EMC Test Report

Project Number: 4032308

Report Number: 4032308EMC01 **Revision Level:** 0

Client: Eaton Cooper Lighting

Equipment Under Test: Wireless Area Controller

Model: WAC-POE

FCC ID: 2AKCY2CL69WAC

IC ID: 4706A-2CL69WAC

Applicable Standards: FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 1, May 2015

ANSI C63.10: 2013

RSS-GEN, Issue 4, November 2014

Report issued on: 30 September 2016

Test Result: Compliant

Tested by: Fendy Liauw, Engineering Technician

Reviewed by: Jeremy Pickens, Senior EMC Engineer

Remarks:
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant
Transmitter Output Power	15.247(b)(3)	RSS-247 S5.4 (4)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant
Conducted Spurious Emissions / Band edge	15.247(d)	RSS-247 S5.5	Compliant
Radiated Spurious Emissions / Restricted Bands	15.35(b),15.209	RSS-GEN S6.13 RSS-GEN S8.10	Compliant
AC Powerline Conducted Emission	15.107, 15.207	RSS-GEN S8.8	N/A(1)

1) Not Applicable – The device is powered from 48Vdc via Power over Ethernet.

2 Modifications Required for Compliance

None

3 General Information

3.1 *Client Information*

Name:	Eaton Cooper Lighting
Address:	1121 Highway 74 South
City, State, Zip, Country:	Peachtree City, GA 30269, USA

3.1 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA
Accrediting Body:	A2LA
Type of lab:	Testing Laboratory
Certificate Number:	3212.01

3.2 *General Information of EUT*

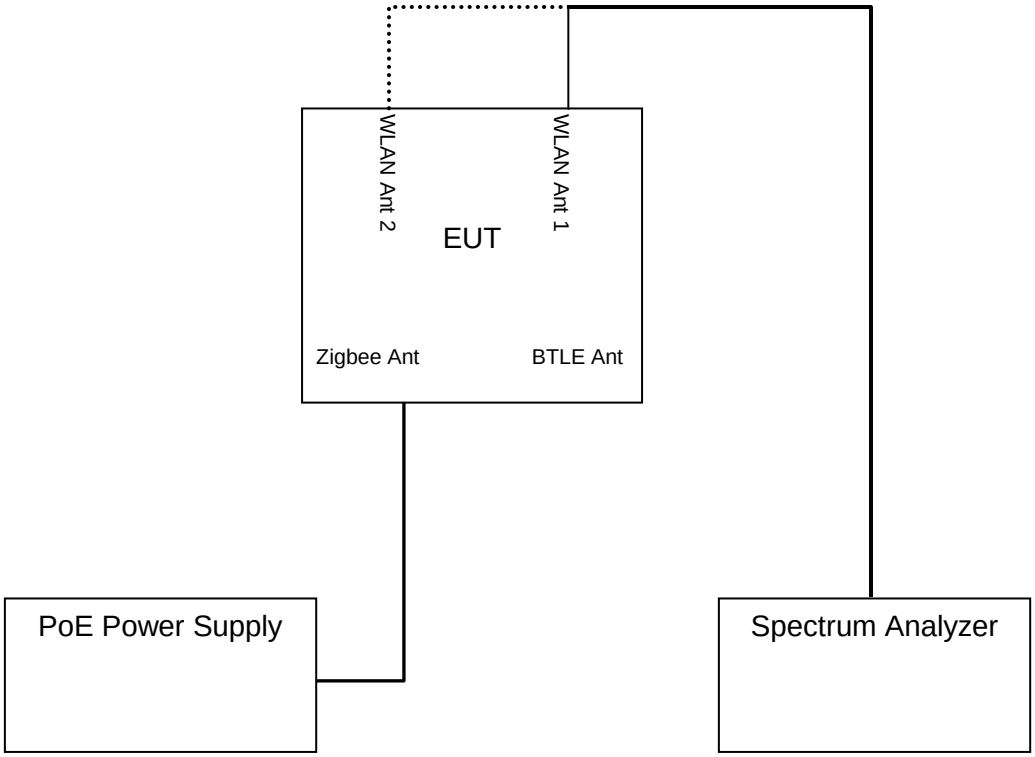
Type of Product:	Wireless Area Controller
Model Number:	WAC-POE
Serial Number:	F40420116290008 (Conducted) F40420116290032 (Radiated)
Frequency Range:	2412-2462MHz
Data Modes:	802.11b, 802.11g, 802.11n (HT20)
Antenna:	2x 2.2dBi Chip Antenna (MIMO not supported)
Rated Voltage:	48Vdc (PoE)
Test Voltage:	48Vdc
Sample Received Date:	25 August 2016
Dates of testing:	25 August – 27 September 2016

3.3 *Operating Modes and Conditions*

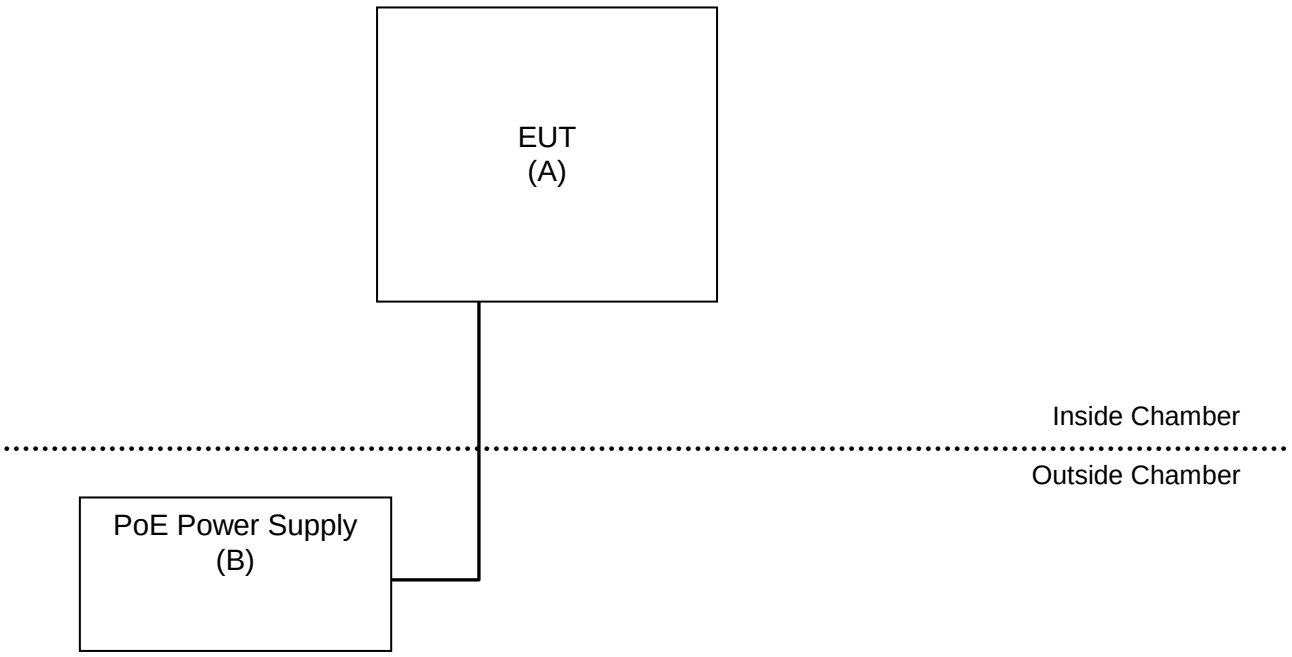
For spurious emissions measurements, only the worst-case mode with respect to peak power was investigated: 802.11b, 1Mbps. Investigations covered the low, middle, and high channels in the 2400-2483.5MHz band.

Continuous traffic was generated using test commands. Where the duty cycle measured below 99% and an RMS detector was employed, corrections of 10*LOG(1/D) were applied according to KDB publication 558074 D01 DTS Meas Guidance v03r05.

3.4 *EUT Connection Block Diagram – Conducted Measurements*



3.5 *EUT Connection Block Diagram – Radiated Measurements*



3.6 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Eaton Cooper Lighting	Wireless Area Controller	WAC-POE	F40420116290008 (Conducted) F40420116290032 (Radiated)
B	Microsemi Corp	PoE Supply	PD-9001GR/AC	C13526561000001961

4 Bandwidth

4.1 *Test Result*

Test Description	Test Specification		Test Result
6 dB bandwidth / 99% OBW	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant

4.2 *Test Method*

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas Guidance v03r05 were used to determine the 6 dB bandwidth and 99% OBW.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.4 °C
Relative Humidity: 53.1 %

4.4 *Test Equipment*

Test Date: 29-Aug-2016 Tester: JC

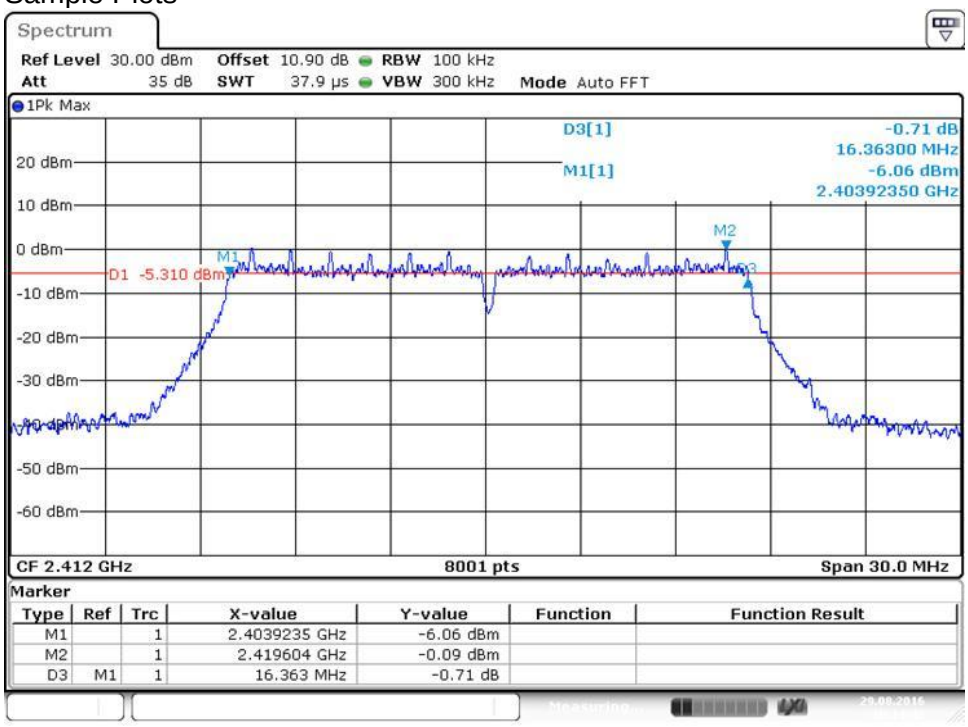
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV40	ROHDE & SCHWARZ	S/N: 101401	19-Aug-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017

Note: The equipment calibration period is 1 year.

