

# Blade Network Technologies, Inc.



Test Summary

## Nortel Blade Switch Modules for IBM BladeCenter Functionality Certification and Cooperative Interoperability Evaluation

*Premise: Network managers who deploy a variety of Fast Ethernet, Gigabit Ethernet and 10GbE switching devices in their networks need guaranteed interoperability of these switches in order to maintain a functional network.*

**B**lade Network Technologies, Inc. commissioned The Tolly Group to evaluate its enterprise-class IBM Nortel LAN switches for interoperability with other brand switches.

Tolly Group engineers subjected three IBM Nortel switch modules — the Layer 2-3 GbE Switch Module, the 10Gb Uplink Ethernet Switch Module, and the 10Gb Ethernet Switch Module, to more than a dozen tests with switches from 3Com, Alcatel-Lucent, Cisco Systems, Enterasys, Extreme Networks, Foundry Networks, Fujitsu, and HP.

Engineers subjected the IBM Nortel switch modules to advanced LAN services tests, including support for 10/100/1000 auto-negotiation, 802.1p/Q VLAN tag propagation, RIP v2, OSPF, BGP4, Virtual Router Redundancy Protocol (VRRP), Rapid Spanning Tree Protocol (RSTP), Jumbo Frames, and others.

Tests were conducted in March/April 2007 at Terremark Worldwide Inc.'s world-class NAP of the Americas facility in Miami, a major Internet peering point for carriers and service providers.

### Test Highlights

IBM Nortel's switch modules:

- ▶ Earned more than 10 Switch Interoperability certifications for Layer 2 and Layer 3 advanced LAN functions
- ▶ Achieved broad Layer 2 and Layer 3 interoperability with 20 switches from nine vendors
- ▶ Interoperated with other devices tested when supporting 10-Gigabit Ethernet LAN PHY interface, 802.1p/Q VLAN tags, Link Aggregation, Multiple Spanning Tree, OSPF and BGP4 protocols, and more

### IBM Nortel Switch Modules by Blade Networking Technologies — Layer 2-3 Switch Features Tested

- 🔗 10/100/1000 Auto-Negotiation
- 🔗 10GbE LAN PHY Support
- 🔗 802.1p/Q VLAN Tag Propagation
- 🔗 Jumbo Frame Support
- 🔗 Link Aggregation Control Protocol (LACP)
- 🔗 Rapid Spanning Tree Protocol (RSTP)
- 🔗 Multiple Spanning Tree Protocol (MSTP)
- 🔗 RIPv2 Routing Protocol Support
- 🔗 OSPF Routing Protocol Support
- 🔗 BGP4 Routing Protocol Support
- 🔗 Virtual Router Redundancy Protocol (VRRP) Support

Source: The Tolly Group, April 2007

Figure 1

# Executive Summary

The IBM Nortel switches demonstrated broad interoperability with 20 other switches for advanced LAN and routing functions at Layer 2 and Layer 3.

In a world of ever-evolving standards and tight budgets, network managers searching for new equipment need to know that the switches they purchase are interoperable with their current infrastructures.

It is important for managers to know which devices can maintain interoperability with different standardized and non-standardized functions.

Engineers tested 23 switches from nine vendors to determine the various levels of interoperability offered.

For the various Layer 2 and Layer 3 features tested, IBM Nortel's Layer 2-3 GbE Switch Module, the 10Gb Uplink Ethernet Switch Module, and the 10Gb Ethernet Switch Module demonstrated broad interoperability with switches from 3Com, Alcatel-Lucent, Cisco Systems, Enterasys Networks, Extreme Networks, Foundry Networks, Fujitsu, and HP.

(Both the IBM Nortel and

HP switch modules were manufactured by Blade Network Technologies.)

See Figures 2 through 4 for detailed results for each IBM Nortel switch module.

## LAYER 2 FUNCTIONS

### AUTO-NEGOTIATION

Devices earning this certification have demonstrated the ability to establish the highest available

speed and duplex settings in all vendor combinations.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10600> for more details.

## 802.1P/Q VLAN TAG PROPAGATION

Devices earning this certification have demonstrated the ability to recognize and propagate 802.1Q VLAN ID and 802.1p VLAN priority tags across all vendor combinations tested.

