

NETGEAR Wi-Fi 6 AX5400 Dual-band Multi-Gig PoE Access Point (WAX625)

Performance vs. Aruba, Meraki and Ubiquiti

EXECUTIVE SUMMARY

Wi-Fi 6 brings WLAN performance to a new level with aggregate throughput potential measured in Gigabits per second. While price points of early products were focused on Enterprise customers, NETGEAR brings Enterprise-class performance into the small-medium business (SMB) price range.

NETGEAR commissioned Tolly to benchmark the performance of its AX5400 Dual-band Multi-Gig PoE Wi-Fi 6 WAX625 Access Point (AP) and comparable APs from Aruba (HPE), Meraki (Cisco) and Ubiquiti. Competing APs were all dual-band, 2.4GHz/5GHz models. Uplink topologies included 1, 2.5, and 5GbE. Performance tests encompassed low-client density, maximum throughput tests, and high-client density scenarios supporting both latency-sensitive VoIP traffic and video streaming.

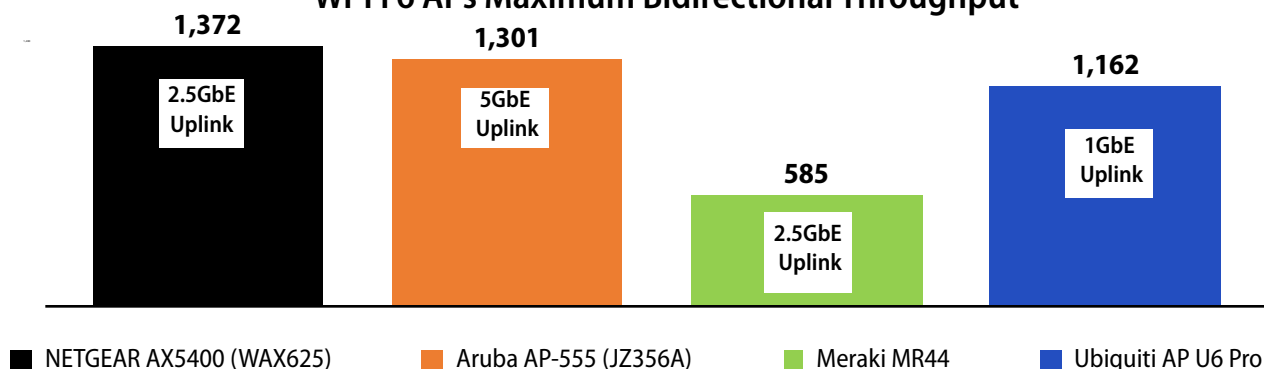
The NETGEAR WAX625 Access point delivered the highest throughput in three of the four test scenarios. In the fourth scenario, the NETGEAR AP results were almost identical to the Aruba AP costing nearly 7x that of NETGEAR.

THE BOTTOM LINE

NETGEAR WAX 625 delivered:

- 1 Highest bidirectional traffic throughput in maximum throughput test
- 2 Highest upstream traffic throughput in maximum throughput test
- 3 Highest throughput in high-density test while maintaining excellent voice quality
- 4 High density test support for 50 simultaneous clients where Ubiquiti could only support 44 simultaneous clients, and Meraki could only support 25 simultaneous clients

Wi-Fi 6 APs Maximum Bidirectional Throughput



Note: Total of six lxChariot clients were used with two 2.4GHz clients and four 5GHz clients to evaluate performance of the AP. Maximum spatial streams used for test: Aruba AP was 8x8, others were 4x4. Each AP connected to a switch from the same vendor. Switch connected to wired client matching uplink speed.

Source: Tolly, February 2023

Figure 1



Background

Testing was focused on MU-MIMO 4x4 Wi-Fi 6 APs with dual-band, 2.4/5GHz support. The Aruba AP was a 4x4/8x8 AP and was tested in 8x8 mode.

