EMC Test Report

Project Number: 4032308

Report Number: 4032308EMC02 **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.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or Testing done by SGS International Electrical Approvals in connection with distribution or use of the product described in this report must be approved by SGS international Electrical Approvals in writing.

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

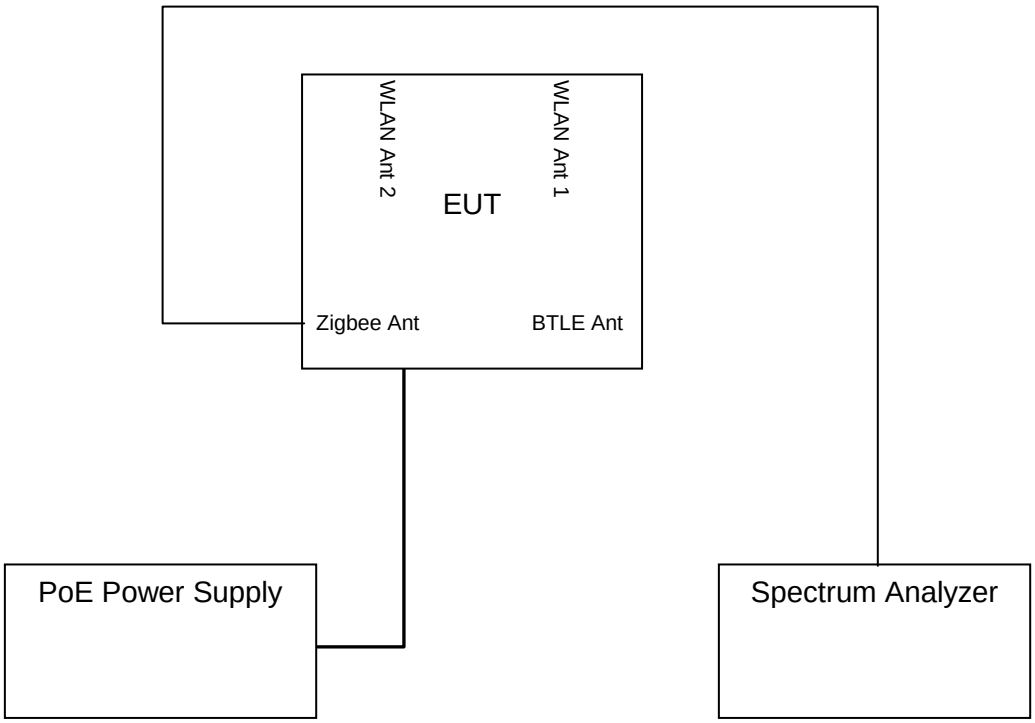
3.2 *General Information of EUT*

Type of Product:	Wireless Area Controller
Model Number:	WAC-POE
Serial Number:	F40420116290008 (Conducted) F40420116290032 (Radiated)
Frequency Range:	2405-2475MHz
Modulation:	802.15.4 (Zigbee)
Antenna:	1.5dBi Chip Antenna
Rated Voltage:	48Vdc (PoE)
Test Voltage:	48Vdc
Sample Received Date:	25 August 2016
Dates of testing:	25 August – 03 October 2016

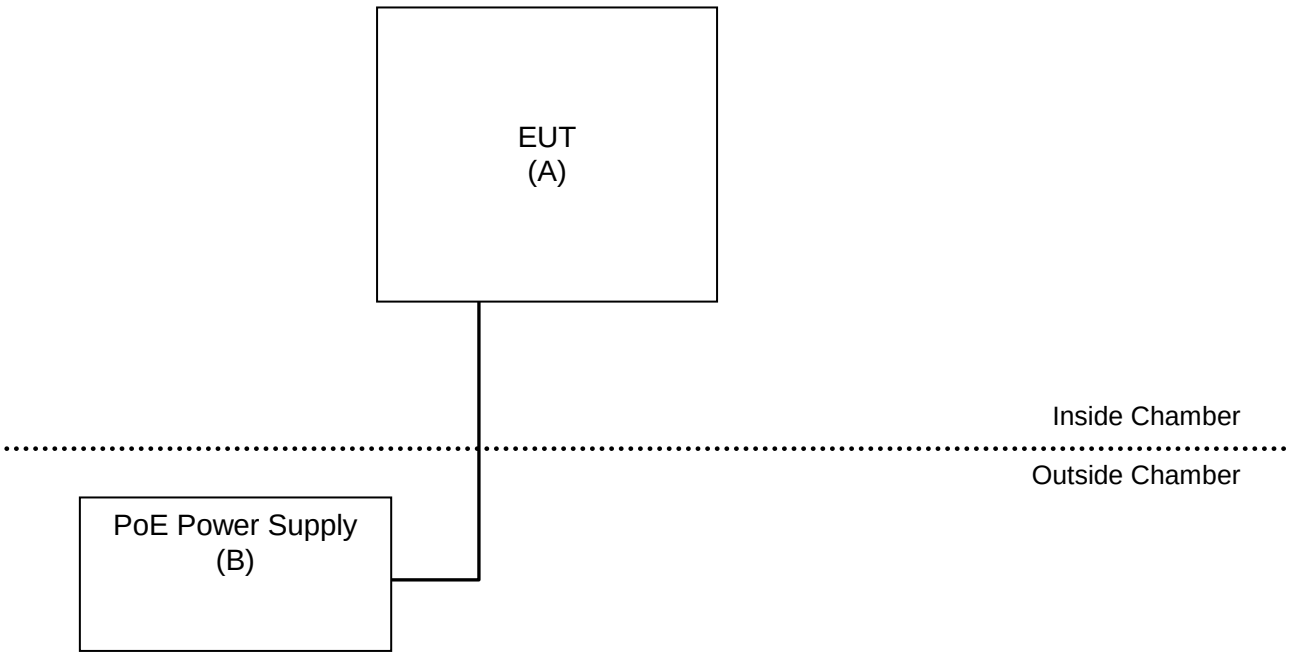
3.3 *Operating Modes and Conditions*

Continuous traffic was generated using test commands. The device was programmed to transmit at 100% duty cycle at low, middle, and high channels.
Channel 11, 2405MHz
Channel 18, 2440MHz
Channel 25, 2475MHz

