

ADTRAN[®], Inc.

NetVanta[®] 1335

Multiservice Access Router

WAN, LAN and Wireless LAN Performance and Feature Evaluation



Test Summary

Premise: *The complexity of network appliances and the performance and security demands of today's applications compel small- to medium-businesses (SMBs) and branch office network managers to deploy a device that consolidates multiple functions into a single managed platform. This reduces costs by simplifying the network. Such a multipurpose solution must provide key functionality, embrace security and seamlessly support converged applications to deliver the required performance.*

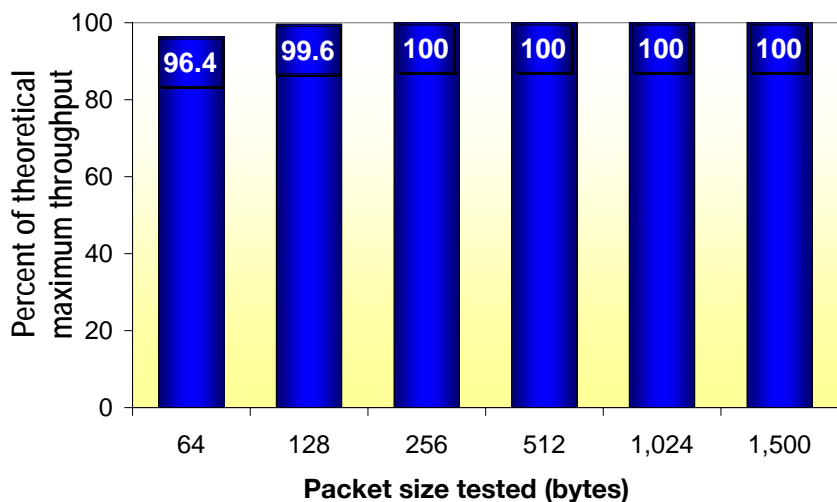
ADTRAN, Inc. commissioned The Tolly Group to evaluate the NetVanta 1335 Multiservice Access Router with integrated functionality such as modular WAN access, 802.11a/b/g Wireless Access Point (WAP), 24-port Layer 3 Power over Ethernet (PoE) switch, stateful inspection firewall, Quality of Service (QoS) and Virtual Private Networking (VPN) in one platform.

Tests measured the zero-loss bidirectional WAN throughput and VoIP call quality across a single T1 PPP connection with QoS and stateful inspection firewall active. Engineers also measured the throughput of the 24-port Layer 2/3 switch and 802.11a/b/g WAP. Lastly, engineers conducted Tolly Verified tests on key network and security features. Testing occurred in July 2007.

Test Highlights

- ▶ Integrates access router, wireless access router, Layer 2/3 PoE switch, firewall, VPN, DSU/CSU in one platform
- ▶ Achieves wire-speed bidirectional WAN throughput for packet sizes of 256 bytes or greater when tested across a single T1 PPP link with QoS and stateful inspection firewall enabled
- ▶ Achieves wire-speed throughput at Layer 2/3 on 24 Fast Ethernet ports in a full-mesh configuration
- ▶ Delivers 23.5/5.1/23.6 Mbps of TCP throughput for 802.11a/b/g wireless LANs, respectively
- ▶ Provides toll-quality VoIP using QoS in an oversubscription network scenario

Zero-Loss Bidirectional Throughput Across a Single T1 PPP WAN with QoS and Firewall Enabled as Reported by Spirent SmartFlow 5.5



