Test Certificate

A sample of the following product received on June 16, 2011 and tested on June 20, 2011 complied with the requirements of

- **EN 301 893 V1.5.1 "Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive"**

given the measurement uncertainties detailed in Elliott report R83753.

Ubiquiti Networks

Model PicoStation5

Mark Briggs
Staff Engineer

Ubiquiti Networks

Printed Name

Testing Cert #2016.01

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Radio Test Report

EN 301 893 V1.5.1
ElectroMagnetic Compatibility and Radio spectrum Matters (ERM); Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN

Model: PicoStation5

COMPANY:	Ubiquiti Networks 91 E. Tasman Drive San Jose, CA 95134
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	July 7, 2011
FINAL TEST DATES:	June 20, 2011
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A2LA ACCREDITED
Testing Cert #2016.01

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	07-07-2011	First release	

TABLE OF CONTENTS

SCOPE

The European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI) publish standards regarding ElectroMagnetic Compatibility and Radio spectrum Matters for radio-communications devices.

Tests have been performed on the Ubiquiti Networks model PicoStation5, pursuant to the relevant requirements of the following harmonized EN standard(s) covering essential requirements under article 3.2 of the R&TTE Directive:

- EN 301 893 V1.5.1 "Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive"

OBJECTIVE

The objective of the manufacturer is to comply with the harmonized standards identified in the previous section. In the case of most equipment, this document requires testing to other EN specifications. In order to demonstrate compliance, the manufacturer or a contracted laboratory makes measurements and takes the necessary steps to ensure that the equipment complies with the appropriate technical standards.

STATEMENT OF COMPLIANCE

The tested sample of Ubiquiti Networks model PicoStation5 complied with the requirements of EN 301 893 V1.5.1 as covered under the scope of this test report (refer to results table on page 5).

The test results recorded herein are based on a single type test of Ubiquiti Networks model PicoStation5 and therefore apply only to the tested sample. The sample was selected and prepared by Jennifer Sanchez of Ubiquiti Networks.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

The scope of testing was limited to an evaluation of the radiated spurious emissions from the receiver as the purpose of testing was to evaluate a new enclosure. Radiated spurious emissions related to the transmitter were not re-evaluated as preliminary testing against other requirements (such as FCC Part 15) indicated that the transmitter spurious had not increased. Antenna port measurements were not repeated as the rf circuitry had not been modified.

TEST RESULTS

EN 301 893 V1.5.1

<table>
<tr><th>Section</th><th>Description</th><th>Channel</th><th>Measured Value</th><th>Limit</th><th>Result</th></tr>
<tr><td>4.2.2</td><td>Centre Frequencies</td><td colspan="4" rowspan="8">Not evaluated. The device, with a different enclosure, had been fully evaluated against all requirements of EN 301 893. The manufacturer declared that the changes in enclosure design would not significantly affect the previously measured values for signals at the rf antenna port of the system.</td></tr>
<tr><td>4.3.2</td><td>Nominal Channel Bandwidth and Occupied Channel Bandwidth</td></tr>
<tr><td rowspan="2">4.4.2.1</td><td>RF output power and power density at the highest power level (5150-5350 MHz)</td></tr>
<tr><td>RF output power and power density at the highest power level (5470-5725MHz)</td></tr>
<tr><td>4.4.2.2</td><td>RF output power at the lowest power level of the TPC range</td></tr>
<tr><td>4.5.2</td><td>Transmitter In-Band Spurious Emissions</td></tr>
<tr><td rowspan="2">4.5.1.2</td><td>Transmitter Out-Of Band Conducted Spurious Emissions</td></tr>
<tr><td>Transmitter Out-Of Band Radiated Spurious Emissions</td></tr>
<tr><td rowspan="3">4.6</td><td>Receiver Conducted Spurious Emissions</td></tr>
<tr><td rowspan="2">Receiver Radiated Spurious Emissions</td><td rowspan="2">5180MHz
5320MHz
5500MHz
5700MHz</td><td>Not performed, see note 1</td><td>25 – 1000 MHz: -57dBm</td><td>N/A Note 1</td></tr>
<tr><td>-50.8dBm erp @ 1080.13 MHz</td><td>1 – 26.5 GHz: -47dBm</td><td>Complies (-3.8dB)</td></tr>
<tr><td>4.7.2</td><td>DFS operational modes</td><td>-</td><td>Master Device</td><td>Master and/or Slave Device</td><td>Complies</td></tr>
<tr><td>4.7.2.1.2
4.7.2.2.2
4.7.2.3.2
4.7.2.4.2</td><td>Requirements related to DFS</td><td colspan="4" rowspan="2">Not evaluated, no changes to the DFS features were made to accommodate the new enclosure.</td></tr>
<tr><td>4.7.2.5.2</td><td>Uniform Spreading – use of available spectrum and probability of channel selection.</td></tr>
<tr><td>4.8.2</td><td>Medium Access Protocol</td><td colspan="3">Not evaluated, no changes to the medium access protocol were made to accommodate the new enclosure.</td><td>-</td></tr>
<tr><td>4.9.2</td><td>User Access Restrictions</td><td>-</td><td>The manufacturer attests to the fact that the DFS controls are not accessible and cannot be disabled/altered by the end user.</td><td>DFS controls (hardware or software) related to radar detection shall not be accessible to the user so that the DFS functions can neither be disabled nor altered.</td><td>Complies</td></tr>
<tr><td colspan="6">Note 1: Ubiquiti Networks consider measurements below 1GHz to fall under the scope of the product specific standard EN 55022 and so measurements against the requirements of EN 301 893for radiated spurious emissions were limited to the frequency range 1 – 26.5 GHz.</td></tr>
</table>

