Compliance Testing, LLC
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Test Report

Prepared for: Ubiquiti Networks, Inc

Models: LBE-5AC-Gen2
LBE-5AC-Omni-Gen2

Description: LiteBeam 5AC (G2)
LiteBeam 5AC Omni (G2)

FCC ID: SWX-LBE5ACG2
IC: 6545A-LBE5ACG2

Serial Number: N/A

To

FCC Part 15.407
IC RSS-247

Date of Issue: April 12, 2017

On the behalf of the applicant:

Ubiquiti Networks, Inc
2580 Orchard Parkway
San Jose, CA 95131

Attention of:

Michael Taylor, Compliance Manager
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Project No: p1710010

Paul Hay
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 17, 2015	Paul Hay	Original Document
2.0	April 7, 2017	Poona Saber	Added Reference Test Data section to page 6; Revised Annex F to include EIRP elevation graphs for 6dBi omni antenna

Table of Contents

Description	Page
Standard Test Conditions Engineering Practices	6
Test Results Summary	9
Peak Output Power	10
Transmitter Power Spectral Density	15
Undesirable Emissions Conducted	20
Undesirable Emissions Radiated	22
Occupied Bandwidth	24
Frequency Stability	25
RF Exposure	26
A/C Powerline Conducted Emission	29
Transmitter E.I.R.P. at Various Elevations	30
Test Equipment Utilized	31

ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

ACCREDITED
TESTING CERT
#2152.01

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
23.0 – 26.5	22.7 – 36.5	962.9 – 972.7

EUT Operation during Tests

The EUT was configured to run in a continuous data stream using ART software through a POE adaptor and Ethernet connection.

EUT Description
Models: LBE-5AC-Gen2, LBE-5AC-Omni-Gen2
Description: LiteBeam 5AC (G2), LiteBeam 5AC Omni (G2)
Firmware: AirOS 8.0.1
Software: AirOS 8.0.1
Serial Number: N/A

Additional Information:
The EUT was tested conducted mode with RF connectors mounted on the EUT at the antenna input.
When the test cable is plugged into the RF connector mounted to the EUT it disables the antenna connection.
The EUT is powered by POE (Power Over Ethernet).
The different data rates were evaluated and the worst case data rate was chosen for all the testing.

Reference Test Data:
This report contains test data from a device which has already been certified pursuant to Part 15.407
FCC ID: SWX- LBE5AC
The certification being sought for LBE-5AC-G2 and LBE-5AC-G2-Omni contains the same RF circuitry as the mentioned FCC ID. The Gen2 device incorporates the 2.4GHz emission which was turned off via software in the previous certification. Testing was performed to FCC Part 15.247 to address the different emissions. This report is included under the 15.247 certification, FCC ID SWX-LBE5ACG2

EUT Specifications

EUT Specifications	15.407
Equipment Code	NII
Model(s)Tested	LBE-5AC-Gen2
Model(s) Covered	LBE-5AC-Omni-Gen2
Maximum Output Power	22.8 dBm
Frequency Ranges covered	5250 – 5350, 5470 – 5725 MHz
EUT temperature range	-40C to 80C
Bandwidths	10/20/30/40/50/60/80 MHz
Data Rates	6, 9, 12, 18, 24, 36, 48, 54, MCS0, MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7, MCS8, MCS9
Modulations	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM

Antenna List

Model No.	Manufacturer	Antenna Type	Peak Gain
LBE-AC Omni	Ubiquiti	OMNI	6
LBE-AC Dish	Ubiquiti	Dish	23

15.203: Antenna Requirement:

	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
X	The EUT must be professionally installed
	The antenna requirement does not apply

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Switching Gigabit Power Supply/POE	Ubiquiti	GP-A240-050G	N/A

Cables: None

Modifications: None

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
§15.203	Antenna Requirements	Pass	
§15.207 §15.407(b)(6)	Line Conducted Emissions	Pass	
§15.407(a)(2)	Conducted Output Power	Pass	
§15.407(a)(2),(5)	Power Spectral Density	Pass	
§15.403(i) 15.407(a)(5)	26dB Occupied Bandwidth	Pass	
	99% Occupied Bandwidth		
§15.407(b)(2)(3)	Undesirable Emissions	Pass	
§15.205 §15.407(b)(2),(3),(5)(6)(7)	General Field Strength Limits (Restricted Bands and Radiated Emission limits)	Pass	
§15.407(g)	Frequency Stability	Pass	
§15.407(f)	RF Exposure	Pass	

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
CFR47, Part 15, Subpart E	Unlicensed Nation Information Infrastructure Devices (U-NII)
ANSI C63.10-2009	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2009	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories
KDB 644545 D03	Guidance for IEEE 802 11ac New Rules
KDB 789033 D02	General U-NII Test Procedures New Rules V01
KDB 926956 D01	U-NII Transition Plan

