

WaveBlade Traffic Generation and Analysis (TGA) Modules



IxVeriWave's WaveBlade series provides a state-of-the-art, industry-first test solution for evaluating the functionality and performance of Ethernet and IEEE 802.11-based WLAN networking products. Designed for testing network infrastructure devices including consumer access points (AP) and reference designs, enterprise/carrier grade access points and controllers, and entire Wireless LAN (WLAN) networks, WaveBlades integrate both traffic generation/analysis and multi-path channel emulation capabilities on a single platform.

WaveBlade Wi-Fi (WBW) modules include:

- The WBW46014, WBW46014-L and WBW46024-L 11ac MIMO modules with support for WaveDynamix, WaveApps, WaveQoE and WaveAutomate
- The WBW3604 11ac 4-port SISO card allowing massive client scaling to 2,000 clients per blade and 16,000 clients per chassis using the IxVeriWave ATA

Ethernet Server WaveBlades provide a complete Layer 2-7 test module used to evaluate the functionality and performance of Ethernet-based networking products. Designed for testing network infrastructure devices such as access points, broadband home gateways, controllers, switches, and routers WaveBlade Ethernet (WBE) modules integrate traffic generation and analysis capabilities on a single platform. Each Ethernet WaveBlade port generates fully interleaved, multi-protocol IP traffic from hundreds of independent Ethernet clients or servers at wire-speed.

WaveBlade Wi-Fi 802.11a/b/g/n/ac and Ethernet line-cards fit into IxVeriWave's WT92 and WT20 chassis and interwork seamlessly with one another to provide complete functional and large-scale testing. Modules provide the essential tools necessary to complete various types of testing ranging from functional testing at the AP level to scale testing a large 802.11ac infrastructure network.

Highlights

- Up to 500 fully independent stateful clients per port
- WaveBlade Wi-Fi (WBW):
 - Highly scaled setup in a single test-bed to test real-world deployment levels of controllers, APs, and clients
 - Ease-of-use through simplified setup including single-click selection of desired channel model
 - Built-in channel models help determine real-world performance in six typical WLAN multi-path scenarios
- WaveBlade Ethernet (WBE):
 - Generates wire-speed stateful TCP traffic
 - Complete control over MAC and IP addressing scheme
 - Wire-speed flow generation
 - Real-time statistics to track more than 130,000 traffic flows
 - Industry-best packet capture
 - Ease-of-use through simplified setup