Source: The Tolly Group, July 2007

Figure 1

Executive Summary

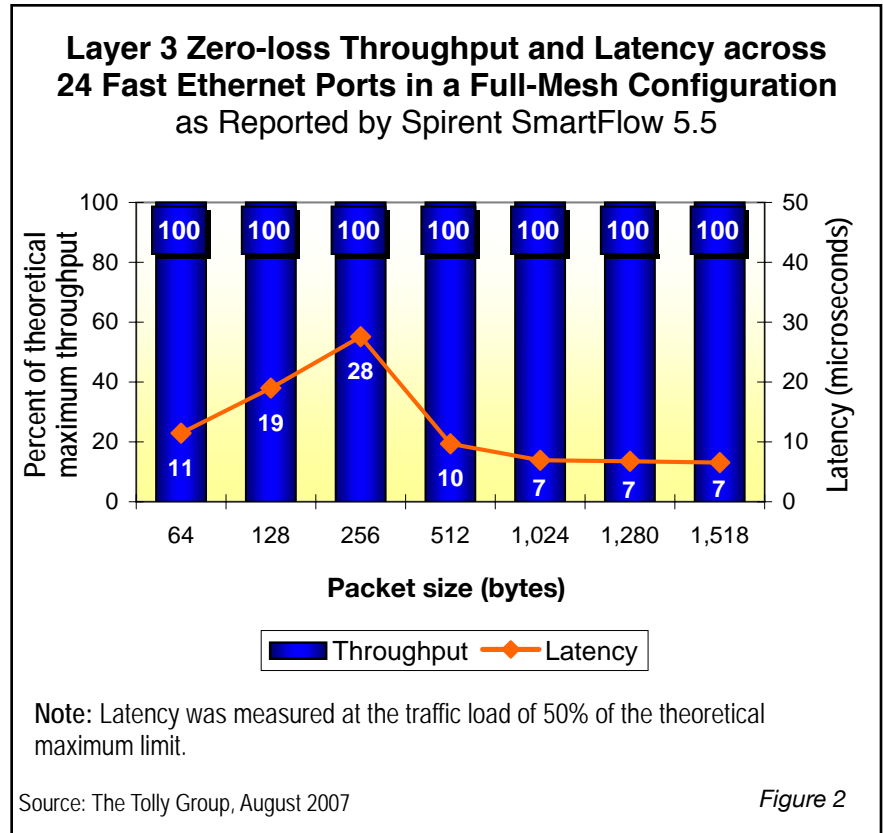
The ADTRAN NetVanta 1335 integrates diverse but important network functions into a single platform for SMB and enterprise branch offices, while providing the robust performance necessary for IP Telephony, corporate connectivity and Internet access.

Today's networks are more complex than ever and applications are demanding higher networking performance and stronger security. More attention needs to be paid to SMB and enterprise branch offices. These businesses require strong security and ample performance in environments where financial and resource issues often exist.

Multiservice network devices can simplify these networks by eliminating the need for multiple network devices. The NetVanta 1335 eliminates as many as six devices including access router, WAP, Layer 2/3 PoE switch, stateful inspection firewall, VPN and DSU/CSU. This can result in visible cost savings.

For this test, Tolly Group engineers focused on validating the performance and functionality of the ADTRAN NetVanta 1335.

Tests show the ADTRAN NetVanta 1335 seamlessly integrates as many as six key network functions — all the functions that are important to SMB and enterprise



branch office workers, while delivering ample performance and functionality.

In the access router test, engineers determined that the NetVanta 1335 provides 100% of the theoretical maximum throughput for a single T1 interface when handling packet sizes of 256 bytes or greater with stateful inspection firewall and QoS enabled.

In the Layer 2/3 Fast Ethernet switch performance test, engineers measured wire-speed throughput and low average latency in a 24 port, Fast Ethernet full-mesh configuration for all frame sizes tested.

In a test of VoIP call quality across the WAN connection, tests demonstrated that the NetVanta 1335 maintained toll-quality VoIP calls even in oversubscribed network conditions.

In a wireless LAN test, engineers measured TCP throughput that is considered to be nearly the maximum for 802.11a, 802.11b and 802.11g, respectively. Engineers

ADTRAN NetVanta 1335

First Unified Wired/Wireless Multiservice Access Router



NetVanta 1335

also generated simulated VoIP calls over the WLAN and proved that they were properly prioritized in the congested wireless LAN networks.

Lastly, the NetVanta 1335 earned 12 Tolly Verified (TV) feature certifications for RSTP, Link Aggregation, Power over Ethernet (PoE) and 802.1x support.

ZERO-LOSS THROUGHPUT OVER A T1 LINK

Tolly Group engineers measured zero-loss bidirectional throughput across a back-to-back WAN connection using a single T1 PPP link with QoS and firewall services active. With QoS and stateful firewall enabled, the NetVanta 1335 achieved 100% of the theoretical maximum throughput of a single T1 PPP link for the packet sizes of 256 bytes or higher. This equates to 3 Mbps of aggregate throughput. For smaller packet sizes, reported throughput was close to the theoretical maximum for a single T1 interface — 96.4% and 99.6% for 64 bytes and 128 bytes, respectively. (See Figure 1.)