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*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C
Relative Humidity: 51.5 %

4.4 *Test Equipment*

Test Date: 28-Sep-2016 Tester: JOP

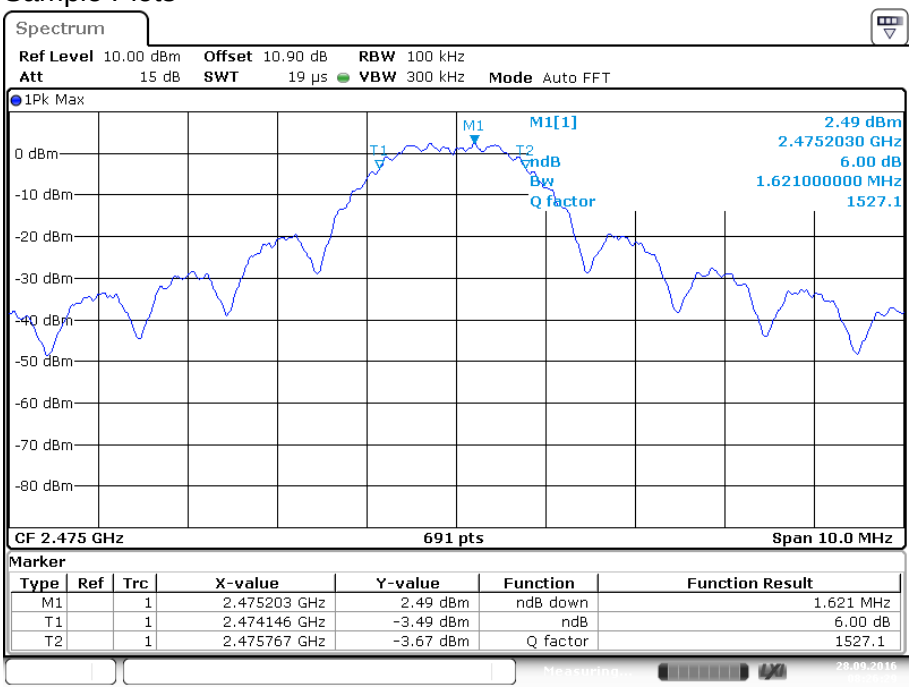
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017

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

4.5 *Test Data*

Channel	6dB Bandwidth (MHz)	Occupied Bandwidth (99%) (MHz)
11	1.606	2.435
18	1.592	2.44
25	1.621	2.489

Sample Plots



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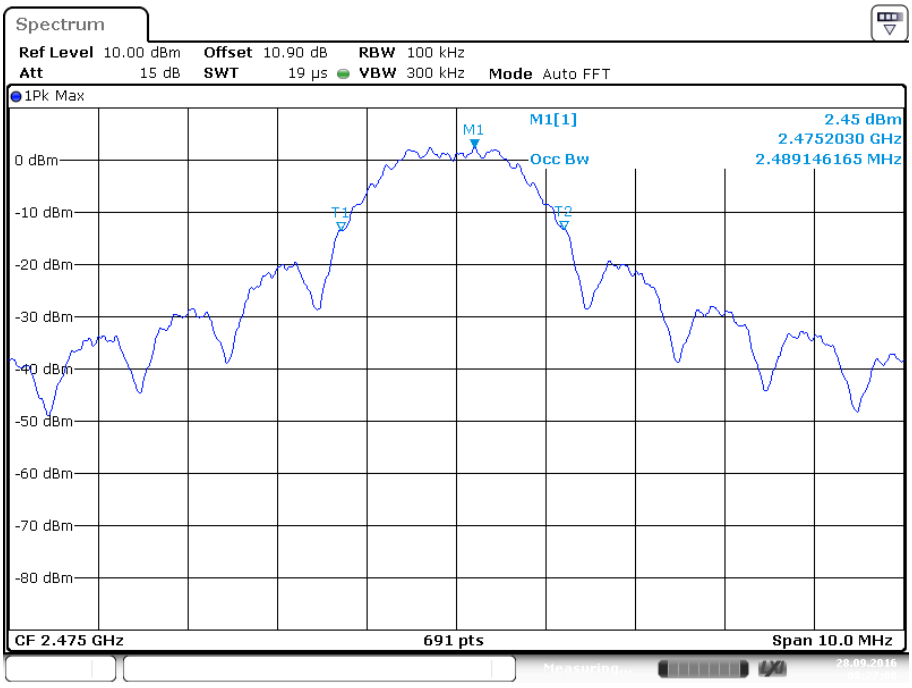


Date: 28.SEP.2016 08:27:08

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 peak power procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v03r05.

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

5.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions
Temperature: 23.2 °C
Relative Humidity: 51.5 %

5.4 *Test Equipment*

Test Date: 28-Sep-2016 Tester: JOP

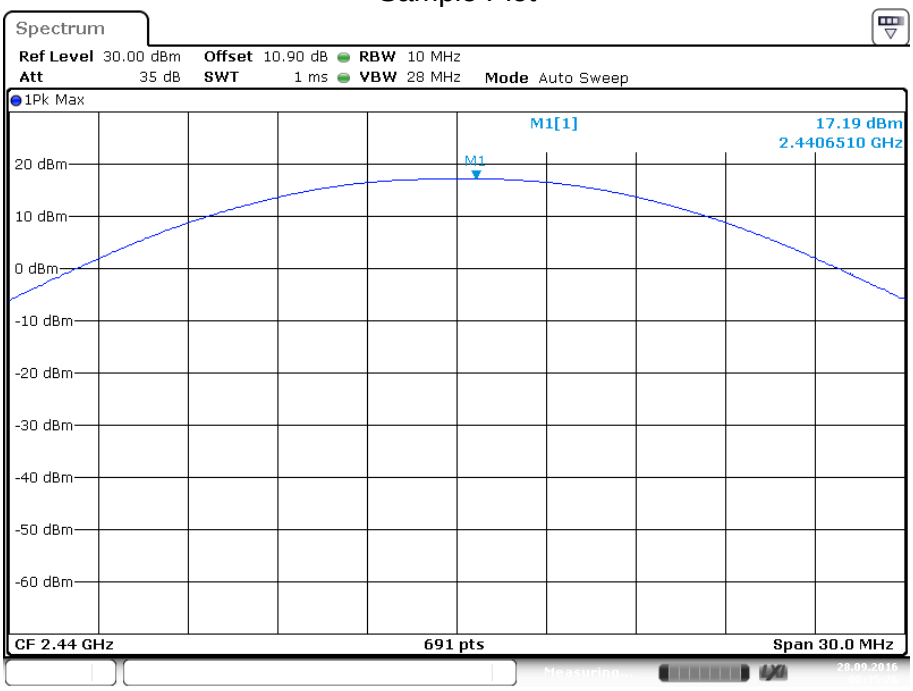
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017