Peak Output Power
Engineer: Paul Hay
Test Date: 8/17/15

Test Requirements

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

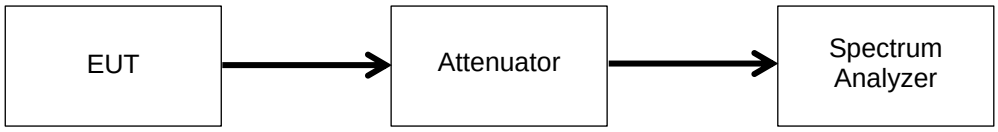
Test Procedure

The RF power was calculated using the spectrum analyzers' band power function per Method SA-1 from KDB 789033 D02 General U-NII Test Procedures New Rules v01. Measurements were made at the low, mid, and high channels of the band.

The Spectrum Analyzer was set to the following:

a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Sweep time = auto
d. Detector = RMS
e. 100 traces in power averaging mode

Test Setup



Test Results

UNII-2A Data with a 6 dBi PTMPAntenna

Bandwidth	Test Frequency	Data Rate	TP	J7 Measured Level	J13 Measured Level	J7 Measured Level	J13 Measured Level	Combined Output Power	Limit	Margin
MHz	MHz			dBm	dBm	mW	mW	dBm	dBm	dB
10	5255	vt0	18	14.5	14.5	28.2	28.2	17.5	24	-6.5
10	5300	vt0	17	13.8	13.9	24.0	24.5	16.9	24	-7.1
10	5340	vt0	5	2.0	2.3	1.6	1.7	5.2	24	-18.8
20	5260	vt0	20	18.0	18.3	63.1	67.6	21.2	24	-2.8
20	5300	vt0	19	15.0	15.2	31.6	33.1	18.1	24	-5.9
20	5335	vt0	0	-3.9	-4.0	0.4	0.4	-0.9	24	-24.9
30	5265	vt0	20	19.0	18.9	79.4	77.6	22.0	24	-2.0
30	5300	vt0	18	14.1	14.0	25.7	25.1	17.1	24	-6.9
30	5325	vt0	8							
30	5330	vt0	-6	-4.8	-4.5	0.3	0.4	-1.6	24	-25.6
40	5270	vf0	20	16.2	16.5	41.7	44.7	19.4	24	-4.6
40	5300	vf0	18	13.8	13.7	24.0	23.4	16.8	24	-7.2
40	5325	vf0	-5	0.1	0.9	1.0	1.2	3.5	24	-20.5
50	5275	vf0	20	16.0	16.4	39.8	43.7	19.2	24	-4.8
50	5300	vf0	20	15.6	15.9	36.3	38.9	18.8	24	-5.2
50	5320	vf0	-5	0.3	1.2	1.1	1.3	3.8	24	-20.2
60	5280	vf0	17	14.5	14.8	28.2	30.2	17.7	24	-6.3
60	5300	vf0	11	7.4	7.6	5.5	5.8	10.5	24	-13.5
60	5315	vf0	-6	-9.0	-9.1	0.1	0.1	-6.0	24	-30.0
80	5290	ve00	8	5.3	5.6	3.4	3.6	8.5	24	-15.5
80	5300	ve00	3	0.3	0.1	1.1	1.0	3.2	24	-20.8

UNII-2A with 23 dBi antenna

Bandwidth	Test Frequency	Data Rate	J7 Measured Level	J13 Measured Level	J7 Measured Level	J13 Measured Level	Combined Output Power	Limit	Margin
MHz	MHz		dBm	dBm	mW	mW	dBm	dBm	dB
10	5255	vt0	-10.6	-10.6	0.1	0.1	-7.6	7	-14.6
10	5300	vt0	-11.3	-11.2	0.1	0.1	-8.2	7	-15.2
10	5340	vt0	-23.1	-22.8	0.0	0.0	-19.9	7	-26.9
20	5260	vt0	-7.1	-6.8	0.2	0.2	-3.9	7	-10.9
20	5300	vt0	-10.1	-9.9	0.1	0.1	-7.0	7	-14.0
20	5335	vt0	-29	-29.1	0.0	0.0	-26.0	7	-33.0
30	5265	vt0	-6.1	-6.2	0.2	0.2	-3.1	7	-10.1
30	5300	vt0	-11	-11.1	0.1	0.1	-8.0	7	-15.0
30	5330	vt0	-29.9	-29.6	0.0	0.0	-26.7	7	-33.7
40	5270	vf0	-8.9	-8.6	0.1	0.1	-5.7	7	-12.7
40	5300	vf0	-11.3	-11.4	0.1	0.1	-8.3	7	-15.3
40	5325	vf0	-25	-24.2	0.0	0.0	-21.6	7	-28.6
50	5275	vf0	-9.1	-8.7	0.1	0.1	-5.9	7	-12.9
50	5300	vf0	-9.5	-9.2	0.1	0.1	-6.3	7	-13.3
50	5320	vf0	-24.8	-23.9	0.0	0.0	-21.3	7	-28.3
60	5280	vf0	-10.6	-10.3	0.1	0.1	-7.4	7	-14.4
60	5300	vf0	-17.7	-17.5	0.0	0.0	-14.6	7	-21.6
60	5315	vf0	-34.1	-34.2	0.0	0.0	-31.1	7	-38.1
80	5290	ve00	-19.8	-19.5	0.0	0.0	-16.6	7	-23.6
80	5300	ve00	-24.8	-25	0.0	0.0	-21.9	7	-28.9
80	5305	ve00	-33.1	-33	0.0	0.0	-30.0	7	-37.0