This result shows that the NetVanta 1335 WAN performance is more than adequate for SMB and branch offices that commonly use a single T1 connection for Internet and corporate access.

VOIP CALL QUALITY

Engineers tested the VoIP call quality across the WAN (T1 PPP) connection with variable levels of background traffic, including oversubscription. To generate a simulated VoIP call and measure call-quality scores, engineers used an Ixia IxChariot VoIP module. This tool reports estimated Mean Opinion Scores (MOS) by gathering the performance statistics from the simulated VoIP call. The estimated MOS scores range from 1.0 to 4.5, with a score of 4.0 or higher representing toll quality. In this test, the NetVanta 1335 maintained toll quality voice by reporting 4.37 when injecting up to 200% of the

theoretical maximum throughput of a T1 link. (Traffic traversing a T1 link cannot exceed 100% of the theoretical maximum). Without QoS, call quality dropped to 1.0 at the 100% background traffic load. (See Figure 3.)

LAYER 2/3 ZERO-LOSS THROUGHPUT AND LATENCY

Engineers subjected the NetVanta 1335 to a typical Tolly Group Layer 2/3 performance test. They measured the zero-loss throughput and average latency by pairing 24 Fast Ethernet ports in a fully meshed pattern for packet sizes from 64 to 1,518 bytes. The NetVanta 1335 is equipped with one GbE uplink port, and 24 Fast Ethernet ports; the GbE port was not used for this test. In the throughput test, engineers measured zero-loss, wire-speed throughput (4.8 Gbps aggregate bidirectional throughput) for both Layer 2 and Layer 3 configurations. From the latency test, engineers measured 7 ~ 28 microseconds of average latency when processing 50% of the theoretical maximum load. What this means to SMB and branch office users is that they do not have to buy a separate Fast Ethernet switch to serve two dozen users. (See Figure 2.)

WIRELESS LAN THROUGHPUT AND VOICE OVER WLAN (VOWLAN)

The NetVanta 1335 achieved nearly the maximum TCP throughput possible for the standard 802.11a, 802.11b and 802.11g with Wi-Fi Protected Access (WPA) security. The NetVanta 1335 achieved throughput of 23.6 Mbps, 5.1 Mbps and 23.5 Mbps, respectively. This proves that the integration of a wireless AP into the wired platform does not degrade its native throughput. Engineers also verified that the

ADTRAN, Inc.

NetVanta
1335

Multiservice
Access Router
Performance and Functionality
Evaluation



Product Specifications

Vendor-supplied information not necessarily verified by The Tolly Group

NetVanta 1335

Performance

- 🔍 Up to 8.8 Gbps non-blocking capacity
- 🔍 45,000 PPS routing capacity
- 🔍 24 Fast Ethernet PoE ports
- 🔍 Copper and optical GbE port(s)

Access Router

- 🔍 Modular WAN: ADSL, Dual T1, T1, T1+DSX-1, E1, E1+G.703, DDS and SHDSL
- 🔍 Dial backup: Analog and ISDN
- 🔍 eBGP/iBGP, OSPF, RIP protocols

Switching

- 🔍 Spanning Tree, Rapid Spanning Tree
- 🔍 255 active VLANs (802.1Q)
- 🔍 802.3ad Link Aggregation
- 🔍 Layer 3 Switching up to 16 remote networks
- 🔍 802.3af & legacy PoE (15.4 watts/port)

Security

- 🔍 Stateful inspection firewall
- 🔍 500 IPsec tunnels (DES/3DES/AES)
- 🔍 Access control lists (ACL)
- 🔍 RADIUS and TACACS+ authentication

VoIP Ready

- 🔍 QoS: Class-based Weighted Fair Queuing, DiffServ Aware/Marking, Frame Relay Fragmentation
- 🔍 CoS: Weighted Round Robin, 802.1p, and DiffServ
- 🔍 Traffic Monitoring (NetFlow 9)

Wi-Fi

- 🔍 802.11a/b/g up to 54 Mbps
- 🔍 WMM QoS
- 🔍 WEP and WEP2 for advanced security

For more information contact:

ADTRAN
901 Explorer Blvd.
Huntsville, AL 35806
Phone: (256) 963-8000
URL:

<http://www.adtran.com/routers>

NetVanta 1335's wireless AP supports Wi-Fi Multimedia (WMM) and Virtual Access Point (VAP) technologies. These help to control wireless LANs by prioritizing high-priority traffic and segmenting or partitioning wireless networks.

