October 31, 2012

VIA ELECTRONIC SUBMISSION

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: Progeny LMS, LLC & Wireless Internet Service Providers Association
Part 15 Joint Test Report
WT Docket No. 11-49

Dear Ms. Dortch:

Progeny LMS, LLC ("Progeny") and the Wireless Internet Service Providers Association ("WISPA") hereby file with the Commission the attached Part 15 Joint Test Report. Pursuant to Section 90.353(d) of the Commission's rules[1] and paragraph 29 of the Commission's *Waiver Order*,[2] Progeny is required to demonstrate that its Multilateration Location and Monitoring Service ("M-LMS") network does not cause unacceptable levels of interference to Part 15 devices. On January 27, 2012, Progeny filed with the Commission the results of testing that were conducted in 2011 on behalf of Progeny by an independent third party testing firm, Spectrum Management Consulting Inc. ("SMC").[3]

At the request of the Commission, Progeny subsequently agreed to additional testing on a joint basis with three entities, WISPA; Itron, Inc. ("Itron"); and Landis+Gyr Company ("Landis+Gyr"). The attached report addresses the tests that were conducted with WISPA.

[1] *See* 47 C.F.R. § 90.353(d).

[2] *See* Request by Progeny LMS, LLC for Waiver of Certain Multilateration Location and Monitoring Service Rules, *Order*, DA 11-2036, ¶ 29 (Dec. 20, 2011) ("*Waiver Order*") (granting conditional waivers of Sections 90.155(e) and 90.353(g) of the Commission's rules).

[3] *See Coexistence of M-LMS Network and Part 15 Devices,* Spectrum Management Consulting Inc. (Jan. 27, 2012) ("*Part 15 Field Test Report*") (included as an attachment to *Letter from Bruce A. Olcott, Counsel to Progeny LMS, LLC, to Marlene H. Dortch, Secretary, Federal Communications Commission,* WT Docket No. 11-49 (Jan. 27, 2012) ("*Progeny Part 15 Field Test Report Filing*").

Part 15 Test Reports addressing the joint tests with Itron and Landis+Gyr are being filed on this date under separate cover.

Please let us know if you have any questions.

Respectfully Submitted,

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JOINT WISPA - PROGENY TESTING

September 25 to 27, 2012

10/26/2012

Table of Contents

1. Introduction

Personnel from the Wireless Internet Service Provider Association (WISPA) and Progeny LMS, LLC (Progeny) completed a joint testing program during September 25 to 27 in the San Jose – Santa Clara area of California to document the effects, if any, of the Progeny M-LMS network on Part 15 outdoor fixed wireless broadband (FWB) equipment such as that used by wireless Internet service providers (WISPs) in the 902-928 MHz band. Consistent with the general outlines of the test plans previously agreed, the groups used iperf as a test tool to complete system-level data throughput tests of deployed FWB equipment in the presence of the operationally deployed Progeny network. The tests included bidirectional transmission tests at multiple frequencies with the Progeny network cycled between active (ON) and inactive (OFF) states several times during each test period.

This document describes the test environments (equipment, configurations, frequencies, testing methods, etc.) and catalogs the joint test results obtained. This document does not assess the data obtained, draw any conclusions or make any recommendations.

2. Equipment Types and Configurations Tested

Equipment chosen for the tests were the two most commonly used 900 MHz FWB systems, the Canopy system (initially manufactured by Motorola, now made by Cambium) and a Ubiquiti Networks system. Model and FCC identification numbers for the equipment are as follows:

- Cambium Canopy Model 9000 AP and 9000 SMC, FCC ID numbers ABZ89FC5809 common to both the AP and the CPE
- Ubiquiti Rocket M900S, FCC ID numbers: CPE SWX M900L and AP SWX M900

The equipment configuration for testing was a point-to-multipoint architecture designed to achieve bidirectional data transmission between one base station Access Point (AP) and one customer premise equipment (CPE) Subscriber Module (SM). The configuration utilized typical sectorized AP antennas and directional SM antennas. The Canopy tests used horizontal polarization, with a 42 degree horizontal beamwidth AP antenna. The Ubiquiti system used dual linear polarization (both horizontal and vertical) with a 120 degree horizontal beamwidth AP antenna. The Progeny system used vertically polarized omni-directional antennas transmitting at 30 W peak ERP.

3. Site Locations

WISPA had previously established desired site considerations including FWB link distances, FWB link stability and throughput, as well as the distance to the nearest Progeny beacons, cellular and paging base stations, and proximity to non-participating 900 MHz WISP installations. The desired link test distance was 10 to 20 miles, or such other link distance and heights as to establish a dependable operational link using reasonable transmission rates at or near the capabilities of the equipment. The desired test sites would be no closer than 600 meters (2000 feet) from the nearest 800 MHz cellular transmitter, 929-930 MHz paging transmitter or non-participating 900 MHz WISP installation. The desired site would be between 600 meters (2000 feet) and 5 miles from the nearest Progeny beacon, and the wireless path of the test links would be neither directly towards nor directly away from concentrations of Progeny beacons. The desired site would include one end at significant elevation (either by building rooftop or ground elevation) with a clear line-of-sight to the other end.

The test teams initially identified a link of 14 miles with both ends on clear elevated hilltops across the Santa Clara valley. The Canopy link was not able to sustain stable operational performance over that distance with the Progeny network off, so shorter line-of-sight wireless paths were identified that allowed adequate data throughput and stable operation with the Progeny network off. Sites were chosen that provided link distances of 2.3 miles for Canopy and 1.5 miles for Ubiquiti. The two links shared one common point on a clear hillside with 380 feet elevation and visibility into the valley (Ervin Way - Location 1, Figures 2.1 and 2.2).

The other ends of the links were in parking lots on the valley floor (Map – Figure 4). Equipment on the valley floor was operated on a mast providing approximately 10 feet of elevation to clear local obstacles. The Canopy hardware was tested at the Hillview Branch Library, (Location 2, Figure 3.1), however, the Ubiquiti equipment was not able to sustain a stable bidirectional link from this location. Therefore, the Ubiquiti hardware was tested at a closer location at the intersection of Wonderama Drive and Supreme Drive just to the west side of the athletic fields (Location 3, Figure 3.2). The Canopy tests located the CPE device at the elevated Ervin Way location, and the Ubiquiti tests located the AP at the elevated Erwin Way location. Distances from the three site locations to the nearest Progeny beacon were 3.2 miles for location 1, 2.5 miles for location 2, and 3.4 miles for location 3 (Map – Figure 5).