4.5 *Test Data*

Protocol	Channel	Data Rate	6dB Bandwidth (MHz)	Occupied Bandwidth (99%) (MHz)
802.11b	1	11 Mbps	10.056	12.313
802.11b	6	11 Mbps	10.103	12.913
802.11b	11	11 Mbps	10.053	12.381
802.11g	1	54 Mbps	16.363	16.472
802.11g	6	54 Mbps	16.367	17.687
802.11g	11	54 Mbps	16.453	16.479
802.11n	1	MCS7	17.484	17.563
802.11n	6	MCS7	17.387	18.178
802.11n	11	MCS7	17.255	17.555

Sample Plots



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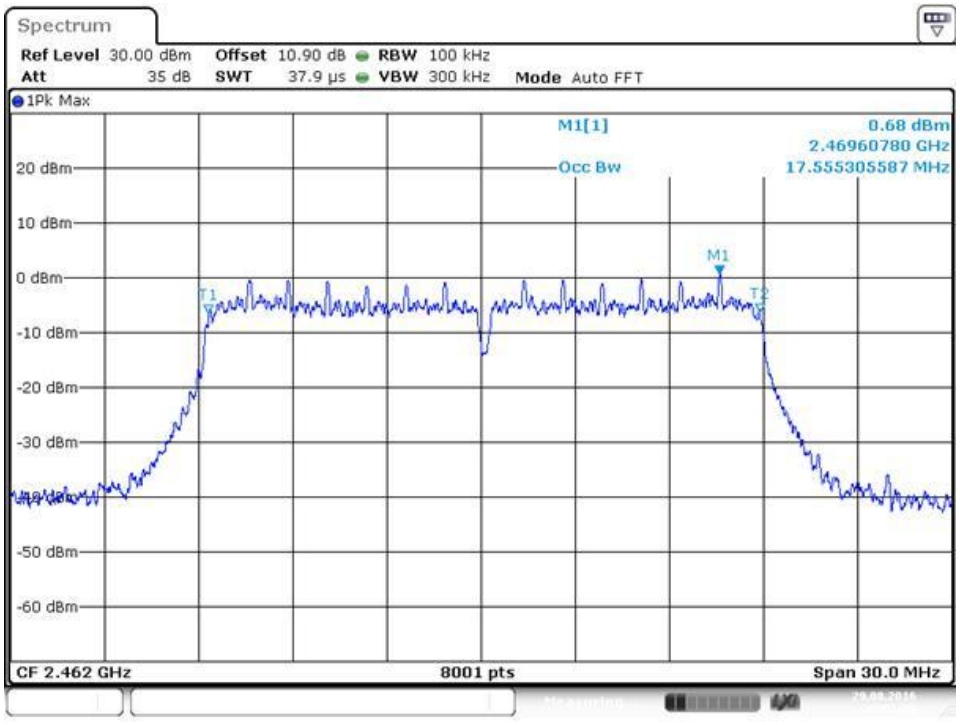

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5 Output Power

5.1 *Test Result*

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b) (3)	RSS-247 S5.4 (4)	Compliant

5.2 *Test Method*

Fundamental power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v03r05. The lowest data rate for each modulation was determined to be the worst-case.

Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g. for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.3 °C
Relative Humidity: 47.9 %

5.4 *Test Equipment*

Test Date: 27-Sep-2016 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

5.5 *Test Data*

Protocol	Channel	Data Rate	Peak Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	1	1 Mbps	16.5	30	-13.5
802.11b	6	1 Mbps	16.7	30	-13.3
802.11b	11	1 Mbps	17.0	30	-13.0
802.11g	1	6 Mbps	22.2	30	-7.8
802.11g	6	6 Mbps	23.3	30	-6.7
802.11g	11	6 Mbps	22.4	30	-7.6
802.11n	1	MCS0	21.5	30	-8.5
802.11n	6	MCS0	22.8	30	-7.2
802.11n	11	MCS0	21.6	30	-8.4

6 Power Spectral Density

6.1 *Test Result*

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant

6.2 *Test Method*

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v03r05. The lowest data rate for each modulation was determined to be the worst-case.

Limit
The limit is 8 dBm.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 22.3 °C
Relative Humidity: 47.9 %

6.4 *Test Equipment*

Test Date: 27-Sep-2016 Tester: JOP

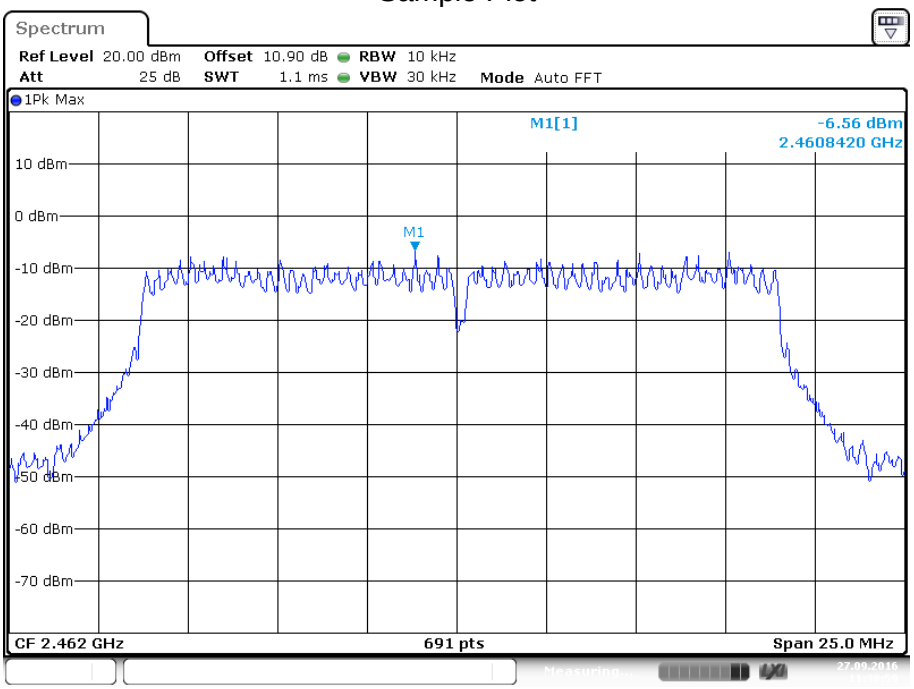
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

6.5 *Test Data*

Protocol	Channel	Data Rate	Peak PSD (dBm)	Limit (dBm)	Margin (dB)
802.11b	1	1 Mbps	-7.63	8	-15.6
802.11b	6	1 Mbps	-7.19	8	-15.2
802.11b	11	1 Mbps	-6.91	8	-14.9
802.11g	1	6 Mbps	-7.26	8	-15.3
802.11g	6	6 Mbps	-5.10	8	-13.1
802.11g	11	6 Mbps	-7.54	8	-15.5
802.11n	1	MCS0	-7.13	8	-15.1
802.11n	6	MCS0	-4.95	8	-13.0
802.11n	11	MCS0	-6.56	8	-14.6

Sample Plot



Date: 27.SEP.2016 11:39:00

7 Conducted Spurious Emissions

7.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

7.2 *Test Method*

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v03r05.

Lowest, middle, and highest channels were investigated. Only the worst-case (lowest data rate) for each modulation was reported.

Because the maximum conducted (average) output power was used to determine compliance with the output power limits, the limit is 30 dB below the maximum in-band peak PSD level in 100 kHz.

7.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.3 °C
Relative Humidity: 47.9 %

7.4 *Test Equipment*

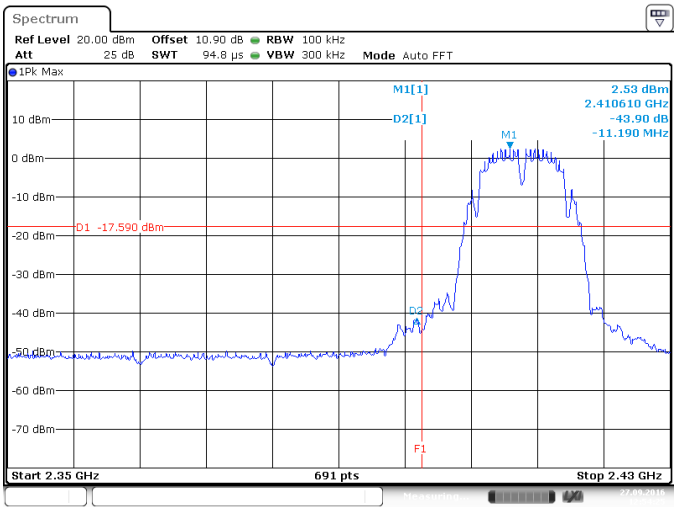
Test Date: 27-Sep-2016 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

7.5 *Test Data – DTS Bandedge*

802.11b
Lower band edge / Upper band edge
Channel 1 / Channel 11
1Mbit/s



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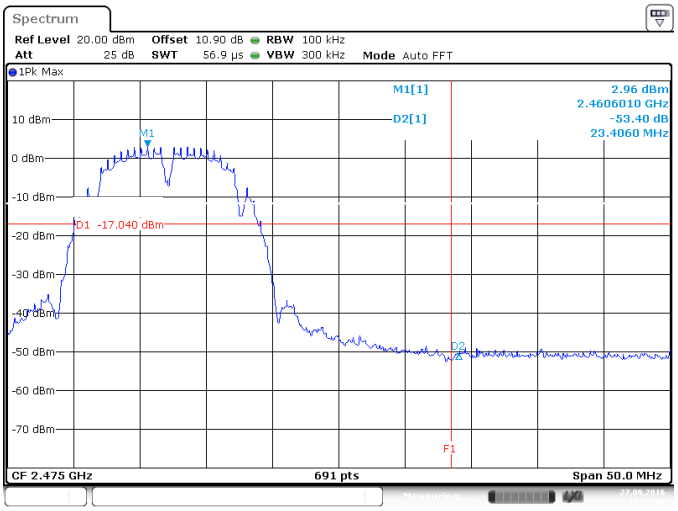
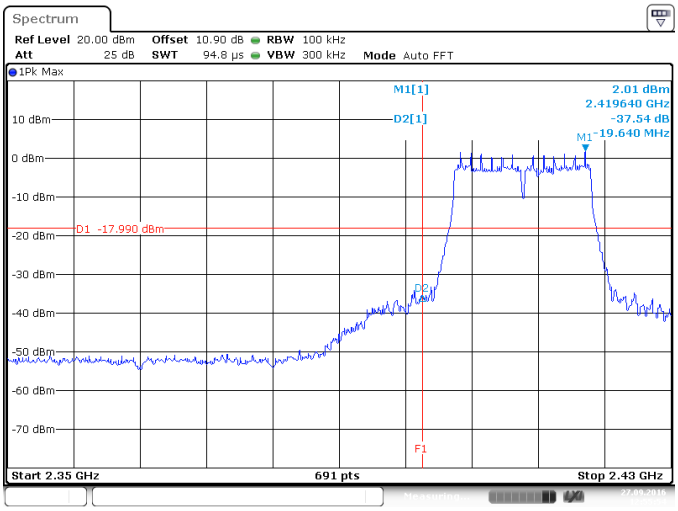


Date: 27.SEP.2016 13:17:29

802.11g
Lower band edge / Upper band edge
Channel 1 / Channel 11
6Mbit/s



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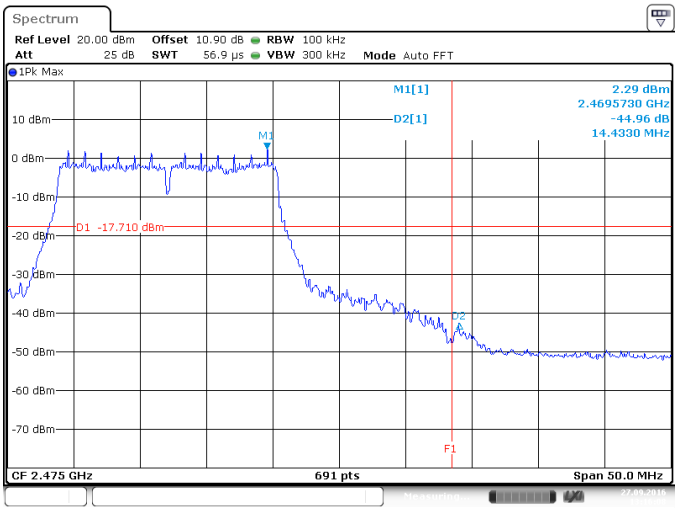