For the Voice over Wireless LAN test, engineers generated simulated VoIP calls with simulated data traffic using an IxChariot tool. This created a congested wireless network. Consequently, a VoIP call with high priority (Expedited Forwarding) achieved a 4.36 estimated MOS score, but the VoIP call with low priority (Best Effort) measured only 2.8 in the congested scenario.

TOLLY VERIFIED (SWITCH FEATURES)

The NetVanta 1335 earned a "VoIP Capable Infrastructure" certification (TV

10501) from the previous test. Engineers verified nine different TV certifications. (See Figure 4.)

The NetVanta 1335 was awarded TV certifications for Rapid Spanning Tree Protocol (802.1w), Link Aggregation (802.3ad), VLAN (802.1Q), Dynamic VLAN - GVRP, Power over Ethernet (PoE) Provider and Storm Control core switching functions.

On the System Management and Security front, the NetVanta 1335 was awarded TVs for User Authentication via 802.1x, Secured Web Management, and Secured Shell (SSH) Access. Tolly Group engineers also verified the device's VPN capabilities by establishing an IPSec VPN tunnel (3DES/SHA-1 and AES(128)/SHA-1) in two units in a back-to-back configuration.

TEST SETUP & METHODOLOGY

Tolly Group engineers tested the ADTRAN NetVanta 1335 Multiservice Access Router version 15.02.00.E (Ver 16.01.00 E was

used for the zero-loss throughput over a single T1 link test) and Wireless Access Point version 1.0. The NetVanta 1335 was equipped with 24 Fast Ethernet PoE ports, one GbE uplink combo port, one WAP module with 802.11a/b/g dual radios and one dual-T1 Network Interface Module (NIM).

Tolly Group engineers used a Spirent SmartBits chassis (SMB-6000B), modules (LAN-3101A), SmartFlow 5.5 and SmartWindow 9.0 for major traffic generation/analysis and used Ixia IxChariot 6.0 for the wireless LAN test and VoIP call generation/analysis. All tests were run three times for 60 seconds and the results were averaged to obtain the final performance results.

For the zero-loss throughput over a single T1 link, engineers connected two NetVanta 1335 units in a back-to-back configuration across a simulated T1 PPP link with QoS and stateful firewall service enabled. In addition to the default firewall rules provided by the Net-

