Keysight WaveTest 6
Wi-Fi 6 Test Platform

Problem: Measuring Wi-Fi 6 Performance Gain Under Deployment Conditions

Benchmarking Wi-Fi 6 AP performance requires a strong handle on several factors that influence the outcome – client scale, client-mix, client capabilities, traffic, QoS, SNR/RSSI, etc. Modeling real-world deployments in the lab and pushing APs to its limits just got more complex with Wi-Fi 6 and OFDMA. Testbeds relying solely on real clients or commercial chipsets often fall short creating enough variations and driving Wi-Fi networks to its limits.

Simulation is just one part of the story, accurate real-time measurements are critical to understanding system issues. Wi-Fi 6 promises to improve user experience by lowering latency and improving throughput. With ever-decreasing latency budgets, there is very little tolerance for error. Measuring KPIs in software often results in inaccuracies.

Highlights

- High performance Wi-Fi 6 validation with industry's only purpose-built Wi-Fi 6 test solution

- Benchmark OFDMA and scheduler performance at high scale – 500 clients per port,

- Simulate real-world Wi-Fi conditions with precise control over individual client configuration

- Line-rate traffic performance measurement of Access Points across all common configurations

- Validate Wi-Fi performance across all Wi-Fi generations 6, 5, 4 & Legacy (a/b/g) from a single platform

- Accelerate troubleshooting with comprehensive real-time statistics and powerful capture analysis tools

WaveTest 6

Solution: Purpose-Built, Scalable, Multi-User OFDMA Wi-Fi 6 Tester

WaveTest 6 is the industry's first purpose-built solution capable of modeling realistic deployment scenarios and measuring multi-user OFDMA performance gain. Each WaveTest 6 can scale up to 2000 stateful clients (in multi-port mode) and is capable of handling concurrent RU allocations across all combinations. This purpose-built hardware is designed for benchmarking APs across all client configurations.

The key is to validate the access point (AP) scheduler performance by modeling the real-world network with a diverse Wi-Fi 6 and legacy client mix at varying distances from the access point. WaveTest 6 provides complete control of Wi-Fi client attributes. Real-time statistics provide critical insights that help to correlate the Wi-Fi 6 network performance across layers. A single capture view helps you debug and diagnosis multi-user OFDMA issues. With full client and test control combined with advanced analysis, this enables quicker time to resolution of problems and faster verification of Wi-Fi 6 features.

WaveTest 6 integrates client simulation, traffic generation/analysis and multi-user OFDMA packet capture capabilities in a single platform, making it a very powerful, one-stop solution for validating 802.11-based products.

WaveTest 6

The Keysight WaveTest 6 is a high-performance test solution that provides multi-client emulation for testing Access Points (APs). The WaveTest 6 delivers powerful independent Wi-Fi benchmarking, functional, soak, and stability testing for wireless local area network (WLAN) APs and home gateways.

Wi-Fi 6 is the next-generation wireless standard that's faster than 802.11ac and introduces technology (such as Orthogonal Frequency-Division Multiple Access or OFDMA) to improve capacity, latency and efficiency in high challenge and congested areas. In dense client environments, the IEEE (Institute of Electrical and Electronic Engineers) goals for Wi-Fi 6 is to increase the per-user throughput by 4x while simultaneously lowering latency, thereby improving the overall user experience. With OFDMA Wi-Fi 6 can now divide a wireless channel into many subchannels. Each of these subchannels service multiple stations simultaneously.

The Keysight WaveTest 6 is a next-generation test tool that is capable of simulating multi-user OFDMA at scale to fully validate the functionality and performance gain promised by Wi-Fi 6 technology. With full client control testing, the WaveTest 6 provides repeatable results and all tests are automatable and easy to configure. To accelerate development, extensive visibility and debugging is also provided.

The WaveTest 6 is built from the ground up to simulate multiple fully stateful 802.11 clients with the capability of testing access points to theoretical limits and beyond. The high performance of the WaveTest 6 provides verification of the access point's scheduler performance and insight into OFDMA performance at the protocol level. Key features of the WaveTest 6 include full configurability and control of clients and full automation while giving consistent and reliable results.

Golden Client

The Golden Client in WaveTest 6 enables various types of validation, ranging from functional testing at the AP level to scale testing for large 802.11 infrastructure networks.

- Up to 2000 fully independent and stateful 802.11 clients per port enables precise measurement of critical performance metrics at data rates reaching maximum theoretical limits
- Large-scale system testbed to validate real-world deployment levels of controllers and Aps
- High accuracy in timing for client generation to produce reliable and repeatable results.
- Full support of IEEE 802.11a/b/g/n/ac/ax client simulation, traffic generation, and analysis through simplified setup in a wide array of IxVeriWave test suites, applications, and WaveAutomation

Ethernet Server

WaveTest 6 Ethernet Server capability provides a complete Layer 2-7 test module used to evaluate the functionality and performance of Ethernet-based networking products. Each Ethernet port generates fully interleaved, multi-protocol IP traffic from hundreds of independent Ethernet clients or servers at wire-speed.