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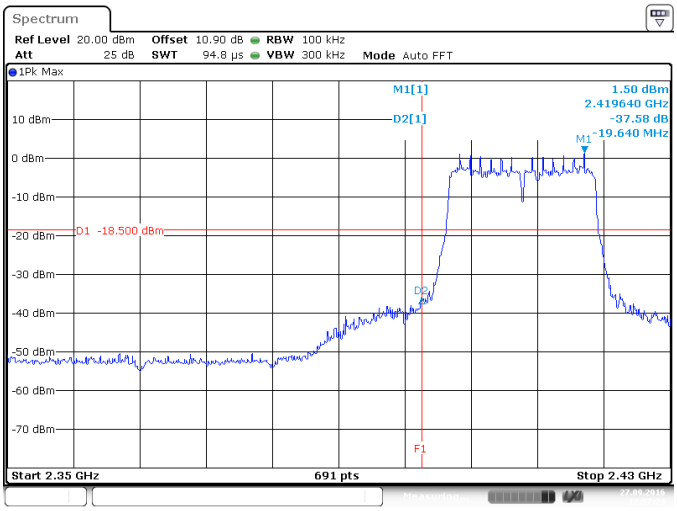
802.11n
Lower band edge / Upper band edge
Channel 1 / Channel 11
MCS0



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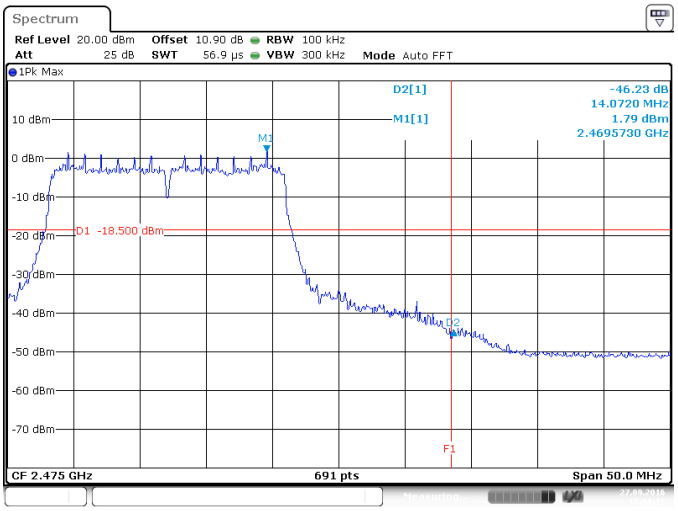

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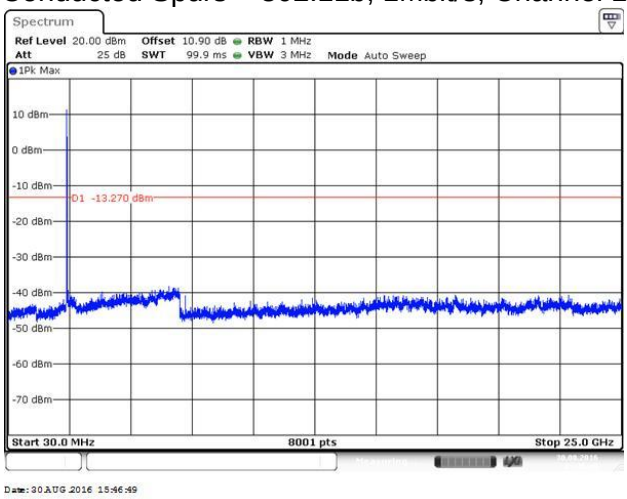
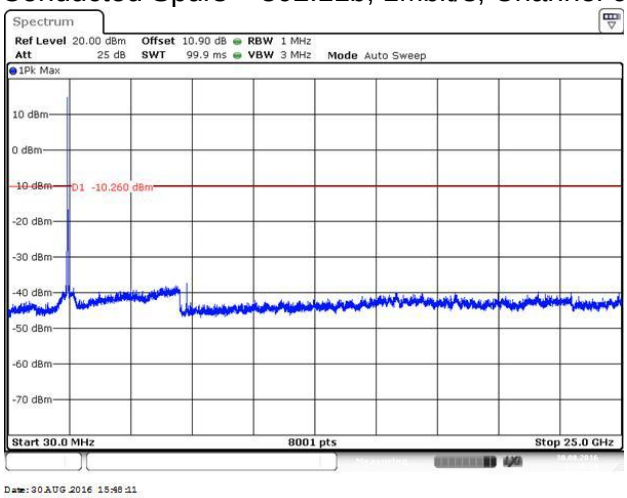
7.6 *Test Data – Conducted Spurious Emissions*

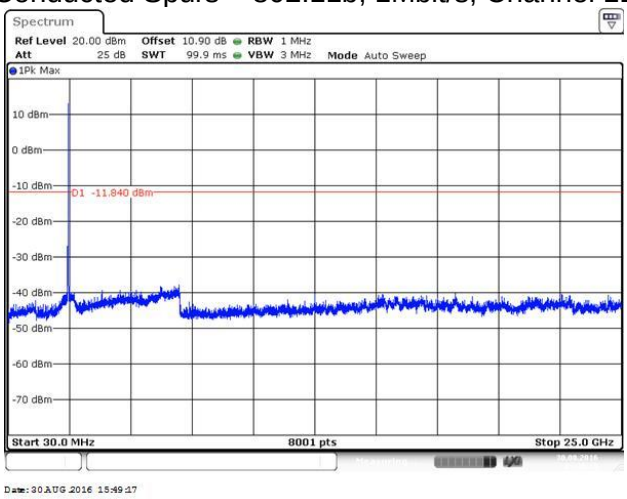
Conducted Spurs – 802.11b, 1Mbit/s, Channel 1



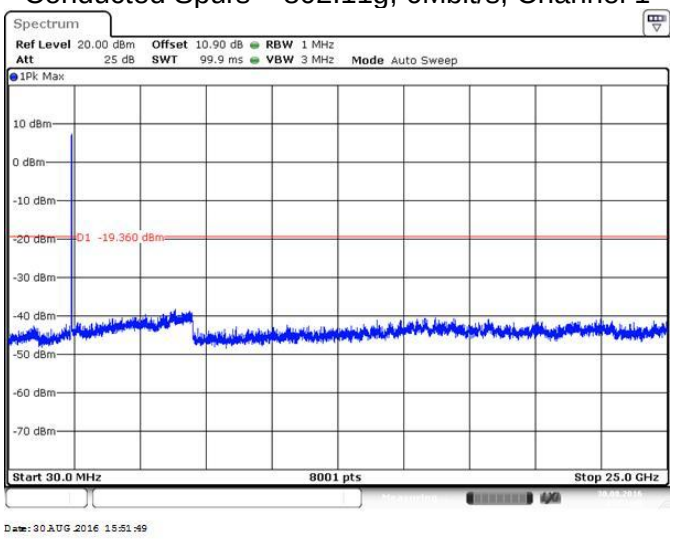
Conducted Spurs – 802.11b, 1Mbit/s, Channel 6



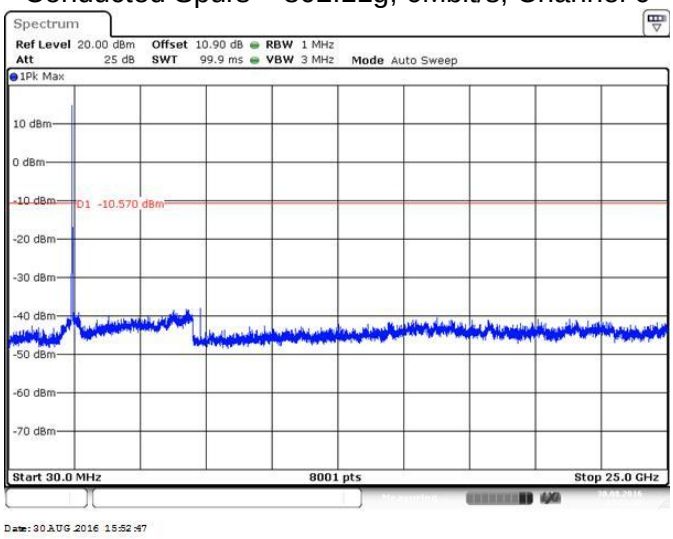
Conducted Spurs – 802.11b, 1Mbit/s, Channel 11



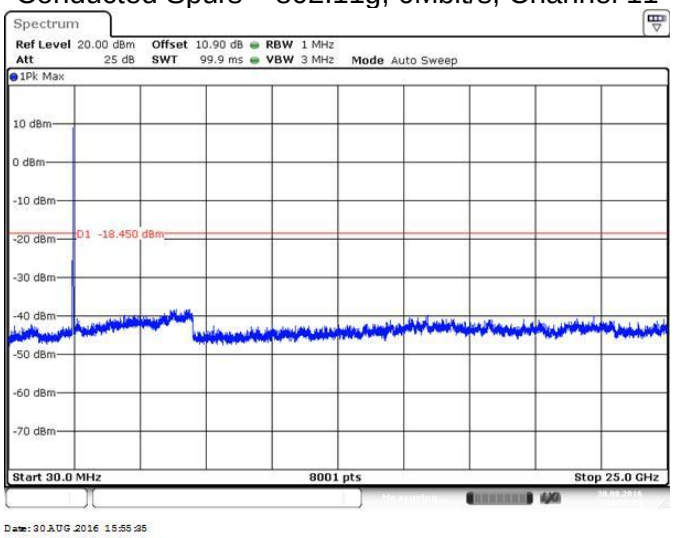
Conducted Spurs – 802.11g, 6Mbit/s, Channel 1



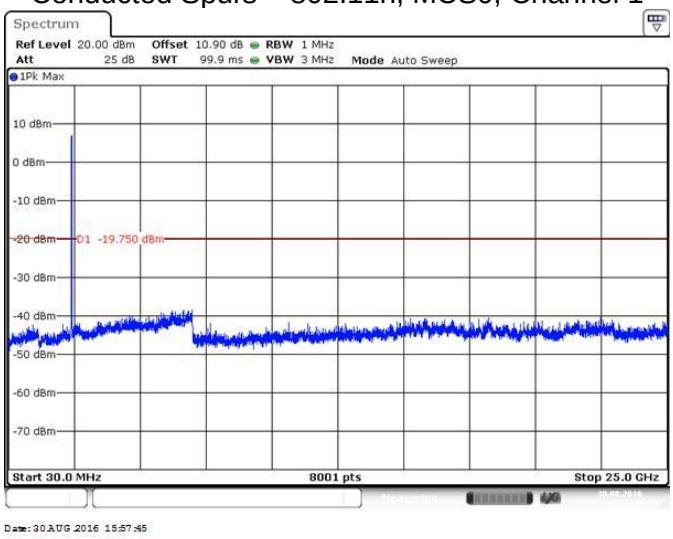
Conducted Spurs – 802.11g, 6Mbit/s, Channel 6



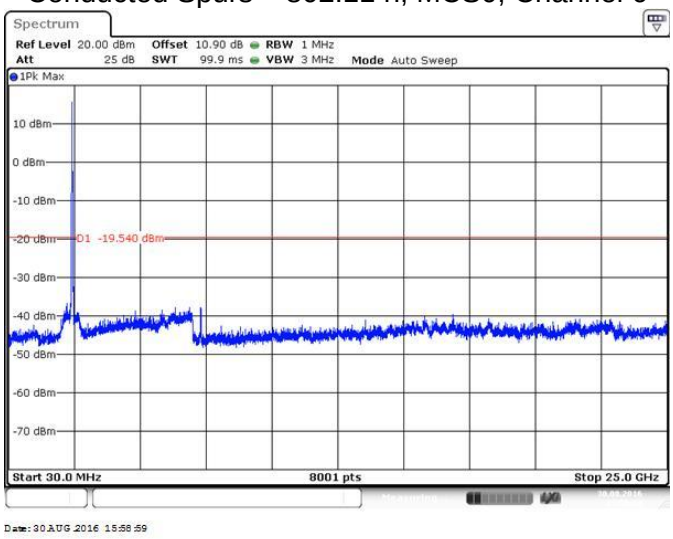
Conducted Spurs – 802.11g, 6Mbit/s, Channel 11



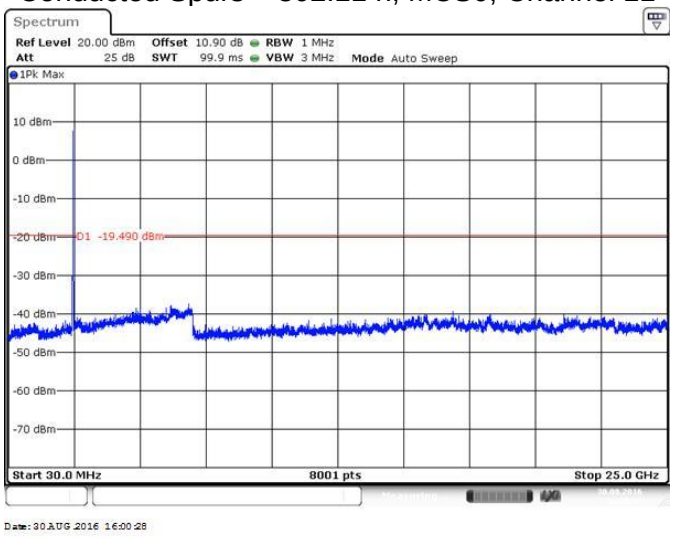
Conducted Spurs – 802.11n, MCS0, Channel 1



Conducted Spurs – 802.11 n, MCS0, Channel 6



Conducted Spurs – 802.11 n, MCS0, Channel 11



8 Field Strength of Spurious Radiation

8.1 *Test Result*

Test Description	Test Specification		Test Result
Spurious Emissions	15.247 (d) and 15.209	RSS-247 S5.5	Compliant

8.2 *Test Method*

The measurement methods defined in ANSI C63.4: 2014 were used.

