



#220129

August 2020

Commissioned by
New H3C Technologies Co., Ltd.

H3C Wi-Fi 6 (802.11ax) Access Points

Performance Evaluation and Feature Validation

Executive Summary

Wi-Fi 6, the sixth generation of Wi-Fi, using new technologies and designs, provides the fastest Wi-Fi wireless speed. By optimizing the physical layer and link layer, this protocol improves multi-client concurrent access efficiency, enables efficient spectrum utilization, and increases throughput in dense client environment in both indoor and outdoor scenarios.

H3C commissioned Tolly to test the performance, maximum number of clients, features, and IoT integration of its WA63 and WA66 series Wi-Fi 6 access points. The test results show that H3C's Wi-Fi 6 access points provide high single-client and multi-client performance. The H3C WA6628 access point delivers single-client throughput as high as 4.176 Gbps on the 5GHz radio.

The Bottom Line

- 1 H3C's Wi-Fi 6 flagship access point WA6628 delivers single-client wireless throughput up to 4.176 Gbps on the 5GHz radio, which is the fastest Wi-Fi connection speed that has been tested by Tolly to date
- 2 The H3C WA63 Wi-Fi 6 access point series provides a single-client downlink wireless throughput over 945 Mbps on the 5 GHz radio and over 460 Mbps on the 2.4 GHz radio, improving performance by more than 33% and 95% over Wi-Fi 5 access points, respectively. (Test client: Huawei P40 Pro mobile phone.)
- 3 The H3C WA6622 Wi-Fi 6 access point supports MU-MIMO on the 5 GHz radio. The MU-MIMO mode improves device performance by 86% than the SU-MIMO mode
- 4 The H3C WA6638, WA6630X, and WA6338 Wi-Fi 6 access points support 1,500 clients on each AP. The H3C WA6330 access point supports 1,280 clients on each AP
- 5 The H3C WA6638 and WA6338 Wi-Fi 6 access points allow 650 clients to simultaneously stream multimedia applications. The WA6630 access point allows 610 clients to simultaneously stream multimedia applications
- 6 Some models of H3C's WA63 and WA66 Wi-Fi 6 access point series provide built-in IoT modules and allows external IoT modules to be added in a chain



Test Results

Single-Client Throughput

WA6628 Single-Client Throughput

To evaluate the 5GHz radio performance of the H3C WA6628 Wi-Fi 6 access point, Tolly engineers used a Spirent C50 Wi-Fi 6 test appliance to simulate single wireless client access to the WA6628. Test results show that the WA6628 provides a downlink TCP/UDP throughput of 4.145Gbps in 8x8 MIMO, eight spatial streams, and 80MHz bandwidth mode and a downlink TCP throughput of 4.176Gbps and a downlink UDP throughput of 4.175Gbps in 4x4 MIMO, four spatial

streams, and 160MHz bandwidth mode. The H3C WA6628 provides the highest single radio performance among the Wi-Fi 6 access point tested by Tolly up to July 2020. The detailed results are shown in Figure 1.

New H3C Technologies Co., Ltd.

Wi-Fi 6 Access Points

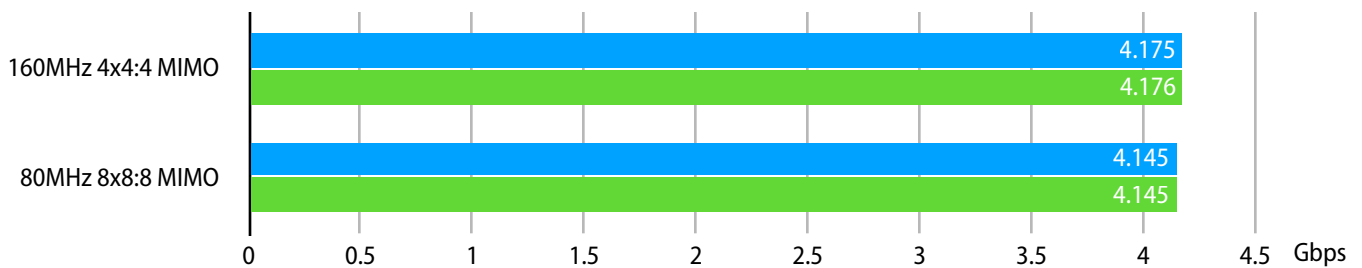
Performance Evaluation and Feature Validation



