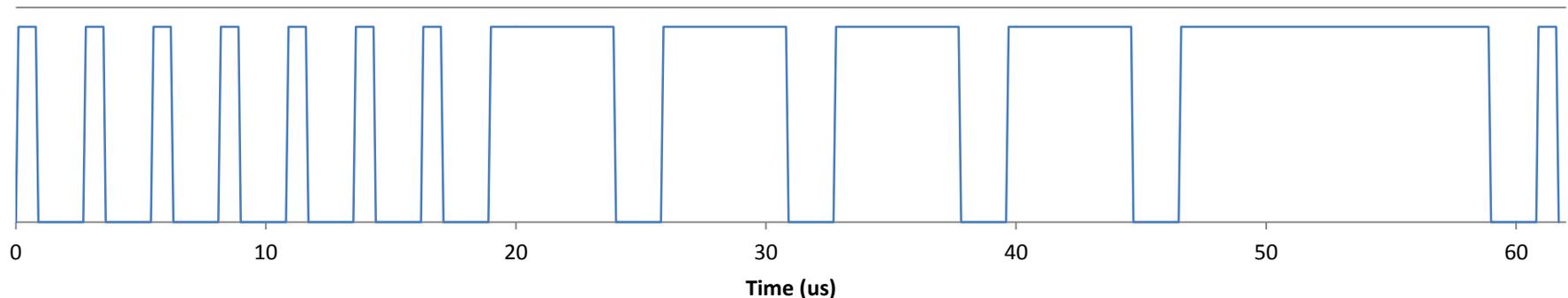- Power may vary due to EEE or similar technologies.

Link-idle Distribution: Example

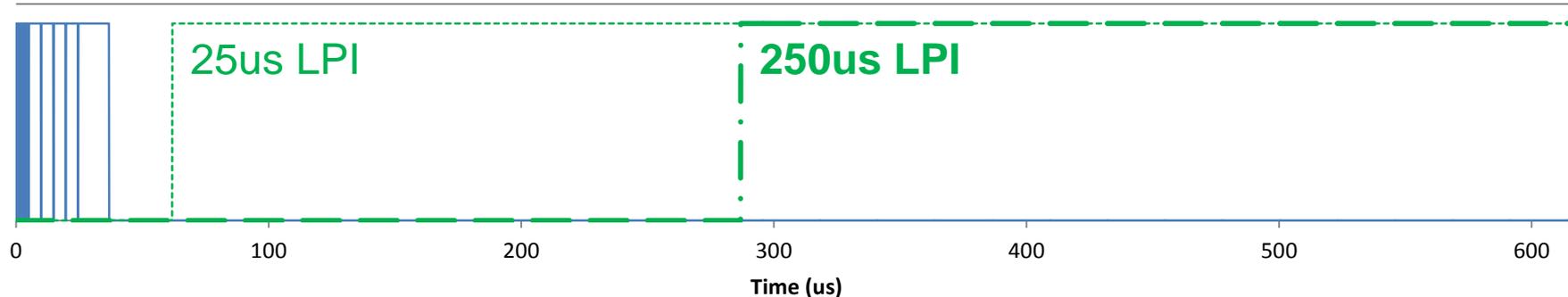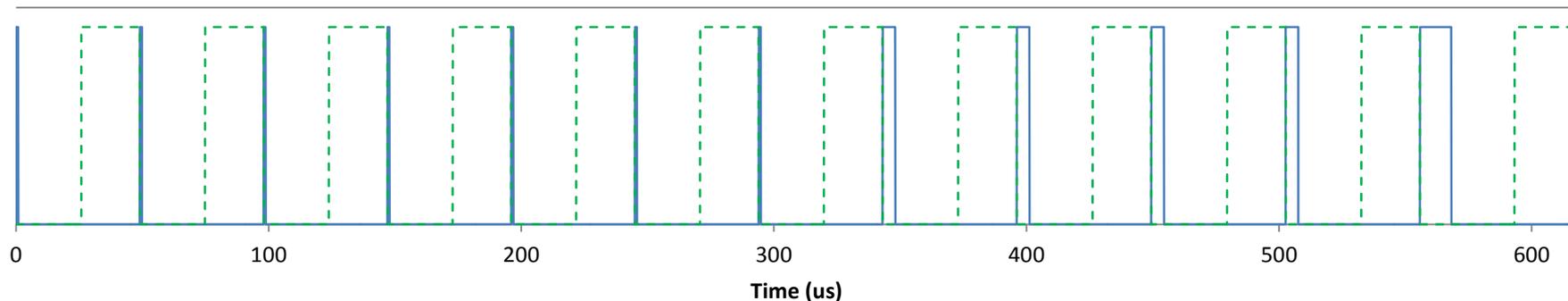- ## 100% NDR: Neither case allows LPI

