Verizon NEBS™ Compliance: TEER Metric Quantification

Verizon Technical Purchasing Requirements

VZ.TPR.9207

Issue 1, January 2009

CHANGE CONTROL RECORD:

Version	Date	Action*	Reason for Revision
1	*1/20/2009*	New	New document.

*** New, Add, Delete, Change, Reissue**

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1.0 PURPOSE

The purpose of this TPR is to quantify the avoidance of cost and reduction of CO_2 emissions achieved from the Verizon energy efficiency initiative VZ.TPR.9205 – *Energy Efficiency Requirements for Telecommunications Equipment*. This document may also serve as a predictor of savings for replacement or retiring of existing network equipment.

2.0 SCOPE

This TPR document applies to all new equipment purchased after January 1, 2009. Legacy equipment and equipment under contract prior to January 1, 2009 are considered outside the scope of this document.

3.0 REFERENCES

VZ.TPR.9205	Energy Efficiency Requirements for Telecommunications Equipment

4.0 ACRONYMS

ADS	Average Dollar Savings
APS	Average Power Savings
EE	Energy Efficiency
kWh	Kilowatt-hour
TEEER	Telecommunications Equipment Energy Efficiency Rating
TPR	Technical Purchasing Requirement

5.0 DEFINITIONS

Baseline – average known performance of legacy equipment for a given class
TEEER – A calculated value based on an equipments power and performance at multiple utilization levels.

6.0 BACKGROUND

To reduce its power consumption and energy costs and shrink its carbon footprint, Verizon has established its own energy-consumption standard and an associated measurement process for new telecommunications-related equipment. The standard, VZ.TPR.9205, is applicable to broadband, video, data-center, network and customer-premises equipment purchased after Jan. 1, 2009. The target provided to the manufacturers of such equipment is 20 percent greater efficiency than today's gear. VZ.TPR.9205 established a series of Telecommunications Equipment Energy Efficiency Ratings (TEEER) based on formulas that test the power consumption of equipment at various utilization levels. Test data is entered into formulas/metrics developed for each type of equipment, which will provide a value that can be compared with other like equipment. The higher a given TEEER value for a specific class of equipment, the more energy efficient the equipment.

7.0 TEEER METRIC CALCULATIONS

The calculations below are used to show the avoidance of cost from the baseline consumption values as determined by VZ.TPR.9205.

APS = ((TEEER – Baseline)/Baseline) * System Wattage (in kW)
ADS = APS * Ave. Cost kWh (e.g. $0.0946) * 8760

Total forecast APS = equipment forecast * APS
Total forecast ADS = equipment forecast * ADS

Example:

XYZ optical transport system
Wattage = 1000
TEEER = 7.68
Forecast = 15

APS = ((TEEER – Baseline)/Baseline)* System Wattage (in kW)
APS = ((7.68 – 6.28)/6.28) * 1
APS = (1.4/6.28) * 1
APS = 0.223 * 1
APS = 0.223 kW

ADS = APS * Ave Cost kWh
ADS = 0.223 * 0.0946 * 8760
ADS = $184.78 per year

Total forecast APS = equipment forecast * APS
Total forecast APS = 15 * 0.223
Total forecast APS = 3.345 kW

Total forecast ADS = equipment forecast * ADS
Total forecast ADS = 15 * 184.84
Total forecast ADS = $2,772.54 per year

8.0 TEEER METRIC SAVINGS CALCULATOR

The attached spreadsheet shall be used to quantify the power consumption savings and CO_2 emissions savings based on an equipments TEEER value. The savings are based on a normalized TEEER value representing the average consumption of a given equipment class deployed in the network.

E:\TEEER Metric Savings Calculator.xls

Modifiable Variable
Data Output
Totals

Product Class	TEEER	Power Consumption (kW)	Forecast Deployment	Average Power Savings (kW)	Average Dollar Saving ($ per year)	Forecast Deployment Ave. Power Savings (kW)	Forecast Deployment Average Dollar Savings ($ per year)	Annual Emissions Savings (lbs of CO2)
Transport								
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
						0	$0.00	0
Switch/Router								
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0

				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
						0	$0.00	0
Access								
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
						0	$0.00	0
Power								
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
						0	$0.00	0
Power Amplifier (Wireless)								
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
				0	$0.00	0	$0.00	0
						0	$0.00	0
			Totals			0	$0.00	0

9.0 EXAMPLE TEEER CALCULATIONS

VZ.TPR.9205 – Energy Efficiency Requirements for Telecommunications Equipment can be downloaded from the Verizon NEBS external website www.verizonnebs.com. The following examples of TEEER calculations are provided for informational purposes. For full details on calculating a TEEER for a given piece of equipment, refer to VZ.TPR.9205.

Transport

Throughput = 40 Gbps
P_{max} = 1,000 W
P_{50} = 950 W
P_{sleep} = 900 W

P_{Total} = (0.35 x 1000) + (0.4 x 950) + (0.25 x 900) = 955 W

TEEER = -log (P_{Total} / Throughput)
= -log (955 / 40,000,000,000)
= -log (0.000000023875)
= 7.62

Switch/Router

Forwarding Capacity = 160 Gbps
P_{max} = 4,320 W
P_{50} = 3,000 W
P_{sleep} = 1,500 W

P_{Total} = (0.35 x 4320) + (0.4 x 3000) + (0.25 x 1500) = 3,087 W

TEEER = -log (P_{Total} / Forwarding Capacity)
= -log (3087 / 160,000,000,000)
= -log (0.00000001929375)
= 7.71

Access

Access Lines = 284
P_{max} = 120 W
P_{50} = 80 W
P_{sleep} = 40 W

P_{Total} = (0.35 x 120) + (0.4 x 80) + (0.25 x 40) = 84 W

TEEER = (Access Lines / P_{Total}) + 1
= (284 / 84) + 1
= 4.38

Power

$P_{Out\ max}$ = 800 W
$P_{Out\ 50}$ = 400 W
$P_{In\ max}$ = 844 W
$P_{In\ 50}$ = 462 W
$P_{Total\ Out}$ = (800 + 400)/2 = 600
$P_{Total\ In}$ = (838 + 462)/2 = 650

TEEER = ($P_{Total\ Out}$ / $P_{Total\ In}$) x 10
= (600 / 650) x 10
= 9.23

Power Amplifiers (Wireless)

Sectors = 3
Carriers = 8
RF Output Power/Carrier, measured at the input of the Antenna P1= 20.0W
Input Power/Watt of output power P2 = 11.425W
Total Input Power for 3 Sector, 8 Carriers Amplification=Sectors x Carriers x P1 x P2
= 3 x 8 x 20 x 11.425 W
= 5484W
Total RF Output Power for 3 Sector, 8 Carriers = Sectors x Carriers x P1
= 3 x 8 x 20 W
= 480W

TEEER = (Total RF Output Power / Total Input Power) x 10
= 480 / 5458 x 10
= 0.875