UNII-2C Data with a 6 dBi PTMP Antenna

Bandwidth	Test Frequency	Data Rate	TP	J7 Measured Level	J8 Measured Level	J7 Measured Level	J8 Measured Level	Combined Output Power	Limit	Margin
MHz	MHz			dBm	dBm	mW	mW	dBm	dBm	dB
10	5480	vt0	16	16.7	16.5	46.8	44.7	19.6	24	-4.4
10	5600	vt0	20	19.6	20.0	91.2	100.0	22.8	24	-1.2
10	5715	vt0	20	19.4	19.6	87.1	91.2	22.5	24	-1.5
20	5485	vt0	16	16.5	16.4	44.7	43.7	19.5	24	-4.5
20	5600	vt0	20	19.2	19.7	83.2	93.3	22.5	24	-1.5
20	5710	vt0	20	19.3	19.3	85.1	85.1	22.3	24	-1.7
30	5490	vt0	10	9.8	10.0	9.5	10.0	12.9	24	-11.1
30	5600	vt0	20	19.3	19.1	85.1	81.3	22.2	24	-1.8
30	5705	vt0	20	19.6	19.5	91.2	89.1	22.6	24	-1.4
40	5495	vf0	9	8.0	8.2	6.3	6.6	11.1	24	-12.9
40	5600	vf0	20	16.8	17.0	47.9	50.1	19.9	24	-4.1
40	5700	vf0	20	18.2	18.6	66.1	72.4	21.4	24	-2.6
50	5500	vf0	8	7.4	7.0	5.5	5.0	10.2	24	-13.8
50	5600	vf0	20	16.9	17.1	49.0	51.3	20.0	24	-4.0
50	5695	vf0	20	18.4	18.6	69.2	72.4	21.5	24	-2.5
60	5505	vf0	6	5.3	6.0	3.4	4.0	8.7	24	-15.3
60	5600	vf0	20	17.1	17.6	51.3	57.5	20.4	24	-3.6
60	5690	vf0	20	18.7	18.3	74.1	67.6	21.5	24	-2.5
80	5515	ve00	5	3.8	4.0	2.4	2.5	6.9	24	-17.1
80	5600	ve00	20	18.8	18.9	75.9	77.6	21.9	24	-2.1
80	5680	ve00	20	18.2	18.5	66.1	70.8	21.4	24	-2.6

UNII-2C with 23 dBi antenna

Bandwidth	Test Frequency	Data Rate	J7 Measured Level	J8 Measured Level	J7 Measured Level	J8 Measured Level	Combined Output Power	Limit	Margin
MHz	MHz		dBm	dBm	mW	mW	dBm	dBm	dB
10	5480	vt0	-0.3	-0.5	0.9	0.9	2.6	7	-4.4
10	5600	vt0	2.6	3.0	1.8	2.0	5.8	7	-1.2
10	5715	vt0	2.4	2.6	1.7	1.8	5.5	7	-1.5
20	5485	vt0	-0.5	-0.6	0.9	0.9	2.5	7	-4.5
20	5600	vt0	2.2	2.7	1.7	1.9	5.5	7	-1.5
20	5710	vt0	2.3	2.3	1.7	1.7	5.3	7	-1.7
30	5490	vt0	-7.2	-7.0	0.2	0.2	-4.1	7	-11.1
30	5600	vt0	2.3	2.1	1.7	1.6	5.2	7	-1.8
30	5705	vt0	2.6	2.5	1.8	1.8	5.6	7	-1.4
40	5495	vf0	-9.0	-8.8	0.1	0.1	-5.9	7	-12.9
40	5600	vf0	-0.2	0.0	1.0	1.0	2.9	7	-4.1
40	5700	vf0	1.2	1.6	1.3	1.4	4.4	7	-2.6
50	5500	vf0	-9.6	-10.0	0.1	0.1	-6.8	7	-13.8
50	5600	vf0	-0.1	0.1	1.0	1.0	3.0	7	-4.0
50	5695	vf0	1.4	1.6	1.4	1.4	4.5	7	-2.5
60	5505	vf0	-11.7	-11.0	0.1	0.1	-8.3	7	-15.3
60	5600	vf0	0.1	0.6	1.0	1.1	3.4	7	-3.6
60	5690	vf0	1.7	1.3	1.5	1.3	4.5	7	-2.5
80	5515	ve00	-13.2	-13.0	0.0	0.1	-10.1	7	-17.1
80	5600	ve00	1.8	1.9	1.5	1.5	4.9	7	-2.1
80	5680	ve00	1.2	1.5	1.3	1.4	4.4	7	-2.6