Key Features

- 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 10Gbps
- Capable of generating wire-speed UDP and RTP traffic including raw Ethernet frames
- 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 4,000 traffic flows and 16 user-customizable latency histogram buckets
- Industry-best simultaneous bi-directional (TX/RX) wire-speed packet capture support of 1GB on each port
- Ease of use through simplified set-up in a wide array of IxVeriWave Test Suites and WaveAutomation

Test Environment

Wi-Fi testing of an AP Under Test is best performed in a fully controlled environment without interference from other devices. That way, results achieved truly reflect the Device's operation under the best case. IxVeriWave provides mechanisms like interference (requires WBX5/RFX5 WaveBlade) that enable testing of real-world operation in a controlled, repeatable way. IxVeriWave test equipment is designed for a lab environment – that includes the AP under test being isolated inside a RF chamber. The ideal setup is an in-cable connection, where IxVeriWave is cabled directly to the AP using high quality SMA cables (provided). Where direct SMA connection is not possible, IxVeriWave provides Near field antennas that can stick to the outside of the Device for close connection. Uses of the Device isolated within a chamber where the distance from antennas (for example, dipole) to the device <3ft/1m is permitted.

This is Over-The-Air (OTA) (Device output power - RSSI at IxVeriWave) should not be higher than within a chamber, and measured loss 50dB.

The use of IxVeriWave OTA in larger walk-in-chambers or directly OTA in a large lab is not supported.

Specifications

WaveTest 6 Specifications		
General Characteristics		
802.11 Versions	802.11a/b/g/n/ac/ax	
Frequency Range / Channels	2.4 GHz: 1-14	
	4.9 GHz: 20-26	
	5.0 GHz: 36, 38, 40, 42, 44, 46, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144, 149, 153, 157, 161, 165	
Channel Bandwidth	20 MHz, 40 MHz, 80 MHz	
OFDMA	Uplink, Downlink OFDMA	
PLCP Type	Legacy, HT, VHT, HE	
RF Connector(s)	Male 50 Ω SMA Connector	
MIMO Configurations	1 port of up to 4x4, 3x3, 2x2, 1x1	
Maximum Number of Spatial Streams	4	
OTA Testing	Keysight RF Isolation Chambers	
Baseband Control Characteristics		
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), 1024-QAM (3/4), 1024-QAM (5/6)	
Supported CCK Preamble Types	Short and long	
OFDM Guard Intervals	400, 800, 1600, and 3200 ns	
Forward Error Correction	LDPC / BCC(Viterbi)	
RF Frequency Control Characteristics		
Frequency Accuracy (Nominal)	Initial Accuracy	+/- 1.0 ppm
	Aging per year	+/- 1.0 ppm

WaveTest 6 Specifications

RF Receiver Characteristics

Rx Maximum Input Power Level	+0 dBm
RSSI Accuracy **(Nominal)**	+/-2.9 dBm for power levels between +0 to -25 dBm
Rx Minimum Sensitivity **(Nominal)**	Min Rx Input power -40dBm Range 40dB
RX EVM **(NOMINAL)**	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 -36 dB for power levels between +0 dBm to -25 dBm

RF Transmitter Characteristics

Transmit Center Frequency Tolerance **(NOMINAL)**	2.5ppm over all operating conditions
Transmit Power	+20 dBm to -60 dBm
Transmit Power Control Resolution	1 dB
Transmit Power Absolute Accuracy **(NOMINAL)**	Any single frame shall be generated with an absolute accuracy of +/-1.75 dB measured over the burst of that frame for power levels between +14 dBm to -30 dBm
Transmit Constellation Error **(NOMINAL)**	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 -35 dB for power levels between +14 dBm to -30 dBm

Minimum Signal to Noise Ratio **(Nominal)**	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	Input Power +97 dB	Input Power +94 dB	Input Power +91 dB

RF Isolation

Isolation: > 80 dBm isolation between Wi-Fi radios

WaveTest 6 Specifications	
Feature Characteristics	
Aggregation	Tx and Rx: A-MPDU and Block-ACK
Traffic Timestamp Accuracy	50 ns
Maximum Number of Stateful Clients per Port	500
Maximum Number of Traffic Flows Generated per Port	1000
Maximum Number of Traffic Flows Analyzed per Port	4000
802.11 MAC Control (all parameters)	Independent per client
802.1x Authentication	PEAP/MSCHAPv2, TLS, LEAP/EAP-FAST, TTLS
OSI Layer 3 and Layer 4 (IP, UDP, etc.) Control (all parameters)	Independent per client
Port Counters	Comprehensive set of Layer 2, 3, and 4 frame types
Flow and Flow group Counters	Frames sent / received, bytes sent / received, out-of-order frames, payload integrity, latency histogram
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 and multicast flows • Max of 32 IPv6 addresses per client: One Link-local, up to 31 Global
Capture Buffer	• 1 GB • Captures all transmitted and received frames during normal testing • Adds IxVeriWave Radio Tap header to provide additional debugging information such as PHY rate, RF power, aggregation, detected errors on per-frame basis

