TEST REPORT

Tolly.

#216145

September 2016

Commissioned by
Linksys, Inc.

Linksys EA7500+RE7000 AC1900 Max-Stream Seamless Roaming Solution

Comparative Wireless LAN Performance

EXECUTIVE SUMMARY

Busy home networks are now the rule rather than the exception with multiple clients demanding multiple high-bandwidth services - like video streaming - simultaneously. The Linksys Max-Stream Bundle consists of the EA7500 AC1900 MU-MIMO Wi-Fi Router and the RE7000 AC1900 MU-MIMO Range Extender. The Linksys EA7500 is a dual-purpose home office and entertainment Wi-Fi router.

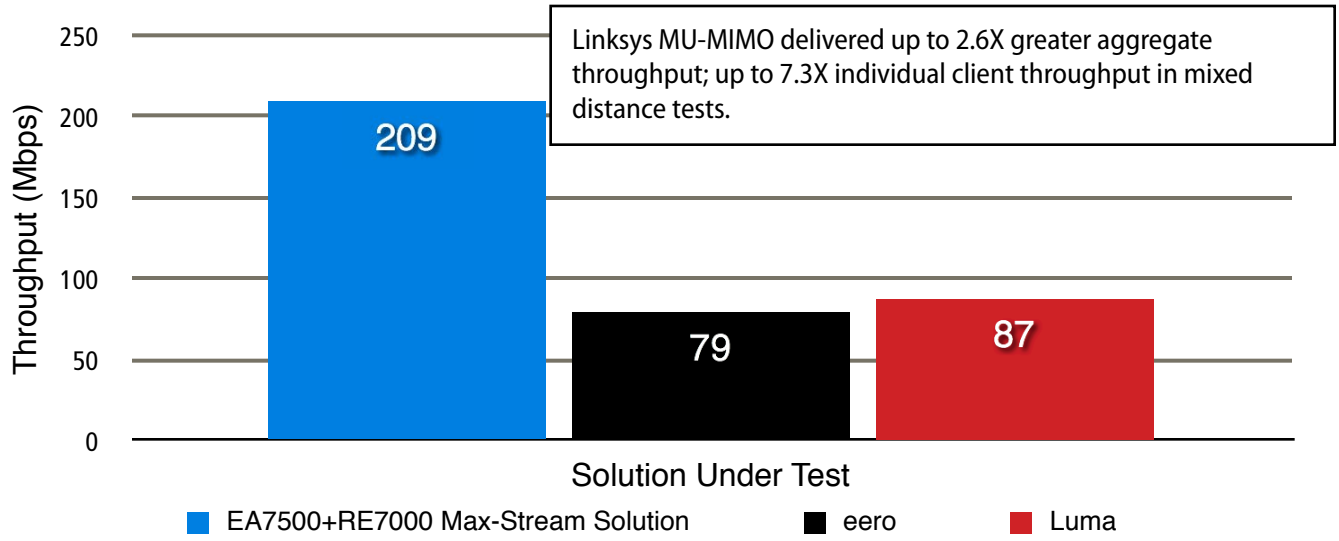
Linksys, Inc. commissioned Tolly to benchmark the multi-client throughput of the Linksys EA7500 bundle and compare that to the aggregate throughput of several competing dual-band wireless LAN (WLAN) solutions. The Linksys solution can deliver up to 2.6X the aggregate downstream throughput of competing solutions. See Figure 1. ...<continued on next page>

THE BOTTOM LINE

Linksys EA7500 AC1900 Wireless Router+ RE7000 AC1900 + Range Extender delivered:

1. Up to 2.6X greater aggregate throughput in mixed distance tests
2. Up to 7.3X greater individual client throughput in mixed distance tests
3. Up to 2.6X faster per client average throughput in mixed distance tests

Wireless LAN MU-MIMO Multi-Client Downstream Performance
Four Clients, Mixed Distance, Aggregate Performance,
(as reported by Ixia IxChariot v7.10 SP3)



Notes: Dual-band devices provide a 2.4GHz radio and a 5GHz radio. All testing used 5GHz band. Average of three runs. The Linksys device was 3x3 MIMO run in conjunction with the Linksys RE7000 4x4 wireless range extender. eero and Luma solutions were 2x2 MIMO and each used three APs.

Source: Tolly, August 2016

Figure 1

Tests were conducted in a residential environment. The Linksys solution consisted of AP and range extender and ran 3x3 MIMO. Competing WLAN 802.11ac solutions ran 2x2 MIMO with three APs each.

In the test, four clients were used with only two near each other. The other two were placed at greater distances on another floor of the house. This scenario illustrates performance with more diverse client locations.

Test Results

Downstream traffic represents data flowing from the Internet to clients. For example, users viewing YouTube videos or downloading software will generate traffic flows where the vast majority of the traffic flows downstream from the AP.

Multi-Client, Mixed Distance

The test of four clients in different locations in the residence showed the benefit of the Linksys solution.

The aggregate throughput of the Linksys solution was significantly higher than the competing solutions. The Linksys results were 2.6X that of eero and 2.4X that of Luma. See Figure 1.

Analyzed on a per-client basis, the best single client throughput for Linksys was 144Mbps. This was 2.6X the best single-client throughput of Luma and 7.3X the best result for eero.

On a per-client average basis, the Linksys solution average of 52Mbps was over 2X the average client throughput of the two

Linksys, Inc.

Linksys EA7500+RE7000 AC1900 Max-Stream Seamless Roaming Solution

MU-MIMO Wireless LAN Performance

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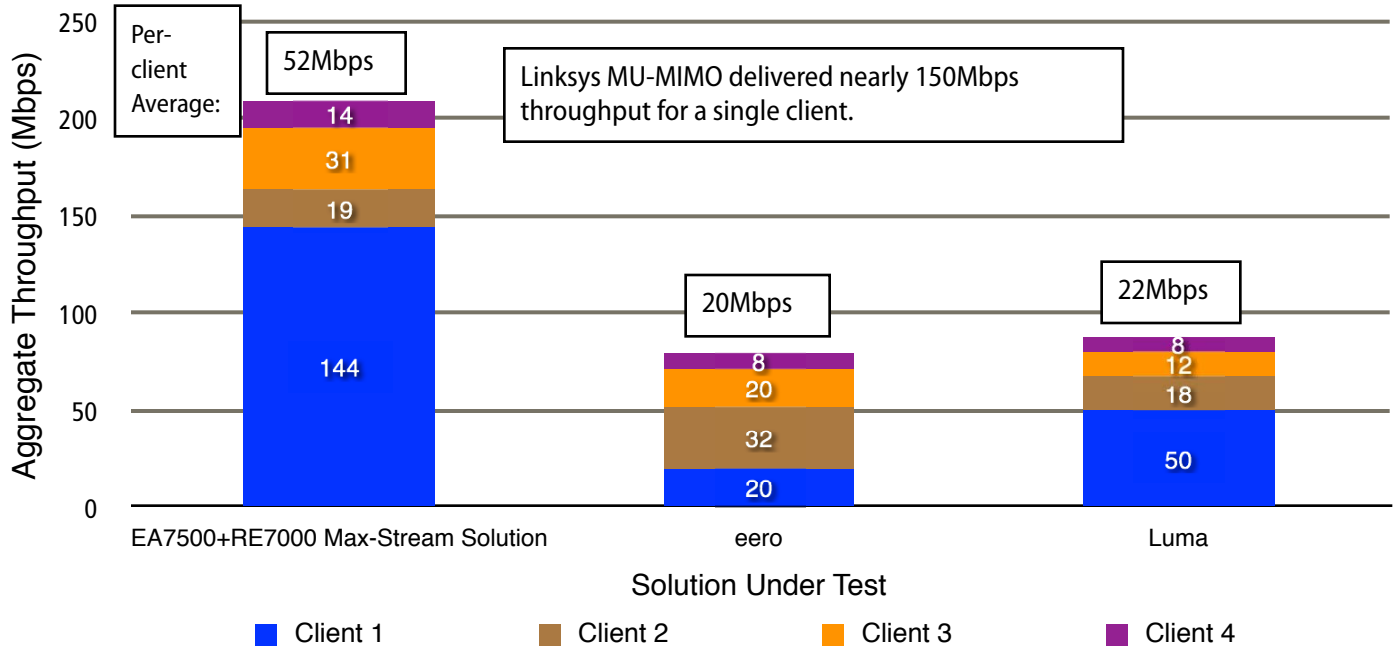
Tested August 2016

Wireless LAN MU-MIMO Multi-Client Downstream Performance

Four Devices, Mixed Distance - Individual Client Performance

(as reported by Ixia IxChariot v7.10 SP3)



Notes: Dual-band devices provide a 2.4GHz radio and a 5GHz radio. All testing used 5GHz band. Average of three runs. The Linksys device was 3x3 MIMO run in conjunction with the Linksys RE7000 wireless range extender. eero and Luma solutions were 2x2 MIMO and each used three APs.

Source: Tolly, August 2016

Figure 2

competing solutions. See Figure 2 and Table 1.

Test Setup & Methodology

Objective

The objective of the test was to benchmark the wireless LAN (WLAN) access points (APs) to determine their downstream throughput.

Systems Under Test

All systems provided access point functionality and were marketed as commercial grade devices. All devices were upgraded to the most current firmware available at time of test. Wherever possible, SUTs were configured with identical settings with respect to bandwidth, channels, transmit power and security. The SUT was connected to a router via a wired Ethernet connection and Gigabit Ethernet switch. The router provided DHCP addressing services for the test clients and was not used during the test runs. The security settings were turned on each of the systems under test using WPA2-PSK (AES).