Subsequent to the tests, the NextNav engineering team obtained location fixes at each of the three test locations. The location fixes and the maximum number of beacons measured at each of the locations is described below.

Test Locations	Location Fix: LAT | LON	Max Number of beacons
Ervin way	37.3565066 | -121.797037	13
Hillview Library	37.3382529 | -121.831012	14
Wonderama & Supreme	37.3399873 | -121.815799	13

Figure 1: Santa Clara Valley view from the elevated Ervin Way test location

Figure 2.1: Location 1 CPE Setup for Canopy System

Figure 2.2: Location 1 AP Setup for Ubiquiti System

Figure 3.1: Location 2 AP setup for Canopy system

Figure 3.2: Location 3 CPE setup for Ubiquiti system

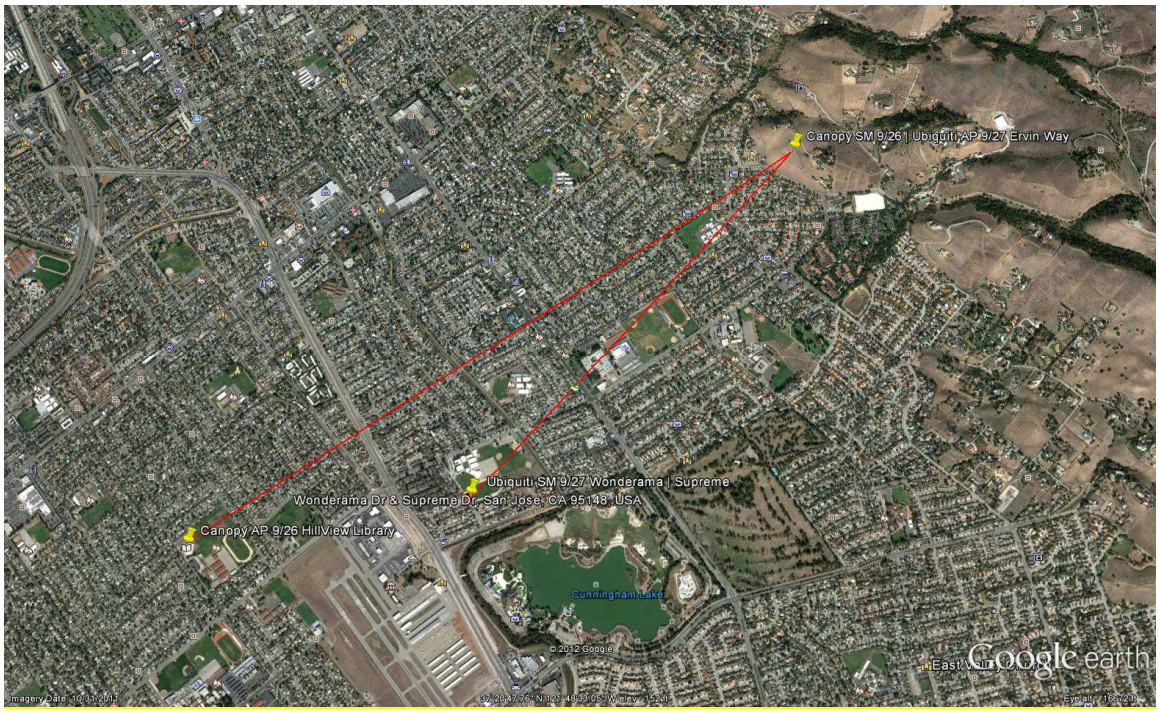

Figure 4: Test links. Canopy link length 2.3 miles, Ubiquiti link length 1.5 miles

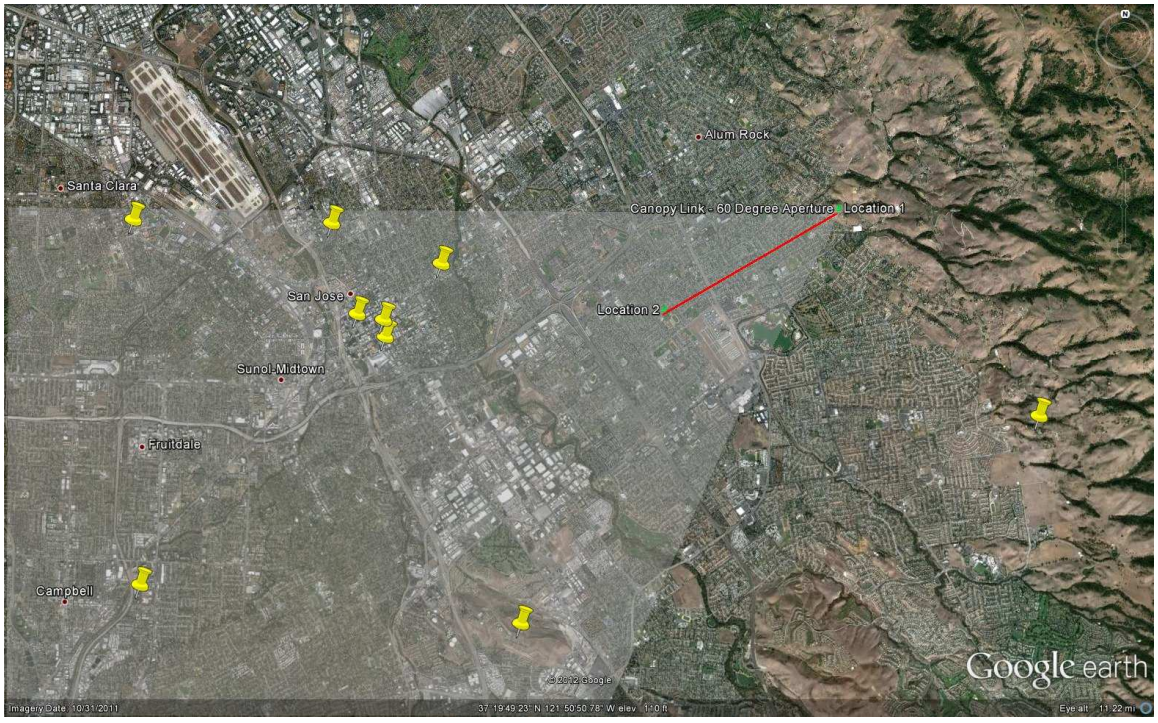

Figure 5.1: Location and beamwidth of Canopy test link in relation to Progeny beacons