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2) and were calculated in accordance with NAMAS document NIS 81 and M3003.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF frequency	Hz	25 to 7000 MHz	1.7×10^{-7}
RF power, conducted	dBm	25 to 7000 MHz	± 0.52 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
Transmitter switch off time	Seconds	-	0.1 sec

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Ubiquiti Networks model PicoStation5 is an outdoor Wi-Fi access point, powered through PoE, which operates in the 5470-5725 MHz band allocated for RLAN devices. Since the EUT would normally be pole-mounted during operation, the EUT was mounted to a non-conductive tripod during testing. The electrical rating of the EUT is 100-240 Volts, 50-60 Hz, 0.3 Amps via a PoE adapter.

The sample was received on June 16, 2011 and tested on June 20, 2011. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number
Ubiquiti Networks	PicoStation5	Outdoor access point	00156DE8315C
Ubiquiti Networks	UBI-POE-15-8	PoE injector	0908-0031810

PERFORMANCE ASSESSMENT

The primary function of the model PicoStation5 is to provide a RLAN.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 4 cm wide by 4 cm deep by 15 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

No local support equipment was used during testing. The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Dell	Vostro	Laptop	30YD5N1	-

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Ethernet	PoE injector	Cat 5	Unshielded	1
LAN (PoE injector)	Laptop	Cat 5	Unshielded	10
AC Power (PoE injector)	AC Mains	3 wire	Unshielded	1

EUT OPERATION

During emissions testing the EUT was configured in a continuous receive mode at the power specified in the individual tests in this log. The high and low channels were tested.

EMISSIONS TESTING

GENERAL INFORMATION

Antenna port measurements were taken at the Elliott Laboratories test site located at 41039 Boyce Road, Fremont, CA 94538-2435.

Final radiated spurious emissions measurements were taken at the Elliott Laboratories Anechoic Chambers and/or Open Area Test Site(s) listed below. The sites conform to the requirements of ANSI C63.4: 2003 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* and CISPR 16-1-4:2007 - *Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus Ancillary equipment Radiated disturbances*. They are registered with the VCCI and are on file with the FCC and industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 7	A2LA accreditation	2845B-7	41039 Boyce Road Fremont, CA 94538-2435

Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

RADIATED EMISSIONS CONSIDERATIONS

CISPR has determined that radiated measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an Open Area Test Site or anechoic chamber, as defined in CISPR 16-1-4 and Annex A of EN 300 328 / EN 301 893 / EN 300 440-1. The test site is maintained free of conductive objects within the CISPR defined elliptical area.

EMISSIONS MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for radiated emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 7000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis.

Measurement bandwidths for the test instruments are set in accordance with the requirements of the standards referenced in this document.

INSTRUMENT CONTROL COMPUTER

Software control is used to convert the receiver measurements to the field strength at an antenna, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are exported in a graphic and/or tabular format, as appropriate.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer runs automated data collection programs that control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the EUT antenna port or receiving antenna and the test receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A combination of biconical, log periodic or bi-log antennas are used to cover the range from 25 MHz to 1000 MHz. Broadband antennas or tuned dipole antennas are used over the entire 25 to 1000 MHz frequency range as the reference antenna for substitution measurements.

Above 1000 MHz, a dual-ridge guide horn antenna or octave horn antenna are used as reference and measurement antennas.

The antenna calibration factors are included in site factors that are programmed into the test receivers and instrument control software when measuring the radiated field strength.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

The test height above ground for non-body worn devices shall be 150 centimeters. Floor mounted equipment will be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

RADIO STANDARD TEST PROCEDURES

RADIATED SPURIOUS EMISSIONS

Radiated emissions measurements are performed in two phases. A preliminary scan of emissions is conducted in either an anechoic chamber or on an OATS during which all significant EUT frequencies are identified with the system in a nominal configuration.

At least two scans are performed across the complete frequency range of interest and at each operating frequency identified in the reference standard. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. Initial scans are made using a peak detector (RBW=VBW) and using scan rates to ensure that the EUT transmits before the sweep moves out of each resolution bandwidth (for transmit mode). Where applicable, final measurements may be made with video averaging enabled.

During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit. The limit is a field strength limit derived from the ERP limit specified in the standard(s).

All signals within 10dB of this calculated limit are re-measured on an OATS or Semi-anechoic chamber. The field strength is recorded and the EUT is then replaced with a substitution antenna of known gain (typically a dipole antenna or a double-ridged horn antenna). The erp of the substitution antenna is measured and used to calculate the erp of the EUT as outlined in section C3 of EN 300 328 and EN 301 893.

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS - RADIATED SPURIOUS EMISSIONS

Receiver readings are compared directly to a converted specification limit (decibel form). The conversion uses the effective radiated power limit specified in the standard to calculate the expected field strength in free space using the following formula:

$$E = \frac{\sqrt{30\ P\ G}}{d}$$

where:

E = Field Strength in V/m
P = Power in Watts
G = Gain of antenna in numeric gain[1]
D = distance in meters

The field strength limit is then converted to decibel form (dBuV/m) and the margin of a given emission peak relative to the limit is calculated as follows:

$$M = R_C - L_S$$

where:

R_C = Corrected Receiver Reading in dBuV/m
L_S = Calculated specification Limit in dBuV/m
M = Margin in dB Relative to Spec

When substitution measurements are required (all signals with less than 6dB of margin relative the field strength limit) the margin of the emissions relative to the effective radiated power limit is calculated from:

$$P_S - S = M$$

where:

P_S = effective radiated power determined from antenna substitution (dBm)
S = Specification Limit in dBm
M = Margin to Specification in +/- dB

[1] Although the gain relative to a dipole should be used for limits expressed as an erp, the isotropic gain is used as this produces a more conservative limit.

Appendix A Test Equipment Calibration Data

Radiated Emissions, 1,000 - 26,500 MHz, 20-Jun-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	5/18/2012
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/8/2012
EMCO	Antenna, Horn, 1-18 GHz	3115	1242	N/A
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	7/14/2011
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts use with #1994 20dB attenuator	NRV-Z32	1423	7/19/2011
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1539	9/13/2011
Agilent	MXG Analog Signal Generator	N5181A	2146	1/26/2012

Appendix B Test Data

T83602 Pages 15 - 18

Client:	Ubiquiti Networks	Job Number:	J82980
Model:	PicoStation5	T-Log Number:	T83602
		Account Manager:	Susan Pelzl
Contact:	Jennifer Sanchez		-
Emissions Standard(s):	FCC 15.247, RSS 210, EN 301 893	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Ubiquiti Networks

Model

PicoStation5

Date of Last Test: 6/20/2011

Client:	Ubiquiti Networks	Job Number:	J82980
Model:	PicoStation5	T-Log Number:	T83602
		Account Manager:	Susan Pelzl
Contact:	Jennifer Sanchez		
Standard:	FCC 15.247, RSS 210, EN 301 893	Class:	N/A

Radiated Spurious Emissions, EN 301 893 V1.5.1

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/20/2011 13:54
Test Engineer: John Caizzi
Test Location: Fremont Chamber #7
Config. Used: 1
Config Change: -
EUT Voltage: PoE

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing. All remote support equipment was located outside the chamber, with all I/O connections running under the ground plane floor through metal conduit, and passed through a ferrite clamp upon exiting the chamber.

The measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 25 °C
Rel. Humidity: 37 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
3,4	Spurious Emissions Receive/Stand-By Mode, 1-26.5 GHz	EN 301 893 (-47dBm)	Pass	-50.8dBm erp @ 1080.13 MHz (-3.8dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Ubiquiti Networks	Job Number:	J82980
Model:	PicoStation5	T-Log Number:	T83602
		Account Manager:	Susan Pelzl
Contact:	Jennifer Sanchez		
Standard:	FCC 15.247, RSS 210, EN 301 893	Class:	N/A

Run #3: Radiated Spurious Emissions, Receive Mode, 30 - 26,500 MHz
Measurements made at 3m

Results Table - All channels, 1000-26,500 MHz

Frequency	Level	Pol	EN 301 893 Note 1		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		Frequency
1080.130	49.9	V	48.3	1.6	PK	167	1.18		100
1080.110	46.5	V	48.3	-1.8	PK	321	2.50		140
1440.020	46.1	V	48.3	-2.2	PK	229	1.39		100
1080.100	45.2	V	48.3	-3.1	Peak	321	2.5		140
1440.030	44.4	V	48.3	-3.9	PK	342	1.31		140
1620.030	42.8	V	48.3	-5.5	PK	39	1.00		140
1620.000	42.7	V	48.3	-5.6	PK	345	2.00		100
1440.090	42.5	V	48.3	-5.8	Peak	342	1.3		140
1259.990	42.4	V	48.3	-5.9	PK	360	1.00		100
1260.100	41.1	V	48.3	-7.2	PK	8	1.91		140
1530.000	40.8	V	48.3	-7.5	PK	181	1.58		100
1619.940	40.1	V	48.3	-8.2	Peak	39	1.0		140
1259.960	38.3	V	48.3	-10.0	Peak	8	1.9		140
2246.280	38.3	V	48.3	-10.0	PK	189	1.00		140
2246.300	37.4	V	48.3	-10.9	Peak	189	1.0		140
1521.860	36.4	V	48.3	-11.9	Peak	166	1.3		140
1520.500	36.4	V	48.3	-11.9	PK	166	1.31		140

Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: $E=\sqrt{(30PG)}/d$. This limit is conservative - it does not consider the presence of the ground plane and, for erp limits, the dipole gain (2.2dBi) has not been included. The erp or eirp for all signals with less than 10dB of margin relative to this field strength limit is determined using substitution measurements.

Client:	Ubiquiti Networks	Job Number:	J82980
Model:	PicoStation5	T-Log Number:	T83602
		Account Manager:	Susan Pelzl
Contact:	Jennifer Sanchez		
Standard:	FCC 15.247, RSS 210, EN 301 893	Class:	N/A

Run #4: Radiated Spurious Emissions, Receive Mode: Final Field Strength and Substitution Measurements
Measurements made at 3m

Frequency	Level	Pol	EN 301 893 Note 1		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		Frequency
1080.130	49.9	V	48.3	1.6	PK	167	1.18		100
1440.020	46.1	V	48.3	-2.2	PK	229	1.39		100
1620.000	42.7	V	48.3	-5.6	PK	345	2.00		100
1259.990	42.4	V	48.3	-5.9	PK	360	1.00		100
1530.000	40.8	V	48.3	-7.5	PK	181	1.58		100
1440.030	44.4	V	48.3	-3.9	PK	342	1.31		140
1080.110	46.5	V	48.3	-1.8	PK	321	2.50		140
2246.280	38.3	V	48.3	-10.0	PK	189	1.00		140
1520.500	36.4	V	48.3	-11.9	PK	166	1.31		140
1620.030	42.8	V	48.3	-5.5	PK	39	1.00		140
1260.100	41.1	V	48.3	-7.2	PK	8	1.91		140

Subsititution Measurements, Vertical

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
1080.130	-1.3	5.8	103.0	98.5	49.9	-48.6	-50.8		-47.0	-3.8
1440.020	-1.5	7.6	104.9	98.8	46.1	-52.7	-54.9		-47.0	-7.9
1620.000	-2.3	8.6	104.8	98.6	42.7	-55.9	-58.1		-47.0	-11.1
1259.990	-1.5	6.9	103.5	98.0	42.4	-55.6	-57.8		-47.0	-10.8
1530.000	-1.8	8.6	105.1	98.3	40.8	-57.5	-59.7		-47.0	-12.7
2246.280	-5.3	8.9	101.9	98.3	38.3	-60.0	-62.2		-47.0	-15.2

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna. A dipole has a nominal gain of 2.2dBi, however the dipole balun loss may reduce the gain of the substitution dipole used.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna, maximized for receive antenna height and transmit antenna azimuth.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured during initial run.