Lowest, middle, and highest channels were investigated. Only the worst-case (802.11b, 1Mbps) was reported except at the restricted band edges where all three modulations were measured.

Test distance:

9k to 30 MHz – Near field prescan to determine if there were any emissions
30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
18 to 26 GHz - The EUT to measurement antenna distance was 1 meter

Limits within restricted bands of operation:

Frequency	Limits(1)		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 (2)	--
88 - 216 MHz	150	43.5 (2)	--
216 - 960 MHz	200	46 (2)	--
960 - 1000 MHz	500	54 (2)	--
1 - 40 GHz	500	54 (3)	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.
(2) Quasi-peak limit
(3) Average limit

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 49.5 %

8.4 *Test Equipment*

Test Date: 7-Sep-2016 Tester: JOP

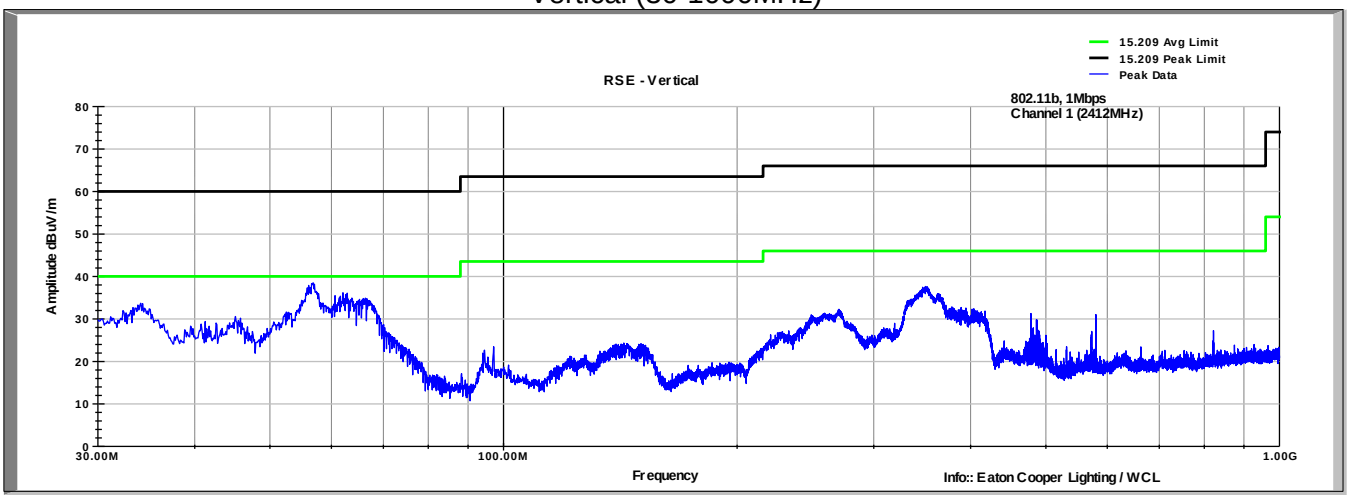
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
ANTENNA, BILOG	CBL 6143A	TESEQ	B085931	1-Dec-2016
RF CABLE	SF106	HUBER & SUHNER	B079712	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079713	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079716	27-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079824	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B085892	27-Jul-2017
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	4-Aug-2017
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2017
HORN(SMALL)	LB-180400-20-C-KF	A-INFO	15007	29-Mar-2017
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	29-Jul-2017

Note: The equipment calibration period is 1 year.

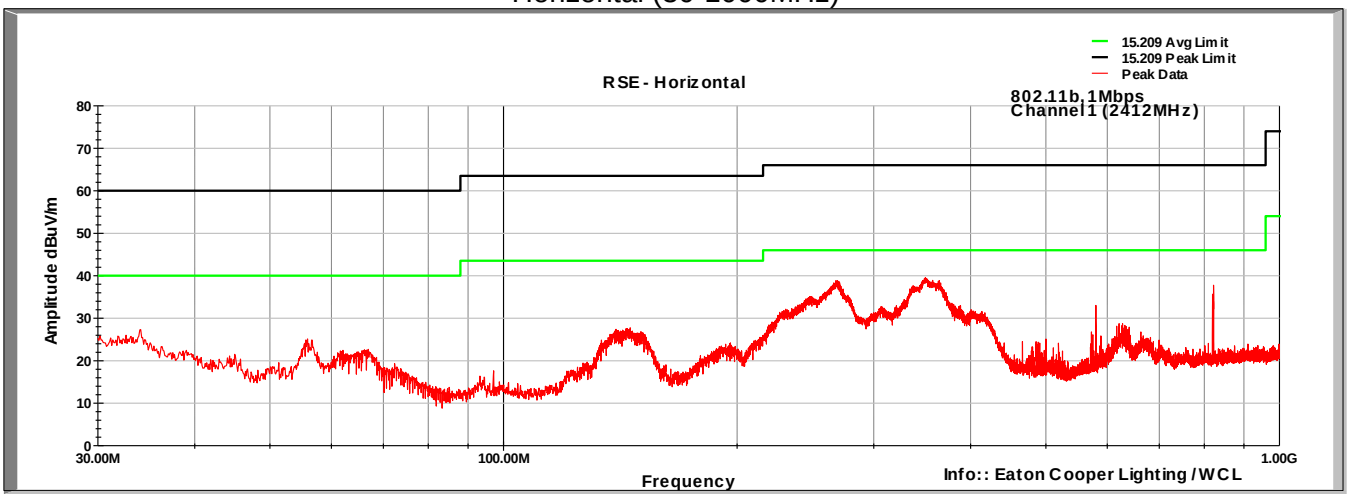
8.5 *Test Data – Peak Plots*

No emissions detected below 30MHz

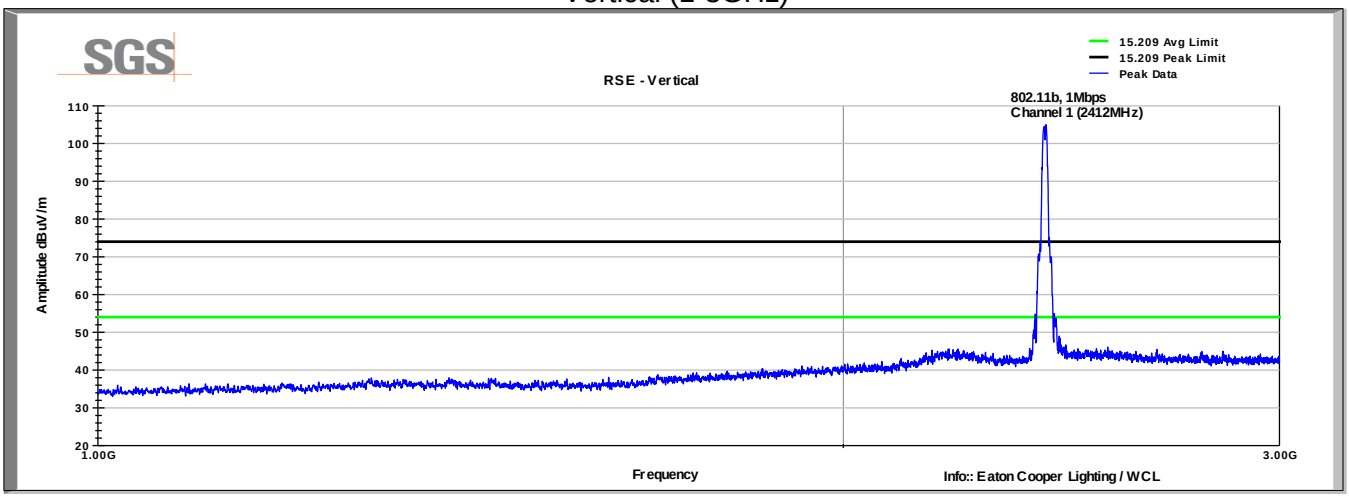
2.4 GHz CH 1, 1Mbps
Vertical (30-1000MHz)



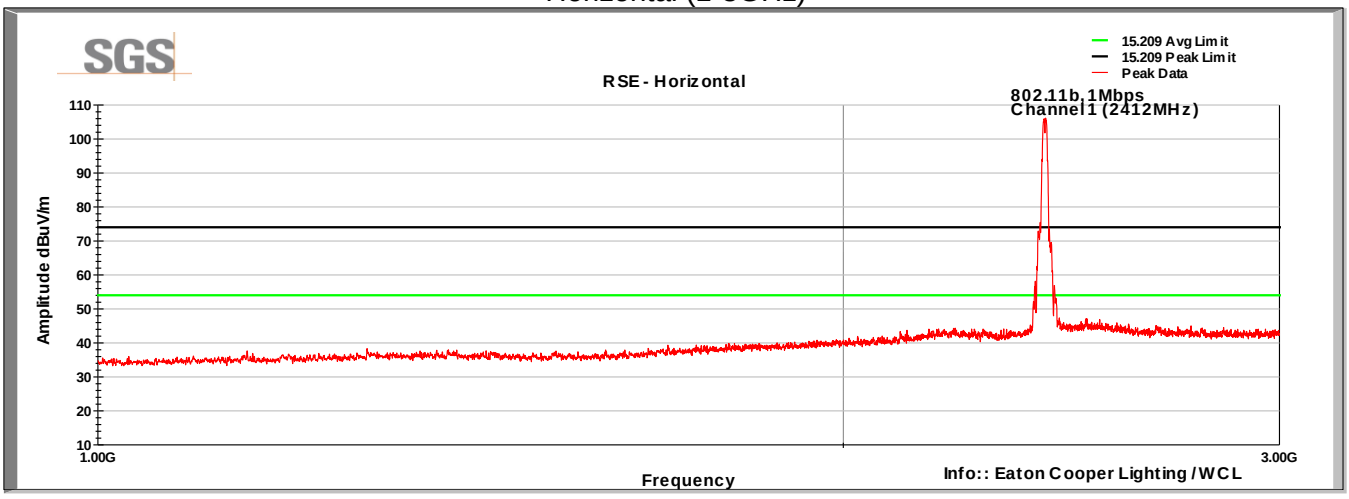
2.4 GHz CH 1, 1Mbps
Horizontal (30-1000MHz)