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

5.5 *Test Data*

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (30dBm)	Margin (dB)
11	2405	15.54	30	-14.46
18	2440	17.19	30	-12.81
25	2475	6.07	30	-23.93

Sample Plot



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 peak PSD procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v03r05.

Limit
The limit is 8 dBm.

6.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions
Temperature: 23.2 °C
Relative Humidity: 51.5 %

6.4 *Test Equipment*

Test Date: 28-Sep-2016 Tester: JOP

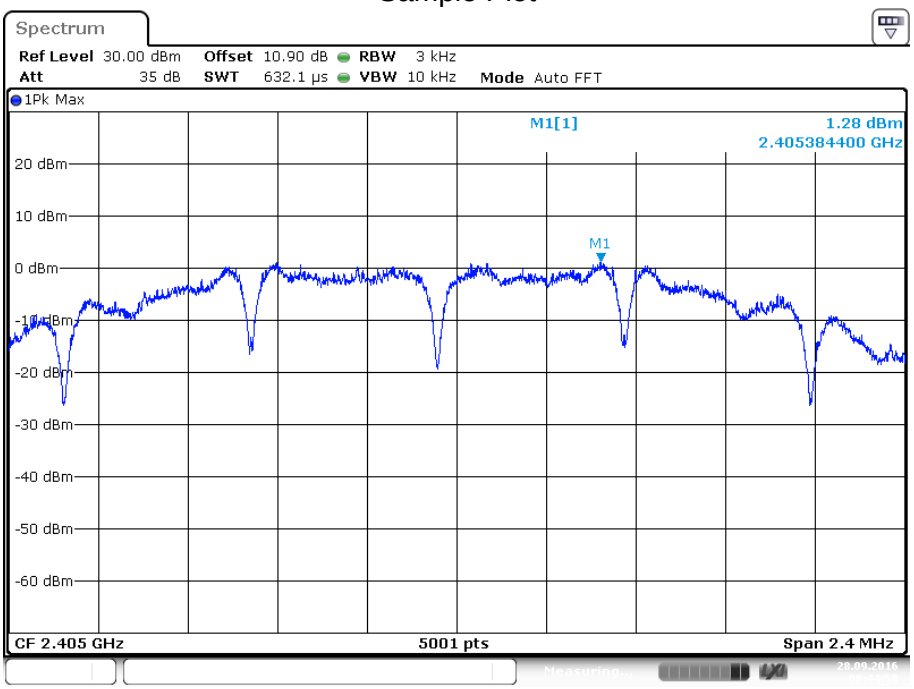
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
RF CABLE	1134	GORE	B094785	26-Jul-2017
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	27-Jul-2017

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

6.5 *Test Data*

Channel	Frequency (MHz)	Peak PSD (dBm)	Limit (30dBm)	Margin (dB)
11	2405	1.28	8	-6.72
18	2440	2.72	8	-5.28
25	2475	-8.47	8	-16.47

Sample Plot



Date: 28.SEP.2016 08:44:58

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. Antenna Port 2 yielded the higher output power levels and was used for conducted spurious measurements. The maximum target power was used (20dBm).

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit is 20 dB below the maximum in-band peak PSD level in 100 kHz.

7.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C
Relative Humidity: 51.5 %