Tested July 2020

H3C WA6628 Wi-Fi 6 Access Point Single-Client Throughput

5 GHz Radio, UDP/TCP, Downlink Traffic
(Reported by Spirent TestCenter)



	8x8 MIMO, 8 spatial streams, 80MHz bandwidth	4x4 MIMO, 4 spatial streams, 160MHz bandwidth
UDP (Gbps)	4.145	4.175
TCP (Gbps)	4.145	4.176

Source: Tolly, July 2020

Figure 1

WA6320/WA6330/WA6338 Single-Client Throughput

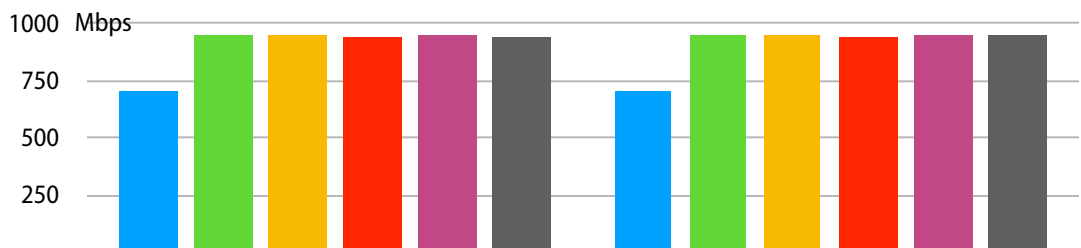
Tolly engineers used a Huawei P40 Pro mobile phone as the Wi-Fi 6 mobile client to access the H3C WA6320, WA6330, and WA6338 Wi-Fi 6 access points, and used IxChariot to test their performance.

The WA6320, WA6330, and WA6338 access points each has a downlink throughput over

945Mbps on the 5GHz radio with 80MHz bandwidth and an uplink throughput over 943Mbps. The WA6320 and WA6338 access points each has a downlink throughput over 460Mbps on the 2.4GHz radio with 40MHz bandwidth and an uplink throughput over 495Mbps. Compared with the Wi-Fi 5 access point WA5320-SI under the same test conditions, the Wi-Fi 6 access points have improved the single-client performance significantly, with over 33% increase on the

5GHz radio and over 95% increase on the 2.4GHz radio.

H3C WA6320/WA6330/WA6338 Wi-Fi 6 Access Point Single-Client Throughput (5GHz Radio) 2x2 MIMO, dual spatial streams, 80MHz bandwidth, compared with Wi-Fi 5 access points (Reported by Keysight IxChariot)



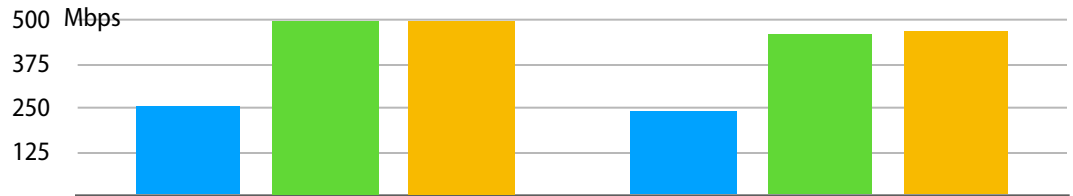
	5GHz Radio Uplink (Mbps)	5GHz Radio Downlink (Mbps)
WA5320-SI (Wi-Fi 5 AP)	702	711
WA6320	949	950
WA6330 (Radio 1)	948	948
WA6330 (Radio 2)	945	945
WA6338 (Radio 1)	948	953
WA6338 (Radio 2)	943	953

Note: The UDP_Throughput script on the IxChariot and 10 streams are used in the test. Compared with Wi-Fi 5 APs, the Wi-Fi 6 APs improve single-client performance on the 5GHz radio by 33%.

Source: Tolly, July 2020

Figure 2

H3C WA6320/WA6330/WA6338 Wi-Fi 6 Access Point Single-Client Throughput (2.4GHz Radio) 2x2 MIMO, dual spatial streams, 40MHz bandwidth, compared with Wi-Fi 5 access points (Reported by Keysight IxChariot)



	2.4GHz Radio Uplink (Mbps)	2.4GHz Radio Downlink (Mbps)
WA5320-SI (Wi-Fi 5 AP)	253	236
WA6320	497	460
WA6338	495	464

Note: The UDP_Throughput script on the IxChariot and 10 streams are used in the test. Compared with Wi-Fi 5 APs, the Wi-Fi 6 APs improve single-client performance on the 2.4GHz radio by 95%.

Source: Tolly, July 2020

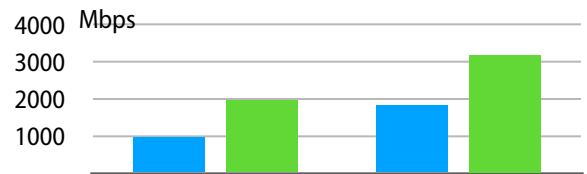
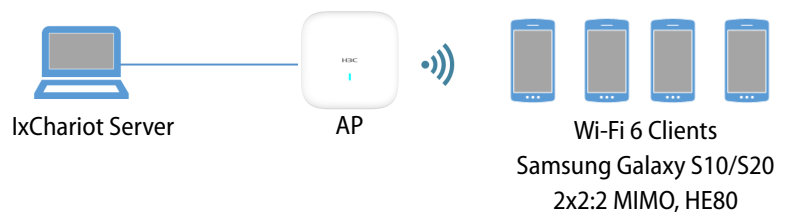
Figure 3

WA6622/WA6638 MU-MIMO Performance

To evaluate the MU-MIMO performance of H3C's Wi-Fi 6 access points, Tolly engineers used four Wi-Fi 6 clients (two Samsung S10 and two Samsung S20 mobile phones) to access the two 5GHz radios of a WA6638, and used IxChariot to test the performance. The test result shows that the access point has a throughput of 3.2Gbps in the MU-MIMO mode that is 1.6 times the throughput in SU-MIMO mode.

Tolly engineers used two Wi-Fi 6 Samsung S10 mobile phones to access the 5GHz radio of a WA6622, and used IxChariot to test the performance. The test results show that the access point has a throughput of 1.84Gbps in MU-MIMO mode that is 1.86 times of the throughput in SU-MIMO mode.

MU-MIMO Performance (Reported by Keysight IxChariot)



	WA6622	WA6638
SU-MIMO Mode (Mbps)	989	2003
MU-MIMO Mode (Mbps)	1846	3200

Note: The H3C WA6622 provides one 5GHz radio. Two clients were used to test its performance. The H3C WA6638 provides two 5GHz radios. Four clients were used to test its performance.

Source: Tolly, July 2020

Figure 4



Multi-Client Performance

WA6330/WA6338/WA6638 Multimedia Streaming

Tolly engineers used two Spirent test appliances to simulate Wi-Fi 6 and Wi-Fi 5 clients, and evaluated the number of clients that the access point can support simultaneously when providing a 1Mbps throughput for each client (1Mbps throughput can meet the requirements of typical multimedia applications). H3C's WA6338 and WA6638 Wi-Fi 6 tri-radio access points each support up to 650 clients and the WA6330 supports up to 610 clients to simultaneously stream multimedia applications smoothly. The detailed results are shown in Table 1.

WA6320/WA6628 Multimedia Streaming

Tolly engineers used a Spirent test appliance to simulate Wi-Fi 6 clients, and evaluated the number of clients that the access point can support simultaneously when providing a 2Mbps throughput for each client (2Mbps throughput can meet the requirements of high-definition multimedia applications). The H3C WA6628 Wi-Fi 6 dual-radio access point supports up to 450 clients and the WA6320 supports up to 350 clients to simultaneously stream high-definition multimedia applications smoothly. The detailed results are shown in Table 2.

