Society of Cable Telecommunications Engineers

ENGINEERING COMMITTEE
Energy Management Subcommittee

SCTE STANDARD

SCTE 210 2015

Performance Metrics for Energy Efficiency & Functional Density of Cable Data Generation, Storage, Routing, and Transport Equipment

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1. Scope

1.1. Introduction

Cable operator networks are large expansive networks that involve hundreds if not thousands of miles of coaxial or fiber cable powered by power supplies in the plant and connecting customers to critical infrastructure facilities such as hubs, headends, data centers, regional and national distribution datacenters. In these facilities is a vast array of equipment responsible for the production and support of the cable products – voice, video and data as well as newer products such as home automation and security, and Wi-Fi to name a few. The importance of powering all of these devices in the critical facilities is ever increasing as the customer expectation of 100% availability of service is growing due to expansion into business services and residential competition from new mark place service providers. The following standard is the first of multiple releases that will provide the cable operator the standard reference to determine how well a piece of rack or shelf equipment performs in terms of minimizing the power required to do its particular job. In addition, this standard will provide the means to quantify the amount of useful work the equipment provides per physical space. This release will focus on the Digital Data Transport critical facility equipment.

1.2. Applicability to Critical Spaces

The energy efficiency and functional density metrics proposed in this document apply to Critical Spaces used by cable operators. Critical Spaces are defined in Section 5.2.

1.3. Objective

The SCTE responded to the cable industry's requirement articulating energy efficiency and service feature functional density requirements. As a body, the objective of this standard is to solve the problem of gauging − in a standard methodology − the density of hardware to meet the needs of optimizing critical space, as well as gauging energy consumption for the various network element classes.

1.4. Hardware Service Feature Density Metrics

This standard seeks to define a method to calibrate product density. Initial thoughts include service features per Rack Unit or "RU", per ft^3, per m^3, or equivalent.

1.5. Energy Consumption Metrics

This standard seeks to define a method to calibrate energy consumption based on service features such as watts/QAM channel, Watts/optical channel, or similar for cable headend, hub, and cable subscriber access equipment.

Datacenter, server, router, network termination, and long-haul transport equipment metrics may either be adapted to SCTE requirements, or adopted from existing industry standards, for example ATIS (Alliance for Telecommunications Industry Solutions) datacenter, server, and router standards.

1.6. Applicable Equipment

Cable operators require that the energy efficiency and functional density metrics apply to ALL indoor equipment used in Critical Spaces. These include the following equipment categories:

1.6.1. Data Center Equipment

- Server blades, storage devices, enterprise switching and routing for LAN access monitoring, and control.
- Routing and switching equipment for interface to the IP backbone and nationwide network, such as metro and core routing equipment, network management equipment.

1.6.2. Headend and Hub Equipment

- All equipment types listed in Section 1.6.1 that operate in a headend or hub.

1.7. Non-Applicable Equipment

This standard does NOT apply to the following equipment classes:

1.7.1. Customer premises equipment (CPE) NOT applicable

- Customer Premises Equipment is not addressed by these energy efficiency and functional density metrics.

1.7.2. Outdoor plant and associated powering equipment NOT applicable

- Will be covered in SCTE EMS 020, "Energy Metrics for Cable Operator Access Networks."

1.7.3. NOT applicable facilities equipment covered by SCTE 184, such as

- Generators and line-power back-up systems
- Building HVAC control and monitoring equipment
- Logistical and physical support such as lighting, fire alarming, and security systems, etc.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of the standard. At the time of Subcommittee approval, the editions indicated were valid. All standards are subject to revision; and while parties to any agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents may not be compatible with the referenced version.

2.1. ATIS-0600015.03.2013, (April 2013)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Router and Ethernet Switch Products
https://www.atis.org/docstore/product.aspx?id=25324

2.2. ATIS-0600015.02.2014, (June 2014)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting – Transport Requirements
https://www.atis.org/docstore/product.aspx?id=25323

2.3. ATIS-0600015.01.2014, (November 2014)

Energy Efficiency for Telecommunications Equipment: Methodology for Measurement and Reporting – Server Requirements
https://www.atis.org/docstore/product.aspx?id=25322

3. Informative References

The following documents may provide valuable information to the reader but are not required when complying with this standard.

3.1. SCTE EMS 020

Energy Metrics for Cable Operator Access Networks

3.2. SCTE 184 (most recent version)

SCTE Energy Management Recommended Practices for Cable Facilities
http://www.scte.org/documents/pdf/Standards/SCTE184.pdf

3.3. ATIS-0600015.2013, (May 2013)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting – General Requirements
https://www.atis.org/docstore/product.aspx?id=25326

3.4. ATIS-0600015.04.2010, (January 2010)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting DC Power Plant – Rectifier Requirements
https://www.atis.org/docstore/product.aspx?id=25325

3.5. ATIS-0600015.05, (April 2010)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting Facility Energy Efficiency
https://www.atis.org/docstore/product.aspx?id=25376&type=3&Add=1

3.6. ATIS-0600015.06.2011, (November 2011)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting of Radio Base Station Metrics
http://webstore.ansi.org/RecordDetail.aspx?sku=ATIS-0600015.06.2011

3.7. ATIS-0600015.07.2013, (May 2013)

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting – Wireline Access, Asymmetric Broadband Equipment
http://webstore.ansi.org/RecordDetail.aspx?sku=ATIS-0600015.07.2013

3.8. ATIS-0600015.08.2014

Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Small Network Equipment
https://www.atis.org/docstore/product.aspx?id=28183

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this specification.
shall not	This phrase means that the item is an absolute prohibition of this specification.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

5. Abbreviations and Definitions

5.1. Abbreviations

ATIS	Alliance for Telecommunications Industry Solutions
bps	bits per second
CATV	cable television (originally *community antenna television*)
CMTS	cable modem termination system
CPE	customer premises equipment
DC	direct current
e.g.	for example (*exempli gratia*)
EMS	[SCTE] Energy Management Subcommittee
ft^3	cubic feet
GHz	gigahertz
HVAC	heating, ventilation, and air conditioning
IP	Internet protocol
LAN	local area network
m^3	cubic meters
QAM	quadrature amplitude modulation
RU	rack unit
SCTE	Society of Cable Telecommunications Engineers
STB	set-top box
TEER	Telecommunications Energy Efficiency Ratio [standard]

5.2. Definitions

Critical Space	The network, facility, and/or building responsible for the reliable delivery of information services
Key Performance Metric	A standard of measurement for the efficient use of energy of cable equipment in critical facilities, or a standard of measurement for rack space/volume of cable equipment in critical facilities
Port Throughput	The rate of traffic (in bps) passing through a port on a sustained basis in either direction, including minimally needed line overhead
System Throughput	The sum of the throughputs on all system ports in the egress direction (in bps)

6. Server Blades, Digital Data Transport Equipment, Digital Data Routing And Switching Equipment

6.1. Introduction

The following subsections briefly describe cable operator datacenter equipment addressed by this standard. By datacenter equipment, this document refers to storage, servers, routers, switches, network digital transport, monitoring, control, and support equipment. Although typically deployed in datacenters, note that such equipment may also be deployed in headend and hub sites.

6.2. Existing Metrics – ATIS

Much work has already been done to define energy efficiency metrics and test methodologies for datacenter equipment. Specifically, DIGITAL data generation, storage, routing, and transport are covered by a series of standards developed by the Alliance for Telecommunications Industry Solutions (ATIS).

The first of these, ATIS-0600015.2013 (May 2013), "Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting – General Requirements", specifies quantities measured and defines an Energy Efficiency Ratio applied in subsequent documents, the Telecommunications Energy Efficiency Ratio or TEER.

6.3. Datacenter Metrics Discussion

Datacenter and data communications (datacomm) equipment vendors are familiar with ATIS standards. ATIS standards are not foreign to datacenter or datacomm equipment vendors as many participated in their draft and creation. The standards apply to many datacenter technologies in use: telecom, datacomm, enterprise routing, core routing, switching, server, and data storage equipment applications. They are already designed-in to many existing, and nearly all future, products of this nature.

The question may be raised, "Why not adopt ATIS energy metrics for ALL equipment, including non-datacenter applications in Headend equipment (HE), remote equipment in protected spaces (hub equipment), and CATV Access formatting, coding, and transmission equipment?" In answering this, the following points *should* be taken into consideration.

- ATIS was crafted to address DIGITAL data transport.
- Video, QAM modulator, CMTS, CATV Optics, are NOT addressed by ATIS.
- Complex modulation techniques such 256-QAM (or any modulation order) transport are not addressed.

ATIS addresses the logistical and powering needs of telecom and data communications (datacomm) equipment. It has no provisions for equipment to interface to CATV plant, e.g. CATV upstream, CATV signaling equipment for Set-Top Box (STB) addressing, etc.

6.4. Energy Metrics for Datacenter Equipment

It is required that SCTE adopt, by normative reference, the following, SPECIFIC, ATIS metrics and test methods for each equipment type below.

6.4.1. Generic Server

Energy Efficiency for Generic Servers ***shall*** be determined using the metrics defined in ATIS-600015.01.2014.

6.4.2. Digital Data Transport Equipment

Energy Efficiency for Digital Data Transport equipment ***shall*** be determined using the metrics defined in ATIS-0600015.02.2014, (June 2014).

6.4.3. Digital Data Routing and Switching Equipment

Energy Efficiency for Digital Data Routing equipment ***shall*** be determined using the metrics defined in ATIS-0600015.03.2013, (April 2013).

6.5. Functional Density Metrics for Datacenter Equipment

The ATIS set of standards does not include functional density metrics for Datacenter equipment. As such, the following metrics have been defined for this SCTE standard.

6.5.1. Generic Server

The Generic Server equipment Storage Density ***shall*** be determined with the following metric:

- *Maximum Number of Terabytes per rack-unit*

The Generic Server equipment Processing Density ***shall*** be determined with the following metric:

- *Maximum Processing Capacity per rack-unit*

Note: *Processing Capacity* is defined as: *The maximum number of server processor cores multiplied by the processor base frequency in GHz*. Therefore the units for Generic Server Processing Density are: GHz per rack-unit.

6.5.2. Digital Data Transport Equipment

The Digital Data Transport equipment System Throughput Density ***shall*** be determined with the following metric:

- *Maximum System Throughput (Bits per second) per rack unit*

Note: “System Throughput” is defined in Section 5 and in ATIS-0600015.03.2013, (April 2013).

6.5.3. Digital Data Routing and Switching Equipment

The Digital Routing and Switching equipment System Throughput Density ***shall*** be determined with the following metric:

- *Maximum System Throughput (Bits per second) per rack unit*

Note: "System Throughput" is defined in Section 5 and in ATIS-0600015.03.2013, (April 2013).

7. Firewall Equipment

7.1. Firewall Equipment Description

A Firewall unit is a network security system that, based on rule sets, analyzes input and output network traffic to control whether or not the data packets *should* be allowed through.

7.2. Energy Metrics for Firewall Equipment

The energy consumption for Firewall Equipment ***shall*** be determined using the router metrics specified in ATIS-0600015.03.2013.

7.3. Functional Density Metrics for Firewall Equipment

The Firewall equipment Functional Density ***shall*** be determined with the following metric:

- *Maximum System Throughput (Bits per second) per Firewall rack-unit*

Note: "System Throughput" is defined in Section 5 and in ATIS-0600015.03.2013, (April 2013).

8. Load Balancing Equipment

8.1. Load Balancing Equipment Description

A Load Balancing unit is a device that serves to distribute network traffic across multiple network elements and data links. Note that Load Balancers can scale from small (e.g. pizza box) to very large scale (e.g. campus-wide support).

8.2. Energy Metrics for Load Balancing Equipment

The energy consumption for Load Balancing equipment ***shall*** be determined using the router metrics specified in ATIS-0600015.03.2013.

An appropriate Router Classification for Load Balancing equipment ***shall*** be chosen from Table A.1 of ATIS-0600015.03.2013.

8.3. Functional Density Metrics for Load Balancing Equipment

The Load Balancing equipment Functional Density ***shall*** be determined with the following metric:

- Maximum Traffic System Throughput (Bits per second) per Load Balancing rack-unit.

Note: "System Throughput" is defined in Section 5 and in ATIS-0600015.03.2013, (April 2013).