7.4 *Test Equipment*

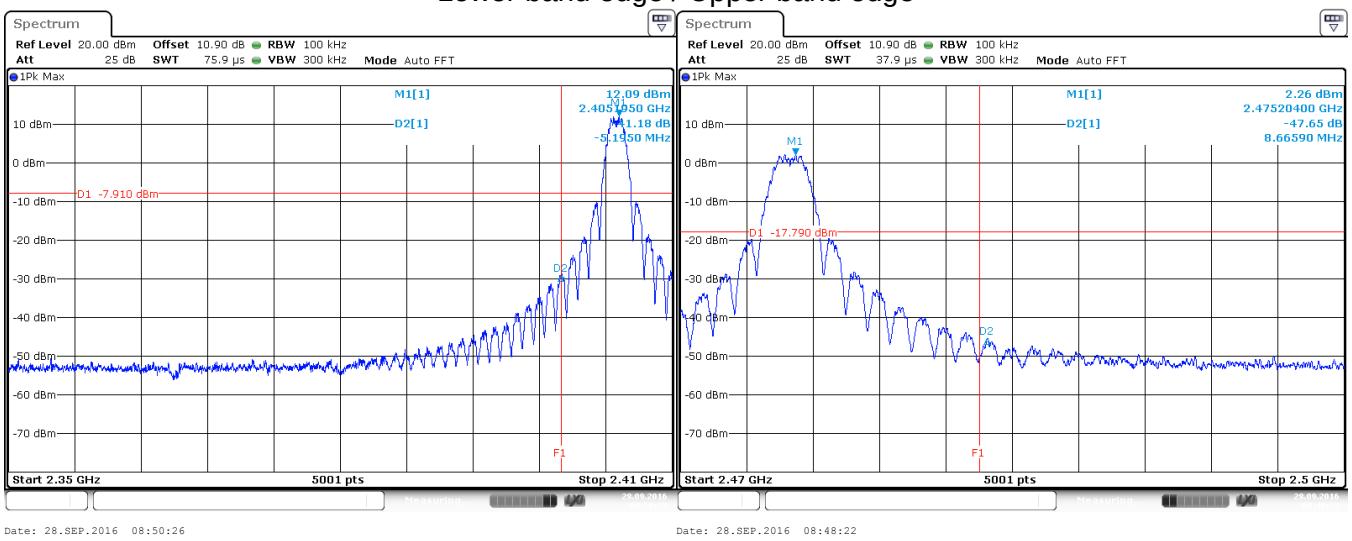
Test Date: 28-Sep-2016 Tester: JOP

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

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

7.5 *Test Data – DTS Bandedge*

Lower band edge / Upper band edge



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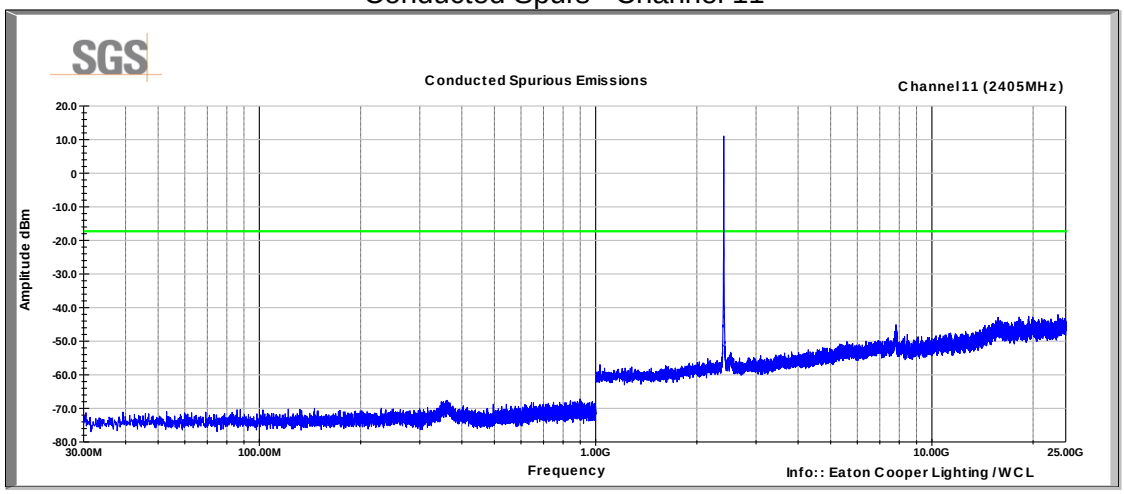
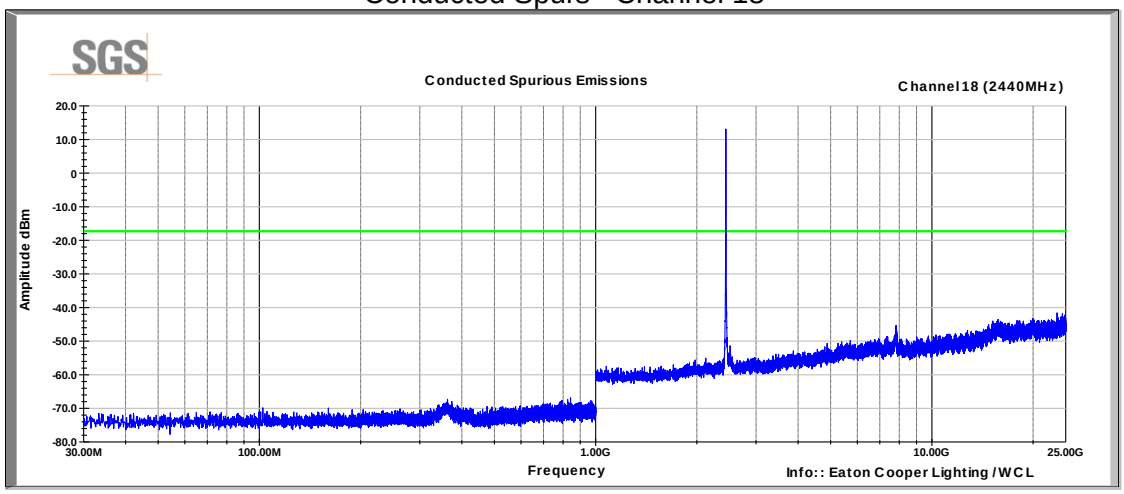
Date: 28.SEP.2016 08:48:22

7.6 *Test Data – Conducted Spurious Emissions*

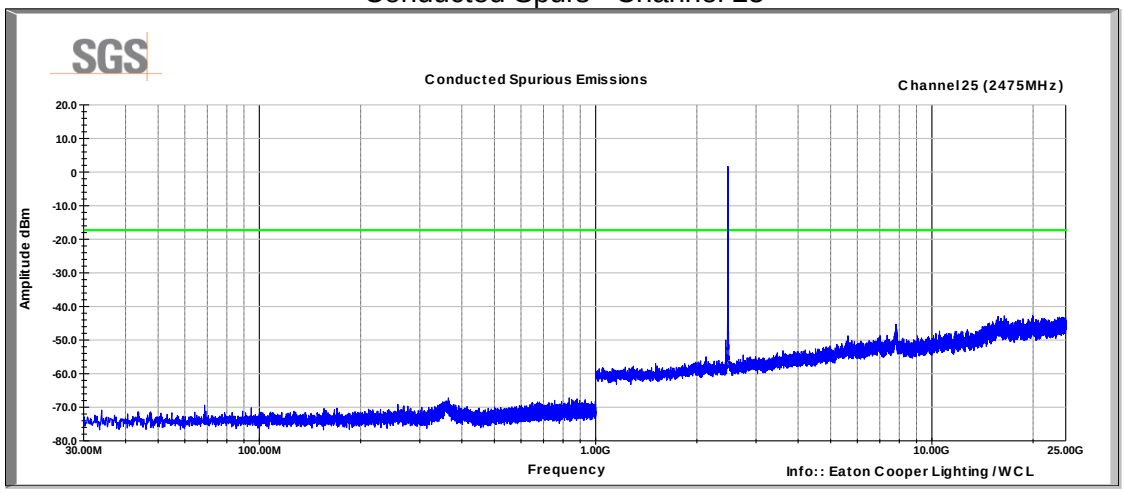
Conducted Spurs –Channel 11



Conducted Spurs –Channel 18



Conducted Spurs –Channel 25



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*

Radiated emission measurements were performed with the chip antennas installed as intended. The measurement methods defined in ANSI C63.4: 2014 were used.