WA6628/WA6638 4K Video Streaming

Tolly engineers used a Spirent test appliance to simulate Wi-Fi 6 clients, and evaluated the number of clients that the access point can support simultaneously when providing a 30Mbps throughput for each client (30Mbps throughput can meet the requirements of 4K video streaming). The H3C WA6628 Wi-Fi

WA6330/WA6338/WA6638 Multimedia Streaming (Reported by Spirent TestCenter)

H3C AP Model	Number of Users with Simultaneously Multimedia Streaming
WA6330 (Tri-radio, dual 2x2:2 5GHz + 2x2:2 2.4GHz/5GHz)	610
WA6338 (Tri-radio, 4x4:4 5GHz + 2x2:2 5GHz + 2x2:2 2.4GHz/5GHz)	650
WA6638 (Tri-radio, dual 4x4:4 5GHz + 4x4:4 2.4GHz)	650

Note: The clients are simulated by Spirent TestCenter C50 test appliances. The AP under test provides a minimum throughput of 1Mbps for each simulated client to simulate multi-client multimedia streaming scenarios.

Source: Tolly, July 2020

Table 1

WA6320/WA6628 Multimedia Streaming (Reported by Spirent TestCenter)

H3C AP Model	Number of Users with Simultaneously HD Multimedia Streaming
WA6320 (Dual-radio, 2x2:2 5GHz + 2x2:2 2.4GHz)	350
WA6628 (Dual-radio, 8x8:8 5GHz + 4x4:4 2.4GHz)	450

Note: The clients are simulated by a Spirent TestCenter C50. The AP under test provides a minimum throughput of 2Mbps for each simulated client to simulate multi-client multimedia streaming scenarios.

Source: Tolly, July 2020

Table 2

WA6628/WA6638 4K Video Streaming (Reported by Spirent TestCenter)

H3C AP Model	Number of Users with Simultaneously 4K Video Streaming
WA6628 (Dual-radio, 8x8:8 5GHz + 4x4:4 2.4GHz, 5GHz with a maximum bandwidth of 160MHz)	100
WA6638 (Tri-radio, dual 4x4:4 5GHz + 4x4:4 2.4GHz, 5GHz with a maximum bandwidth of 80MHz)	96

Note: The clients are simulated by the Spirent TestCenter Wi-Fi module. The APs under test provide a minimum throughput of 30Mbps for each simulated client to simulate multi-user 4K video streaming scenarios. In the test, the WA6628 uses HE160 on the 5GHz radio. The WA6638 uses HE80 on the 5GHz radio.