Transmitter Power Spectral Density
Engineer: Paul Hay
Test Date: 8/17/15

Test Requirements

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

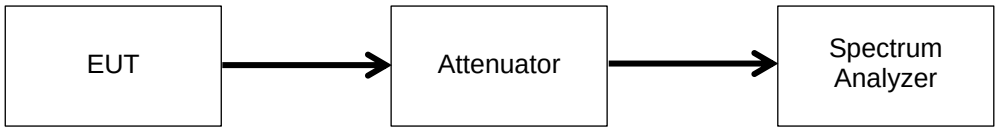
Test Procedure

The Power Spectral Density was measured using the method per SA-1 from KDB 789033 D02 General U-NII Test Procedures New Rules v01. Measurements were made at the low, mid, and high channels of the band. The maximum PSD was determine by finding the peak value across the carrier bandwidth.

The Spectrum Analyzer was set to the following:

a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Span 1.5 * BW
d. Sweep time = auto
e. Detector = RMS
f. 100 traces in power averaging mode

Test Setup



Test Results

UNII-2A Data with a 6 dBi PTMP Antenna

Bandwidth	Test Frequency	Data Rate	TP	J7 Measured Level	J13 Measured Level	J7 Measured Level	J13 Measured Level	Combined Spectral Density	Limit	Margin
MHz	MHz			dBm	dBm	mW	mW	dBm	dBm	dB
10	5255	vt0	18	8.0	7.9	6.3	6.2	11.0	11	0.0
10	5300	vt0	17	7.5	7.5	5.6	5.6	10.5	11	-0.5
10	5340	vt0	5	-3.9	-3.4	0.4	0.5	-0.6	11	-11.6
20	5260	vt0	20	6.3	6.4	4.3	4.4	9.4	11	-1.6
20	5300	vt0	19	5.9	6.0	3.9	4.0	9.0	11	-2.0
20	5335	vt0	0	-12.0	-12.1	0.1	0.1	-9.0	11	-20.0
30	5265	vt0	20	4.3	5.0	2.7	3.2	7.7	11	-3.3
30	5300	vt0	18	0.9	1.1	1.2	1.3	4.0	11	-7.0
30	5330	vt0	-6	-17.9	-16.2	0.0	0.0	-14.0	11	-25.0
40	5270	vf0	20	1.1	1.0	1.3	1.3	4.1	11	-6.9
40	5300	vf0	18	-0.7	0.0	0.9	1.0	2.7	11	-8.3
40	5325	vf0	-5	-18.7	-18.0	0.0	0.0	-15.3	11	-26.3
50	5275	vf0	20	0.4	0.6	1.1	1.1	3.5	11	-7.5
50	5300	vf0	20	0.3	0.5	1.1	1.1	3.4	11	-7.6
50	5320	vf0	-5	-19.8	-20.0	0.0	0.0	-16.9	11	-27.9
60	5280	vf0	17	-3.7	-3.5	0.4	0.4	-0.6	11	-11.6
60	5300	vf0	11	-8.8	-8.7	0.1	0.1	-5.7	11	-16.7
60	5315	vf0	-6	-21.5	-22.0	0.0	0.0	-18.7	11	-29.7
80	5290	ve00	8	-13.6	-12.9	0.0	0.1	-10.2	11	-21.2
80	5300	ve00	3	-18.1	-17.9	0.0	0.0	-15.0	11	-26.0
80	5305	ve00	-5	-22.1	-22.1	0.0	0.0	-19.1	11	-30.1