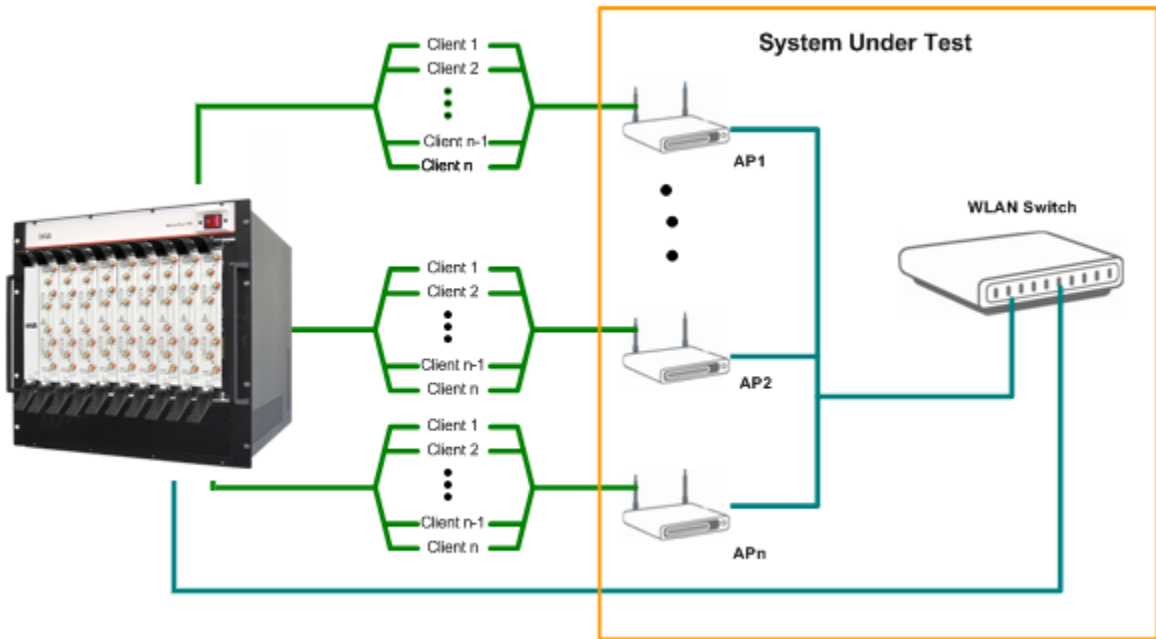


Figure 1: Typical lab test setup using WT90

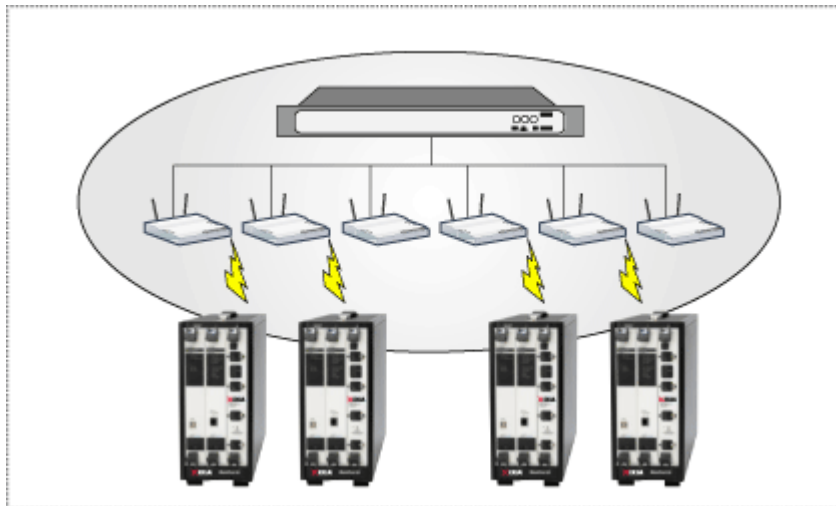


Figure 2: Open-air field test using WT20



Figure 3: WaveBlade Ethernet

Key Features

- WaveBlade Wi-Fi (WBW):
 - Up to 500 fully independent, stateful 802.11 clients per port enable precise measurement of critical performance metrics at data rates reaching up to maximum theoretical limits
 - Highly scaled setup in a single test-bed to test real-world deployment levels of controllers, APs, and clients
 - Ease-of-use through simplified setup including single-click selection of desired channel model to be used on clients in a wide-array of IxVeriWave Test Suites
 - Built-in channel models help determine real-world performance in six typical WLAN multi-path scenarios, per recommendations of IEEE 802.11n task group
 - Full support of IEEE 802.11 a/b/g/n/ac traffic generation and analysis simplified setup in a wide array of IxVeriWave Test Suites, applications, and WaveAutomation
- WaveBlade Ethernet (WBE)
 - Up to 500 fully independent Ethernet clients /subscribers or servers per port enable precise measurement of critical performance metrics at data rates reaching up to 1 Gbps
 - Capable of generating wire-speed stateful TCP traffic and other traffic including raw Ethernet frames, UDP, RTP etc.
 - Complete control over MAC and IP address scheme including automatic addressing and incremental addressing per user-defined step sizes
 - Wire-speed interleaved flow generation with unique ID, rate, timestamps, sequence numbers, data integrity signature, and flow group identifiers
 - Real-time statistics to track up to 131,072 traffic flows and 16 user customizable latency histogram buckets
 - Industry-best simultaneous bi-directional (TX/RX) wire-speed packet capture support of up to 256MB on each port
 - Ease-of-use through simplified set-up in a wide-array of IxVeriWave Test Suites and WaveAutomation