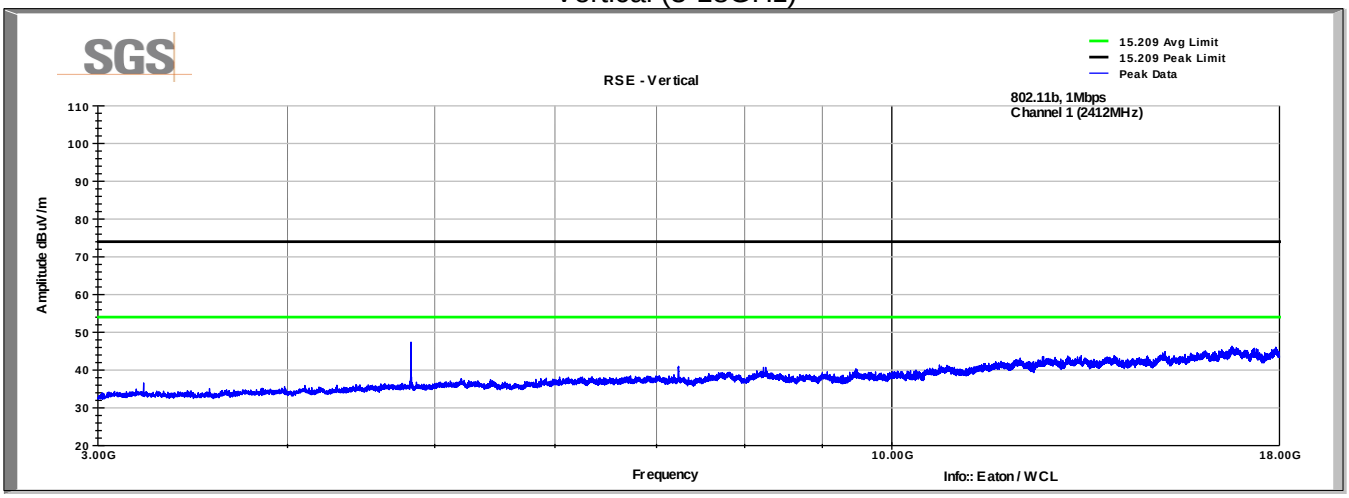
2.4 GHz CH 1, 1Mbps
Vertical (1-3GHz)



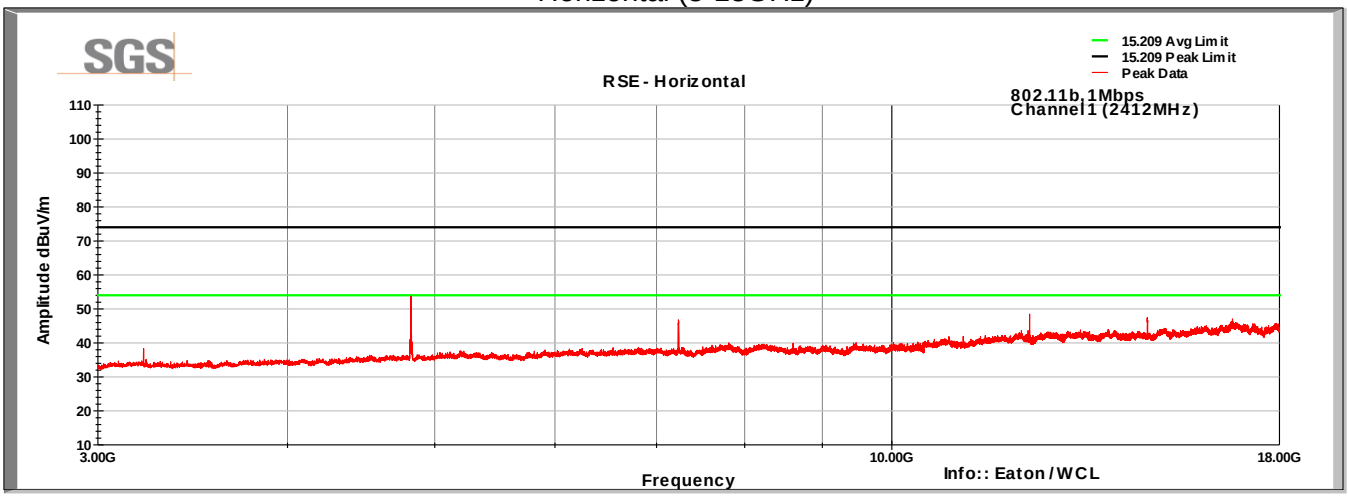
2.4 GHz CH 1, 1Mbps
Horizontal (1-3GHz)



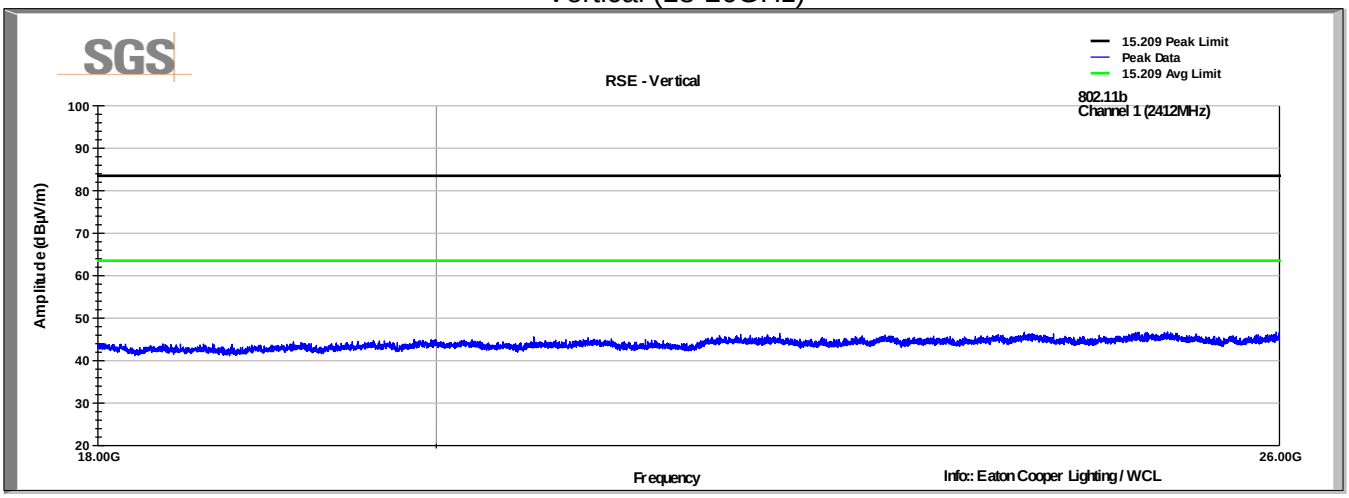
2.4 GHz CH 1, 1Mbps
Vertical (3-18GHz)



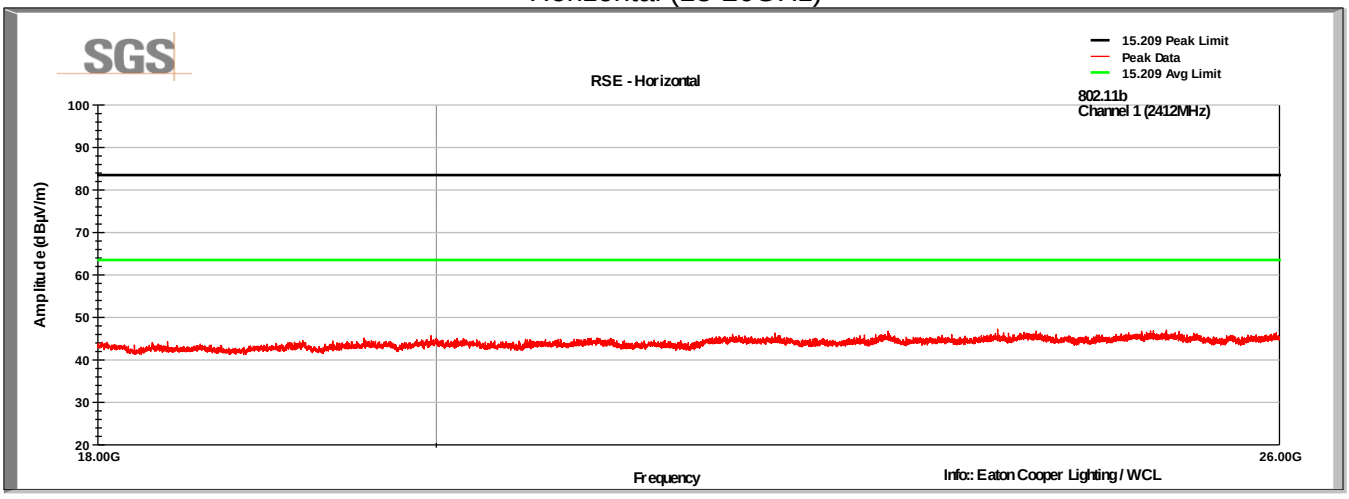
2.4 GHz CH 1, 1Mbps
Horizontal (3-18GHz)



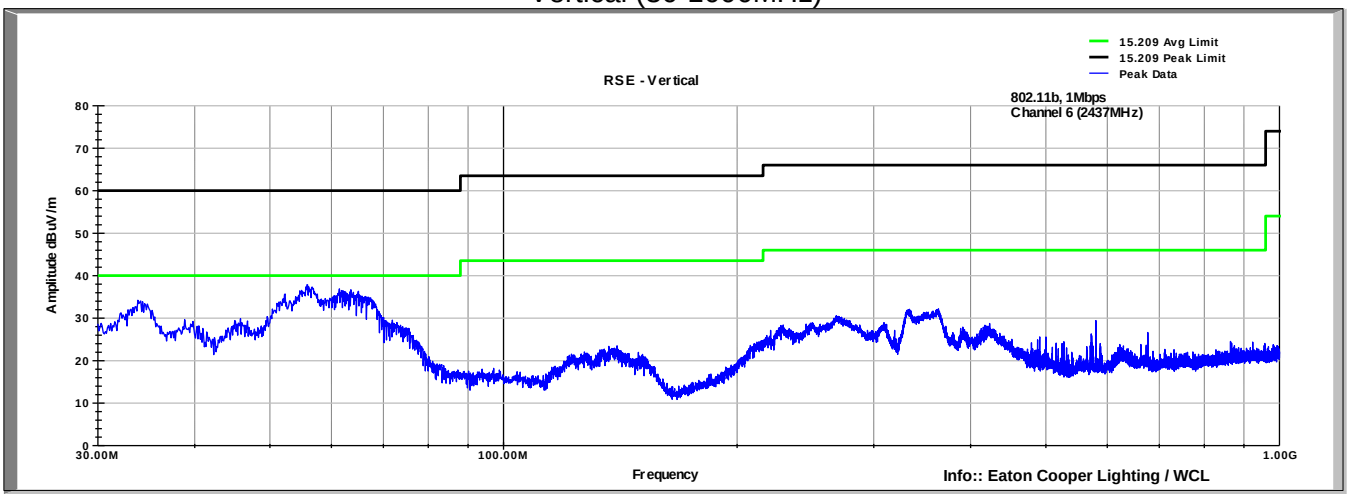
2.4 GHz CH 1, 1Mbps
Vertical (18-26GHz)



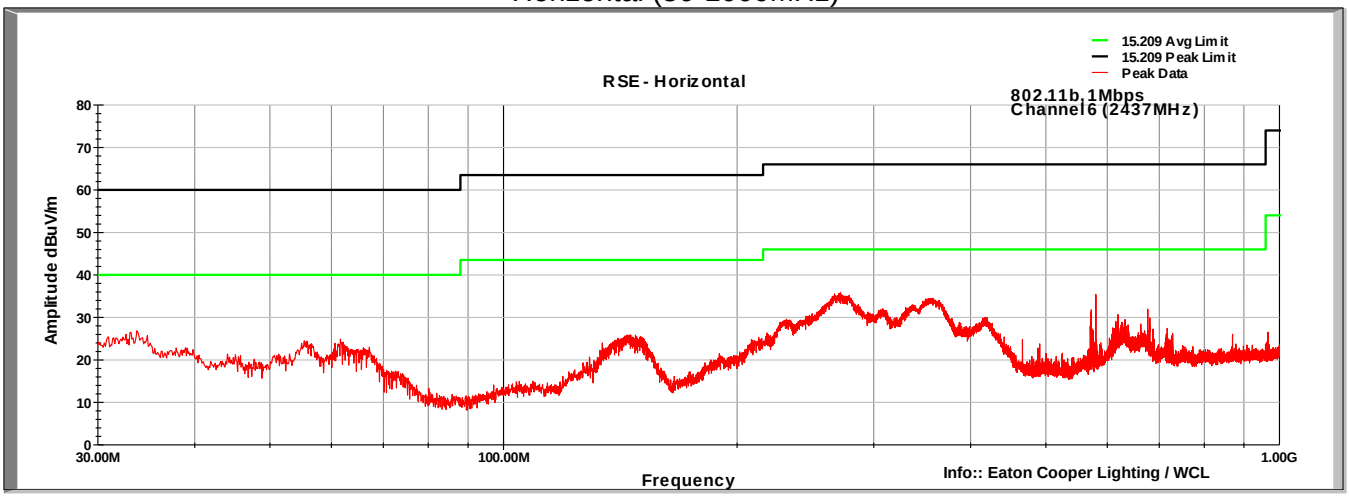
2.4 GHz CH 1, 1Mbps
Horizontal (18-26GHz)