The Aruba AP had a 5GbE uplink. NETGEAR and Meraki each had a 2.5GbE uplink. The Ubiquiti AP had a 1GbE uplink. For all details of the APs under test and the switches to which each was connected see Table 2.

In addition to evaluating the maximum performance of a single AP engineers conducted high client density tests with up to 50 clients.

Test Results

Maximum Throughput

These tests measured the maximum throughput of a single AP with separate tests run using bidirectional traffic, upstream-only, and downstream-only

traffic profiles. These tests used 2 clients on the 2.4GHz band and 4 clients on the 5GHz band. Details of all tests can be found in the Test Setup & Methodology section of this report.

Bidirectional Traffic. Because all upstream/downstream traffic travels from the wireless clients to the wired test client via a single uplink, the bidirectional capacity of that link is the upper limit for throughput. Thus, for a 1GbE link, 2Gbps is the maximum.

The NETGEAR WAX625 delivered the highest average bidirectional throughput at 1,372Mbps. The Aruba AP-555 delivered 1,301Mbps and the Ubiquiti U6 Pro delivered 1,162Mbps. The Meraki MR44 delivered throughput of 585Mbps. See Figure 1.

Downstream Traffic

This test consisted of 100% traffic sent from the wired client down to all of the wireless clients. The maximum unidirectional throughput is limited by the link speed.

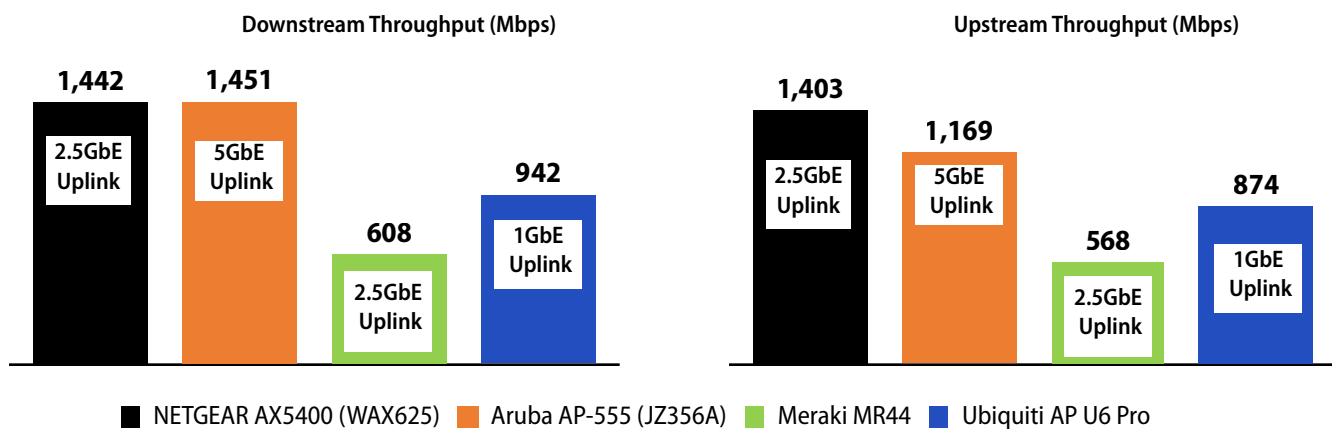
NETGEAR**Wi-Fi 6 AX5400
(WAX625)
Access Point****WLAN
Performance***Tested
February
2023*

That is, an AP with a 1GbE uplink cannot exceed an average of 1Gbps throughput

The NETGEAR WAX625 delivered the average throughput of 1,442Mbps. The Aruba AP-555 delivered slightly higher throughput at 1,451Mbps. Both of these APs were using the additional bandwidth provided by their higher speed uplinks.

The Ubiquiti U6 Pro delivered 942Mbps of throughput apparently limited by the 1GbE uplink. Even though Meraki was configured with a 2.5GbE uplink, the Meraki MR44 throughput was 608Mbps. See Figure 2.