UNII-2A Power Spectral Density Test Results with a 23 dBi PTMP Antenna

Bandwidth	Test Frequency	J7 Measured Level	J13 Measured Level	J7 Measured Level	J13 Measured Level	Combined Spectral Density	Limit	Margin
MHz	MHz	dBm	dBm	mW	mW	dBm	dBm	dB
10	5255	-17.1	-17.2	0.0	0.0	-14.1	-6	-20.1
10	5300	-17.6	-17.6	0.0	0.0	-14.6	-6	-20.6
10	5340	-29	-28.5	0.0	0.0	-25.7	-6	-31.7
20	5260	-18.8	-18.7	0.0	0.0	-15.7	-6	-21.7
20	5300	-19.2	-19.1	0.0	0.0	-16.1	-6	-22.1
20	5335	-37.1	-37.2	0.0	0.0	-34.1	-6	-40.1
30	5265	-20.8	-20.1	0.0	0.0	-17.4	-6	-23.4
30	5300	-24.2	-24	0.0	0.0	-21.1	-6	-27.1
30	5330	-43	-41.3	0.0	0.0	-39.1	-6	-45.1
40	5270	-24	-24.1	0.0	0.0	-21.0	-6	-27.0
40	5300	-25.8	-25.1	0.0	0.0	-22.4	-6	-28.4
40	5325	-43.8	-43.1	0.0	0.0	-40.4	-6	-46.4
50	5275	-24.7	-24.5	0.0	0.0	-21.6	-6	-27.6
50	5300	-24.8	-24.6	0.0	0.0	-21.7	-6	-27.7
50	5320	-44.9	-45.1	0.0	0.0	-42.0	-6	-48.0
60	5280	-28.8	-28.6	0.0	0.0	-25.7	-6	-31.7
60	5300	-33.9	-33.8	0.0	0.0	-30.8	-6	-36.8
60	5315	-46.6	-47.1	0.0	0.0	-43.8	-6	-49.8
80	5290	-38.7	-38	0.0	0.0	-35.3	-6	-41.3
80	5300	-43.2	-43	0.0	0.0	-40.1	-6	-46.1
80	5305	-47.2	-47.2	0.0	0.0	-44.2	-6	-50.2

UNII-2C Data with a 6 dBi PTMP Antenna

Bandwidth	Test Frequency	Data Rate	TP	J7 Measured Level	J8 Measured Level	J7 Measured Level	J8 Measured Level	Combined Spectral Density	Limit	Margin
MHz	MHz			dBm	dBm	mW	mW	dBm	dBm	dB
10	5480	vt0	16	-1.7	-1.5	0.7	0.7	1.4	11	-9.6
10	5600	vt0	20	0.9	1.0	1.2	1.3	4.0	11	-7.0
10	5715	vt0	20	1.5	1.4	1.4	1.4	4.5	11	-6.5
20	5485	vt0	16	-0.1	0.0	1.0	1.0	3.0	11	-8.0
20	5600	vt0	20	2.5	2.6	1.8	1.8	5.6	11	-5.4
20	5710	vt0	20	2.9	3.0	1.9	2.0	6.0	11	-5.0
30	5490	vt0	10	-8.4	-8.1	0.1	0.2	-5.2	11	-16.2
30	5600	vt0	20	1.2	1.4	1.3	1.4	4.3	11	-6.7
30	5705	vt0	20	1.6	1.5	1.4	1.4	4.6	11	-6.4
40	5495	vf0	9	-6.8	-6.5	0.2	0.2	-3.6	11	-14.6
40	5600	vf0	20	4.0	3.9	2.5	2.5	7.0	11	-4.0
40	5700	vf0	20	3.1	3.2	2.0	2.1	6.2	11	-4.8
50	5500	vf0	8	-8.4	-8.0	0.1	0.2	-5.2	11	-16.2
50	5600	vf0	20	1.6	1.7	1.4	1.5	4.7	11	-6.3
50	5695	vf0	20	2.8	3.0	1.9	2.0	5.9	11	-5.1
60	5505	vf0	6	-11.2	-11.0	0.1	0.1	-8.1	11	-19.1
60	5600	vf0	20	1.1	1.3	1.3	1.3	4.2	11	-6.8
60	5690	vf0	20	2.3	2.1	1.7	1.6	5.2	11	-5.8
80	5515	ve00	5	-13.0	-13.1	0.1	0.0	-10.0	11	-21.0
80	5600	ve00	20	0.7	0.7	1.2	1.2	3.7	11	-7.3
80	5680	ve00	20	0.6	0.4	1.1	1.1	3.5	11	-7.5