Layer 2-3 Tolly Interoperability Certifications Awarded to IBM Nortel Layer 2-3 GbE Switch Module										
Certification	10/100/1000 Auto-Negotiation	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	Link aggregation	Rapid Spanning Tree Protocol support	Multiple Spanning Tree Protocol support	RIP v2	BGP4	OSPF	Virtual Router Redundancy Protocol (VRRP)
3Com Switch 4200G 24-Port	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
3Com Switch 4500G 24-Port	✓	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A
3Com Switch 5500G-EI PWR 48-Port	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
Alcatel-Lucent OmniSwitch 6850-P24X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alcatel-Lucent OmniSwitch 9800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cisco Catalyst 6509-E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys SecureStack A2*	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
Enterasys SecureStack B3*	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
Enterasys SecureStack C3*	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
Enterasys Matrix N DFE*	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
Enterasys Matrix X Secure Core Router	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extreme Summit X450a-24t	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extreme BlackDiamond 8806	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry FastIron Edge X424 Premium	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry FastIron SX 800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry NetIron MLX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry BigIron RX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fujitsu XG700	N/A	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A
Fujitsu XG2000	N/A	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A
IBM Nortel 10Gb Ethernet Switch Module	N/A	✓*	✓*	✓*	✓*	✓*	✓*	✓*	✓*	✓*
IBM Nortel 10Gb Uplink Ethernet Switch Module	✓	✓	✓	✓*	✓*	✓*	✓	✓	✓	✓
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem*	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓

✓ = PASS      N/A = Feature not supported  
 ✓\* = Not enough common physical interfaces between the switches  
 NOTE: (\*) Does not offer 10GbE uplink ports

Source: The Tolly Group, April 2007

Figure 2

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10601> for details.

**JUMBO FRAME SUPPORT**

Devices earning this certification have demonstrated the ability to transmit Jumbo Frames (9K bytes) across all tested vendor switch combinations.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10614> for details.

**10GbE LAN PHY SUPPORT**

This verifies that the device tested has the ability to transmit data between multiple vendors' 10 GbE interfaces.

In this test, IBM Nortel Layer 2-3 GbE Switch Module, four Enterasys models — SecureStack A2, B3, C3, and the Matrix N DFE, as well as the HP GbE2c L2/3 Ethernet Blade Switch were not tested since those devices did not offer the 10GbE support.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10615> for details.

**LINK AGGREGATION 802.3AD**

This test verifies a device's ability to trunk multiple switch ports across multiple vendor combinations using LACP.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10602> for details.

**RAPID SPANNING TREE PROTOCOL (802.1W)**

Devices earning this certification have demonstrated the ability to detect a failure of the Layer 2 Spanning Tree via the Rapid Spanning Tree protocol and to establish a new Layer 2 "tree."

In networks where multiple data paths exist, this approach provides a quicker re-establishment of traffic paths and dramatically reduces user downtime when compared with

**Blade Network Technologies, Inc.**

- IBM Nortel Layer 2-3 GbE Switch Module
- IBM Nortel 10Gb Uplink Ethernet Switch Module
- IBM Nortel 10Gb Ethernet Switch Module



**Layer 2/3 Feature Interoperability**

the recovery mechanism of traditional 802.1D Spanning Tree bridges/switches.

Layer 2-3 Tolly Interoperability Certifications Awarded to IBM Nortel 10Gb Ethernet Switch Module										
Certification	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	10GbE LAN PHY support	Link aggregation	Rapid Spanning Tree Protocol support	Multiple Spanning Tree Protocol support	RIP v2	BGP4	OSPF	Virtual Router Redundancy Protocol (VRRP)
3Com Switch 4200G 24-Port	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
3Com Switch 4500G 24-Port	✓	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A
3Com Switch 5500G-EI PWR 48-Port	✓	✓	✓	✓	✓*	✓*	✓	N/A	✓	✓
Alcatel-Lucent OmniSwitch 6850-P24X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alcatel-Lucent OmniSwitch 9800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cisco Catalyst 6509-E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys SecureStack A2*	✓*	✓*	N/A	✓*	✓*	✓*	N/A	N/A	N/A	N/A
Enterasys SecureStack B3*	✓*	✓*	N/A	✓*	✓*	✓*	N/A	N/A	N/A	N/A
Enterasys SecureStack C3*	✓*	✓*	N/A	✓*	✓*	✓*	N/A	N/A	N/A	N/A
Enterasys Matrix N DFE*	✓*	✓*	N/A	✓*	✓*	✓*	✓	N/A	✓	✓
Enterasys Matrix X Secure Core Router	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extreme Summit X450a-24t	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extreme BlackDiamond 8806	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry Fastron Edge X424 Premium	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry Fastron SX 800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry NetIron MLX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry BigIron RX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fujitsu XG700	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
Fujitsu XG2000	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
IBM Nortel Layer 2-3 GbE Switch Module*	✓*	✓*	N/A	✓*	✓*	✓*	✓	✓	✓	✓
IBM Nortel 10Gb Uplink Ethernet Switch Module	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem*	✓	✓	N/A	✓	✓	✓	✓	N/A	✓	✓