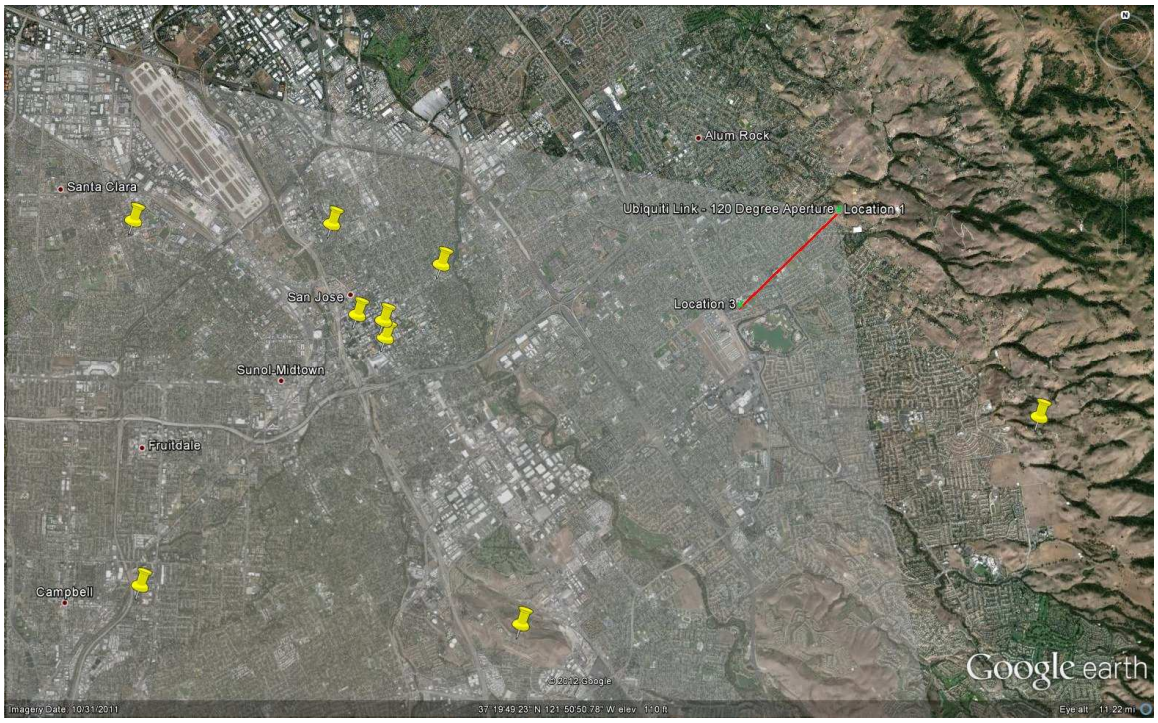

Figure 5.2: Location and beamwidth of Ubiquiti test link in relation to Progeny beacons

4. Equipment Modulation and Frequency Settings

The Canopy hardware utilizes Frequency Shift Keying (FSK) modulation and generates an 8 MHz wide carrier. The operating frequency is selectable in 1 MHz steps from 906 MHz to 924 MHz. Three center frequencies were tested, with one frequency outside the Progeny bands, and two within. The frequencies tested were 906 MHz, 920 MHz (partially overlapping the Progeny band and centered on the Progeny M-LMS B block carrier) and 923 MHz (centered in the entire Progeny band and co-channel with both the Progeny B and C block M-LMS carriers). The spectrum plots for the carrier configurations are shown in Figures 6, 7 and 8, and pictures of the specific equipment, with serial numbers are shown in Figures 18 through 24 in the appendix. The spectrum plots are idealized and show the approximate shape and width of the Canopy channel occupation in relationship to the Progeny channels. Tests were conducted with data settings for a symmetrical allocation of capacity in each direction (AP to CPE and CPE to AP).