UNII-2C Data with a 23 dBi PTMP Antenna

Bandwidth	Test Frequency	Data Rate	TP	J7 Measured Level	J8 Measured Level	J7 Measured Level	J8 Measured Level	Combined Spectral Density	Limit	Margin
MHz	MHz			dBm	dBm	mW	mW	dBm	dBm	dB
10	5480	vt0	16	-18.7	-18.5	0.0	0.0	-15.6	-6	-9.6
10	5600	vt0	20	-16.1	-16	0.0	0.0	-13.0	-6	-7.0
10	5715	vt0	20	-15.5	-15.6	0.0	0.0	-12.5	-6	-6.5
20	5485	vt0	16	-17.1	-17	0.0	0.0	-14.0	-6	-8.0
20	5600	vt0	20	-14.5	-14.4	0.0	0.0	-11.4	-6	-5.4
20	5710	vt0	20	-14.1	-14	0.0	0.0	-11.0	-6	-5.0
30	5490	vt0	10	-25.4	-25.1	0.0	0.0	-22.2	-6	-16.2
30	5600	vt0	20	-15.8	-15.6	0.0	0.0	-12.7	-6	-6.7
30	5705	vt0	20	-15.4	-15.5	0.0	0.0	-12.4	-6	-6.4
40	5495	vf0	9	-23.8	-23.5	0.0	0.0	-20.6	-6	-14.6
40	5600	vf0	20	-13	-13.1	0.1	0.0	-10.0	-6	-4.0
40	5700	vf0	20	-13.9	-13.8	0.0	0.0	-10.8	-6	-4.8
50	5500	vf0	8	-25.4	-25	0.0	0.0	-22.2	-6	-16.2
50	5600	vf0	20	-15.4	-15.3	0.0	0.0	-12.3	-6	-6.3
50	5695	vf0	20	-14.2	-14	0.0	0.0	-11.1	-6	-5.1
60	5505	vf0	6	-28.2	-28	0.0	0.0	-25.1	-6	-19.1
60	5600	vf0	20	-15.9	-15.7	0.0	0.0	-12.8	-6	-6.8
60	5690	vf0	20	-14.7	-14.9	0.0	0.0	-11.8	-6	-5.8
80	5515	ve00	5	-30	-30.1	0.0	0.0	-27.0	-6	-21.0
80	5600	ve00	20	-16.3	-16.3	0.0	0.0	-13.3	-6	-7.3
80	5680	ve00	20	-16.4	-16.6	0.0	0.0	-13.5	-6	-7.5

Undesirable Emissions Conducted

Engineer: Paul Hay

Test Date: 7/27/15

Test Requirements

Unwanted Emissions that fall Outside Restricted Bands

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

As specified in § 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz maximum emission limit.

The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz

The provisions of §15.205 apply to intentional radiators operating under this section

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

For Conducted Unwanted Emissions in the Restricted Bands

For conducted measurements above 1000 MHz, EIRP was determined and then the field strength computed by the following:
E[dBµV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and d = 3m
E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

Test Procedure

Per KDB 789033 D02 General U-NII Test Procedures New Rules v01 conducted RF port measurements were made in lieu of radiated. In addition, Cabinet Emissions measurements were performed in a semi-anechoic chamber with the antenna port terminated by a matching load. See additional section for Radiated Emissions.

The following criteria were addressed:

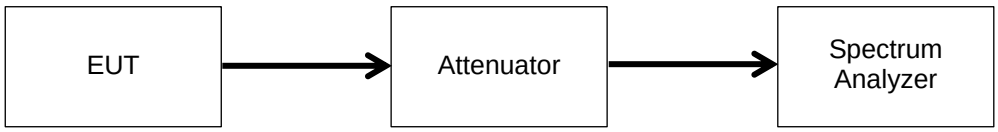
The Spectrum Analyzer was set to the following for emissions > 1000MHz:

a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Detector = Peak.
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
f. VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10 Hz

For emissions below 1000MHz the Spectrum Analyzer settings were as follows:

a. RBW = 100 kHz
b. VBW ≥ 300 kHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold

Test Setup



Test Results: **See Annex A: Undesirable Emissions Conducted**

Undesirable Emissions Radiated
Engineer: Paul Hay
Test Date: 8/14/15

Test Requirements

The provision of §15.209 were applied. In addition the requirements of §15.205 were also applied.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits

Frequency (MHz)	Frequency (microvolts/meter)	Frequency (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dBµV/m) = 20 log E field strength (uV/m)

Test Procedure

The EUT was setup in accordance with ANSI C63.10. 2009 and tested per KDB 789033. The antenna was replaced with non-radiating matched load. The EUT is placed on non-conductive platform at a height of 0.8 meters above the ground plane of the semi-anechoic chambers. The EUT was rotated 360 degrees and the receive antenna raised and lowered to find the maximum emissions from 30MHz to the 10th harmonic of the fundamental. The EUT was set to the maximum power level allowed and the low, mid, and high channels were investigated for emissions.

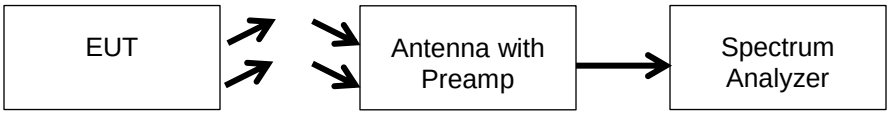
The Spectrum Analyzer was set to the following for emissions > 1000MHz:

a. (RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
f. RBW = 1 MHz
g. VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10Hz