WaveTest 6 Specifications	
Signal/Frame Generation Controls	
Frame Generation	Encoding
	Length
	Frame Transmission Rate
Modulation	a/b/g/n/ac/ax PHY Rates
	Preamble
	FEC
Ethernet Specifications	
Number of Ports	2
Number of Interleaved Flows	2000
Connector Type	RJ45
Ethernet PHY Type	1/2.5/5/10 Gbps 10GBASE-T
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 per Port	• 500 per port • Up to 1,000 total
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,

WaveTest 6 Specifications	
	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, checksum errors, IP Multicast packets, Sent/Received IP Packets
Flow Analysis	Real-time statistics to track up to 4000 flows
Time-Stamp Accuracy	50 ns resolution
IPv4, UDP	Hardware checksum generation
IPv6	• NDP: Neighbor/router discovery and address assignment • ICMPv6 and DHCPv6 • Multicast listener discover (MLDv1. MLDv2) • Dual-stack operation of both IPv4 and IPv6 • UDP, RTP and multicast flows • Max of 32 IPv6 addresses per client: One Link-local, up to 31 Global
Physical Specifications	
Weight	85 lbs. (38.6 kg)
Size	• Height: 7 inches (17.7 cm) [4U] • Width: 18.8 inches (47.7 cm) • Depth: 30.9 inches (78.6 cm)
Mounting Screw Torque	3.5 inch-lbs
SMA Cable Torque	4 inch-lbs
Environmental Characteristics	
Note: This product is intended for indoor use only	
Temperature	Operating +15ºC to +35ºC ambient Storage: -40ºC to +70ºC
Humidity	95% relative humidity up to +35ºC (non-condensing)
Altitude	4600 meters (approx. 15,000 feet)

WaveTest 6 Specifications	
Acoustic statement	(European Machinery Directive) Acoustic noise emission LpA up to 90 dB, Operator position, Normal operation mode per ISO7779
Stress	Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include, but are not limited to, temperature, humidity, shock, vibration, altitude, and power line conditions; test methods are aligned with IEC 60068-2 and levels are similar to MILPRF-28800F Class 3
Power Specifications	
Max Power	1400 W
Power	100/120, 220/240 Vac; 50/60Hz This instrument can operate with mains supply voltage fluctuations up to 10% of nominal voltage
Certifications	
Safety	Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates and editions are citied in the Declaration of Conformity): • IEC/EN 61010-1 • Canada: CSA C22.2 No. 61010-1 • USA: UL std no. 61010-1
EMC	Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): • IEC/EN 61326-1 • CISPR 11 Group 1, Class A • AS/NZS CISPR 11 • ICES/NMB-001
South Korean Class A EMC declaration	This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference. 사 용 자 안 내 문

WaveTest 6 Specifications
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서   가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.   ※ 사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.

Functional Test Certification

The WaveTest 6 will undergo functional test certification before shipment to ensure the equipment performs as expected under Ixia's procedures. WaveTest 6 performance characteristics are detailed in this datasheet. The functional test certification includes RF radio functional tests. Customers can elect to recertify their WaveTest 6 chassis depending on their specific requirements. It is recommended that WaveTest 6 is returned on a yearly basis for functional test certification to ensure continued as expected operation.

Definitions

Characteristics describe product performance that is useful in the application of the product but is not covered by the product warranty. They describe performance that is typical of the majority of a given product but is not subject to the same rigor associated with specifications.

Nominal describes non-warranted product performance and provides an indication of expected performance of the product.

Reference Keysight publication 5991-1732:

https://literature.cdn.keysight.com/litweb/pdf/5991-1732EN.pdf

Ordering Information

980-2092

Ixia IxVeriWave WaveTest 6, high-performance Wi-Fi traffic generator and performance analyzer. Supports Wi-Fi 6, 5, 4 and legacy Wi-Fi operation. Requires: IxVeriWave software bundle (980-3081).

wavetel
a simac group company

WAVETEL PARIS | RENNES | LARMOR-PLAGE | LANNION
Espace du Ter - 13 Boulevard Jean Monnet - 56260 LARMOR-PLAGE

+33(0)2 99 14 69 65 - sales@wavetel.fr - www.wavetel.fr

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

KEYSIGHT
TECHNOLOGIES