

## Huawei AP7050DE, AP6050DN, AP4050DN-HD and AP4030TN Performance Evaluation vs. Aruba, Cisco Systems and Ruckus Wireless

### EXECUTIVE SUMMARY

Wireless devices (e.g. smartphones, tablets, laptops, etc.) play an increasingly significant role in people's daily life. Seamless Wi-Fi coverage and high-speed Wi-Fi network access become necessary for most organizations. Based-on the deep understanding of wireless communications technologies as a vendor for wireless telecommunications operators, smart phones, as well as enterprise networks, Huawei developed their 802.11ac Wave 2 wireless access points.

Tolly engineers evaluated 802.11ac Wave 2 access points from leading vendors and compared their performance. The devices under test include Huawei AP7050DE, Huawei AP6050DN, Aruba AP-325, Cisco Aironet 1852i, and Ruckus ZoneFlex R710.

Tolly engineers also evaluated performance and verified features on the Huawei AP4050DN-HD and Huawei AP4030TN access points which are specially designed for high-density scenarios.

### THE BOTTOM LINE

- 1 In the Multi-client performance test, with 20 to 100 clients, Huawei AP7050DE and AP6050DN outperformed competitors' 802.11ac Wave 2 access points constantly. Take the results of 100 clients for example, Huawei AP7050DE had 25%, 99%, and 48% higher throughput than Aruba AP-325, Cisco Aironet 1852i, and Ruckus ZoneFlex R710 respectively. Meanwhile, Huawei AP6050DN had 21%, 92%, and 42% advantage.
- 2 In the MU-MIMO performance improvement test, when 10 Wave 1 clients were replaced gradually with 10 Wave 2 clients, Huawei AP7050DE and AP6050DN's consistently outperformed competitors' Wave 2 access points. All APs under test had more than 100% performance gain from using all Wave 1 clients to using all Wave 2 clients.
- 3 In the anti-interference test, with and without interference, Huawei AP7050DE and AP6050DN outperformed competitors' Wave 2 access points constantly. After the co-channel interference occurred, Huawei AP7050DE and AP6050DN's performance dropped 10.6% and 11.7% respectively which are much better than Aruba AP-325, Cisco 1852i, and Ruckus R710's 28.9%, 30.9%, and 27.0% drop.
- 4 Huawei AP4050DN-HD is specially designed for high-ceiling high-density environments such as stadiums, airports, train stations, exhibition halls. It equips with high-density smart antennas with accurate signal coverage and strong anti-interference capability. Huawei AP4050DN-HD's performance was 38% better than the omni-antenna Cisco 1832i AP. Meanwhile, Huawei AP4050DN-HD supported PoE OUT (PoE power sourcing equipment capability) to power other devices.
- 5 Huawei AP4030TN (Wave 1 access point) supported 3 radios (one 5GHz radio and two 2.4GHz/5GHz radios) with 120 clients streaming one HD video very smoothly. It supported Software Defined Radio (SDR). Two radios could be switched between 2.4GHz and 5GHz. Administrators could configure the third radio to be used for user access, or Wi-Fi positioning, or WDS bridging.
- 6 Huawei AP7050DE, AP6050DN, AP4050DN-HD and AP4030TN supported security features including application recognition, URL filtering, anti-virus, and IPS.



# Test Results

## AP7050DE and AP6050DN

Huawei AP7050DE and AP6050DN are both high end 802.11ac Wave 2 access point which support 4 x 4 MIMO and four spatial streams each. The AP7050DE provides smart antennas.

### Multi-client Performance

Tolly engineers evaluated multi-client performance for 802.11ac Wave 2 APs from Huawei, Aruba, Cisco and Ruckus.