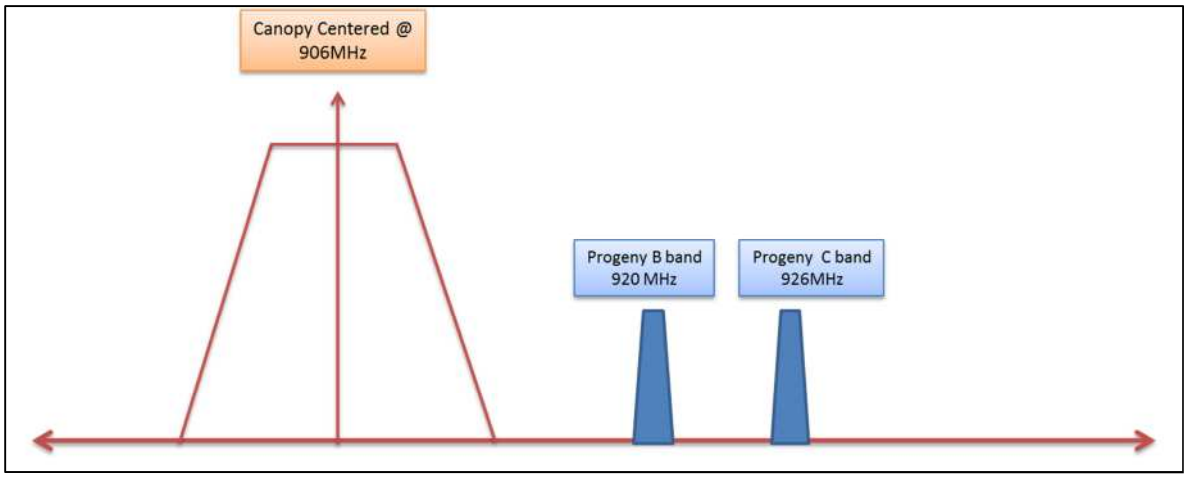

Figure 6: Canopy centered at 906MH

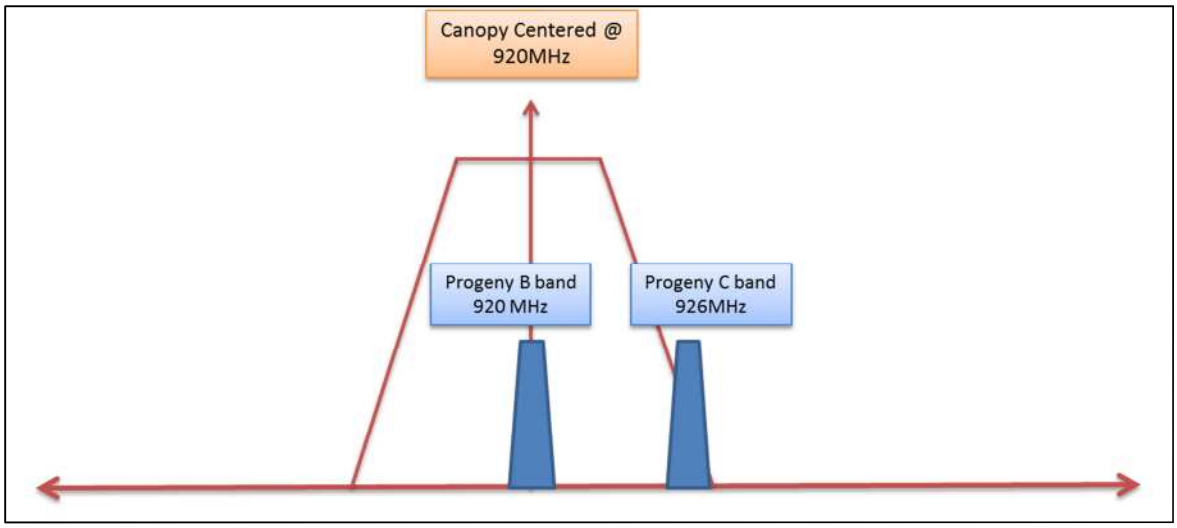

Figure 7: Canopy centered at 920 MHz

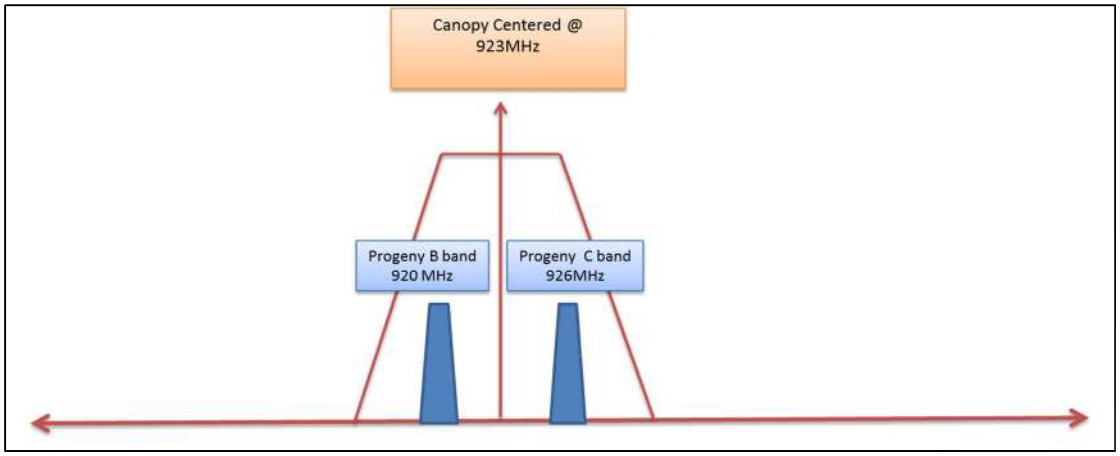

Figure 8: Canopy centered at 923 MHz

The Ubiquiti equipment utilizes DSSS modulation and a 2X2 MIMO configuration with selectable carrier bandwidths ranging from 3 MHz to 20 MHz. The tests were conducted utilizing the 10 MHz bandwidth option. The equipment offers four selectable frequencies of operation in this configuration (907 MHz, 912 MHz, 917 MHz, and 922 MHz). Three frequencies were used for the testing: 907 MHz was selected as a frequency outside the Progeny M-LMS spectrum, and 917 MHz and 922 MHz were selected as either overlapping or co-channel with the Progeny M-LMS spectrum. The spectrum plots for the carrier configurations within the Progeny band are shown in Figures 9, 10 and 11, and pictures of the specific equipment with serial numbers are shown in Figures 21 through 24 in the appendix. The spectrum plots are idealized and show the approximate shape and width of the Ubiquiti channel occupation in relationship to the Progeny channels.