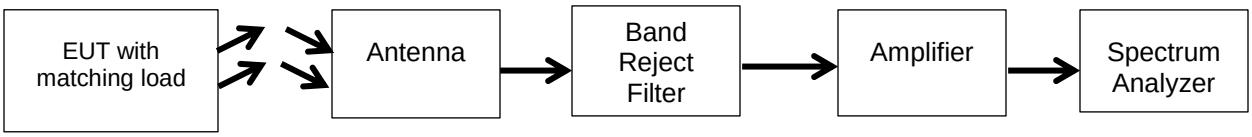
For emissions below 1000MHz the Spectrum Analyzer settings were as follows:

a. RBW = 100 kHz
b. VBW ≥ 300 kHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: A quasi peak detector was used for emissions where the peak exceeded that of the average 15.209 emission limits

Test Setup below 1000MHz



Test Setup above 1000MHz



Test Results: **See Annex B: Undesirable Emission Radiated**

Occupied Bandwidth
Engineer: Paul Hay
Test Date: 7/30/15

Test Requirement

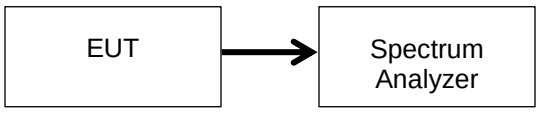
The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement

Test Procedure

The Spectrum Analyzer was set to the following parameters:

a. RBW = approximately 1 to 5% of the emission bandwidth.
b. VBW > RBW.
c. Detector = Peak.
d. Trace mode = max hold.

Test Setup



Test Results: **See Annex C: Occupied Bandwidth**

Frequency Stability
Engineer: Alex Macon
Test Date: 8/19/15

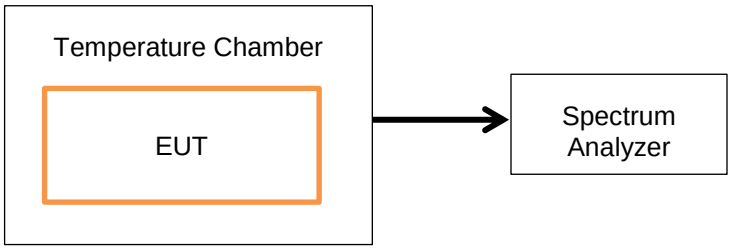
Test Requirement

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Test Procedure

a. The EUT was placed into a temperature chamber and the temperature ranges were set to the manufacturer's specifications.
b. The RF output of the EUT was connected to a spectrum analyzer
c. The lowest and highest channels of the band were set to transmit
d. The carrier plots were measured to insure that the 26dB band width remained within the band over the prescribed temperature extremes.

Test Setup



Test Results: **See Annex D: Frequency Stability**

RF Exposure
Engineer: Alex Macon
Test Date: 8/19/15

Requirements

U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. In addition, systems operating under the provisions of this section shall be operated in a manner that insures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Exposure Limits

At operating frequencies less than or equal to 6 GHz, the limits for maximum permissible exposure (MPE) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Section 1.1307(b), except for portable devices as defined in §2.1093 as these evaluations shall be performed according to the SAR provisions in §2.1093 of this chapter.

MPE Limit Calculations

Exposure Limit 1mW/cm^2

Source Based Time Averaged Power Calculation

Average Power Calculations

Average Power = Peak Power * duty-cycle%

UNII-2A

Tuned Frequency (MHz)	Conducted Peak Output Power (mW)	Duty Cycle (%)	Average Power (mW)
5265	158	100	158

UNII-2C

Tuned Frequency (MHz)	Conducted Peak Output Power (mW)	Duty Cycle (%)	Average Power (mW)
5600	191	100	191

MPE Evaluation

This is a **fixed/mobile** device used in uncontrolled /general population exposure environment.

Limits Uncontrolled Exposure	0.3-1.234 MHz	Limit [mW/cm²] = 100
47 CFR 1.1310	1.34-30 MHz	Limit [mW/cm²] = (180/f²)
Table 1, (B)	30-300 MHz	Limit [mW/cm²] = 0.2
	300-1500 MHz	Limit [mW/cm²] = f/1500
	1500-100,000 MHz	Limit [mW/cm²] = 1.0

Test Data

Test Frequency, MHz	5265
Power, Conducted, mW (P)	158
Antenna Gain Isotropic	23
Antenna Gain Numeric (G)	199.53
Antenna Type	Dish
Distance (R)	20cm

$$S = \frac{P * G}{4\pi r^2}$$

Power Density (S) mw/cm^2	Power mW (P)	Numeric Gain (G)	Distance (r^2) cm
6.2720316728	158	199.53	20

Power Density (S) =	6.3
Limit =(from above table) =	1.0

The Power Density of 6.27 mw/cm^2 is over the limit of 1.0 mw/cm^2 for the uncontrolled /general population exposure environment so Minimum Safe Distance was calculated.

$R=\sqrt{(PG/4\pi L)}$

Distance (R) cm	Power mW (P)	Numeric Gain (G)	Limit (L)
50.10001144	158	199.53	1.0

The minimum safe distance is 50.1 cm.

MPE Evaluation

This is a **fixed/mobile** device used in uncontrolled /general population exposure environment.