Each client group had 20 different types of 802.11ac Wave 1 and Wave 2 clients. Huawei AP7050DE and AP6050DN had constant better performance than competitors with 1, 2, 3, 4, or 5 groups of clients (total 20, 40, 60, 80, or 100 clients). Huawei AP7050DE had 21% to 99% higher throughput than Aruba AP-325, Cisco 1852i, and Ruckus R710 access points. Huawei AP6050DN also had 16% to 92% higher throughput than all three

competitors' APs. See Figure 1 and Table 2 for detailed results.

### 802.11ac Wave 2 MU-MIMO Performance Improvement

Multi-user MIMO (MU-MIMO) is the key feature for the 802.11ac Wave 2 standard. It allows the AP to communicate with multiple clients simultaneously. With the same Wave 2 AP, multiple Wave 2 clients' aggregated throughput is expected to be much higher than multiple Wave 1 clients'.

Tolly engineers used 10 802.11ac Wave 1 clients and 10 Wave 2 clients to evaluate the advantage of the Wave 2 standard on each AP. In each test run, 10 total clients were used with different combinations of Wave 1 and Wave 2 clients. Huawei AP7050DE and AP6050DN always outperformed Aruba AP-325, Cisco 1852i, and Ruckus R710. In all combinations of clients, Huawei AP7050DE had 19% to 52% higher throughput than the competitors' APs while Huawei AP6050DN had 6% to 30% advantage.

Huawei Technologies Co., Ltd.

Huawei AP7050DE, AP6050DN, AP4050DN-HD and AP4030TN



Tested October 2016

Performance Evaluation and Feature Validation

The MU-MIMO feature worked properly for all APs under test. Huawei AP7050DE and AP6050DN had more than 2X downstream throughput with Wave 2 clients than with Wave 1 clients. See Figure 2 and Table 3 for detailed results.

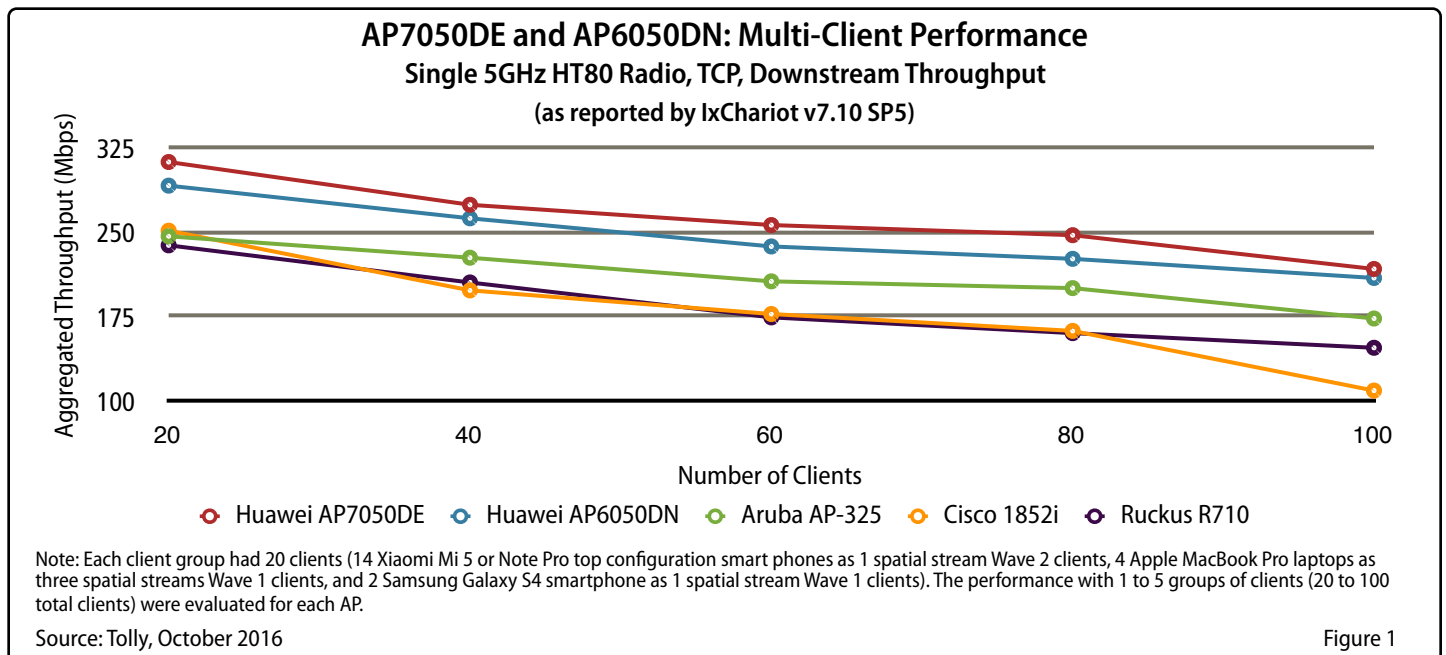


Figure 1



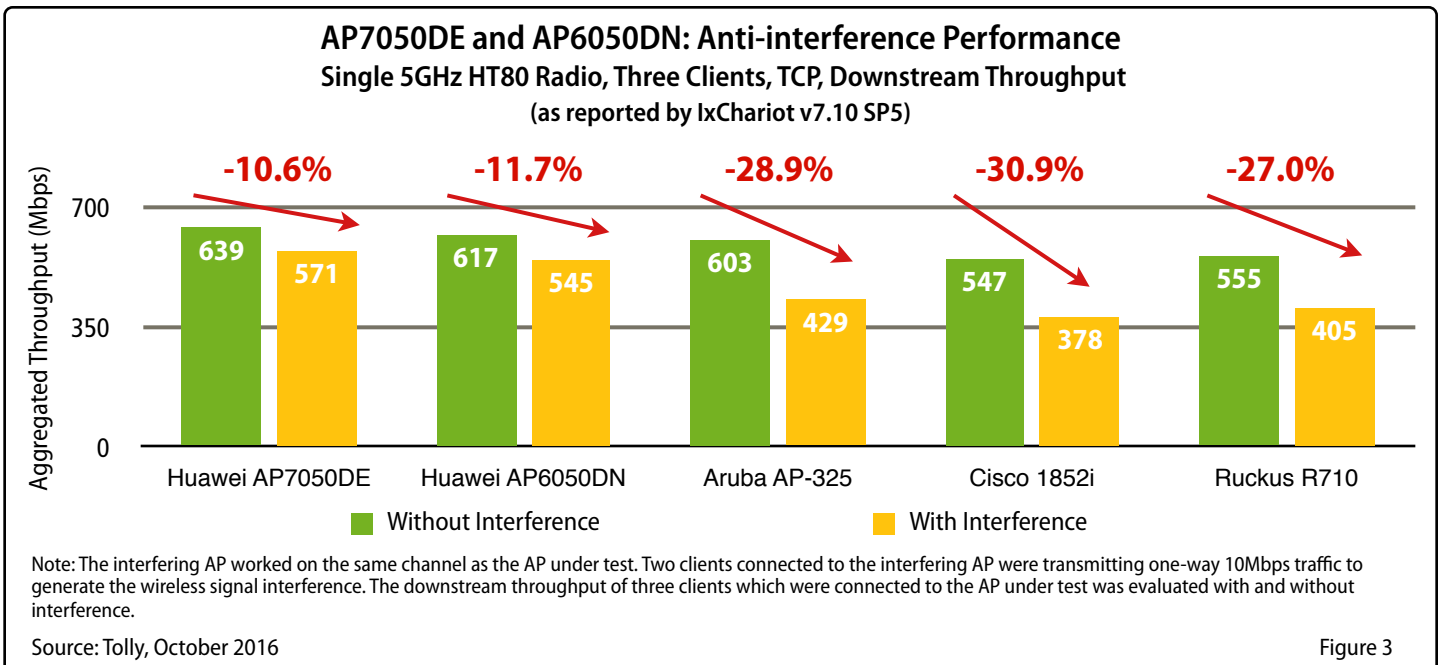
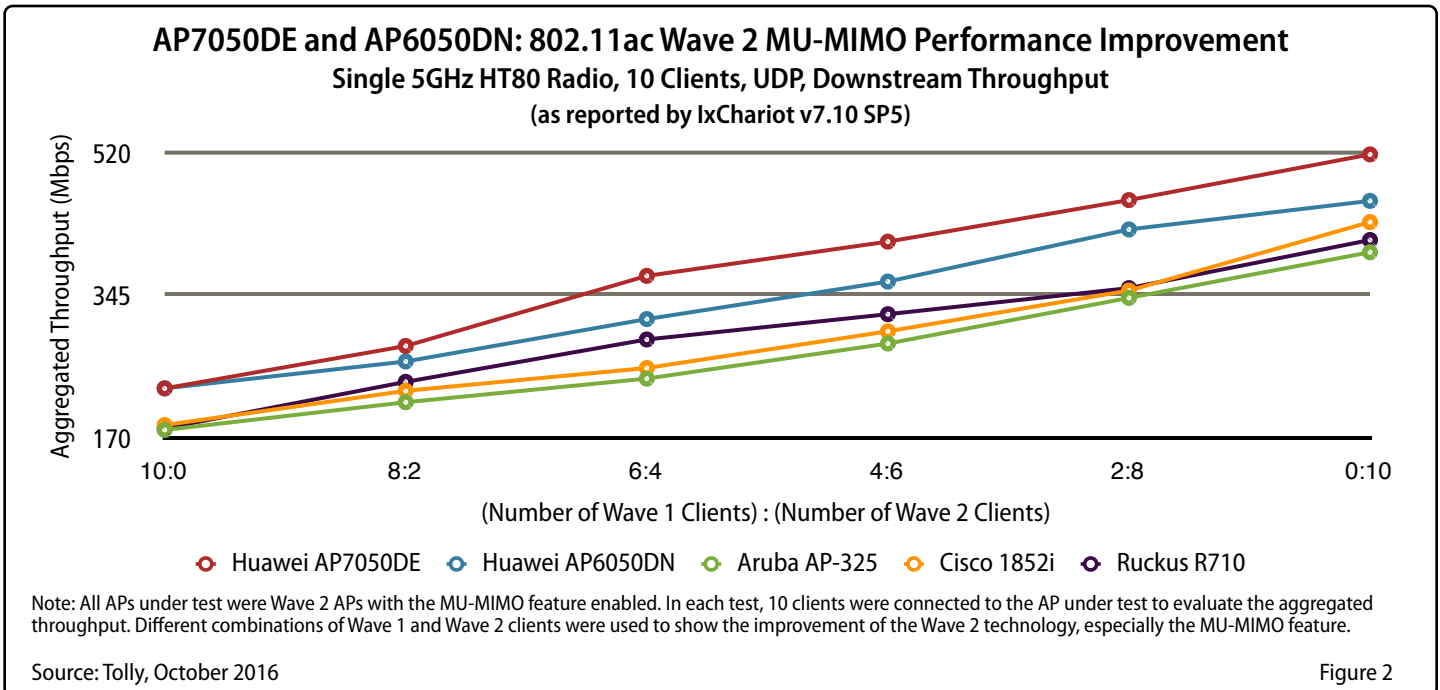
### Anti-Interference Performance

Co-channel interference is the key factor in slowing down (degrading) wireless performance. Tolly engineers tested each AP's performance with and without

interference to evaluate the anti-interference capability.

Huawei AP7050DE and AP6050DN's performance dropped 11% and 12% with interference. Aruba AP-325, Cisco 1852i and Ruckus R710's performance dropped

29%, 31% and 27%. From the results, Huawei AP7050DE and AP6050DN had better anti-interference capability with much less performance degradation when interference occurs. See Figure 3 for detailed results.