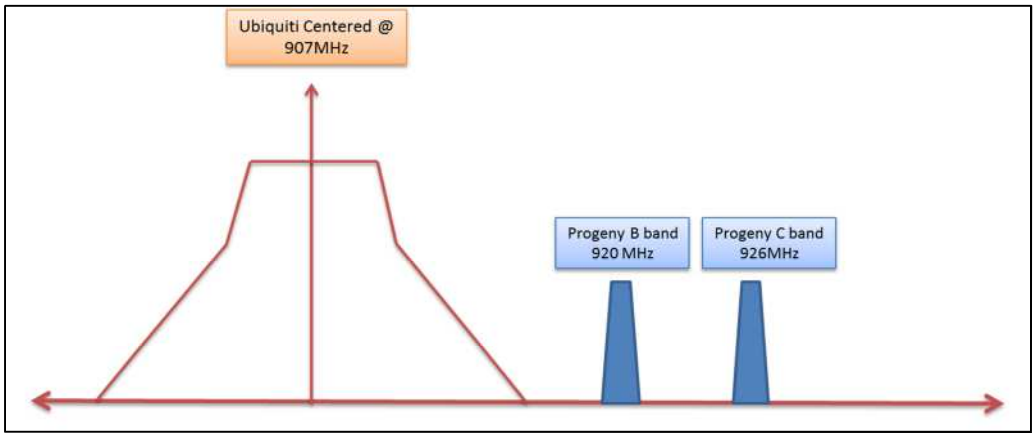

Figure 9: Ubiquiti centered at 907MHz

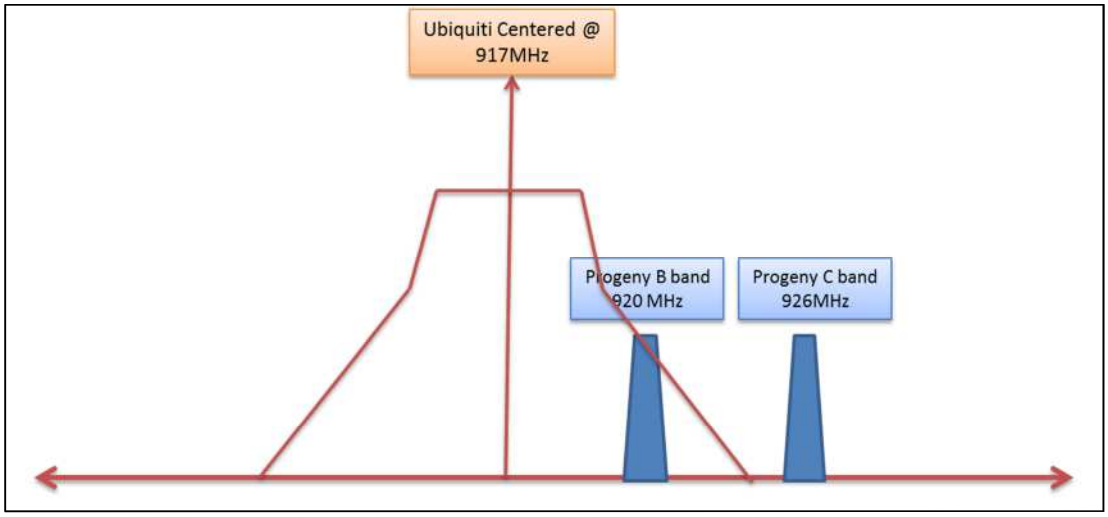

Figure 10: Ubiquiti centered at 917MHz

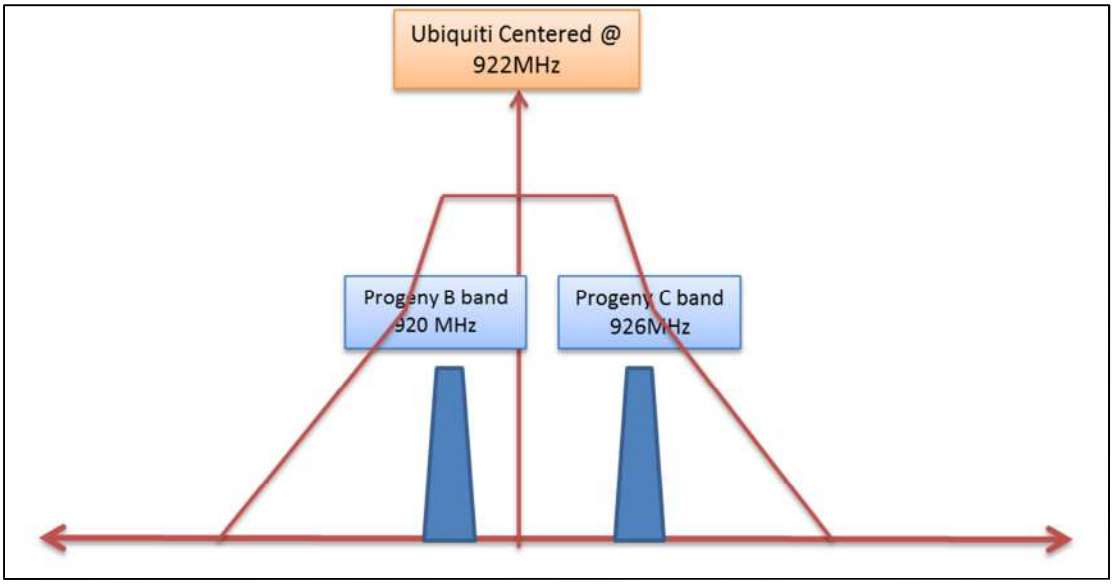

Figure 11: Ubiquiti centered at 922MHz

5. Test Data Documentation

In each of the tests, the parties participated jointly in establishing the test link, documenting the equipment setup, identifying the locations, and monitoring the test instruments and equipment. Test templates were created to denote which test configurations were completed and which test case number was assigned to each set of test results. The two numbers in the Time Tracking cells indicate when the command was given to change state (toggle the Progeny beacon stations from ON to OFF and vice versa) and when the acknowledgement was received that the action was complete. Turning the network off took less than 5 seconds while turning it on took upwards of 20 seconds. As an example for the Canopy Test 1 below, the command was given at 287 seconds to change state and it was complete at time 302 (287/302).

Test Matrix for Canopy on September 26

			Time Tracking (in seconds from a 0 time start)							
Test Tracking	Direction	Center Freq	Test Start Off	Net On 300	Net Off 600	Net On 900	Net Off 1200	Net On 1500	Finish 1800	File Name
Test 1	AP-SM	906	0	287/302	590/595	895/915	1195/1202	1495/1510	1800	canopy906apclient
Test 2	SM-AP	906	0	295/310	595/599	895/910	1195/1197	1495/1512	1800	canopy906apserver
Test 3	AP-SM	920	0	295/312	640/646	895/913	1195/1197	1495/1513	1800	canopy920apclient
Test 4	SM-AP	920	0	295/311	595/597	895/912	1195/1197	1495/1510	1610	canopy920apserver
Test 5	AP-SM	923	0	295/310	595/598	895/911	1195/1197	1495/1510	1800	canopy923apclient
Test 6	SM-AP	923	0	295/312	595/598	895/913	1195/1197	1495/1507	1800	canopy923apserver