Lowest, middle, and highest channels were investigated.

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

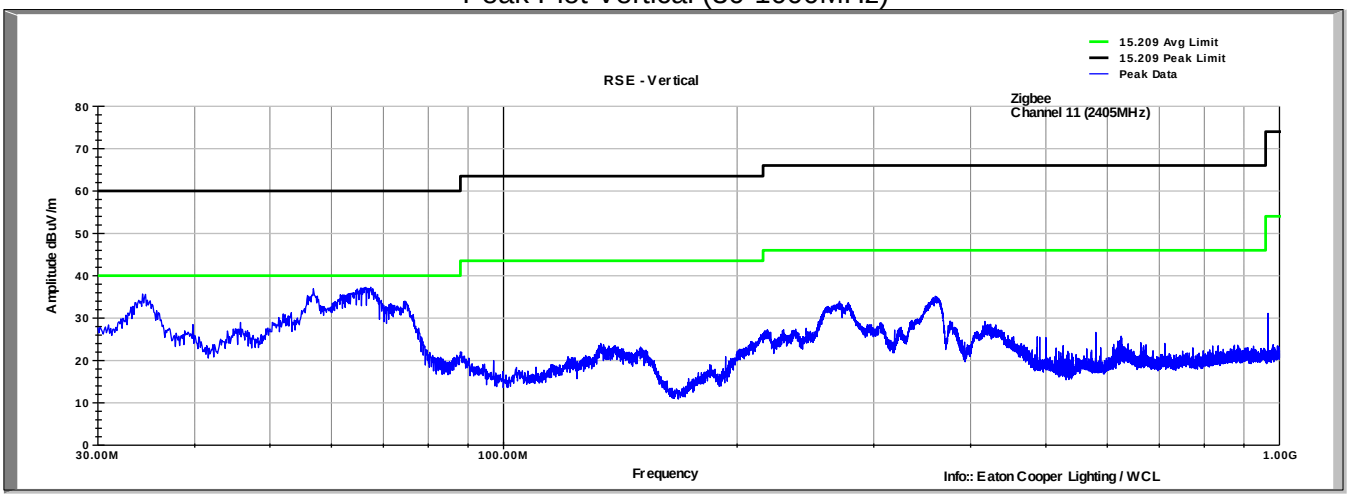
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
ANTENNA, BILOG	CBL 6143A	TESEQ	B085931	1-Dec-2016
RF CABLE	SF106	HUBER & SUHNER	B079712	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079713	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079716	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

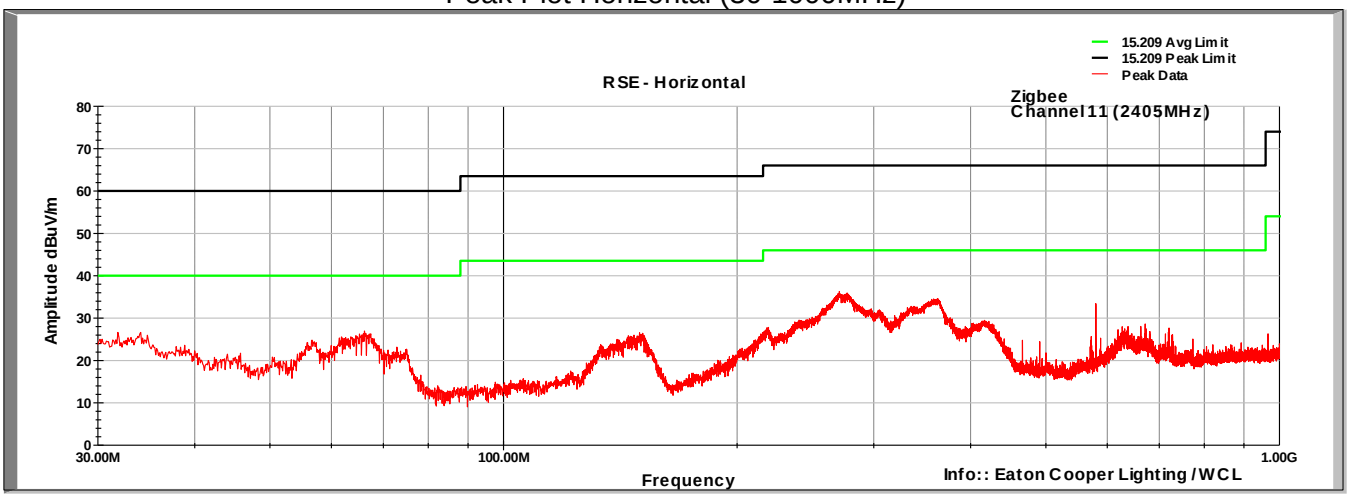
Low Channel (Channel 11, 2405MHz)
Peak Plot Vertical (30-1000MHz)



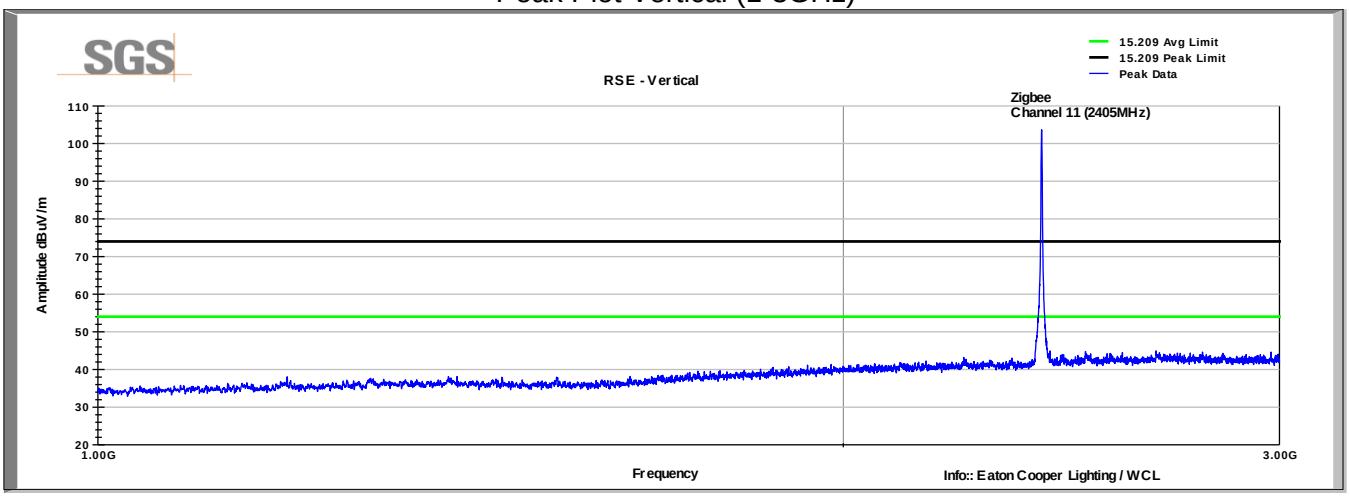
35.6dBµV/m @ 34.559MHz, 4.4dB Margin
36.9dBµV/m @ 56.869MHz, 3.1dB Margin
37.2dBµV/m @ 66.375MHz, 2.8dB Margin

Note: There was no change in the emission profile below 1GHz when switching among Channels 11, 18, and 25.

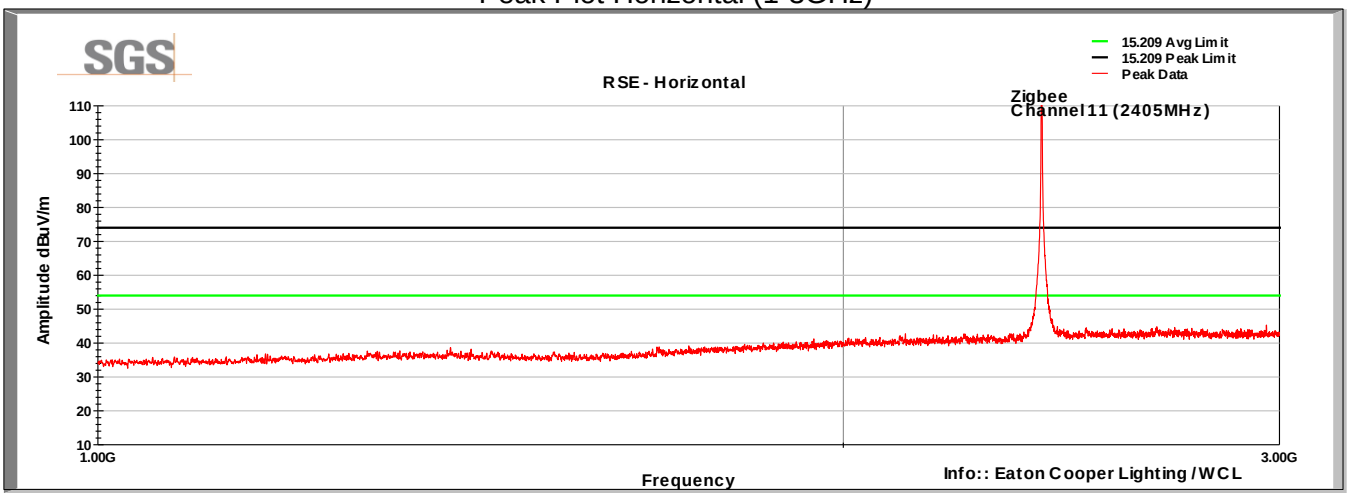
Low Channel (Channel 11, 2405MHz)
Peak Plot Horizontal (30-1000MHz)



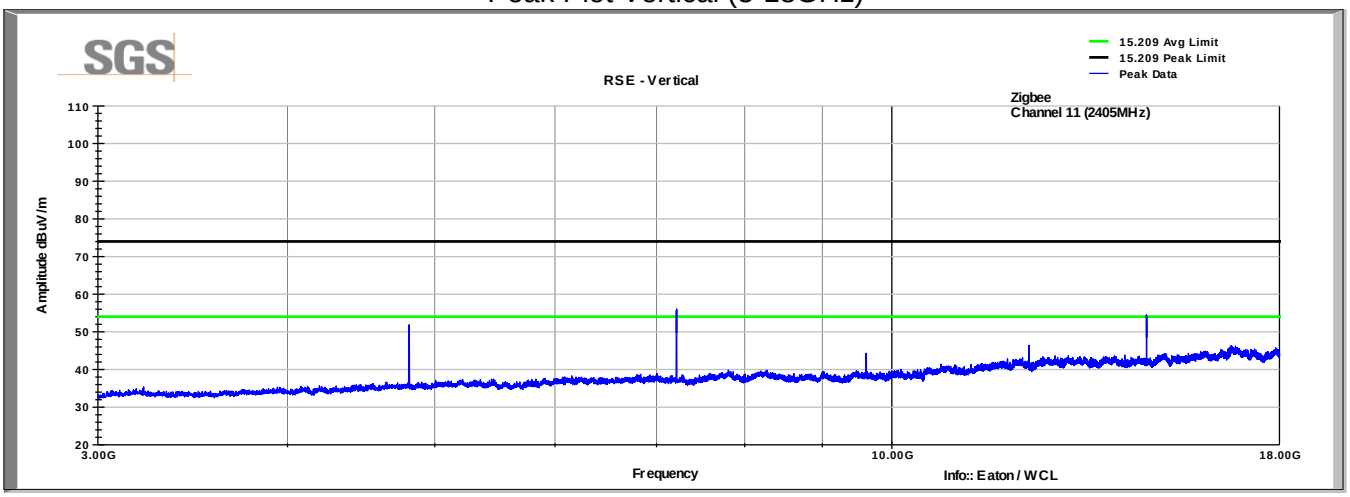
Low Channel (Channel 11, 2405MHz)
Peak Plot Vertical (1-3GHz)