✓ = PASS      N/A = Feature not supported  
 ✓\* = Not enough common physical interfaces between the switches  
 NOTE: (\*) : Does not offer 10GbE uplink ports

Source: The Tolly Group, April 2007

Figure 3

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10603> for details.

**MULTIPLE SPANNING TREE PROTOCOL SUPPORT**

This test verifies a device’s ability to implement Multiple Spanning Tree instances on a switch port to selectively allow or block multiple VLANs, without blocking the entire traffic traversing the port.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10867> for details.

**LAYER 3 FUNCTIONS**

**RIP v2 ROUTING PROTOCOL SUPPORT**

This test verifies that the switches exchange IPv4 routing table information via the RIP v2 protocol.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10606> for more details.

**BGP4 SUPPORT**

Devices earning this certification demonstrated the ability to share routing information via BGP4 with all vendor combinations.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10608> for details.

**OSPF SUPPORT**

This test verifies a switch’s ability to share OSPF routing table data with other participating switches.

See

<http://www.tolly.com/TVProgDetail.aspx?ProgID=10607> for details.

**VRRP SUPPORT**

Devices earning this certification have demonstrated interoperability using VRRP in both Master and Back-up configurations with all possible vendor combinations. This verifies a device's ability to act as a standby router in the event of a primary router failure using VRRP standards in a multi-vendor network.

See <http://www.tolly.com/TVProgDetail.aspx?ProgID=10613> for more details.

<http://www.tolly.com/TVProgDetail.aspx?ProgID=10613> for more details.

**TEST SETUP AND METHODOLOGY**

Tolly Group engineers tested the IBM Nortel models Layer 2-3 GbE, 10Gb Uplink Ethernet, and 10Gb Ethernet Switch Modules.

Full details on the software version of the IBM Nortel Layer 2-3 GbE, 10Gb Uplink Ethernet, and 10Gb Ethernet Switch Modules tested, and informa-

Layer 2-3 Tolly Interoperability Certifications Awarded to IBM Nortel 10Gb Uplink Ethernet Switch Module											
Certification	10/100/1000 Auto-Negotiation	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	10-GbE LAN PHY support	Link aggregation	Rapid Spanning Tree Protocol support	Multiple Spanning Tree Protocol support	RIP v2	BGP4	OSPF	Virtual Router Redundancy Protocol (VRRP)
3Com Switch 4200G 24-Port	✓	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
3Com Switch 4500G 24-Port	✓	✓	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A
3Com Switch 5500G-EI PWR 48-Port	✓	✓	✓	✓	✓*	✓	✓	✓	N/A	✓	✓
Alcatel-Lucent OmniSwitch 6850-P24X	✓	✓	✓	✓	✓*	✓	✓	✓	✓	✓	✓
Alcatel-Lucent OmniSwitch 9800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cisco Catalyst 6509-E	✓	✓	✓	✓	✓*	✓	✓	✓	✓	✓	✓
Enterasys SecureStack A2*	✓	✓	✓	N/A	✓*	✓*	✓*	N/A	N/A	N/A	N/A
Enterasys SecureStack B3*	✓	✓	✓	N/A	✓*	✓*	✓*	N/A	N/A	N/A	N/A
Enterasys SecureStack C3*	✓	✓	✓	N/A	✓*	✓*	✓*	N/A	N/A	N/A	N/A
Enterasys Matrix N DFE*	✓	✓	✓	N/A	✓*	✓*	✓*	✓	N/A	✓	✓
Enterasys Matrix X Secure Core Router	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extreme Summit X450a-24t	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extreme BlackDiamond 8806	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry FastIron Edge X424 Premium	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry FastIron SX 800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry NetIron MLX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry BigIron RX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fujitsu XG700	N/A	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
Fujitsu XG2000	N/A	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A
IBM Nortel Layer 2-3 GbE Switch Module*	✓	✓	✓	N/A	✓*	✓*	✓*	✓	✓	✓	✓
IBM Nortel 10Gb Ethernet Switch Module	N/A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem*	✓	✓	✓	N/A	✓	✓	✓	✓	N/A	✓	✓

✓ = PASS      N/A = Feature not supported  
 ✓\* = Not enough common physical interfaces between the switches  
 NOTE: (°): Does not offer 10GbE uplink ports

Source: The Tolly Group, April 2007

Figure 4

tion on the other 20 switches can be found in Figure 5 below. Test bed topology for various tests is shown in Figure 6.