Test Matrix for Ubiquiti on September 27

			Time Tracking (in seconds from a 0 time start)							
Test Tracking	Direction	Center Freq	Test Start Off	Net On 180	Net Off 360	Net On 540	Net Off 720	Net On 900	Finish 1080	File Name
Test 7	SM-AP	907	0	180/195	360/362	540/555	740/743	897/910	1080	ubiquiti907sm_ap5
Test 8	AP-SM	907	0	190/202	357/360'	542/560	720/723	897/915	1080	ubiquiti907ap_sm6
Test 9	SM-AP	917	0	185/195	360/336	540/555	717/720	'897/912	1080	ubiquiti917sm_ap3
Test 10	AP-SM	917	0	178/194	356/359	538/553	'722/725	897/912	1080	ubiquiti917ap_sm4
Test 11	SM-AP	922	0	180/197	360/362	540/555	720/726	900/913	1080	ubiquiti922sm_ap1
Test 12	AP-SM	922	0	181/197	360/365	546/560	720/723	900/913	1080	ubiquiti922ap_sm2

6. Test Results

Throughput plots, measured against test time, are included below for each of the test configurations. Tests 1-6 are for the Canopy system, with tests 1-2 at 906 MHz, tests 3-4 at 920 MHz, and tests 5-6 at 922 MHz. Each Canopy test lasted 30 minutes (1800 seconds), starting with the Progeny network in an OFF state, and then with the Progeny network cycled ON and OFF in increments of 300 seconds for each state, for a total of six state conditions during the 30 minutes (three "ON" and three "OFF"). Data during the few seconds of network transition, as well as 2 seconds to either side of the transition period, were excluded from the data set to prevent anomalous readings. The throughput data was measured and the standard deviation calculated for the "ON" versus "OFF" states in each case.

A similar test procedure was employed for the Ubiquiti system on Day 2 of testing, although it was agreed that, for testing efficiency, it was not necessary to test each state for a full 300 seconds, so the Ubiquiti measurement windows in each state was reduced to 180 seconds. Tests 7-12 are for the Ubiquiti system, with tests 7-8 at 907 MHz, tests 9-10 at 917 MHz, and tests 11-12 at 922 MHz. As with the Canopy tests, each test was initiated with the Progeny network in an "OFF" state and then the Progeny network was cycled "ON and OFF" in increments of 180 seconds until data for the six state conditions (three "ON" and three "OFF") were recorded. Data from the period of network transition, as well as 2 seconds to either side of the transition period were excluded to prevent anomalous readings. The throughput data was measured and standard deviation calculated for the "ON" versus "OFF" states.

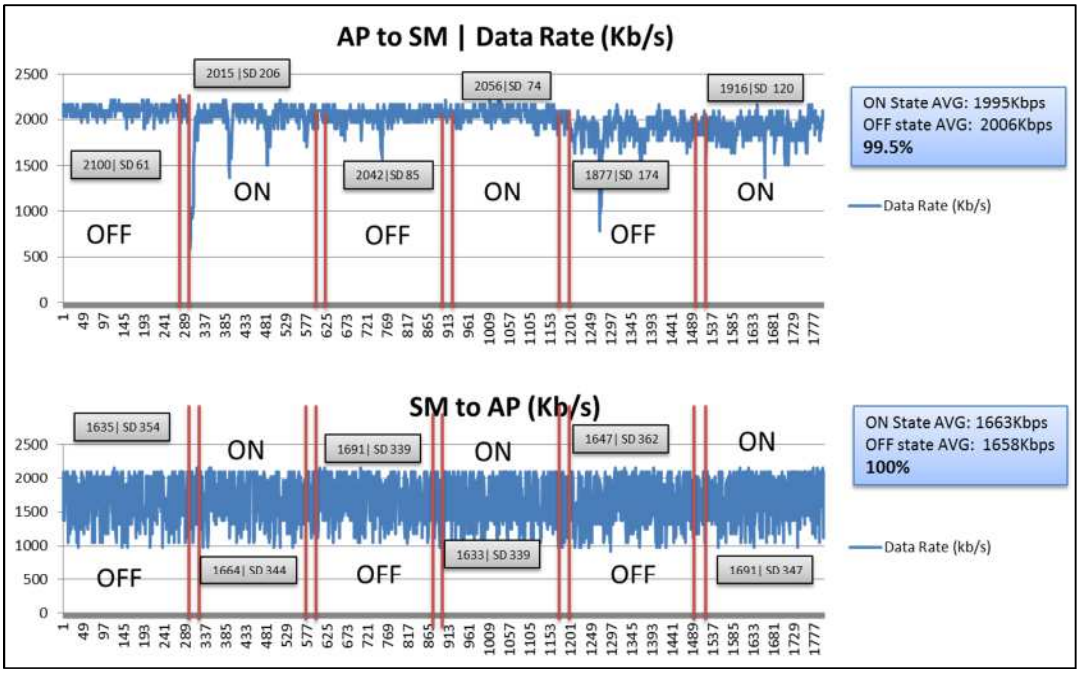

Figure 12: Canopy 906 MHz (Tests 1-2)