Lumped 100%

| 576B Data | 576B Data | 576B Data | 576B Data | 1500B Data | No Data (Link-idle) |

7x40B Data

Time (us)

Spread 100%

Time (us)

Link-idle Distribution: Example

- 10% NDR: Both allow 25us LPI; Lumped allows 250us LPI

Lumped 10%

25us LPI **250us LPI**

Time (us)

Spread 10%

Time (us)

Link-idle Distribution

- ATIS nor the Draft 1 Test Method specify anything regarding packet spacing

- DOE requests feedback on the difference in power usage between lumped and spread packets for EEE products

- DOE also requests any information on typical traffic patterns to help develop these requirements

Revision #8 – Power Management Features

Preliminary Approach Proposal

Power management and/or power-saving features shall be disabled during testing.

Draft 1 Proposal

Any power management and/or power-saving feature shall be enabled during testing if it is enabled "as-shipped".

Rationale:
- "As-shipped" condition reflects the typical configuration for an end-user.
- Any effect that a power management feature has on power or performance will be captured by the data throughput test.

Revision #9 – Incremental Throughput Granularity

Preliminary Approach Proposal

Throughput must be able to change by less than 1% of max non-drop rate (NDR).

Draft 1 Proposal

No requirement is included regarding incremental throughput granularity.

Rationale:

- The Ethernet standard inherently allows for the fine adjustment of the throughput.

Summary of Proposed Changes

Topic	Preliminary Approach	Draft 1 Test Method
Power over Ethernet (PoE)	• No PoE test	• PoE test included
Half-Port Testing	Data throughput test has: • All ports connected	Data throughput test has: • All ports connected; and • Half of the ports connected
Idle/VLU Test	• 0% utilization	• 0.01% utilization

Summary of Proposed Changes

Topic	Preliminary Approach	Draft 1 Test Method
Efficiency Metric	• Calculate efficiency using TEER	• No efficiency calculation included
Packet Size Statistical Distribution	• Accurate IMIX	• Simple IMIX
Partial Utilization Load Requirements	• 10% when testing access, edge, or aggregation LNE • 30% when testing data center or core LNE	• 10% and 30% for all LNE

Summary of Proposed Changes

Topic	Preliminary Approach	Draft 1 Test Method
Energy Efficient Ethernet	• No EEE requirements included	• Requirements are included for testing EEE-compatible products
Power Management Features	• Power management features are disabled during testing	• Power management features are enabled "as-shipped"
Incremental Throughput Granularity	• Test equipment must be able to change its throughput by less than 1% of max NDR	• No incremental throughput granularity requirements included

Test Method Development Timeline

Preliminary Approach Version 1.0 Test Method to stakeholders	October 2012
Preliminary Approach Version 1.0 Test Method comments due	October 2012
Draft 1 Version 1.0 Test Method to stakeholders	June 2013
Draft 1 Version 1.0 Test Method comments due	July 2013
Draft 2 Version 1.0 Test Method to stakeholders	Autumn 2013
Draft 2 Version 1.0 Test Method comments due	Autumn 2013

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Timeline

- ## June 2013
  - ### Draft 1 test method and specification framework documents released

Track A:
- Summer 2013
  - Draft assembly started
- Autumn 2013
  - Data assembly finished
  - Draft 2 test method released
- Q4 '13 – Q2 '14
  - Additional test method and specification development
- Q2 '14: v1.0 final, effective

Track B:
- Autumn 2013
  - Draft 2 test method released
  - Data assembly started
- December 2013
  - Data assembly finished
- Q1 '14 – Q3 '14
  - Additional test method and specification development
- Q3 '14: v1.0 final, effective

Open Comment

- EPA and DOE would now like to open the line for any additional comments or questions.

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