Terremark Worldwide’s NAP of the Americas facility in Miami, FL hosted the testing, and provided state-of-the-art power provisioning, management and cooling that were critical to a test of this scale. The Siemon Company provided custom length, reliable, high quality patch cables for the testing – 10G Augmented Cat 6 Shielded patch cables, and XGLO™ Singlemode Fiber Optic Cables.

**Product Specifications**

*Vendor-supplied information not necessarily verified by The Tolly Group*

**Blade Network Technologies, Inc.**

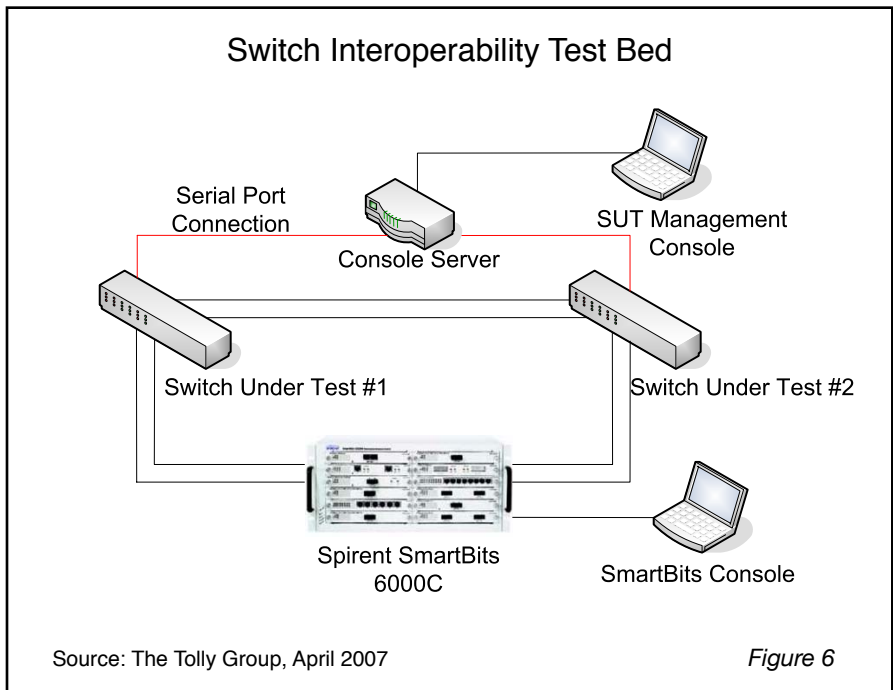
- IBM Nortel 10Gb Ethernet Switch Module:**  
**Uplinks:** 7 Ports: 6 10Gb (XFP) and 1 1Gb RJ-45 for management or data  
**Internal ports:** 2 Ports: 100Base-T mgmt. Ports, 14 Ports: 10Gb to servers  
**Full line rate performance:** 400 Gbps (Full Duplex)
- IBM Nortel 10Gb Uplink Switch Module:**  
**Uplinks:** 4 Ports: 3 10G (2 CX4, 1 XFP) and 1 1G RJ-45 SFP) for mgmt. or data  
**Internal ports:** 2 Ports: 100Base-T management ports, 14 Ports: 1000Base-CX to servers  
**Full line rate performance:** 90 Gbps (Full Duplex)
- IBM Nortel Layer 2-3 GbE Switch Module:**  
**Uplinks:** 6 Ports: 10/100/1000Base-T RJ45  
**Internal ports:** 2 Ports: 100Base-T management ports, 14 Ports: 1Gb to servers  
**Full line rate performance:** 40Gbps (Full Duplex)

**For more information contact:**  
 Blade Network Technologies, Inc.  
<http://www.bladenetwork.net>  
 Tel: (408) 850-8999  
 Fax: (408) 855-9550