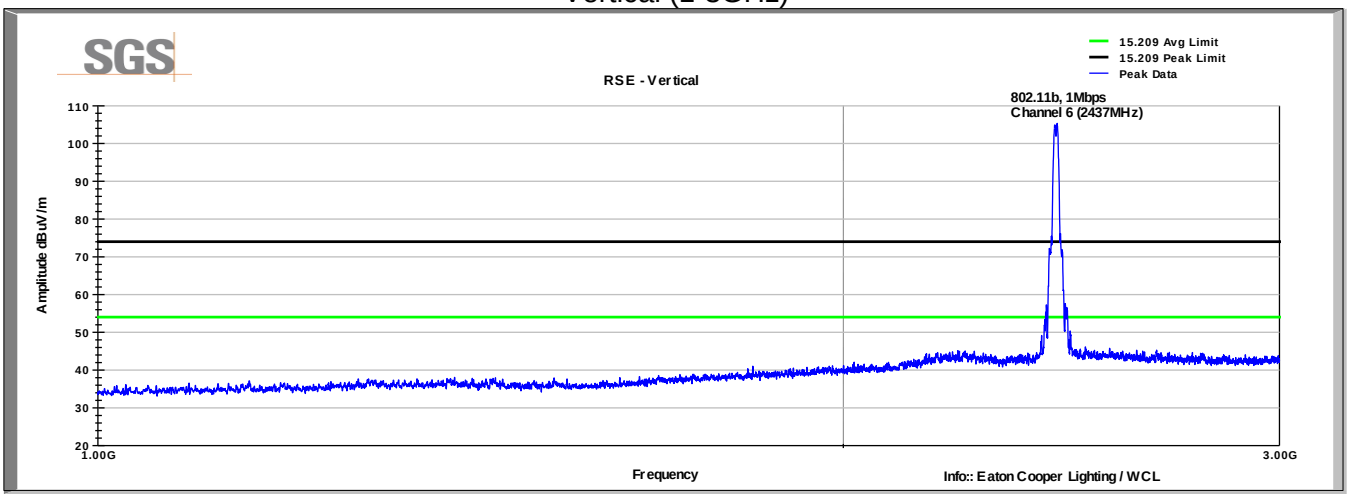
2.4 GHz CH 6, 1Mbps
Vertical (30-1000MHz)



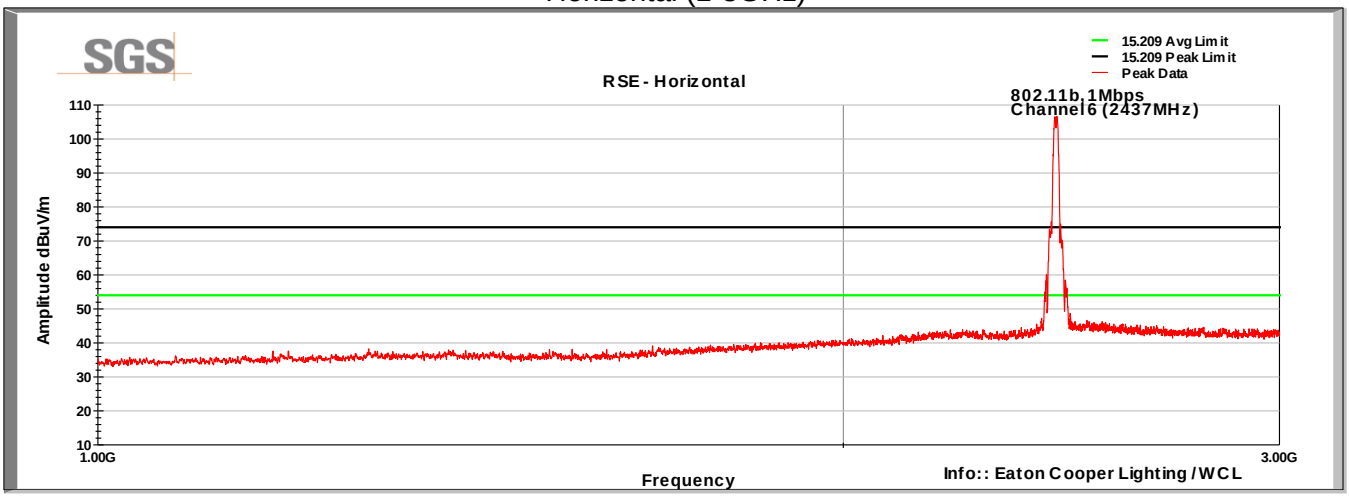
2.4 GHz CH 6, 1Mbps
Horizontal (30-1000MHz)



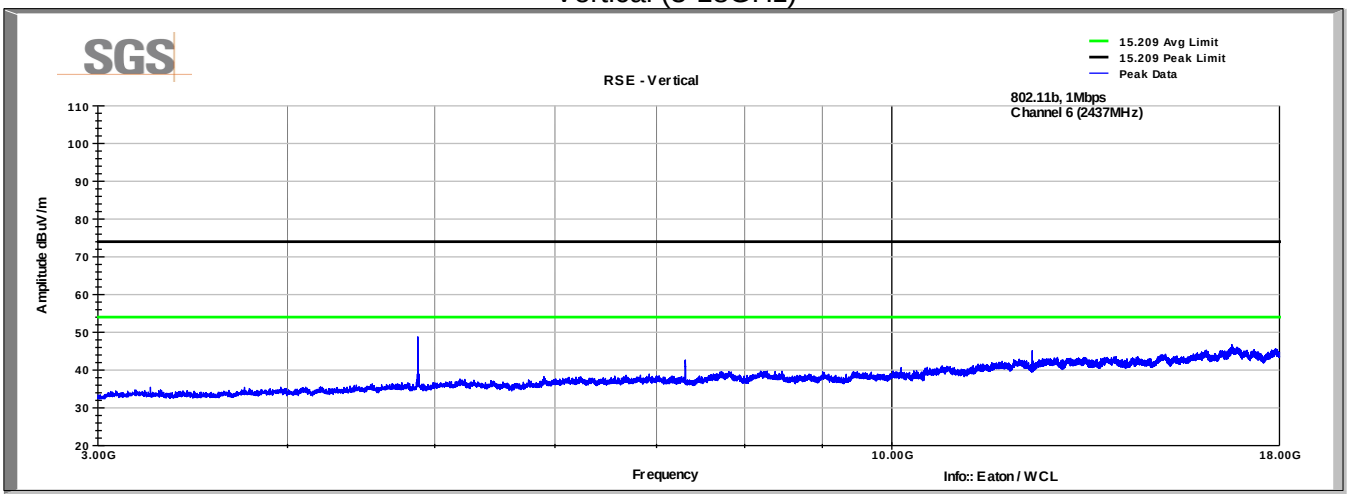
2.4 GHz CH 6, 1Mbps
Vertical (1-3GHz)



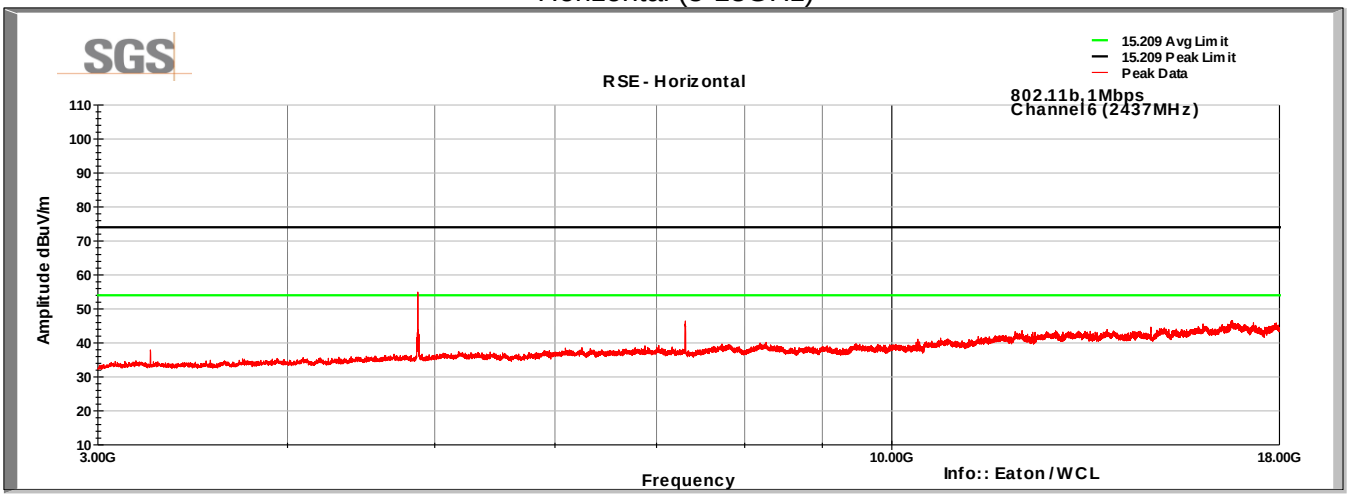
2.4 GHz CH 6, 1Mbps
Horizontal (1-3GHz)



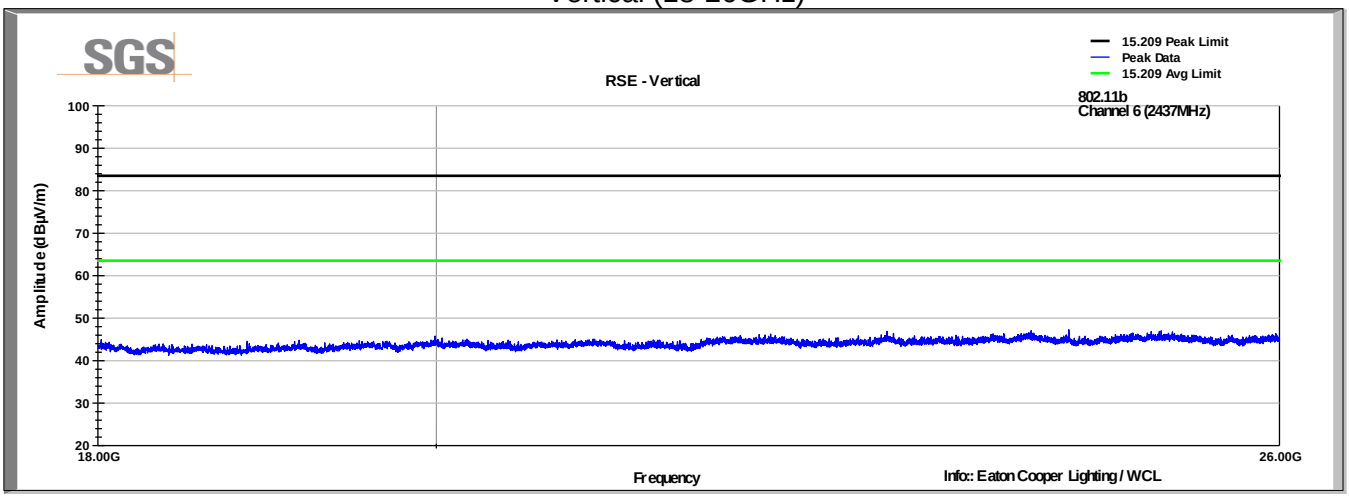
2.4 GHz CH 6, 1Mbps
Vertical (3-18GHz)



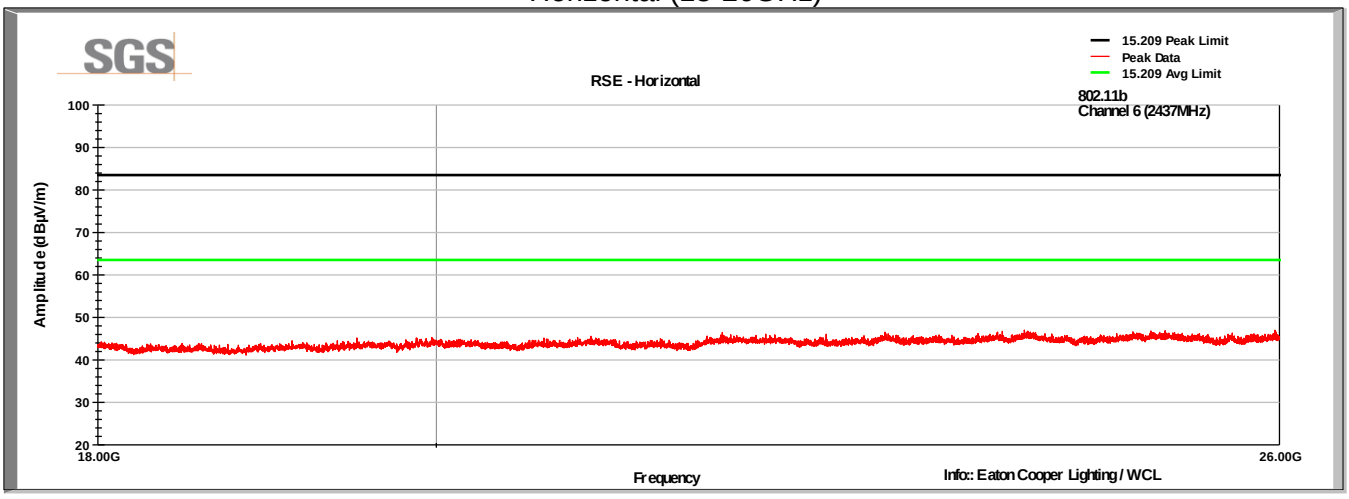
2.4 GHz CH 6, 1Mbps
Horizontal (3-18GHz)



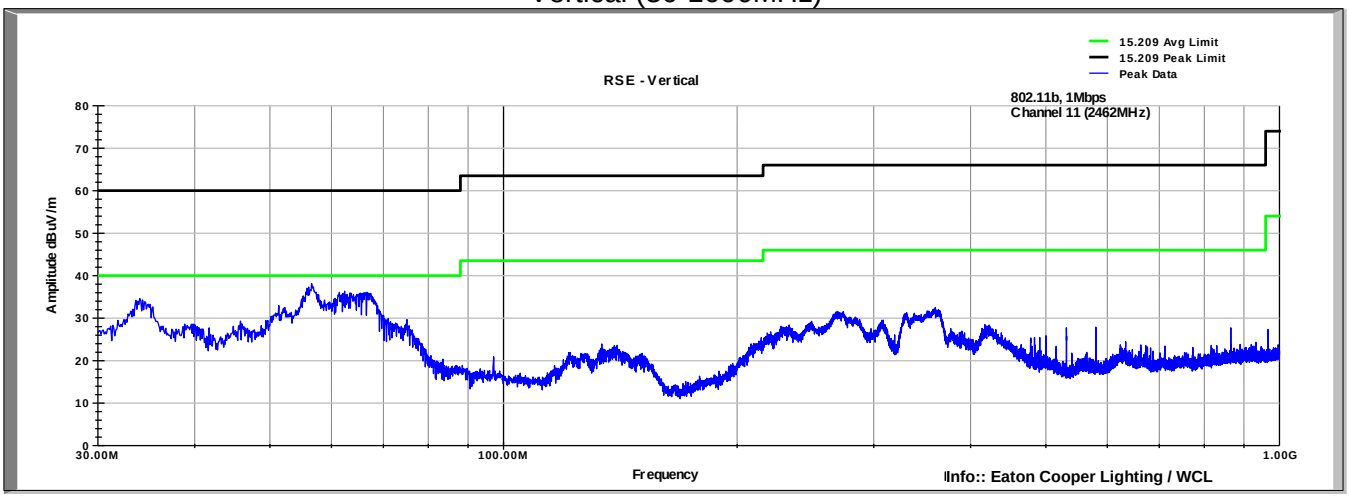
2.4 GHz CH 6, 1Mbps
Vertical (18-26GHz)



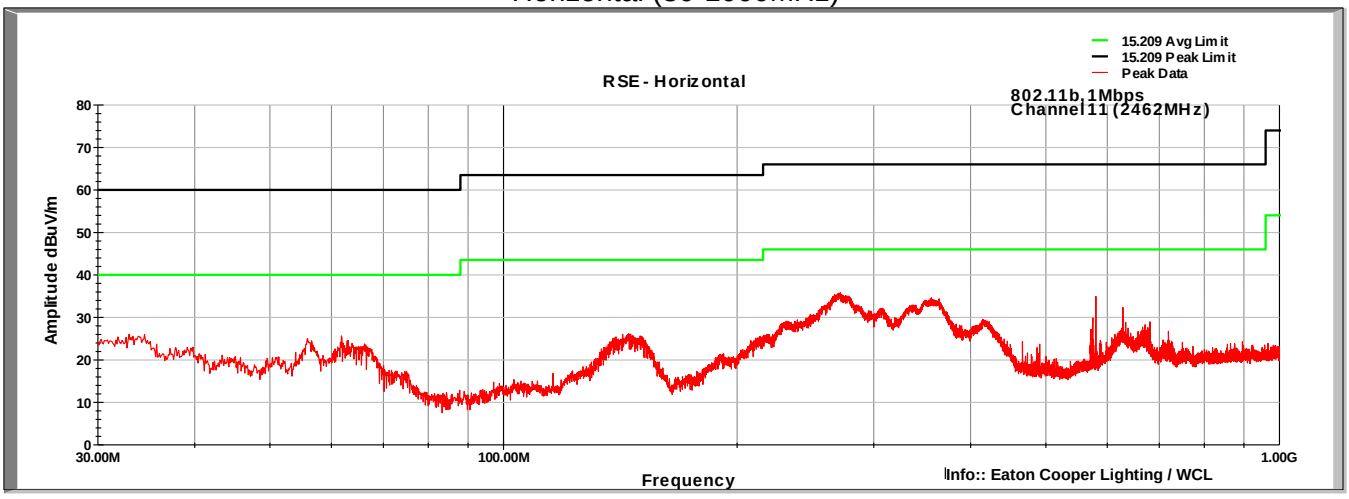
2.4 GHz CH 6, 1Mbps
Horizontal (18-26GHz)



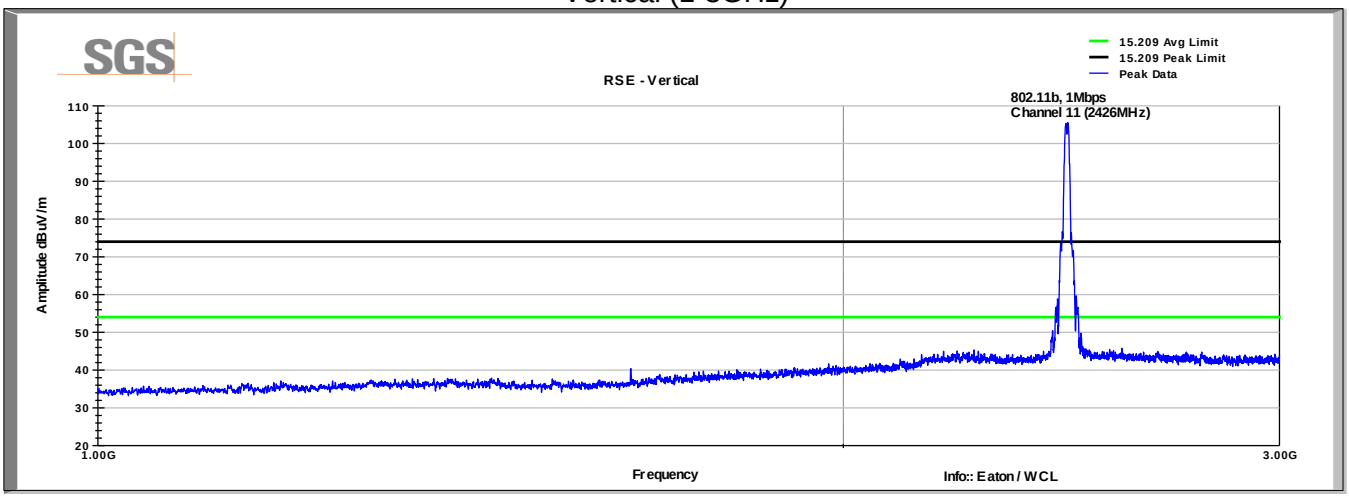
2.4 GHz CH 11, 1Mbps
Vertical (30-1000MHz)



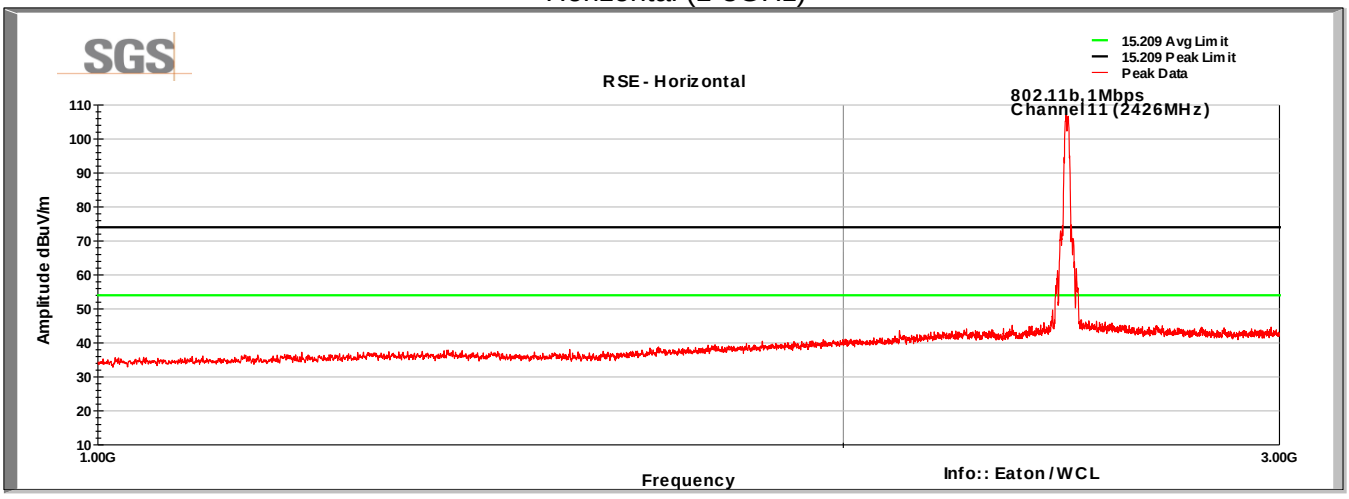
2.4 GHz CH 11, 1Mbps
Horizontal (30-1000MHz)



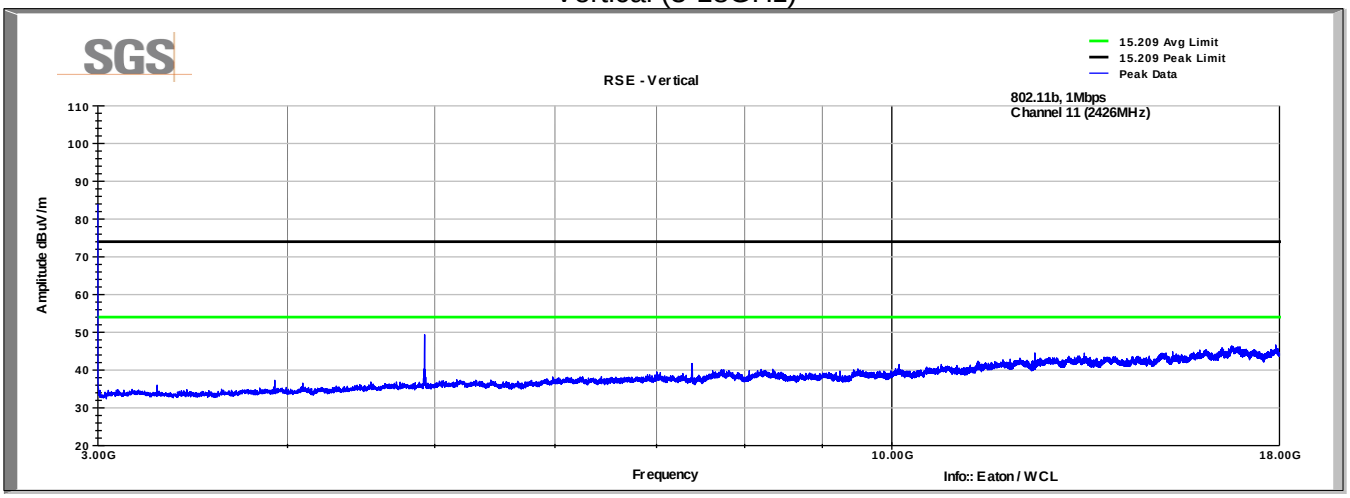
2.4 GHz CH 11, 1Mbps
Vertical (1-3GHz)



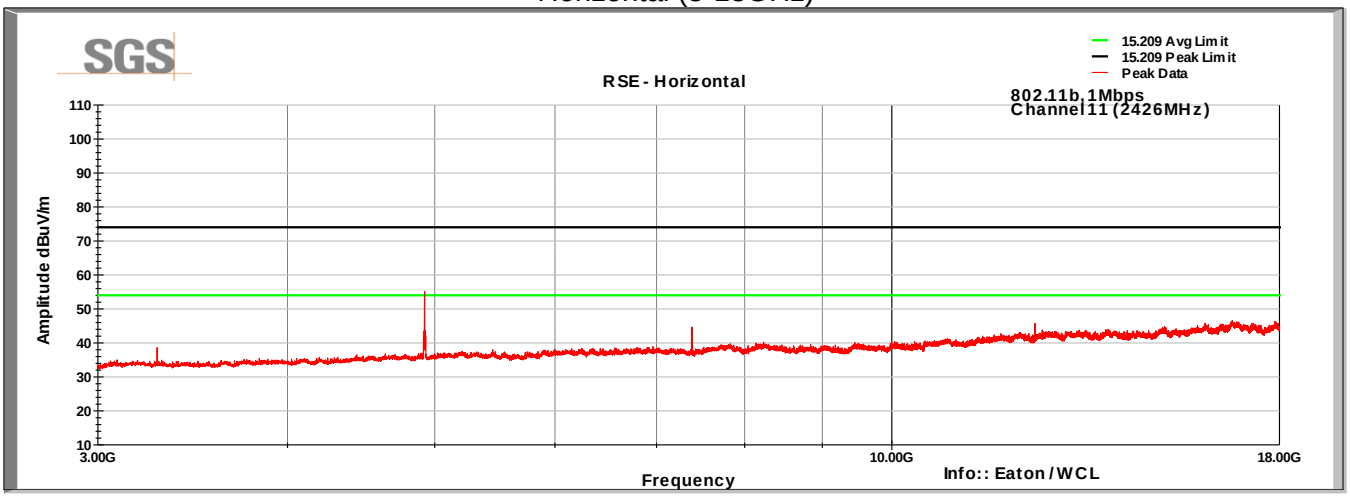
2.4 GHz CH 11, 1Mbps
Horizontal (1-3GHz)



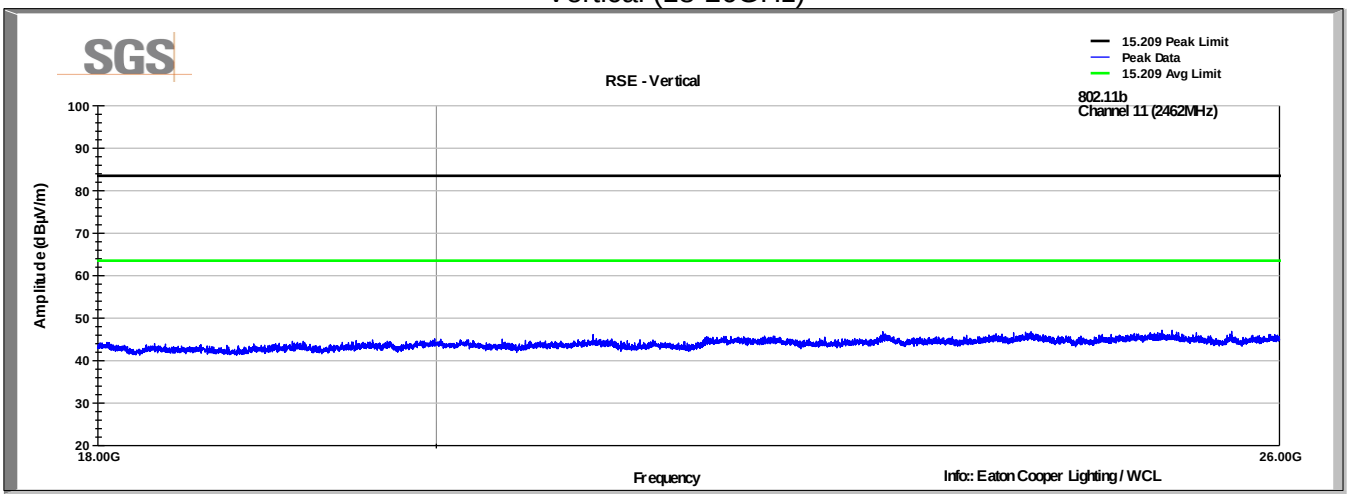
2.4 GHz CH 11, 1Mbps
Vertical (3-18GHz)



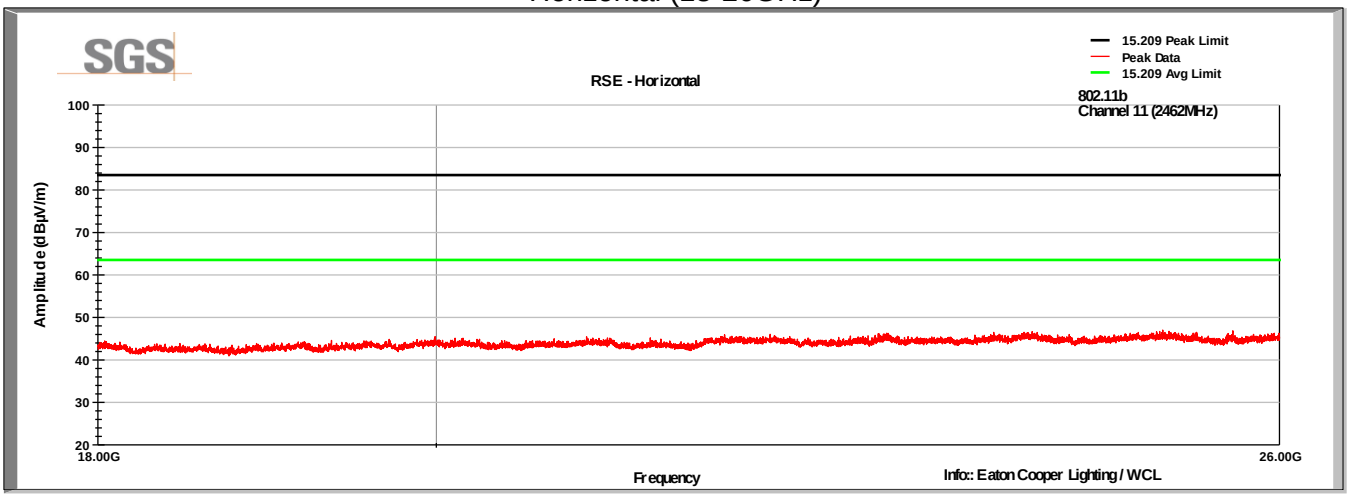
2.4 GHz CH 11, 1Mbps
Horizontal (3-18GHz)



2.4 GHz CH 11, 1Mbps
Vertical (18-26GHz)



2.4 GHz CH 11, 1Mbps
Horizontal (18-26GHz)



8.6 *Test Data – Tabular Data*

Frequency MHz	Raw Meas (dBuV)	Polarity (V/H)	Correction (dB/m)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
Channel 1 (2412MHz)							
4824.00	43.6	V	3.8	47.4	74.0	-26.6	Peak
4824.00	40.3	V	3.8	44.1	54.0	-9.9	Average
4824.00	50.0	H	3.8	53.8	74.0	-20.2	Peak
4824.00	46.6	H	3.8	50.4	54.0	-3.6	Average
Channel 6 (2437MHz)							
4874.00	45.0	V	3.8	48.8	74.0	-25.2	Peak
4874.00	41.8	V	3.8	45.6	54.0	-8.4	Average
4874.00	51.1	H	3.8	54.9	74.0	-19.1	Peak
4874.00	47.6	H	3.8	51.4	54.0	-2.6	Average
Channel 11 (2467MHz)							
4934.00	45.6	V	3.8	49.4	74.0	-24.6	Peak
4934.00	42.3	V	3.8	46.1	54.0	-7.9	Average
4934.00	51.3	H	3.8	55.1	74.0	-18.9	Peak
4934.00	47.8	H	3.8	51.6	54.0	-2.4	Average

9 Radiated Emissions at Band Edge / Restricted Band

9.1 *Test Result*

Test Description	Test Specification		Test Result
Spurious Emissions	15.205 / 15.209	RSS-GEN S8.9 / 8.10	Compliant

9.2 *Test Method*

Radiated field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz for each modulation. Measurements were made using the radiated methods defined in Section 12 of FCC publication D01 DTS Meas Guidance v03r05.

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 49.5 %

9.4 *Test Equipment*

Test Date: 7-Sep-2016 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
RF CABLE	SF106	HUBER & SUHNER	B079712	27-Jul-2017
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	4-Aug-2017
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2017

Note: The equipment calibration period is 1 year.

9.5 *Test Data – Restricted Band Edge*

Frequency MHz	Raw Meas (dBuV)	Polarity (V/H)	Correction (dB/m)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
802.11b Channel 1							
2390.00	61.2	V	3.4	64.6	74.0	-9.4	Peak
2390.00	47.9	V	3.4	51.3	54.0	-2.7	Average
802.11b Channel 11							
2483.50	64.8	V	3.4	68.2	74.0	-5.8	Peak
2483.50	49.5	V	3.4	52.9	54.0	-1.1	Average
802.11g Channel 1							
2390.00	60.8	V	3.4	64.2	74.0	-9.8	Peak
2390.00	48.0	V	3.4	51.4	54.0	-2.6	Average
802.11g Channel 11							
2483.50	64.0	V	3.4	67.4	74.0	-6.6	Peak
2483.50	48.3	V	3.4	51.7	54.0	-2.3	Average
802.11n Channel 1							
2390.00	63.0	V	3.4	66.4	74.0	-7.6	Peak
2390.00	49.5	V	3.4	52.9	54.0	-1.1	Average
802.11n Channel 11							
2483.50	63.5	V	3.4	66.9	74.0	-7.1	Peak
2483.50	49.5	V	3.4	52.9	54.0	-1.1	Average

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	30 September 2016