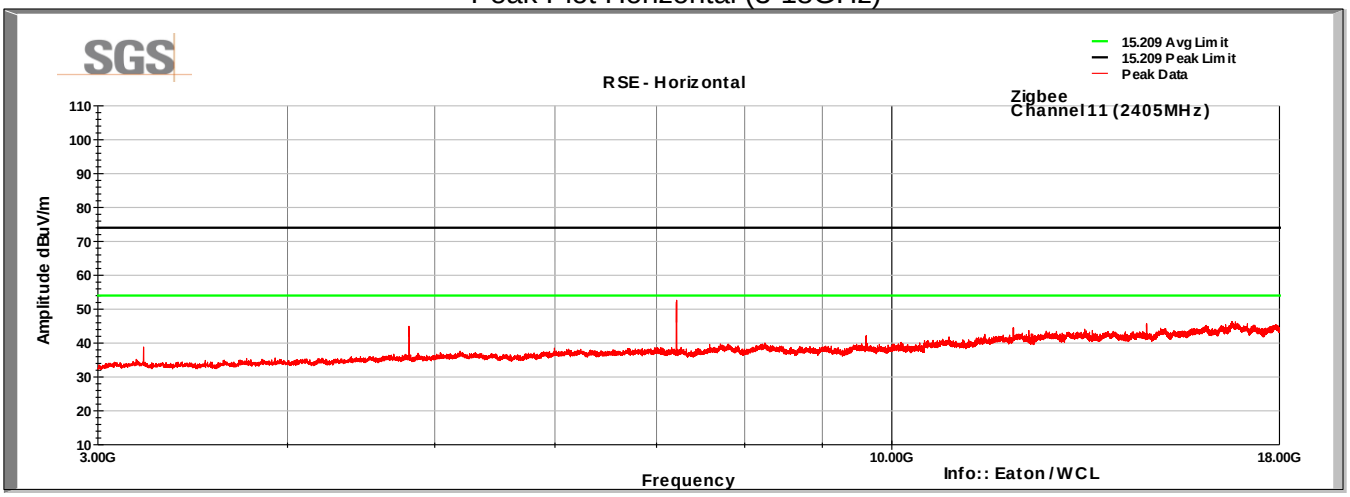
Low Channel (Channel 11, 2405MHz)
Peak Plot Horizontal (1-3GHz)



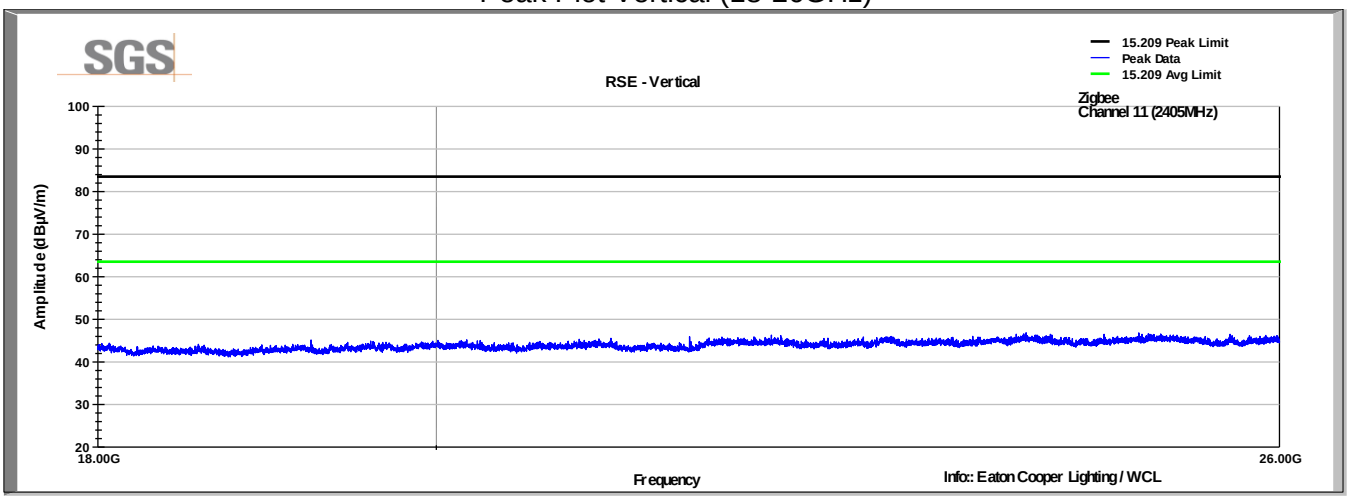
Low Channel (Channel 11, 2405MHz)
Peak Plot Vertical (3-18GHz)