The Tolly Group Switch Interoperability Study 2007		
Device Under Test (DUT) Information		
Device Under Test	SW Version	HW Revision (Chassis Revision for Modular Switch)
3Com Switch 4200G 24-Port	3Com OS V3.01.00s168	REV. B
3Com Switch 4500G 24-Port	3Com OS V5.01.00s168p01	REV. B
3Com Switch 5500G-EI PWR 48-Port	3Com OS V3.02.00s168	REV. C
Alcatel-Lucent OmniSwitch 6850-P24X	6.1.3.719.R01	06
Alcatel-Lucent OmniSwitch 9800 (OS9800-CMM, OS9-XNI-U2, OS9-GNI-C24)	6.1.3.719.R01	B05
Cisco Catalyst 6509-E (WS-SUP720-3BXL, WS-X6704-10GE, WS-X6748-GE-TX)	12.2(18)SXF4	1.2
Enterasys SecureStack A2H124-48	01.04.05	BCM5655 REV 18
Enterasys SecureStack B3G124-24	01.00.70	BCM56504 REV 19
Enterasys SecureStack C3G124-48	01.00.76	BCM56504 REV 19
Enterasys Matrix N1-DFE (7G4202-30)	05.35.16	0
Enterasys Matrix X4 Secure Core Router (X-CM-00-RH, X4-FM-RH, X-M2-00-RH, X-T32-00)	1.3.3	0
Extreme Summit X450a-24t	ExtremeXOS ver. 11.6.1.9	1.0
Extreme BlackDiamond 8806 (800112-00-20, 800116-00-02, 800159-00-04)	ExtremeXOS ver. 11.6.1.9	5.0
Fujitsu XG700	E10L10 XF0073 2005/10/26-13:14:42	
Fujitsu XG2000	E10L10 X12 2007/02/09-08:26:03	
Foundry FastIron Edge X424 Premium	03.2.00T3e3	
Foundry FastIron SX800 (SX-FI2XGMR4, SX-F424C)	03.2.00T3e3	
Foundry NetIron MLX (NI-MLX-MR, NI-MLX-10Gx4, NI-MLX-1Gx20-GC)	IronWare Ver. 3.3.0T163	
Foundry BigIron RX (RX-BI-MR, RX-BI-4XG, RX-BI-24C)	IronWare Ver. 2.3.0bT143	
IBM Nortel Layer2-3 GbE Switch Module (Copper)	1.2.5.0	1
IBM Nortel 10Gb Uplink Ethernet Switch Module	1.0.1.1	0
IBM Nortel 10Gb Ethernet Switch Module	1.0.1.1	5
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem	2.0.0	0A

Source: The Tolly Group, April 2007

Figure 5




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 <http://www.tolly.com>, [sales@tolly.com](mailto:sales@tolly.com)

## Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment used in this project.

Vendor	Product	Web
Spirent Communications 	SmartFlow 5.5, SmartWindow 9.0, SmartBits 6000C, SmartMetrics 10G Ethernet module XFP-3730A, SmartMetrics XD module LAN-3324A	<a href="http://spirentcom.com">http://spirentcom.com</a>

## Terms of Usage

**USE THIS DOCUMENT ONLY IF YOU AGREE TO THE TERMS LISTED HEREIN.**

*This document is provided, free-of-charge, to help you understand whether a given product, technology or service merits additional investigation for your particular needs. Any decision to purchase must be based on your own assessment of suitability.*

*This evaluation was focused on illustrating specific features and/or performance of the product(s) and was conducted under controlled, laboratory conditions and certain tests may have been tailored to reflect performance under ideal conditions; performance may vary under real-world conditions. Users should run tests based on their own real-world scenarios to validate performance for their own networks. Commercially reasonable efforts were made to ensure the accuracy of the data contained herein but errors and/or oversights can occur. In no event shall The Tolly Group be liable for damages of any kind including direct, indirect, special, incidental and consequential damages which may result from the use of information contained in this document*

*The test/audit documented herein may also rely on various test tools the accuracy of which is beyond our control. Furthermore, the document relies on certain representations by the sponsor that are beyond our control to verify. Among these is that the software/hardware tested is production or production track and is, or will be, available in equivalent or better form to commercial customers.*

*When foreign translations exist, the English document is considered authoritative. To assure accuracy, only use documents downloaded directly from The Tolly Group's Web site. All trademarks are the property of their respective owners.*