Limits Uncontrolled Exposure	0.3-1.234 MHz	Limit [mW/cm²] = 100
47 CFR 1.1310	1.34-30 MHz	Limit [mW/cm²] = (180/f²)
Table 1, (B)	30-300 MHz	Limit [mW/cm²] = 0.2
	300-1500 MHz	Limit [mW/cm²] = f/1500
	1500-100,000 MHz	Limit [mW/cm²] = 1.0

Test Data

Test Frequency, MHz	5600
Power, Conducted, mW (P)	191
Antenna Gain Isotropic	23
Antenna Gain Numeric (G)	199.53
Antenna Type	Dish
Distance (R)	20cm

$$S = \frac{P * G}{4\pi r^2}$$

Power Density (S) mw/cm^2	Power mW (P)	Numeric Gain (G)	Distance (r^2) cm
7.5820129715	191	199.53	20

Power Density (S) =	7.58
Limit =(from above table) =	1.0

The Power Density of 7.58mw/cm^2 is over the limit of 1.0 mw/cm^2 for the uncontrolled /general population exposure environment so Minimum Safe Distance was calculated.

$R=\sqrt{(PG/4\pi L)}$

Distance (R) cm	Power mW (P)	Numeric Gain (G)	Limit (L)
55.08406286	191	199.53	1.0

The minimum safe distance is 55.1 cm.

A/C Powerline Conducted Emission

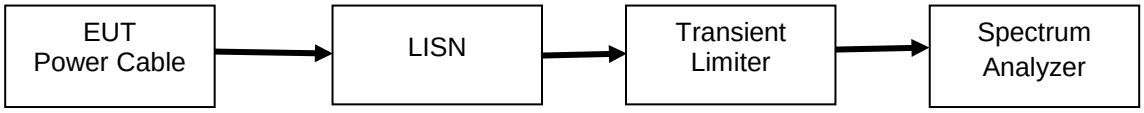
Engineer: Alex Macon

Test Date: 8/20/15

Test Procedure

The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup



Test Results: **See Annex E: A/C Powerline Conducted Emission**

Transmitter E.I.R.P. at Various Elevations

Engineer: Paul Hay

Test Date: 2/2/16

Test Requirements

(i) For an outdoor access point operating in the band 5.25-5.35 GHz, the maximum power spectral density shall not exceed -13 dBW in any 1 megahertz band for 0°≤ θ< 8°, -13 − 0.716 (θ-8) dBW/MHz for 8° ≤ θ< 40°, -35.9 − 1.22 (θ-40) dBW/MHz for 40° ≤ θ ≤ 45° and -42 dBW/MHz for θ > 45°. θ is the angle above the local horizontal plane (of the Earth). For ease of testing the following conversion was used.

1dBm = -29dBW

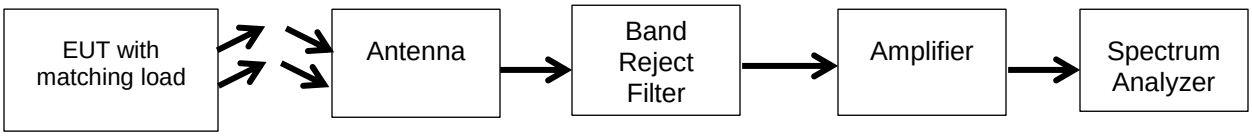
Test Procedure

The Power Spectral Density was measured using the method per RSS-247 May 2015. The maximum PSD was determined by finding the peak value across the carrier bandwidth.

The Spectrum Analyzer was set to the following:

a. RBW = 1 MHz
b. VBW = 1 MHz
c. Span = 1.5 * BW
d. Sweep time = auto
e. Detector = Peak

Test Setup



Test Results: **See Annex F: Elevation EIRP**

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Temperature Chamber	Tenney	Tenney Jr	i00027	NCR	NCR
Temperature Chamber	Tenney	Tenney II Benchmaster	i00287	NCR	NCR
EMI Receiver	HP	8546A	i00033	2/26/15	2/26/16
Preamplifier	HP	8447D	i00055	NCR	NCR
Horn Antenna	EMCO	3116	i00085	1/29/15	1/29/17
Bi-Log Antenna	Schaffner	CBL611C	i00267	2/24/14	2/24/16
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	5/8/14	5/8/16
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/22/15	4/22/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	4/1/15	4/1/16
Spectrum Analyzer	Agilent	E4407B	i00331	6/13/14	6/13/15 **
Data Logger	Fluke	Hydra Data Bucket	i00343	3/24/15	3/24/16
EMI Analyzer	Agilent	E7405A	i00379	2/5/15	2/5/16
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	3/12/16
Spectrum Analyzer	Agilent	E4448A	S/N:MY46180566	12/1/2014	12/1/2016

** Equipment is under a 90 day calibration extension per Lab Manager

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT