SCTE · ISBE

STANDARDS

Energy Management Subcommittee

AMERICAN NATIONAL STANDARD

ANSI/SCTE 210 2020

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

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1. Introduction

1.1. Executive Summary

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, and 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, security, and Wi-Fi. The importance of powering all of these devices in critical facilities is ever increasing as the customer expectation of 100% availability of service is growing due to expansion of business services and residential competition.

1.2. Scope

This standard enables a cable operator to determine how well a piece of rack or shelf equipment performs in terms of minimizing the power required to do a particular job. It provides the means to quantify the amount of useful work the equipment provides per physical space. This standard focuses on the data transport critical facility equipment.

These energy efficiency and functional density metrics apply to all indoor equipment used in critical spaces. These include the following data center, headend, and hub data transport equipment including:

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

This standard does NOT apply to the following equipment classes: customer premise equipment; outside plant equipment; and building support devices such as generators, air conditioning units, and other items mentioned in SCTE 184.

1.3. Benefits

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 data transport equipment.

By leveraging this standard, cable operators can improve their overall energy footprint by enabling engineering-driven decisions that reduce energy consumption for data transport equipment. This document also addresses the foundation of the energy supply chain by providing metrics that define measurable energy performance in terms of useful work/activity.

1.4. Intended Audience

Cable operator critical facility engineers and procurement teams.

1.5. Areas for Further Investigation or to be Added in Future Versions

None at this time.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document 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 might not be compatible with the referenced version.

2.1. SCTE References

- No normative references are applicable.

2.2. Standards from Other Organizations

- ATIS-0600015.03.2016, (August 2016), Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Router and Ethernet Switch Products https://global.ihs.com/doc_detail.cfm?item_s_key=00526067&item_key_date=830431

- ATIS-0600015.02.2016, (March 2016), Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting –Transport Requirements https://standards.globalspec.com/std/10014508/atis-0600015-02

- ATIS-0600015.01.2014, (November 2014), Energy Efficiency for Telecommunications Equipment: Methodology for Measurement and Reporting – Server Requirements https://standards.globalspec.com/std/9881977/atis-0600015-01

2.3. Published Materials

- No normative references are applicable.

3. Informative References

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

3.1. SCTE References

- SCTE 211, Energy Metrics for Cable Operator Access Networks
- SCTE 184 (most recent version), SCTE Energy Management Recommended Practices for Cable Facilities http://www.scte.org/documents/pdf/Standards/SCTE184.pdf

3.2. Standards from Other Organizations

- ATIS-0600015.2018, (May 2018), Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting – General Requirements https://global.ihs.com/doc_detail.cfm?document_name=ATIS%200600015&item_s_key=00519264

- ATIS-0600015.04.2017, (December 2017), Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting DC Power Plant – Rectifier Requirements
  https://www.techstreet.com/atis/standards/atis-0600015-04-2017?product_id=2002333
- ATIS-0600015.05, (April 2010), Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting Facility Energy Efficiency
  https://global.ihs.com/doc_detail.cfm?document_name=ATIS%200600015%2E05&item_s_key=00552529&rid=&csf=TIA
- 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
- ATIS-0600015.07.2018, (August 2018), Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting – Wireline Access, Asymmetric Broadband Equipment
  https://www.techstreet.com/standards/atis-0600015-07-2018?product_id=2033892
- ATIS-0600015.08.2014, Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Small Network Equipment
  https://infostore.saiglobal.com/en-us/standards/atis-0600015-08-2014-166473_saig_atis_atis_407828/

3.3. Published Materials

- No informative references are applicable.

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
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.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

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, inclEuding minimally needed line overhead
system throughput	The sum of the throughputs on all system ports in the egress direction (in bps)
TEER	Useful work/activity divided by power, where useful work/activity is defined in the referenced ATIS standards based on the equipment function (examples could be, but are not limited to: data rate, throughput, processes per second, etc.) and power is an average of power in watts.

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-0600015.2018 (May 2018), "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-0600015.02.2016, (March 2016).

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-0600015.03.2016, (August 2016).

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-0600015.03.2016, (August 2016).

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-0600015.03.2016, (August 2016).

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-0600015.03.2016.

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-0600015.03.2016, (August 2016).

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-0600015.03.2016.

An appropriate Router Classification for Load Balancing equipment ***shall*** be chosen from Table A.1 of ATIS-0600015.03.2016.

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-0600015.03.2016, (August 2016).