The Linksys solution consisted of the AP and one range extender. The eero and Luma solutions each used three APs. For details about the systems under test and the test clients, see Tables 2 and 3.

Environment & Setup

All testing was conducted using 5GHz.

Four Client - Mixed Distance

For this test, which used 2 Acer Aspire V3-371-51UJ with WUSB6100M Wi-Fi cards and 2 Apple MacBook Pro A1502 systems, engineers placed one Acer client in the kitchen on the second floor of the home. One Apple client was located on the second floor of the home through one wall. The second Acer client was located in the garage, which is on the first floor of home. The second Apple client was located just outside of the first floor front door. All systems used Channel 36 with bandwidth on Auto.

For the Linksys test setup, the EA7500 was connected to the two clients on the 2nd floor of the home. The EA7500 was situated at table level. The RE7000 was connected to the two clients on the first floor of the home. The RE7000 was located on the first floor of the home.

For the eero test setup, the first AP was located on the second floor of the home and situated at table level. The second AP was located on the first floor of the home in

WLAN MU-MIMO Downstream Throughput Test Result Details

(Data Summarized in Figures1 & 2)

Wireless LAN MU-MIMO Multi-Client Downstream Performance Four Devices, Mixed Distance, Aggregate Throughput (as reported by Ixia IxChariot v7.10 SP3)			
	EA7500+RE7000 Max-Stream Solution	eero	Luma
Client 1	144.33	19.72	49.78
Client 2	19.43	31.75	17.73
Client 3	31.49	19.59	12.28
Client 4	13.85	8.09	7.65
Per-Client Average	52.27	19.79	21.86
Total	**209**	**79**	**87**

Notes: Dual-band devices provide a 2.4GHz radio and a 5GHz radio. All testing used 5GHz band. Average of three runs. The Linksys device was 3x3 MIMO run in conjunction with the Linksys RE7000 4x4 wireless range extender. Eero and Luma solutions were 2x2 MIMO and each used three APs.

Source: Tolly, August 2016

Table 1

802.11ac Systems Under Test

Vendor	Short Reference	Formal Name	Firmware Version	MIMO Streams	Antenna Location
Linksys, Inc.	EA7500	Linksys EA7500 Max-Stream™ AC1900 MU-MIMO Gigabit Router	1.1.2.172843	3x3	3 External
Linksys, Inc.	RE7000	Linksys RE7000 Max-Stream™ AC1900+ Wi-Fi Range Extender	1.0.00 build 64	4x4	4 Internal
eero inc	eero	eero	eeroOSv1.0.3	2x2	2 External
Luma Home Inc.	Luma	Luma	Current as of August 2016	2x2	2 External

Note: The Linksys solution consisted of the EA7500 router and the RE7000 range extender.

Source: Tolly, August 2016

Table 2

bedroom #1 on the first floor of the home and two feet off the ground. The third AP was located on the first floor of the home in the garage at table level.

For the Luma test setup, the first AP was located on the second floor of the home and situated at table level. The second AP was located on the first floor of the home in bedroom #1 on the first floor of the home and two feet off the ground. The third AP was located on the first floor of the home in the garage at table level.

Test traffic was generated using the Ixia IxChariot benchmarking system. All testing used the IxChariot High Throughput script.

Four WLAN clients running the IxChariot Endpoint software communicated with a single IxChariot Endpoint that was connected via wired Ethernet connection to the test network via the aforementioned Gigabit Ethernet switch. Run time for each test was one minute at each test location. Tolly engineers monitored the AP under test to be certain that four clients were communicating with the appropriate SSID/ radio being tested.

Test Equipment Summary

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

Vendor	Product	Web
Ixia	**IxChariot v7.10 SP3 Console & Endpoint & IxChariot Endpoint 9**	ixia TESTED http://www.ixiacom.com

WLAN Client System Details

Function	Wired Chariot Endpoint & Console	Wireless Chariot Endpoint	Wireless Chariot Endpoint
Quantity	1	2	2
Computer Brand	HP	Acer	Mac
Model	Envy 17	Aspire V3-371-51UJ	MacBook Pro A1502
CPU	Intel i7 2630QM	Intel i5 5200U	Intel Core i5-4258U
Operating System	Windows 7	Windows 8.1	OS X Yosemite 10.10.2
LAN/WiFi Card	Ethernet Realtek PCIe GBE Family Controller	WUSB6100M	AirPort Extreme (0x14E4, 0x112)
Driver	7.23.623.2010	11.1.0.49 (4/27/2016)	Broadcom BCM43xx 1.0
Chariot Version	Console & Endpoint 7.10 SP3	Endpoint 9.1	Endpoint 9.0

Source: Tolly, August 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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