Wi-Fi 6 APs Maximum Downstream/Upstream Throughput



Note: Total of six IxChariot clients were used with two 2.4GHz clients and four 5GHz clients to evaluate performance of the AP. Downstream and upstream tests were run separately as two different tests. Maximum spatial streams used for test: Aruba AP was 8x8, others were 4x4. Each AP connected to a switch from the same vendor. Switch connected to wired client matching uplink speed.

Source: Tolly, February 2023

Figure 2



Upstream Traffic

This test consisted of 100% traffic sent from the wireless clients up to the wired client.

The NETGEAR WAX625 delivered the highest average throughput of 1,403Mbps. The Aruba AP-555 delivered lower throughput at 1,169Mbps. Again, both of these APs were using the additional bandwidth provided by their higher speed uplinks.

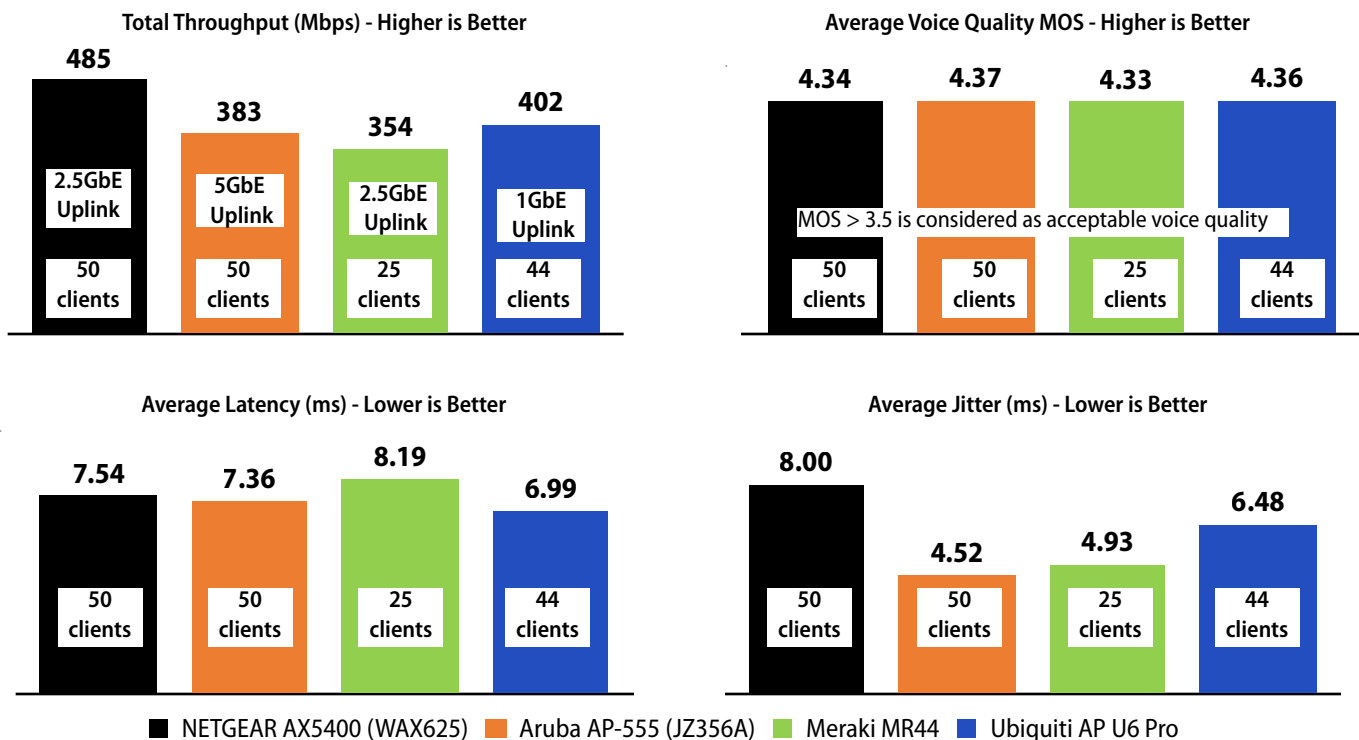
The Ubiquiti U6 Pro delivered 874Mbps of throughput. The Meraki MR44 throughput was 568Mbps. Again, see Figure 2.