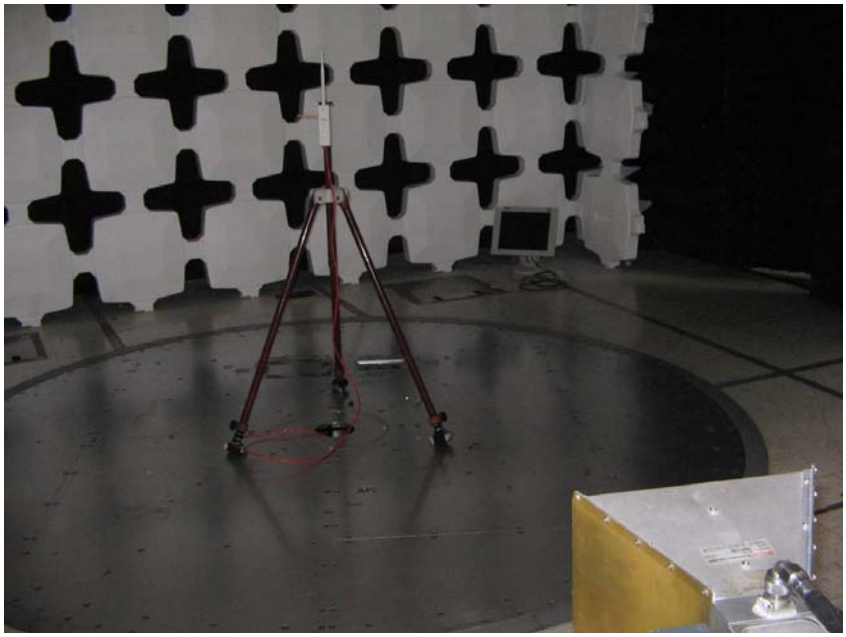
Appendix C List Of Technical Requirements To Be Tested

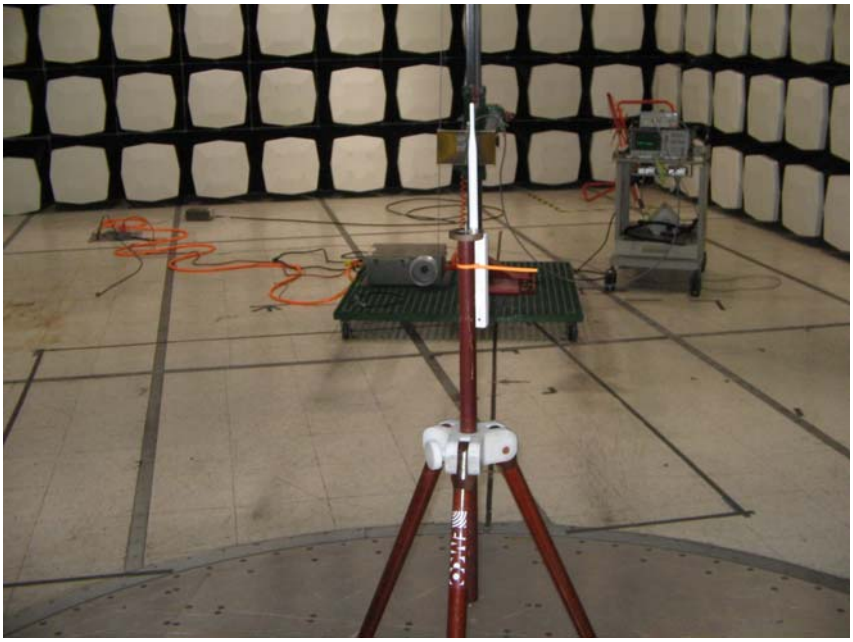
The list of technical requirements called for in EN 301 893 [2] is given below. Only those tests highlighted in green are covered under the scope of this report. The remaining requirements are considered by Ubiquiti Networks to have been covered by previous testing performed on a different version of this product.

Transmitter parameters	
EN Clause	**Transmitter parameters**
4.2	Carrier Frequencies
4.3	RF Output power, Transmit Power Control (TPC) and power Density
4.4	Transmitter unwanted emissions
4.4.1	Transmitter unwanted emissions outside the 5 GHz RLAN bands
4.4.2	Transmitter unwanted emissions within the 5 GHz RLAN bands
4.6	Dynamic Frequency Selection (DFS)
4.6.2.1	Channel Availability Check
4.6.2.2	In-Service Monitoring
4.6.2.3	Channel Shutdown
4.6.2.4	Non-Occupancy Period
4.6.2.5	Uniform Spreading

Receiver parameters	
EN Clause	**Receiver parameters**
4.5	Receiver spurious emissions

Appendix D Photographs





End of Report

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