### Maximum Number of Clients

Huawei AP7050DE and AP6050DN each supported a maximum of 256 clients on each radio and 512 clients on each access point.

### Bluetooth Positioning

The bluetooth positioning feature let users locate themselves.

The Huawei iBeacon bluetooth stations can be deployed to cover an area to help users locate themselves in the area. Through the AP7050DE with the bluetooth technology which communicates with the iBeacon stations, the Huawei eSight management platform can monitor all iBeacon stations' status. Administrators can set the floor plan, iBeacon stations' locations and APs' locations in eSight. Mobile app developers can then develop the app using Huawei's SDK and eSight's OpenAPI to retrieve the topology information and display the mobile device's location in the app. In our test environment, the bluetooth

positioning accuracy was 100% within 1 meter with less than 1 second delay.

### AP4050DN-HD

Huawei AP4050DN-HD is a Wave 2 AP that is specially designed for high-ceiling and high-density stadiums, airports, train stations, or exhibition halls. It uses built-in smart high-density antennas to cover the clients accurately with improved overall performance and anti-interference capability.

### High-Density Scenario Performance

To compare APs with omni antennas, Tolly engineers evaluated Huawei AP4050DN-HD's performance versus Cisco Aironet 1832i omni-antenna access point's performance with and without interference.

With either one AP or two APs, Huawei AP4050DN-HD always performed better than the Cisco 1832i access point.

With one access point without interference, Huawei AP4050DN-HD's multi-client performance was 38% better.

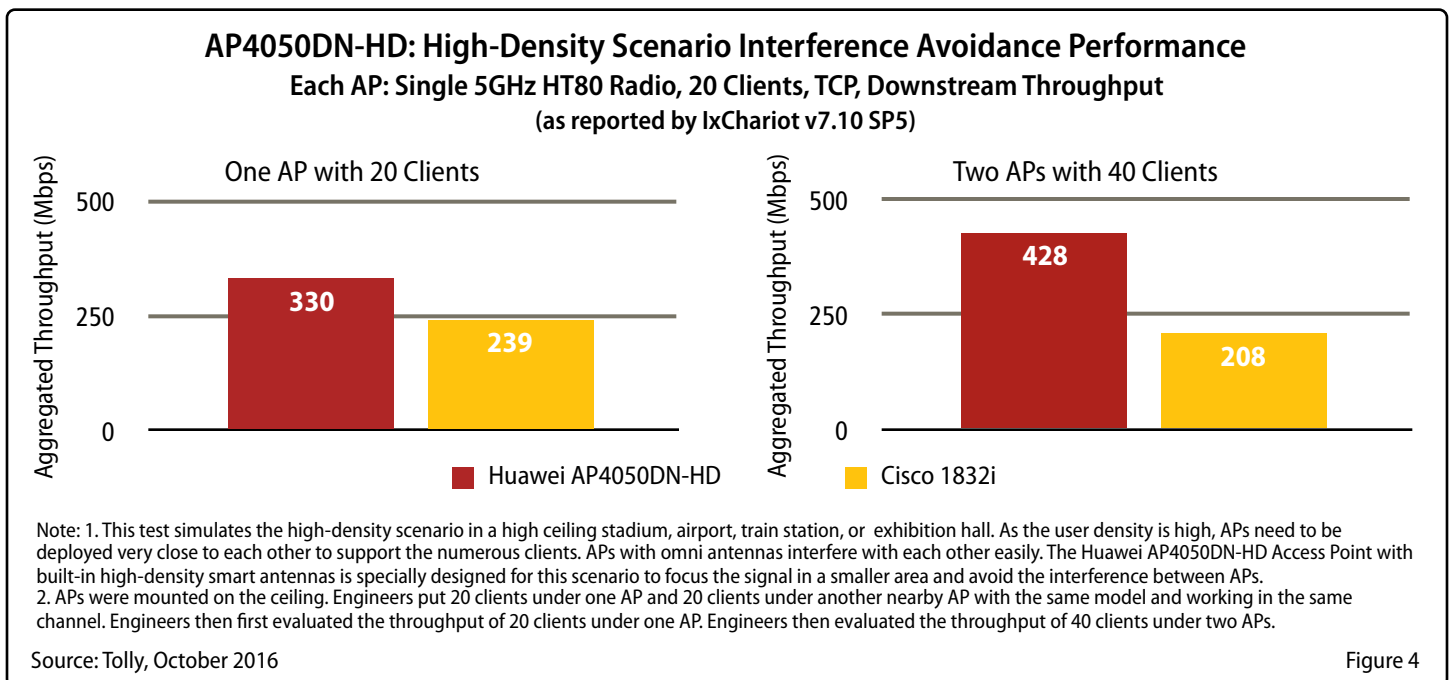
With two access points, which were working on the same channel with interference, the Huawei AP4050DN-HD access points' performance were 106% better than the two Cisco 1832i access points.

In any test, 20 clients were associated with each AP.

From the results, Huawei AP4050DN-HD had better performance and better anti-interference capability than the Cisco 1832i access point. See Figure 4.

### Multi-client Performance

With one radio, the Huawei AP4050DN-HD supported 236Mbps throughput with 60 clients.





### Maximum Number of Clients

Huawei AP4050DN-HD supported a maximum of 128 clients on each radio and 256 clients on each access point.

### PoE Out

The AP4050DN-HD's downlink port supported the PoE power source (PoE Out) capability to be able to power another AP4050DN-HD access point.

### AP4030TN

Huawei AP4030TN is an 802.11ac Wave 1 access point which supports three radios (one 5GHz radio and two 2.4GHz/5GHz radios). Each radio supports 2 x 2 MIMO and 2 spatial streams. With three radios, it can supports high-density clients in eClassrooms, shopping malls, or supermarkets.

### High-Density Video Streaming Test

In the eClassroom scenario, students in a classroom stream an instructional video at the same time. Tolly engineers verified that the Huawei AP4030TN access point supported 120 clients streaming one video with a 2Mbps bitrate very smoothly at the same time. See Figure 5 for the test environment.

**AP4030TN: High-Density Video Streaming Test Environment**  
120 Clients Streaming One HD Video Very Smoothly through One Huawei AP4030TN Access Point



Note: 1. 25 Apple MacBook Pro laptops were used. Other clients were Xiaomi Mi 5 or Mi Note Pro top configuration smart phones with 802.11ac Wave 2 1 spatial stream support. The video's bitrate was 2,006kbps. The video was hosted on one video playback system and played on each client in a Web browser.  
2. The Huawei AP4030TN Access Point supports three radios (configured as one 2.4GHz radio and two 5GHz radio). The 2.4GHz radio connected 20 clients. Each 5GHz radio connected 50 clients.

Source: Tolly, October 2016

Figure 5



## Multi-Client Performance

With three radios (configured as one 2.4GHz radio and two 5GHz radios), the Huawei AP4030TN supported 454Mbps throughput with 100 clients.

## Maximum Number of Clients

Huawei AP4030TN supported a maximum of 128 clients on each radio and 384 clients on each access point.

## Software Defined Radio

The AP4030TN access point has three radios (one 5GHz radio and two 2.4GHz/5GHz radios) comparing to two radios for most access points. Administrators can define the usage of each radio more flexibly.

## Wi-Fi Positioning

Based upon the three-point positioning algorithm and the fingerprint positioning algorithm, Huawei developed its proprietary patented PAIRS positioning algorithm, which can eliminate the affect of the transmission power difference on positioning accuracy. Tolly engineers configured the third radio of the AP4030TN access point for Wi-Fi positioning. In our test environment, the positioning accuracy was 100% within 3 meters.

## Wireless Bridging

Tolly engineers used the third radio to bridge two AP4030TN access points.

Not all places can deploy Ethernet cables as access points uplinks. AP4030TN can still be deployed to these places with wireless bridging.

## 2.4GHz/5GHz Switching

Two radios of the AP4030TN access point could be switched between 2.4GHz and 5GHz.

The 5GHz radio has more available channels and typically less interference than the 2.4GHz radio. The performance is also better on 5GHz at short distance locations. So for certain scenarios where there is no 2.4GHz client, administrators can choose to switch two 2.4GHz/5GHz Huawei AP4030TN radios to 5GHz and improve the aggregated throughput of the access point.

## Security Features

Tolly engineers verified the following security features on AP7050DE, AP6050DN, AP4050DN-HD and AP4030TN.

### URL Filtering

URL filtering regulates online behavior by controlling which URLs users can access. Huawei access points supported URL filtering to block client access to certain URLs.

### Anti-Virus

The anti-virus function depends on the powerful and constantly updated virus signature database to secure the network and system data. Huawei access points supported anti-virus to block transferring infected files.

## Wireless Intrusion Prevention System (WIPS)

Intrusion prevention detects intrusions, such as buffer overflow attacks, Trojan horses, and worms, by analyzing network traffic and takes actions to quickly terminate the intrusions. In this way, intrusion prevention protects the information system and network architecture of enterprises. Huawei access points supported Wireless Intrusion Prevention System (IPS) functions.

## Application Recognition

Application recognition uses the service awareness technology to identify packets of dynamic protocols such as HTTP and RTP by checking Layer 4 to Layer 7 information in the packets, helping implement fine-grained QoS management. Huawei access points supported application recognition.

## Test Methodology

### AP7050DE and AP6050DN

#### Multi-Client Performance

Each client group had 20 clients (14 Xiaomi Mi 5 or Note Pro top configuration smart phones as 1 spatial stream Wave 2 clients, 4 Apple MacBook Pro laptops as three spatial streams Wave 1 clients, and 2 Samsung Galaxy S4 smartphone as 1 spatial stream Wave 1 clients). The performance with 1 to 5 groups of clients (20 to 100 total clients) were evaluated for each AP.

The Ixia IxChariot high performance throughput TCP script was used. For 20 clients tests, four downstreams were used for each client; for 40 and 60 clients tests, two downstreams were used for each client; for 80 and 100 clients tests, single downstream was used for each client. One 5GHz HT80 Wave 2 radio was used for each AP under test.

#### 802.11ac Wave 2 MU-MIMO Performance Improvement

10 Wave 1 clients (Samsung Galaxy S4) and 10 Wave 2 clients (Xiaomi Mi Note Pro highest configuration model) were used. The test started with 10 Wave 1 clients. Then engineers replaced two Wave 1 clients with Wave 2 clients after each test run. Thus, (number of Wave 1 clients) : (number of Wave 2 clients) as 10:0, 8:2, 6:4,



4:6, 2:8, 0:10 were tested. In each test, the aggregated throughput of all 10 clients were evaluated.

The UDP high throughput script was used. Each client had 6 downstreams. One 5GHz Wave 2 HT80 radio was used on each AP under test.

### Anti-interference Performance

The interfering AP worked on the same channel as the AP under test. Two clients connected to the interfering AP were transmitting one-way 10Mbps traffic to generate the wireless signal interference. The downstream throughput of three clients which were connected to the AP under test was evaluated with and without interference.

One 5GHz HT80 Wave 2 radio was used for each AP under test. The high performance throughput TCP script was used. Each client had 20 downstreams.

## AP4050DN-HD

### High-Density Scenario Interference Avoidance Performance

APs were mounted on the ceiling. Engineers put 20 clients under one AP and 20 clients under another nearby AP with the same model and working in the same channel. Engineers then first evaluated the throughput of 20 clients under one AP. Engineers then evaluated the throughput of 40 clients under two APs.

40 Xiaomi Mi Note Pro highest end configuration model were used as the clients. One 5GHz HT80 Wave 2 radio was used for each AP. Each client had 2 downstreams. The high performance throughput TCP script was used.

### Multi-client Performance

60 Xiaomi Mi Note Pro or Mi 5 Wave 2 clients were used. Each client had one downstream. The high throughput UDP script was used. One 5GHz HT80 Wave 2 radio was used for the AP4050DN-HD.

## AP4030TN

### High-Density Video Streaming Test

25 Apple MacBook Pro laptops were used. Other clients were Xiaomi Mi 5 or Mi Note Pro top configuration smart phones with 802.11ac Wave 2 1 spatial stream support. The video's bitrate was 2,006kbps. The video was hosted on one video playback system and played on each client in a Web browser.

The Huawei AP4030TN Access Point supports three radios (configured as one 2.4GHz HT40 radio and two 5GHz HT80 radio). The 2.4GHz radio connected 20 clients. Each 5GHz radio connected 50 clients.

### Multi-client Performance

100 clients were used. The 2.4GHz HT40 radio connected 20 clients. Two 5GHz HT80 radios each connected 40 clients.

### Maximum Number of Clients

The Ixia WaveTest 90 chassis with software version 6.5 was used to simulate clients and connect to each AP under test.

### Systems Under Test

Vendor	Access Point Model	Software Version
Huawei Technologies Co., Ltd.	AP7050DE (802.11ac Wave 2, 4 x 4 MIMO, four spatial streams, smart antennas) AP6050DN (802.11ac Wave 2, 4 x 4 MIMO, four spatial streams) AP4050DN-HD (802.11ac Wave 2, 2 x 2 MIMO, two spatial streams) AP4030TN (802.11ac Wave 1, 2 x 2 MIMO, two spatial streams)	V200R007
Aruba, a Hewlett Packard Enterprise company	AP-325 (802.11ac Wave 2, 4 x 4 MIMO, four spatial streams)	6.4.4.6
Cisco Systems, Inc.	AIR-AP1852I-H-K9 (802.11ac Wave 2, 4 x 4 MIMO, four spatial streams) AIR-AP1832I-H-K9 (802.11ac Wave 2, 3 x 3 MIMO, two spatial streams)	8.3.102.0
Ruckus Wireless, Inc.	ZoneFlex R710 (802.11ac Wave 2, 4 x 4 MIMO, four spatial streams)	9.12.2.0.204

Source: Tolly, October 2016

Table 1



**AP7050DE and AP6050DN: Multi-client Performance - Detailed Results of Figure 1**  
**Single 5GHz HT80 Radio, TCP, Downstream Throughput**  
 (as reported by IxChariot v7.10 SP5)

Number of Clients	20	40	60	80	100
Huawei AP7050DE	312	274	256	247	217
Huawei AP6050DN	291	262	237	226	209
Aruba AP-325	246	227	206	200	173
Cisco 1852i	251	198	177	162	109
Ruckus R710	238	205	174	160	147

Source: Tolly, October 2016

Table 2

**AP7050DE and AP6050DN: 802.11ac Wave 2 MU-MIMO Performance Improvement**  
**- Detailed Results of Figure 2**  
**Single 5GHz HT80 Radio, 10 Clients, TCP, Downstream Throughput**  
 (as reported by IxChariot v7.10 SP5)

Number of Wave 1 Clients : Number of Wave 2 Clients	10:0	8:2	6:4	4:6	2:8	0:10
Huawei AP7050DE	230	282	368	410	461	517
Huawei AP6050DN	230	263	315	361	425	460
Aruba AP-325	179	213	242	285	341	397
Cisco 1852i	185	227	255	300	350	434
Ruckus R710	181	238	290	321	353	412

Source: Tolly, October 2016

Table 3





### About Tolly


The Tolly Group companies have been delivering world-class IT services for more than 25 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services.

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### Test Equipment Summary

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

Vendor	Product	Web
Ixia	IxChariot 7.10 WaveTest 90	 <a href="http://www.ixiacom.com">http://www.ixiacom.com</a>

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