High Density Performance

This test demonstrated both downstream performance and its impact on voice quality (representing a latency-sensitive application) This single test generated four metrics. Tests measured voice quality scores for 10 clients while the remaining clients had their throughput measured streaming 4K YouTube video traffic.

The throughput of the NETGEAR WAX625 was more than 20% greater than the nearest competitor. The NETGEAR WAX625 delivered 485Mbps of throughput compared to 402Mbps for the Ubiquiti U6 Pro. Interestingly, the test could not complete successfully for Ubiquiti when all 50 clients were active. Engineers needed to remove six of the streaming clients before those tests completed successfully. NETGEAR was able to run the test successfully with all 50 clients active. See Figure 3 for all high density results.

Wi-Fi 6 APs - High-Density Performance (Up to 50 Clients)



Notes: 5GHz Wi-Fi clients (35 Wi-Fi 5 clients and 15 Wi-Fi 6 clients). In each test run, 10 clients ran downstream G711μ codec voice IxChariot traffic (QoS = control) and 40 clients ran downstream YouTube 4K video IxChariot traffic (QoS = Background). For Meraki and Ubiquiti tests, some IxChariot clients timed out. In such cases, tests were re-tried. After subsequent failure, the client count was reduced until all clients ran without error. Final client count noted on throughput chart.

After the test run, IxChariot reports total throughput of all 50 clients, average MOS of each voice call, average latency and average jitter of traffic to each client. Thus, the four bar charts are derived from one test.

Source: Tolly, February 2023

Figure 3



The Aruba AP-555 had the next highest throughput of 383Mbps. Aruba was able to complete the test successfully with all 50 clients active.

The Meraki MR44 had the lowest throughput with 354Mbps using 25 clients active. Engineers began the test with 50 clients but needed to remove clients incrementally until all clients ran with just 25 clients.

All of the vendors delivered very high quality MOS scores (around 4.3) indicating that VoIP traffic running at the same time as the video streaming would not be degraded in the slightest. Relative to the other APs, NETGEAR's high quality VoIP is more meaningful because its AP was much busier as it was delivering more traffic.

Latency measures the delay on the VoIP session. That value was ~7 to 8ms for all APs. Again, NETGEAR was processing significantly more traffic while exhibiting low latency.

Jitter is related to latency and measures the regularity of packet arrival with lower jitter being better. While NETGEAR's jitter measurement was the highest, it was also delivering more data throughput than any of the other APs.

default AP settings were used. All APs had internal antennas.

All tests were conducted in a 12' x 12' x 8' RF shielded room.

Tests were conducted using both 2.4GHz and 5GHz bands with 20MHz and 80MHz bandwidth respectively with all test clients being Wi-Fi 6 capable.

Keysight IxChariot v9.6 was used for all tests to generate traffic and measure throughput and generate voice quality data. Tests were run twice for three minutes each and the average result was reported.

Each AP was paired with a switch from the same vendor. Uplink topology varied and was between 1GbE and 5GbE. No convertible radios were used.

Test Setup & Methodology

Overview

In any given test, only one AP was online and under test. Unless otherwise noted,

Wi-Fi 6 Access Points Pricing (List)

	NETGEAR AX5400 (WAX625)	Aruba AP-555 (JZ356A)	Meraki MR44	Ubiquiti AP U6 Pro
Manufacturer's Suggested List Price (MSRP) for AP	\$269.99	\$1,990.00	\$1,537.75	\$159
AP SKU	WAX625	JZ356A	MR44-HW	U6-Pro-US
5 Year Cloud Subscription List Price	\$88.00 (NETGEAR Insight Pro, \$22 per year per device, first year free.)	\$505.00 (Aruba Central Foundation)	\$752.63 (Cisco Meraki Enterprise Cloud Controller)	\$0.00 (UniFi Network Application. No charge for management software. See note below.)
Cloud Management SKU	NPR1SNG1-10000S	Q9Y60AAE	LIC-ENT-5YR	N/A
5 Year Total Cost of Ownership per AP	\$357.99	\$2,495.00	\$2,290.38	\$159 (without multi-tenant/location management)