Wi-Fi Module Specifications

General Specifications						
Frequency Range / Channels Supported	2.4 GHz		1-14			
	4.9 GHz		21, 25			
	5.0 GHz		34, 36, 38, 40, 42, 44, 46, 48, 52, 56, 60, 64			
			100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140			
		149, 153, 157, 161, 165				
Channel Bandwidth		20 MHz, 40 MHz, 80 MHz				
PLCP Type		Legacy and Mixed Mode				
RF Connector(s)		Male 50 Ω SMA Connector				
	WBW46014	WBW46014-L	WBW46024-L	WBW3604	WBW1601P	WBW1604N
802.11 versions supported	a/b/g/n/ac			a/b/g/n/ac	a/b/g/n	a/b/g/n
Number of Test Ports per WaveBlade	1	1	2	4	1	4
MIMO Configuration	1x1, 2x2, 3x3 or 4x4			1x1	1x1	1x1
Maximum Number of Spatial Streams	4			1	1	1
SU/MU-MIMO Support	Both SU and MU MIMO	N/A	N/A	N/A	N/A	N/A

Baseband Control Specifications						
	WBW46014	WBW46014-L	WBW46024-L	WBW3604	WBW1601P	WBW1604N
Supported Modulation Schemes	DBPSK DQPSK CCK (4bits) CCK (8bits) BPSK (1/2) BPSK (3/4) QPSK (1/2) QPSK (3/4) 16-QAM (1/2) 16-QAM (3/4) 64-QAM(2/3) 64-QAM (3/4) 64-QAM (5/6) 256-QAM (3/4) 256-QAM (5/6)				DBPSK DQPSK CCK (4bits) CCK (8bits) BPSK (1/2) BPSK (3/4) QPSK (1/2) QPSK (3/4) 16-QAM (1/2) 16-QAM (3/4) 64-QAM(2/3) 64-QAM (3/4) 64-QAM (5/6)	
IEEE Channel Models	<ul style="list-style-type: none"> • By-pass mode - to not impose any channel conditions • Model A - typical home/small office environment • Model B - typical medium office environment • Model C - typical large office environment • Model D - typical open space environment • Model E - typical large open space environment • Model F - complex environment with many scatters 				N/A	
Supported CCK Preamble Types	Short and long					
OFDM guard Intervals	400 and 800 ns					
PLCP Type	Legacy and Mixed Mode					
Forward Error Correction	BCC(Viterbi) / LDPC			BCC(Viterbi)		

RF Frequency Control Specifications (WBW46014 / WBW46014-L / WBW46024-L / WBW3604)

Frequency Accuracy	Initial Accuracy	+/- 1.0 ppm
	Aging per year	+/- 1.0 ppm

RF Receiver Specifications (WBW46014 / WBW46014-L / WBW46024-L / WBW3604)

Rx Maximum Input Power Level	+15dBm
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RSSI Accuracy	+/- 1 dBm TYP (over input range of 0 to +15 dBm)
	+/- 2 dBm (over input range of -1 to -82 dBm)

Rx Minimum Sensitivity (typical)	Modulation	Coding Rate	Minimum sensitivity (dBm) 20 MHz channel Spacing	Minimum sensitivity (dBm) 40 MHz channel Spacing	Minimum sensitivity (dBm) 80 MHz channel Spacing	Modulation
		BPSK	1/2	-82	-79	-76
	BPSK	3/4	-81	-78	-75	BPSK
	QPSK	1/2	-79	-76	-73	QPSK
	QPSK	3/4	-77	-74	-71	QPSK
	16-QAM	1/2	-74	-71	-68	16-QAM
	16-QAM	3/4	-70	-67	-64	16-QAM
	64-QAM	2/3	-66	-63	-60	64-QAM
	64-QAM	3/4	-65	-62	-59	64-QAM
	64-QAM	5/6	-64	-61	-58	64-QAM
	256-QAM	3/4	-59	-56	-53	256-QAM
	256-QAM	5/6	-57	-54	-51	256-QAM
	Receiver performance criteria are based on achieving a frame error rate of less than 10% using 4096 octet frames.					

RX EVM	The relative constellation RMS error, averaged over subcarriers, OFDM frames and packets for a data rate of 64-QAM with a coding rate of 5/6 is less than -41dB(0.891%) TYP, -40dB(1%) MAX for power levels less than -10dBm.
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RF Transmitter Specifications (WBW46014 / WBW46014-L / WBW46024-L / WBW3604)				
Transmit Center Frequency Tolerance	Typical, 2.5ppm over all operating conditions			
Transmit Power	+14dBm to -50dBm			
Transmit Power Control Resolution	1 db			
Transmit Power Absolute Accuracy	<p>Any single frame shall be generated with an absolute accuracy of +/- 2dB measured over the burst of that frame.</p> <p>Multiple consecutive frames from the same client shall be generated such that the initial frame shall have an absolute accuracy of +/- 2dB. Subsequent frames from that client shall be generated with an absolute accuracy of +/- 1dB.</p>			
Transmit Constellation Error*	The relative constellation RMS error, averaged over subcarriers, OFDM frames and packets for a data rate of 64-QAM with a coding rate of 5/6 is less than:			
	Power level greater or equal to -10dbm		Power level less than -10dBm	
	Typical	Max	Typical	Max
	-35dB (1.778%)	-34dB (1.995%)	-39dB (1.122%)	--37dB (1.413%)
	*Measured on a per radio basis transmitting a single 20MHz spatial stream.			
Minimum Signal to Noise Ratio	Power	Bandwidth (MHz)		
	(dBm)	20	40	80
	-34 to +15	62 dB	59 dB	56 dB
	-40 to -35	57 db	54 dB	51 dB
	Below -41	Power + 97 (dB)	Power + 94 (dB)	Power + 91 (dB)

Feature Specifications	
Aggregation	Tx and Rx: A-MPDU and Block-ACK Rx only: A-MSDU
Traffic Timestamp Accuracy	50 nS
Maximum Number of Stateful Clients	500
Maximum Number of Traffic Flows Generated per Port	1000
Maximum Number of Traffic Flows Analyzed per Port	131,000
802.11 MAC Control (all parameters)	Independent per client
802.1ax Authentication	PEAP/MSCHAPv2, TLS, LEAP/EAP-FAST, TTLS
Encryption Support	WEP-40 and WEP-104, TKIP (WPA), AES-CCMP (WPA2)
OSI Layer 3 and Layer 4 (IP, UDP, TCP, etc.) Control (all parameters)	Independent per client
Port Counters	Comprehensive set of layer 2, 3 and 4 frame types
Flow and Flowgroup Counters	Frames sent / received, bytes sent / received, out-of-order frames, payload integrity, latency histogram
IPv6	<ul style="list-style-type: none"> • NDP: Neighbor/router discovery and address assignment • ICMPv6 & DHCPv6 • Multicast Listener Discover (MLDv1, MLDv2) • Dual stack operation of both IPv4 and IPv6 • UDP, RTP, stateful TCP, and multicast flows • Max of 32 IPv6 addresses per client: One Link-local, up to 31 Global
Capture Buffer	256 Mbytes Captures all transmitted and received frames during normal testing. Adds IxVeriWave RadioTap header to provide additional debugging information such as PHY rate, RF power, aggregation, detected errors on per-frame basis

Physical Specifications						
	WBW46014	WBW46014-L	WBW46024-L	WBW3604	WBW1601P	WBW1504N
Weight	5.0 lbs (2.27 kg)				2.5 lbs (1.13 kg)	3.0 lbs (1.36 kg)
Size	Height: 10.5 inches (26.7 cm) Width: 1.6 inches (4.1 cm) Depth: 15.5 inches (39.4 cm)					
Mounting screw torque	3.5 inch-lbs					
SMA Cable torque	8 inch-lbs					
Environmental Specifications (As installed in a WaveTest 92 or WaveTest 20 chassis)						
Operating Temperature	0° to +40° C Storage: -20° to +70° C					
Guaranteed Temperature Specification	+20° to +30° C ambient					
Storage Temperature	-20° to +70° C					
Humidity	Operating: 20% to 80% relative humidity Storage: +40° C at 95% relative humidity, non condensing					
Altitude	Operating: -1000 ft. to +6560 ft. (2000 meters)					
Vibration, random	Operating: 5 Hz to 500 Hz, 0.27 Gms Non-operating: 5 Hz to 500 Hz, 2.3G					
Shock	20 G shock tolerance					
RF Isolation	Isolation: > 80 dBm isolation between WaveBlade WiFi radios					

Power Specifications					
WBW46014	WBW46014-L	WBW46024-L	WBW3604	WBW1601P	WBW1604N
125 Watts	125 Watts	150 Watts	125 Watts	60 Watts	90 Watts
Certifications					
Product Safety Compliance	Listed TUV-USA and TUV-Canada Low Voltage Direction EN6101-1:2010				
Electromagnetic Compliance	EU EMC Directive 89/336/ECC, as amended EN 61000-6-2:2001: Class B Radiated Emissions EN 55011(AMD. A1:199) Class B Conducted Emissions EN 61000-3-2:2000: Current Harmonics EN 61000-3-3:2001: Voltage Fluctuations EN61000 -6-2:2001: Immunity Class A part 15 FCC Standards for Radiated and Conducted Emissions				

Ethernet Module Specifications

	WBE 1601	WBE 1604
Number of ports	1	4
Maximum number of ports per chassis	9	36
Number of interleaved flows (per WaveBlade)	1000	4000
Connector type	RJ45	
Ethernet PHY type	10/100/1000 Mbps	
Transmit capability	Wire-speed hardware frame generation with timestamps, sequence numbers, data integrity signature, and flow group Identifiers	
Receive capability	Wire-speed frame filtering, data integrity, and sequence checking, capture, real-time latency measurement on each flow	
Maximum number of stateful clients	500	500 per port

	WBE 1601	WBE 1604
per port		2,000 total per Wave-Blade
User defined field modifier (per flow)	Increment or decrement by user-defined step; up to 256 bytes from start of frame	
Frame length control	Fixed, increment by user-defined step or automatic	
Statistics and rate counters	Link State, Line Speed, Frames Sent, Signature Valid Frames Received, Signature Error Frames Received, Bytes Sent/Received, Fragments Received, Undersize, Oversize, VLAN Tagged Frames, Per User Priority QoS counters, FCS errors, Bad Sequence Errors, Bad Payload Checksum, ARP, DHCP and Ping requests and replies, IP/ICMP/UDP/TCP checksum errors, IP Multicast packets, Sent/Received IP Packets	
Flow analysis	Real-time statistics to track up to 131,072 flows	
Time-stamp accuracy	50 ns resolution	
IPv4, UDP, TCP	Hardware checksum generation	
IPv6	NDP: Neighbor/router discovery and address assignment ICMPv6 & DHCPv6 Multicast Listener Discover (MLDv1. MLDv2) Dual stack operation of both IPv4 and IPv6 UDP, RTP, stateful TCP, and multicast flows Max of 32 IPv6 addresses per client: One Link-local, up to 31 Global	
Physical Specifications		
	WBE1601	WBE1604
Weight	2.5 lbs (1.33 kg)	3.0 lbs (1.36 kg)
Size	Height: 10.5 inches (26.7 cm) Width: 1.6 inches (4.1 cm) Depth: 15.5 inches (39.4 cm)	
Mounting screw torque	3.5 inch-lbs	