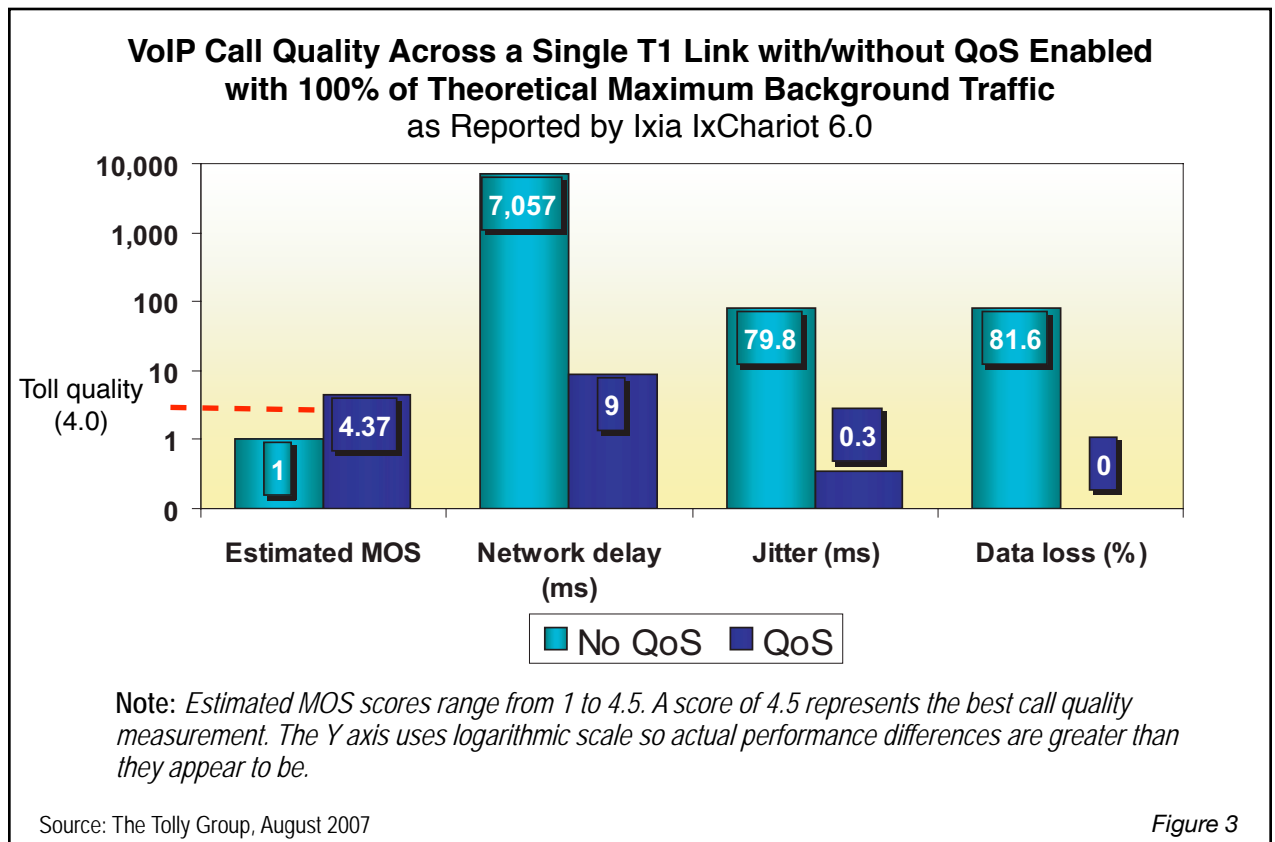


Figure 3

Vanta 1335, engineers added 10 more rules to the WAN port. Engineers used Smart-Bits SmartFlow to generate 100 symmetrical UDP flows with a unique MAC/IP address for each and measured the WAN throughput for packets ranging from 64 to 1,500 bytes.

For the VoIP call-quality test, engineers measured the estimated MOS scores in various network conditions. Engineers used the Ixia IxChariot for VoIP call simulation and for performance measurement, and SmartBits for background traffic across a T1 link. The different background traffic included 0%, 50%, 100% and 150% of the theoretical maximum throughput on a T1 link using a 512-byte packet size. Actual traffic traversing the WAN link did not exceed 100% of the theoretical maximum, but any background traffic over 100% created over-subscription scenarios and caused QoS to drop lower priority packets at the WAN egress port.

Engineers configured IxChariot to generate the VoIP packets with DSCP tagged. They configured IxChariot to tag VoIP packets for Best Effort and Expedited Forwarding for the “No QoS” and “QoS” test scenarios. The VoIP streams from IxChariot used a G.711u codec with default configurations.

For the zero-loss Layer 2/3 throughput and latency test, engineers connected the 24 Fast Ethernet ports on the switch to the SmartBits ports and configured the SmartBits to generate the simulated UDP flows in a full-mesh pattern for the packet sizes of 64, 128, 256, 512, 1,024, 1,280 and 1,518 bytes.

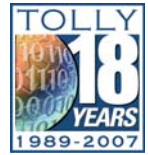
The wireless LAN test was conducted under ideal test

conditions with no noticeable radio interference and no distance effect. Engineers connected one laptop to the NetVanta 1335 wirelessly using 802.11a/b/g and the second laptop to one of the Fast Ethernet ports on the NetVanta 1335. Both laptops ran IxChariot Endpoint and one of them ran the IxChariot console. WPA-PSK was used for the security option throughout the test.

For the Voice over WLAN test, engineers used IxChariot to generate multiple data/VoIP streams over the 802.11g wireless link simultaneously to introduce congestion and measured the estimated MOS score. They used IxChariot’s canned “Throughput” script for data-oriented application simulation and its VoIP module to generate and analyze the simulated VoIP streams. Bidirectional traffic streams were generated for the measurement.

Full test methodology details of the various Tolly Verified certifications

The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.