Notes: NETGEAR pricing from NETGEAR store. Aruba pricing from Chicago Computer Supply, an HPE Solution Provider, - <https://www.chicagocomputersupply.com>. Meraki pricing from CloudWifiWorks, a Cisco Meraki authorized online reseller, - <https://www.cloudwifiworks.com>. Ubiquiti pricing from the Ubiquiti store. Ubiquiti does not charge any fee for its cloud management software. To use that software, however, requires a one-time purchase of a hardware "Cloud Key" for \$199. All prices from US websites. Does not include power adapter or optional mounting brackets.

Source: Tolly, February 2023

Table 1



Wi-Fi 6 Access Points Under Test

	NETGEAR	Aruba	Meraki	Ubiquiti
Access Point	AX5400 (WAX625)	AP 555 JZ356A	MR 44	AP U6 Pro
Firmware Version	10.3.1.8	8.11.0.1_85787 SSR	MR 29.4.1	6.2.49
2.4GHz Streams	2x2	4x4	2x2	2x2
5.GHz Streams	4x4	8x8	4x4	4x4
Uplink Topology (GbE)	2.5	5	2.5	1
LAN Switch used or uplink connection	MS510TXUP	2930M (ROM668)	Cisco MS350-24X	UniFi XG Switch US-XG-6POE

Source: Tolly, February 2023

Table 2

All tests were run between a wired computer connected to the same switch as the AP uplink and the WLAN clients communicating with the AP under test. The network adapter of the wired client was set to match the uplink speed of the AP. The ixChariot controller was also connected via wired connection.

The wired client and the controller were Dell Technologies 7080/7090 OptiPlex SFF type PCs with Intel i7 CPUs. The wired client was outfitted with a TP-Link 10GBase-T network interface adapter that could support all uplink speeds required for the testing. The adapter was manually configured for the uplink speed required for each AP under test.

Maximum Throughput

This test was conducted using 2 x Intel AX210¹ Wi-Fi clients on the 2.4GHz band and 4 x Intel AX210 Wi-Fi clients on the 5GHz band. The clients were ~6' to 10' from the AP under test.

¹ AX210 drivers were 22.190.0.4.

Tests used the IxChariot TCP High Performance script. Default parameters were used except that the "Send Buffer Size" and "Receive Buffer Size" were both set to 256,000. A total of 12 TCP pairs were used.

Three tests were run for each AP: 1) Downstream (wired to WLAN), 2) Upstream (WLAN to wired), and 3) Bidirectional.

High-Density Performance

The test was conducted with 50 WLAN stations. 35 stations were Intel AX210 15 clients were Samsung S10e Ultra. All clients connected to the 5GHz SSID.

All clients were configured for 80MHz bandwidth. The clients were ~6' to 10' from the AP under test.

10 clients ran downstream G711μ codec voice IxChariot traffic (QoS = control). The remaining clients all ran the IxChariot YouTube 4K traffic.

IxChariot reported the total throughput for all clients, average MOS of each voice call,

average latency and average jitter of traffic to each client.

The goal was to test 50 clients simultaneously without connection errors. With some APs, IxChariot clients reported TCP connection timeouts on the YouTube 4K stream while the test was running. In such cases, the number of streaming clients was reduced and the test was run again. Streaming clients were decreased until the test could run to completion without any IxChariot clients reporting connection errors. The number of total clients was noted in the results.

Pricing

Pricing is list price as reported by the referenced site for new products purchased and delivered from the US. Five years subscription for cloud management is listed as a separate line item. If AP vendor website/store provided pricing, those prices from the US store were used. If not, pricing was from certified VARs for the given vendor.



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