



ATIS-0600015.03.2015

**Energy Efficiency for Telecommunication Equipment:  
Methodology for Measurement and Reporting for  
Routers and Ethernet Switch Products**

**AMERICAN NATIONAL STANDARD FOR TELECOMMUNICATIONS**



As a leading technology and solutions development organization, the Alliance for Telecommunications Industry Solutions (ATIS) brings together the top global ICT companies to advance the industry's most pressing business priorities. ATIS' nearly 200 member companies are currently working to address the All-IP transition, 5G, network functions virtualization, big data analytics, cloud services, device solutions, emergency services, M2M, cyber security, network evolution, quality of service, billing support, operations, and much more. These priorities follow a fast-track development lifecycle — from design and innovation through standards, specifications, requirements, business use cases, software toolkits, open source solutions, and interoperability testing.

ATIS is accredited by the American National Standards Institute (ANSI). The organization is the North American Organizational Partner for the 3rd Generation Partnership Project (3GPP), a founding Partner of the oneM2M global initiative, a member of and major U.S. contributor to the International Telecommunication Union (ITU), as well as a member of the Inter-American Telecommunication Commission (CITEL). For more information, visit [www.atis.org](http://www.atis.org).

## AMERICAN NATIONAL STANDARD

Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached and directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

**CAUTION NOTICE:** This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

## Notice of Disclaimer & Limitation of Liability

The information provided in this document is directed solely to professionals who have the appropriate degree of experience to understand and interpret its contents in accordance with generally accepted engineering or other professional standards and applicable regulations. No recommendation as to products or vendors is made or should be implied.

NO REPRESENTATION OR WARRANTY IS MADE THAT THE INFORMATION IS TECHNICALLY ACCURATE OR SUFFICIENT OR CONFORMS TO ANY STATUTE, GOVERNMENTAL RULE OR REGULATION, AND FURTHER, NO REPRESENTATION OR WARRANTY IS MADE OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. ATIS SHALL NOT BE LIABLE, BEYOND THE AMOUNT OF ANY SUM RECEIVED IN PAYMENT BY ATIS FOR THIS DOCUMENT, AND IN NO EVENT SHALL ATIS BE LIABLE FOR LOST PROFITS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES. ATIS EXPRESSLY ADVISES THAT ANY AND ALL USE OF OR RELIANCE UPON THE INFORMATION PROVIDED IN THIS DOCUMENT IS AT THE RISK OF THE USER.

NOTE - The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to whether use of an invention covered by patent rights will be required, and if any such use is required no position is taken regarding the validity of this claim or any patent rights in connection therewith. Please refer to [\[http://www.atis.org/legal/patentinfo.pdf\]](http://www.atis.org/legal/patentinfo.pdf) to determine if any statement has been filed by a patent holder indicating a willingness to grant a license either without compensation or on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain a license.

## ATIS-0600015.03.2016, Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Router and Ethernet Switch Products

Is an American National Standard developed by the **Telecommunications Energy Efficiency (TEE) Subcommittee** under the **ATIS Sustainability in Telecom: Energy and Protection (STEP)**.

Published by  
**Alliance for Telecommunications Industry Solutions**  
1200 G Street, NW, Suite 500  
Washington, DC 20005

Copyright © 2016 by Alliance for Telecommunications Industry Solutions  
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher. For information contact ATIS at 202.628.6380. ATIS is online at < <http://www.atis.org> >.

**ATIS-0600015.03.2016**

(Revision of ATIS-0600015.03.2013)

American National Standard for Telecommunications

# **Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Router and Ethernet Switch Products**

**Alliance for Telecommunications Industry Solutions**

Approved June 24, 2016

## **Abstract**

This document specifies the definition of router and Ethernet switch products based on their position in a network, as well as a methodology to calculate the Telecommunication Energy Efficiency Ratio (TEER). The standard will also provide requirements for how equipment vendors shall respond to a TEER request based on a specific application description by making use of relevant data from internal and independent test reports.

## Foreword

---

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between providers, customers, and manufacturers. The Sustainability in Telecom: Energy and Protection (STEP) Committee – formerly the Network Interface, Power, and Protection Committee (NIPP) – engages industry expertise to develop standards and technical reports for telecommunications equipment and environments in the areas of energy efficiency, environmental impacts, power, and protection. The work products of STEP enable vendors, operators and their customers to deploy and operate reliable, environmentally sustainable, energy efficient communications technologies. STEP is committed to proactive engagement with national, regional, and international standards development organizations and forums that share its scope of work.

ANSI guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcomed. They should be sent to the Alliance for Telecommunications Industry Solutions, STEP, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time it approved this document, STEP, which was responsible for its development, had the following roster:

- K. Biholar STEP Chair (Nokia)
- J. Krahner, STEP Vice Chair (AT&T)
- L. Rabinovich, STEP TEE Chair (Cisco)
- S. Martin, STEP TEE Vice Chair (AT&T)
- L. Rabinovich, Technical Editor (Cisco)

The Telecommunications Energy Efficiency (TEE) Subcommittee was responsible for the development of this document.