The company is based in Boca Raton, FL and can be reached by phone at (561) 391-5610, or via the Internet at:

Web: <http://www.tolly.com>,
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earned by the NetVanta 1335 can be found at

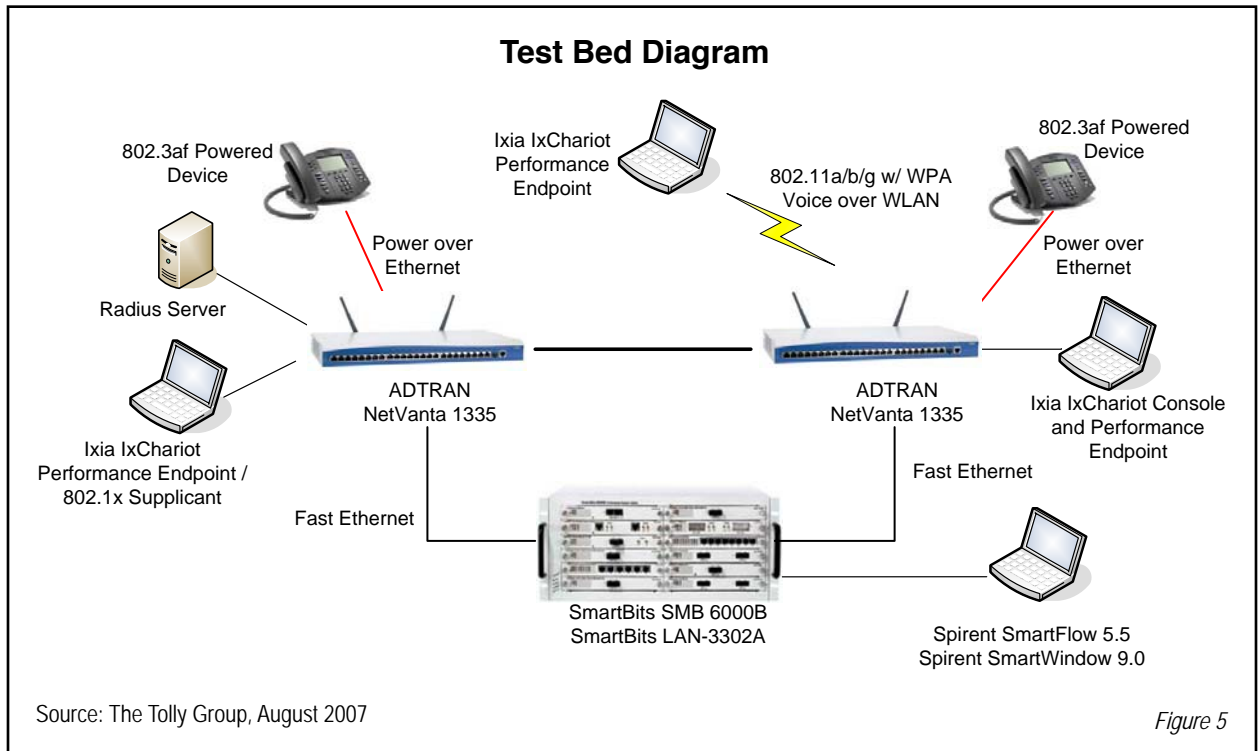
http://www.tolly.com/TV_Home.aspx.

ADTRAN NetVanta 1335 Tolly Verified Certifications Earned		
Certification ID	Certification	Category
10501	VoIP Capable Infrastructure	LAN Switch Core
10507	Rapid Reconfiguration Spanning Tree Support (IEEE 802.1w)	LAN Switch Core
10511	Link Aggregation (IEEE 802.3ad)	LAN Switch Core
10532	VLAN Support (IEEE 802.1Q)	LAN Switch Core
10836	Dynamic VLAN - GVRP Support	LAN Switch Core
10639	Power over Ethernet (PoE) Provider	LAN Switch Core
10853	Storm Control	LAN Switch Core
10636	Embedded Web Management via Secure Sockets Layer (SSL) or Transport Layer Security (TLS)	System Management
10559	User Authentication via IEEE 802.1X	System Security and User Management
10575	Secure Shell (SSH) Remote Access	System Security and User

Note: Figure shows only features validated by The Tolly Group, not the entire spectrum of ADTRAN NetVanta 1335 product features.

Source: The Tolly Group, August 2007

Figure 4



Test Equipment Summary

Vendor	Product	Web URL
Spirent Communications	SmartBits 6000B, SmartFlow 5.5	http://www.spirentcom.com
IXIA	IxChariot 6.0	http://www.ixiacom.com

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