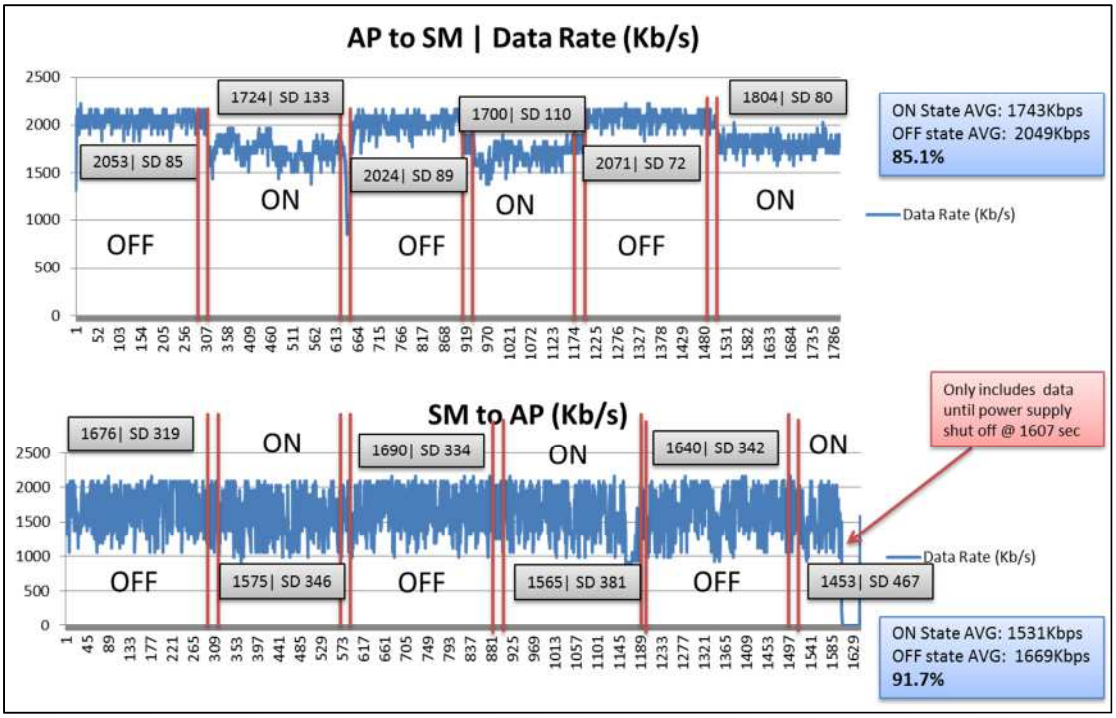

Figure 13: Canopy 920 MHz (Tests 3-4)

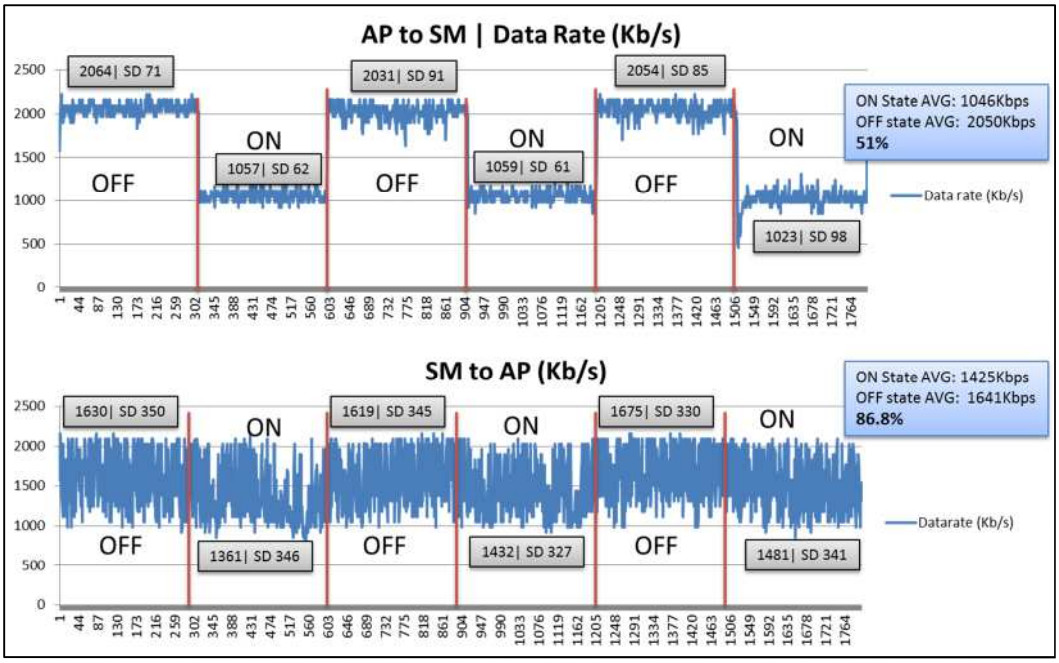

Figure 14: Canopy 923MHz (Tests 5-6)

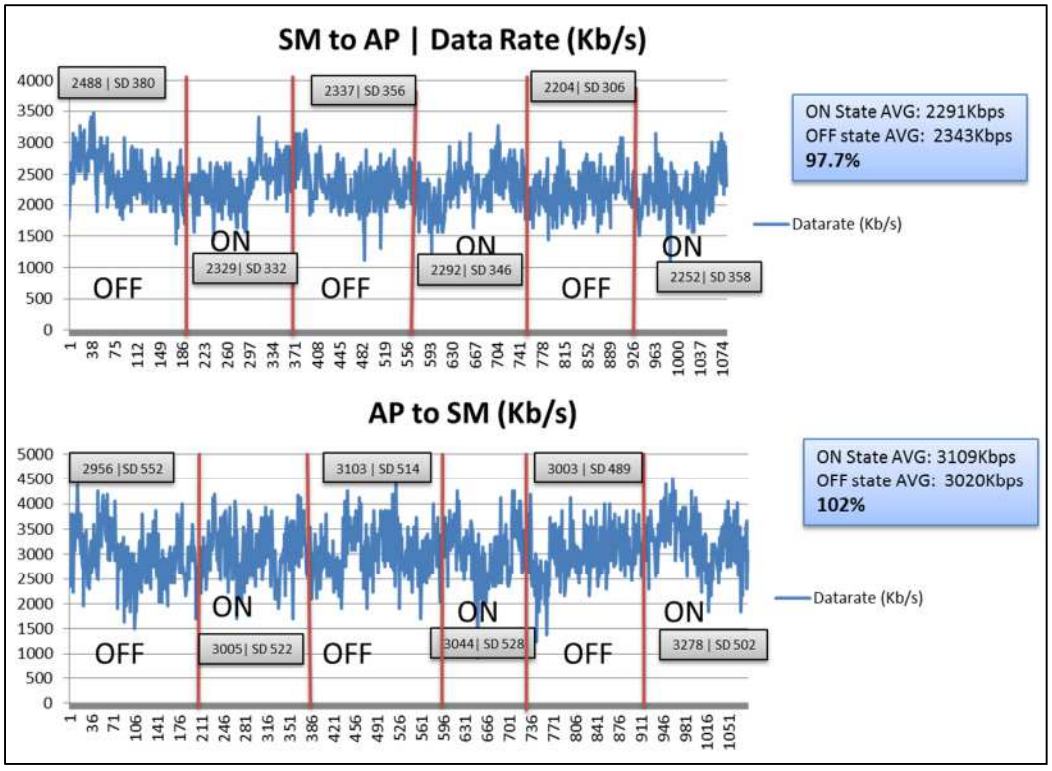

Figure 15: Ubiquiti 907 MHz (Tests 7-8)