## Table of Contents

1	Scope, Purpose, & Application .....	1
1.1	Scope .....	1
1.2	Purpose .....	1
1.3	Application .....	1
2	Normative References .....	1
3	Definitions, Acronyms, & Abbreviations .....	2
3.1	Definitions .....	2
3.2	Acronyms & Abbreviations .....	2
4	Equipment Category Description .....	3
5	Metric Definition .....	3
5.1	Preamble .....	3
5.2	TEER Metric Definition (Representative).....	3
5.3	TEER Metric Definition (modular).....	5
5.4	TEER Evaluation.....	6
6	Test Procedure .....	6
6.1	General Measurement Condition .....	6
6.2	Equipment Configuration.....	6
6.3	TEER Measurements – Modular Method .....	6
6.4	Traffic Generation/Operational Conditions .....	7
6.4.1	<i>Traffic Topology</i> .....	7
6.4.2	<i>Use of Traffic Generators</i> .....	8
6.5	Measurement Procedure.....	9
6.5.1	<i>Step 1: Qualification</i> .....	9
6.5.2	<i>Step 2: Full Load</i> .....	9
6.5.3	<i>Step 3: Utilization (u2)</i> .....	9
6.5.4	<i>Step 4: Idle Load</i> .....	10
7	Reporting & Documentation .....	10
7.1	General Requirements .....	10
7.2	EUT Information .....	10
A	Classification Examples .....	11
A.1	Reference Tables .....	11
A.2	Informative References .....	13
B	Modular System TEER Report Example .....	14
C	Supplementary Metrics .....	15
C.1	Supplementary Metric Definition for Module Based Power Saving Technique.....	15
C.2	Supplementary Metric Definition for Explicit Power States .....	15
C.3	Supplementary Metric Definition for Peak Metric.....	15
C.4	ITU-T Recommendation L.1310 .....	16
C.5	Methods for Effective Throughput Computation.....	16
C.5.1	<i>Method 1</i> .....	16
C.5.2	<i>Method 2</i> .....	16

C.5.3 Other notes ..... 16

D IMIX Traffic..... 17

**Table of Figures**

Figure 6.1 – Topology for “vertical” snake with partial mesh traffic.....**Error! Bookmark not defined.**

Figure 6.2 – Example EUT Test Interconnect for two groups of ports .....**Error! Bookmark not defined.**

**Table of Tables**

Table 1 – Class definitions, TEER calculation parameters, and load profiles for Routing Products ..... 4

Table 2 – Class definitions, TEER calculation parameters and load profiles for Ethernet Switching Products ..... 5

Table 3 – Example of Modular System Hardware Data Reporting ..... 7

Table A.1 – Router Classifications ..... 11

Table A.2 – Ethernet Switch Classifications ..... 12

Table B.1 – Example of Modular System Data Reporting ..... 14

Table D.1 – Simple IMIX ..... 17

Table D.2 – Complete IMIX (Informative) ..... 18

Table D.3 – Accurate IMIX (Informative)..... 18

Table D.4 – Additional IMIX Information ..... 18

American National Standard for Telecommunications –

# Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting for Router and Ethernet Switch Products

## 1 Scope, Purpose, & Application

---

### 1.1 Scope

The requirements and definitions in this document are for router and Ethernet switch products. This document represents one part of the larger ATIS suite of standards concerning Telecommunications Energy Efficiency.

### 1.2 Purpose

This document provides a set of definitions, requirements, and guidelines for calculating the Telecommunications Energy Efficiency Ratio (TEER) of a system. The document also provides standardized definitions of operational data rates and conditions to be used when calculating the TEER of any given configuration. The test methodology used to independently verify the Energy Consumption used as part of the TEER calculation is addressed in ATIS-0600015.2013.

### 1.3 Application

This document (and supporting documentation) is intended to be used by network operators, equipment manufacturers, and re-sellers as a standard method for determining the energy efficiency of Router and Ethernet Switch products. By comparing the TEER reports of multiple platforms that meet a common set of requirements, a communications network operator can select the equipment that best meets their energy efficiency targets.

## 2 Normative References

---

The following standards contain provisions which, through reference in this text, constitute provisions of this ATIS Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this ATIS Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ISO 17025, *General Requirements for the competence of testing and calibration laboratories*.<sup>1</sup>

ATIS-0600015.2013 *Methodology for Measurement and Reporting: General Requirements*.<sup>2</sup>

---

<sup>1</sup> This document is available from the International Organization for Standardization at:  
< <http://www.iso.ch/iso/en/prods-services/ISOstore/store.html> >.

<sup>2</sup> This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 at: < <https://www.atis.org/docstore/product.aspx?id=25326> >.