Environmental Specifications (As installed in a WaveTest 92 or WaveTest 20 chassis)

Operating Temperature	0° to +40° C Storage: -20° to +70° C
Guaranteed Temperature Specification	+20° to +30° C ambient
Storage Temperature	-20° to +70° C
Humidity	Operating: 20% to 80% relative humidity Storage: +40° C at 95% relative humidity, non condensing
Altitude	Operating: -1000 ft. to +6560 ft. (2000 meters)
Vibration, random	Operating: 5 Hz to 500 Hz, 0.27 Gms Non-operating: 5 Hz to 500 Hz, 2.3G
Shock	20 G shock tolerance

Power Specifications

WBE1601	WBE1604
125 Watts	125 Watts

Certifications

Product Safety Compliance	Listed TUV-USA and TUV-Canada Low Voltage Direction EN6101-1:2010
Electromagnetic Compliance	EU EMC Directive 89/336/ECC, as amended EN 61000-6-2:2001: Class B Radiated Emissions EN 55011(AMD. A1:199) Class B Conducted Emissions EN 61000-3-2:2000: Current Harmonics EN 61000-3-3:2001: Voltage Fluctuations EN61000 -6-2:2001: Immunity Class A part 15 FCC Standards for Radiated and Conducted Emissions

Calibration

The WBW modules are calibrated at the factory and maintain advertised specifications. Customers can elect to recalibrate WBW modules depending on their specific requirements.

Minimum Requirements

IxVeriWave Test System	1 x IxVeriWave WaveTest 92™ or WaveTest 20™ system
Host Computer	x86-based PC with 2 GHz processor and 8 GB RAM Windows 7, or Linux (2.6 or higher kernel level) with Web Browser installed to manage the WaveBlade

Ordering Information

980-2053-02

IxVeriWave WBW46014, 1 port, 4 spatial stream per port, IEEE 802.11ac L2 - L7 multi-client High Performance Traffic Generator and Performance Analyzer with LDPC and MU-MIMO Support

980-2068-01

IxVeriWave WBW46014-L, 1 port, 4 spatial stream per port, IEEE 802.11ac L2 - L7 multi-client High Performance Traffic Generator and Performance Analyzer with LDPC

980-2085-01

IxVeriWave WBW46024-L, 2 port, 4 spatial stream per port, IEEE 802.11ac L2 - L7 multi-client High Performance Traffic Generator and Performance Analyzer with LDPC

980-2050-01

IxVeriWave WBW3604, four port, single spatial stream per port (SISO), IEEE 802.11ac L2 - L7 multi-client Traffic Generator and Performance Analyzer

980-2009-01

IxVeriWave WBW1601P, High Power SISO Single port WaveBlade WiFi 802.11a/b/g/n; multi-client IPv6-capable Traffic Generator/Performance Analyzer for 802.11 a/b/g/n networks, includes Standard Accessory Package C

980-2010-01

IxVeriWave WBW1604N, 4-port Low Power SISO WaveBlade WiFi 802.11a/b/g/n; multi-client IPv6-capable Traffic Generator/Performance Analyzer for 802.11n networks, includes Standard Accessory Package A

980-2011-01

IxVeriWave WBE1601, 1-port WaveBlade Ethernet; multi-client IPv6-capable Traffic Generator / Performance Analyzer for 10/100/1000 Mbps Ethernet networks

980-2012-01

IxVeriWave WBE1604, 4-port WaveBlade Ethernet; multi-client IPv6-capable Traffic Generator / Performance Analyzer for 10/100/1000 Mbps Ethernet networks