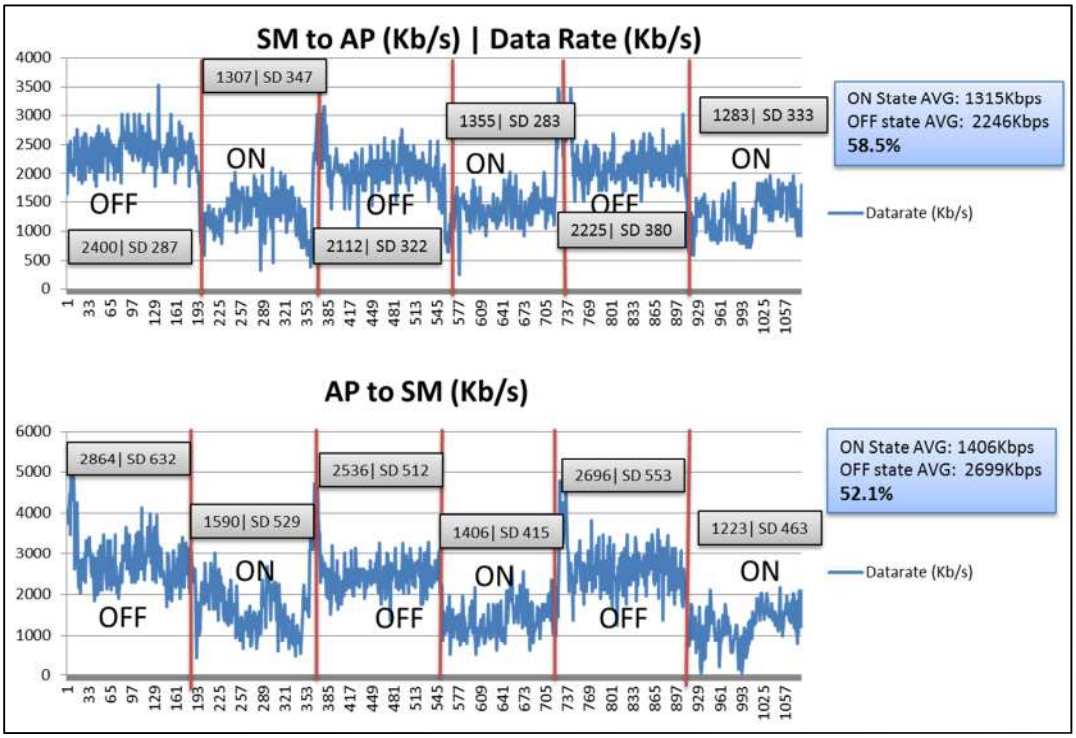

Figure 16: Ubiquiti 917 MHz (Tests 9-10)

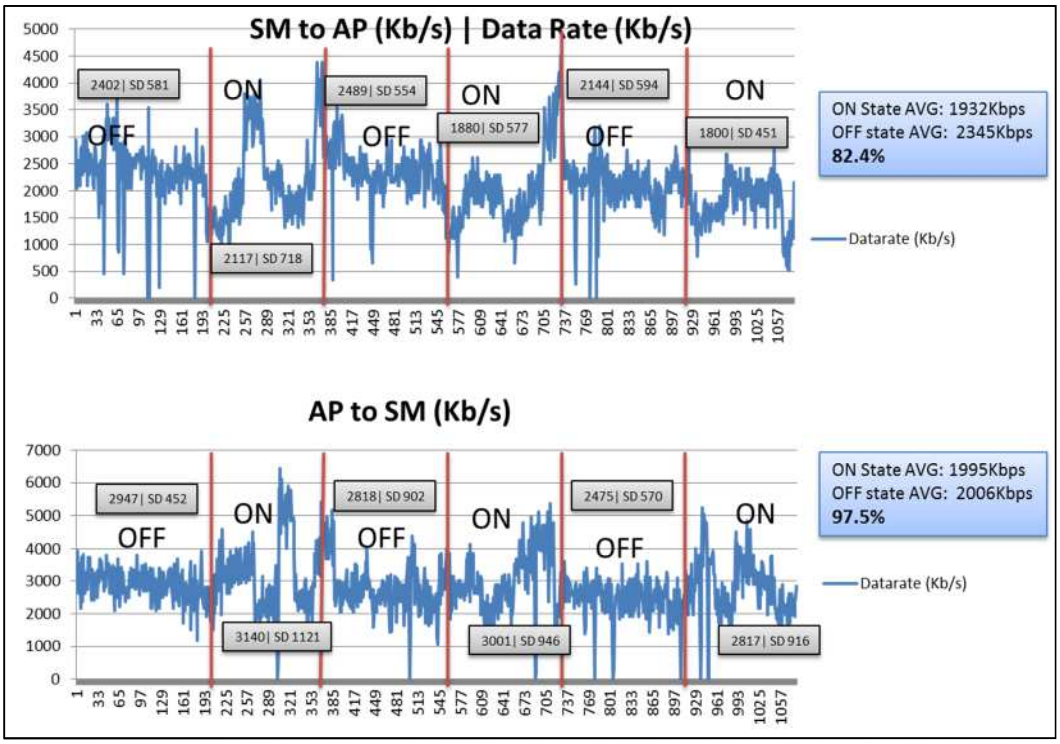

Figure 17: Ubiquiti 922 MHz (Tests 11-12)

7. Appendix

The pictures of the equipment tested, showing model and serial numbers follow.

Figure 18: ARC Wireless Antenna used for Canopy AP

Figure 19: Canopy AP Radio module

Figure 20: Canopy CPE

Figure 21: Ubiquiti AP

Figure 22: Ubiquiti AP serial number

Figure 23: Ubiquiti CPE

Figure 24: Ubiquiti CPE Serial number