Source: Tolly, July 2020

Table 3



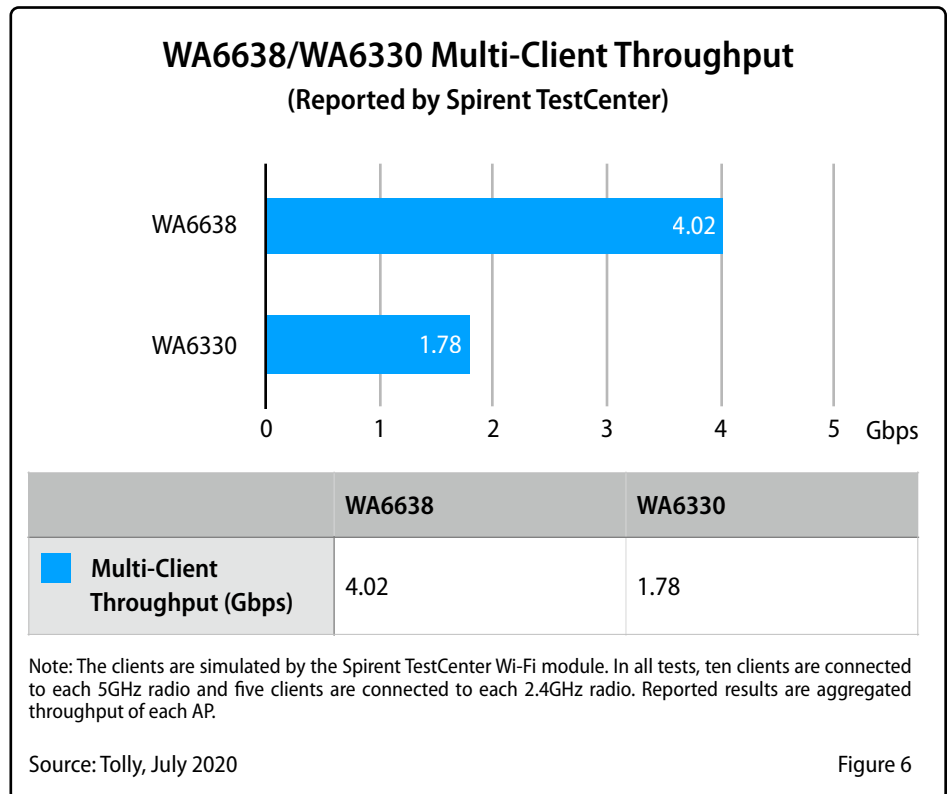
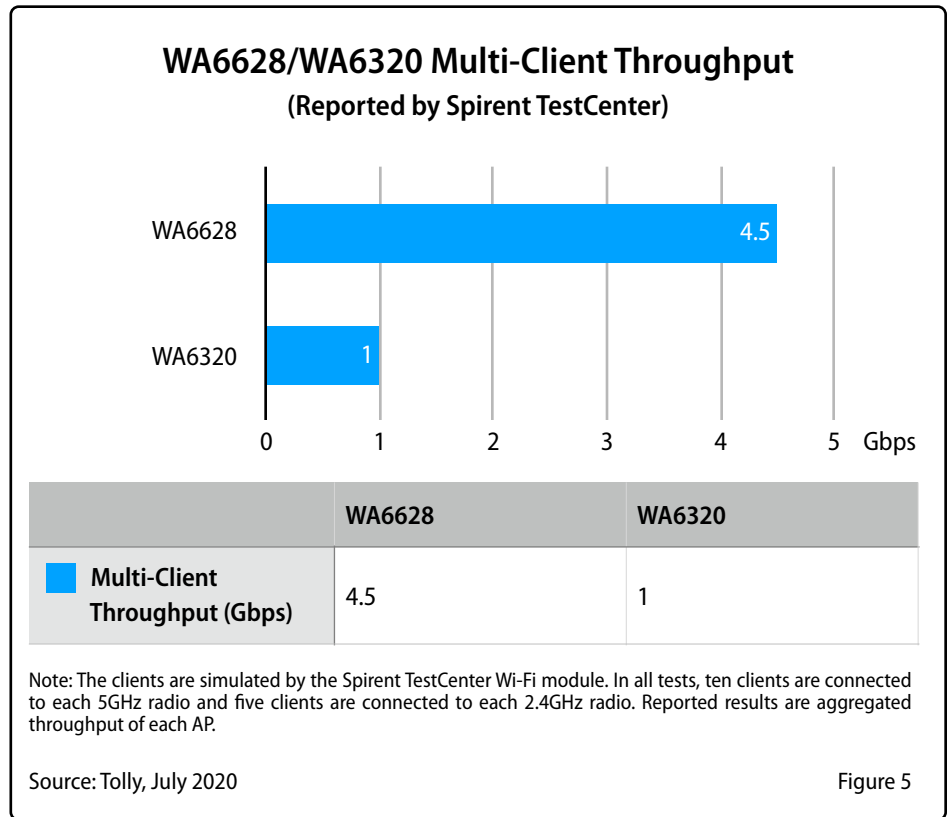
6 access point supports up to 100 clients and the WA6638 supports up to 96 clients to simultaneously stream 4K videos smoothly. The detailed results are shown in Table 3.

WA6628/WA6320 Multi-Client Throughput

The H3C WA6628 and WA6320 Wi-Fi 6 dual-radio access points each provide two radios (a 5GHz radio and a 2.4GHz radio). Tolly engineers used a Spirent C50 test appliance to simulate 15 Wi-Fi 6 clients to access the two radios, with ten clients on the 5GHz radio and five clients on the 2.4GHz radio. Tolly engineers verified that the WA6628 has a system throughput up to 4.5Gbps with 15 Wi-Fi 6 clients connected to it. The WA6320 has a system throughput of 1Gbps with 15 Wi-Fi 6 clients connected to it. The detailed results are shown in Figure 5.

WA6638/WA6330 Multi-Client Throughput

The H3C WA6638 and WA6330 Wi-Fi 6 triple-radio access points each provide three radios (two 5GHz radios and one 2.4GHz radio). Tolly engineers use a Spirent C50 test appliance to simulate 25 Wi-Fi 6 clients to access the three radios, with ten clients on each of the two 5GHz radios and five clients on the 2.4GHz radio. Tolly engineers verified that the WA6638 has a system throughput up to 4.02Gbps with 25 Wi-Fi 6 clients connected to it. The WA6330 has a system throughput of 1.78Gbps with 25 Wi-Fi 6 clients connected to it. The detailed results are shown in Figure 6.





User Capacity

The H3C WA6338, WA6630X, and WA6638 access points each provides two 5GHz radios and a 2.4GHz radio. By using an Keysight IxVeriWave test appliance, Tolly engineers verified that these access points each can provide wireless access simultaneously for 1,500 clients.

The H3C WA6330 access point provides two 5GHz radios and a 2.4GHz radio. By using an Keysight IxVeriWave test appliance, Tolly engineers verified that this access point can provide wireless access simultaneously for 1,280 clients.

The H3C WA6320, WA6320H, WA6322, WA6322H, WA6622, and WA6628 access points each provide a 5GHz radio and a 2.4GHz radio. By using an Keysight IxVeriWave test appliance, Tolly engineers verified that these access points each can provide wireless access simultaneously for 1,024 clients.

The test result is shown in Table 4.

Dual Uplink Backup

Two Ethernet uplinks of an H3C WA6628 access point can be combined into a link aggregation group. When one of the links breaks down, the other link takes over automatically to ensure wireless service continuity.

Compatibility with Earlier Wi-Fi Standards

Tolly engineers configured the 802.11b, 802.11a, 802.11g, 802.11n (Wi-Fi 4) 2.4GHz/5GHz, and 802.11ac (Wi-Fi 5) working modes in turn for the Intel AX200 wireless network card in a Windows laptop. In each of these modes, the computer can successfully

H3C Wi-Fi 6 Access Points User Capacity
(Reported by Keysight IxVeriWave)

H3C AP Model	User Capacity
WA6320	1,024
WA6320H	1,024
WA6322	1,024
WA6322H	1,024
WA6330 (Tri-radio)	1,280
WA6338 (Tri-radio)	1,500
WA6622	1,024
WA6628	1,024
WA6630X (Tri-radio)	1,500
WA6638 (Tri-radio)	1,500

Source: Tolly, July 2020

Table 4

connect to the Wi-Fi network of H3C's WA63 series and WA66 series.

IoT Integration

The H3C WA6320, WA6320H, WA6322, WA6622, WA6628, WA6630X, and WA6638 access points can use built-in Bluetooth low energy (BLE) and RFID, and the H3C WA6330 access point can use built-in BLE to exchange data with IoT endpoints. Tolly engineers connected an IoT bracelet to an H3C access point through Bluetooth, and successfully uploaded the health data (such as the wearer's heart rate) of the IoT bracelet to the H3C U-Center Cloudnet. The engineers exchanged RFID ID card and RFID asset tag data with the H3C access point and successfully uploaded the data to the H3C U-Center Cloudnet, enabling personnel (wearing RFID ID cards) and asset (attached with RFID tags) location positioning.

The WA6322, WA6330, WA6622, WA6630X, and WA6638 access points provide PoE ports. These ports can connect to and supply power and transmit data for T320M external IoT modules. A chain of nine T320 modules can connect to the T320M module, enabling application of BLE and RFID functions on the IoT network.



H3C WA66 Series Wi-Fi 6 Access Points - Tolly Verified Performance and Features

WA6622 Performance	
MU-MIMO vs. SU-MIMO on the 5GHz radio	SU-MIMO mode: 989Mbps MU-MIMO mode: 1,846Mbps MU-MIMO mode performance is 1.86 times of SU-MIMO mode performance

WA6628 Performance	
Wi-Fi 6 single-client performance on the 5 GHz radio	HE80, 8x8:8 mode: TCP: 4.145Gbps; UDP: 4.145Gbps HE160, 4x4:4 mode: TCP: 4.176Gbps; UDP: 4.175Gbps
Multimedia streaming capacity with 2Mbps throughput for each client	450 concurrent users/clients
4K video streaming capacity with 30Mbps throughput for each client	100 concurrent users/clients
Multi-client aggregated throughput of the AP (10 clients on the 5GHz radio and 5 clients on the 2.4GHz radio)	4.5Gbps

WA6638 Performance	
MU-MIMO vs. SU-MIMO on the two 5GHz radios	SU-MIMO: 2,003Mbps MU-MIMO: 3,200Mbps MU-MIMO mode performance is 1.6 times of SU-MIMO mode performance
Multimedia streaming capacity with 1Mbps throughput for each client	650 concurrent users/clients
4K video streaming capacity with 30Mbps throughput for each client	96 concurrent users/clients
Multi-client aggregated throughput of the AP (10 clients on the 5GHz radio and 5 clients on the 2.4GHz radio)	4.02Gbps

WA66 Series Capacity and Features				
	WA6622	WA6628	WA6630X	WA6638
User capacity	1024	1024	1500	1500
Dual uplink backup	-	Supported	-	-
Compatibility with earlier Wi-Fi standards	802.11b, 802.11a, 802.11g, 802.11n (Wi-Fi 4) 2.4GHz/5GHz and 802.11ac (Wi-Fi 5)			
IoT integration	Supports PoE OUT Supports built-in BLE and RFID Supports external BLE and RFID IoT module	Supports built-in BLE and RFID	Supports PoE OUT Supports built-in BLE and RFID Supports external BLE and RFID IoT module	Supports PoE OUT Supports built-in BLE and RFID Supports external BLE and RFID IoT module

Source: Tolly, July 2020

Table 5



H3C WA63 Series Wi-Fi 6 Access Points - Tolly Verified Performance and Features

WA6320 Performance

Wi-Fi 6 single-client performance on the 5GHz radio HE80, 2x2:2, UDP	Uplink 949Mbps Downlink 950Mbps
Wi-Fi 6 single-client performance on the 2.4GHz radio HE40, 2x2:2, UDP	Uplink 497Mbps Downlink 460Mbps
Multimedia streaming capacity with 2Mbps throughput for each client	350 concurrent users/clients
Multi-client aggregated throughput of the AP (10 clients on the 5GHz radio and 5 clients on the 2.4GHz radio)	1Gbps

WA6330 Performance

Wi-Fi 6 single-client performance on the 5GHz radio HE80, 2x2:2, UDP	5GHz radio 1: uplink 948Mbps; downlink 948Mbps 5GHz radio 2: uplink 945Mbps; downlink 945Mbps
Multimedia streaming capacity with 1Mbps throughput for each client	610 concurrent users/clients
Multi-client aggregated throughput of the AP (10 clients on the 5GHz radio and 5 clients on the 2.4GHz radio)	1.78Gbps

WA6338 Performance

Wi-Fi 6 single-client performance on the 5GHz radio HE80, 2x2:2, UDP	5GHz radio 1: uplink 948Mbps; downlink 953Mbps 5GHz radio 2: uplink 943Mbps; downlink 953Mbps
Wi-Fi 6 single-client performance on the 2.4GHz radio HE40, 2x2:2, UDP	Uplink 495Mbps Downlink 464Mbps
Multimedia streaming capacity with 1Mbps throughput for each client	650 concurrent users/clients

WA63 Series Capacity and Features

	WA6320	WA6320H	WA6322	WA6322H	WA6330	WA6338
User capacity	1024	1024	1024	1024	1280	1500
Compatibility with earlier Wi-Fi standards	802.11b, 802.11a, 802.11g, 802.11n (Wi-Fi 4) 2.4GHz/5GHz and 802.11ac(Wi-Fi 5)					
IoT integration	Supports built-in BLE and RFID	Supports built-in BLE and RFID	Supports PoE OUT Supports built-in BLE and RFID Supports external BLE and RFID IoT module	-	Supports PoE OUT Supports built-in BLE Supports external BLE and RFID IoT module	-

Source: Tolly, July 2020

Table 6



Test Methodology

All APs under test operate in fit AP mode and are deployed and tested in AC + Fit AP networking model.

The Spirent C50 test appliance uses TCP/UDP traffic with the 1500-byte frame size to verify the device performance.

Keysight IxVeriWave is used to simulate client accesses to evaluate the user capacity of each AP.

Devices Under Test

Access controller: H3C WX3540H.

H3C WA63 series Wi-Fi 6 access points: WA6320/WA6320H/WA6322/WA6322H/WA6330/WA6338;

H3C WA66 series Wi-Fi 6 access points: WA6622/WA6628/WA6630X/WA6638.

H3C Wi-Fi 5 access point: WA5320-SI.

Test Tool

Spirent C50 chassis with Spirent TestCenter version 5.08;

Keysight IxChariot version 7.30 SP5;

Keysight IxVeriWave version 6.11.

H3C Wi-Fi 6 Access Points Product Information

Panel	WA6628	WA6528	WA6622	WA6620	WA6322	WA6320		
Wall-Plate	WA6320H	WA6322H	Outdoor	WA6630X	WA6620X	Railway	WA6628X	WA6628E-T
High Density	WA6638i	WA6638	WA6338	WA6330	Terminator	WTU630	WTU630H	WTU632H-IOT

Scenario-oriented products

Wi-Fi 6 eXtreme enhanced technology

Remarkable design

Smart O&M

Source: H3C, July 2020

Figure 7



About Tolly

The Tolly Group companies have been delivering world-class ICT services for over 30 years. Tolly is a leading global provider of third-party validation services for vendors of ICT products, components and services.

You can reach the company by E-mail at sales@tolly.com, or by telephone at +1 561.391.5610.

Visit Tolly on the Internet at: <http://www.tolly.com>

Learn More About H3C

H3C is an industry leader in the provision of Digital Solutions, and is committed to becoming the most trusted partner of its customers in their quest for business innovation and digital transformation. H3C offers a full portfolio of Digital Infrastructure products, spanning across compute, storage, networking, 5G, security and related domains, and provides a comprehensive one-stop digital platform that includes cloud computing, big data, artificial intelligence (AI), industrial internet, information security, intelligent connectivity, new safety, and edge computing, as well as end-to-end technical services. H3C is also the exclusive provider of HPE® servers, storage and associated technical services in China.

For more information, visit: <https://www.h3c.com/en/>

Terms of Usage

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 a product must be based on your own assessment of suitability based on your needs. The document should never be used as a substitute for advice from a qualified IT or business professional. This evaluation was focused on illustrating specific features and/or performance of the product(s) and was conducted under controlled, laboratory conditions. 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.

Reasonable efforts were made to ensure the accuracy of the data contained herein but errors and/or oversights can occur. 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. Accordingly, this document is provided "as is", and Tolly Enterprises, LLC (Tolly) gives no warranty, representation or undertaking, whether express or implied, and accepts no legal responsibility, whether direct or indirect, for the accuracy, completeness, usefulness or suitability of any information contained herein. By reviewing this document, you agree that your use of any information contained herein is at your own risk, and you accept all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from any information or material available on it. Tolly is not responsible for, and you agree to hold Tolly and its related affiliates harmless from any loss, harm, injury or damage resulting from or arising out of your use of or reliance on any of the information provided herein.

Tolly makes no claim as to whether any product or company described herein is suitable for investment. You should obtain your own independent professional advice, whether legal, accounting or otherwise, before proceeding with any investment or project related to any information, products or companies described herein. When foreign translations exist, the English document is considered authoritative. To assure accuracy, only use documents downloaded directly from Tolly.com. No part of any document may be reproduced, in whole or in part, without the specific written permission of Tolly. All trademarks used in the document are owned by their respective owners. You agree not to use any trademark in or as the whole or part of your own trademarks in connection with any activities, products or services which are not ours, or in a manner which may be confusing, misleading or deceptive or in a manner that disparages us or our information, projects or developments.