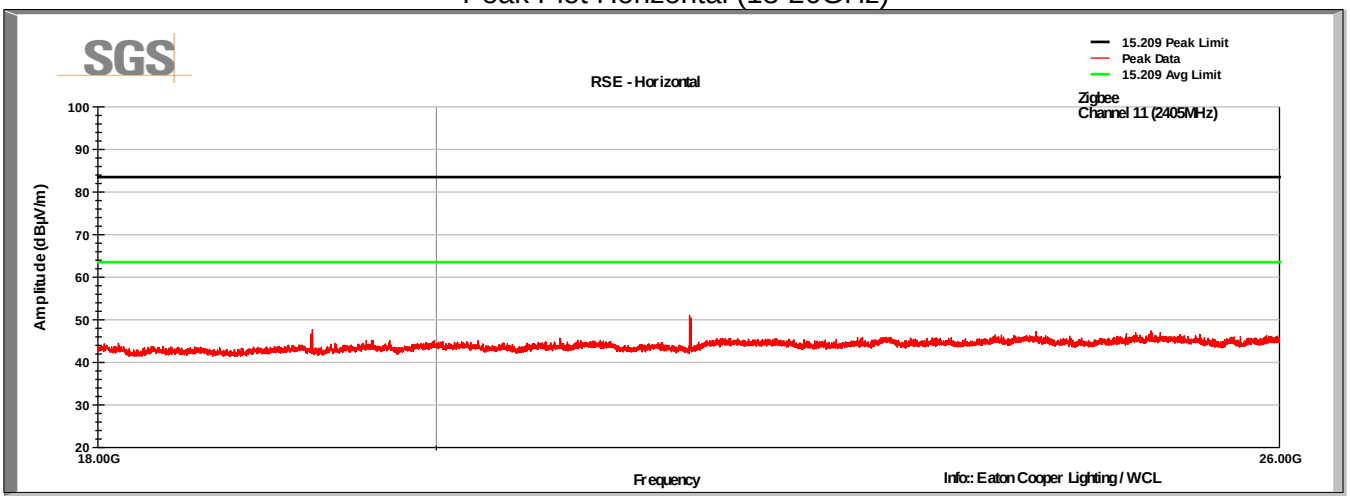
Low Channel (Channel 11, 2405MHz)
Peak Plot Horizontal (3-18GHz)



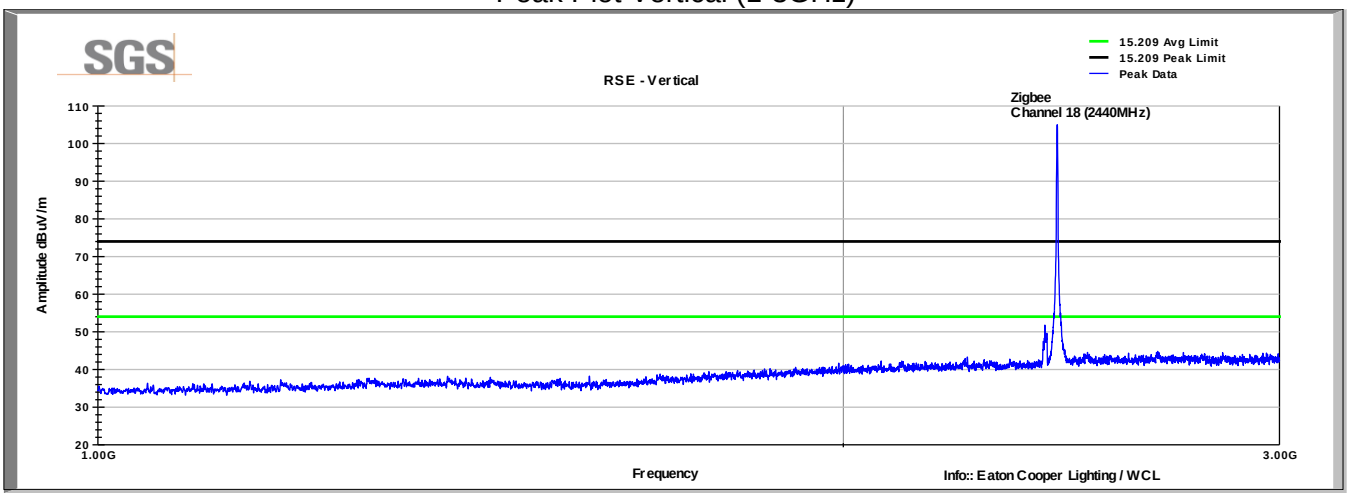
Low Channel (Channel 11, 2405MHz)
Peak Plot Vertical (18-26GHz)



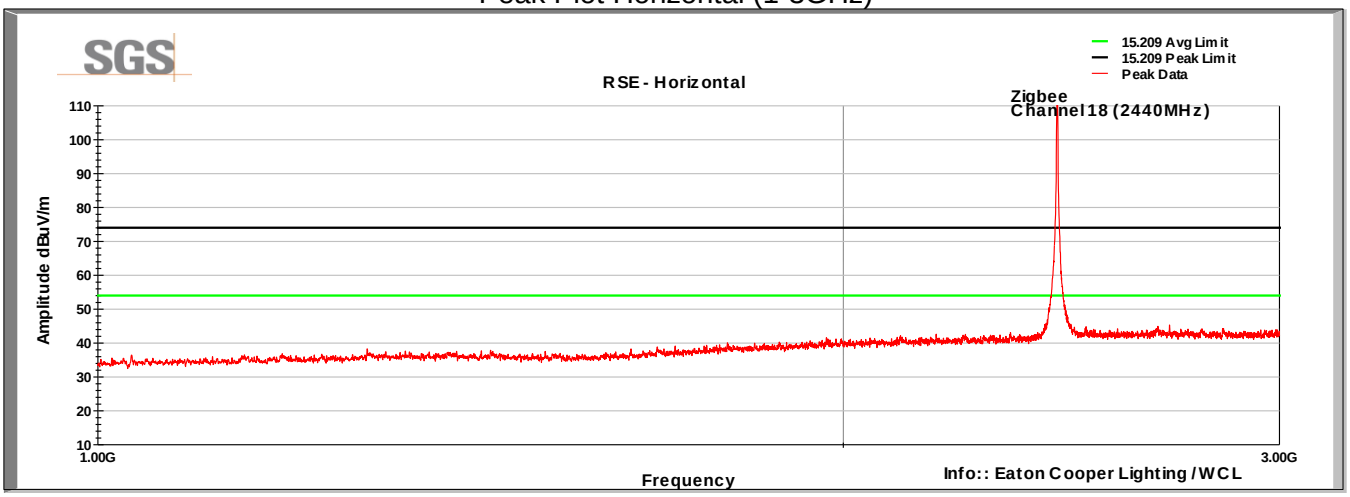
Low Channel (Channel 11, 2405MHz)
Peak Plot Horizontal (18-26GHz)



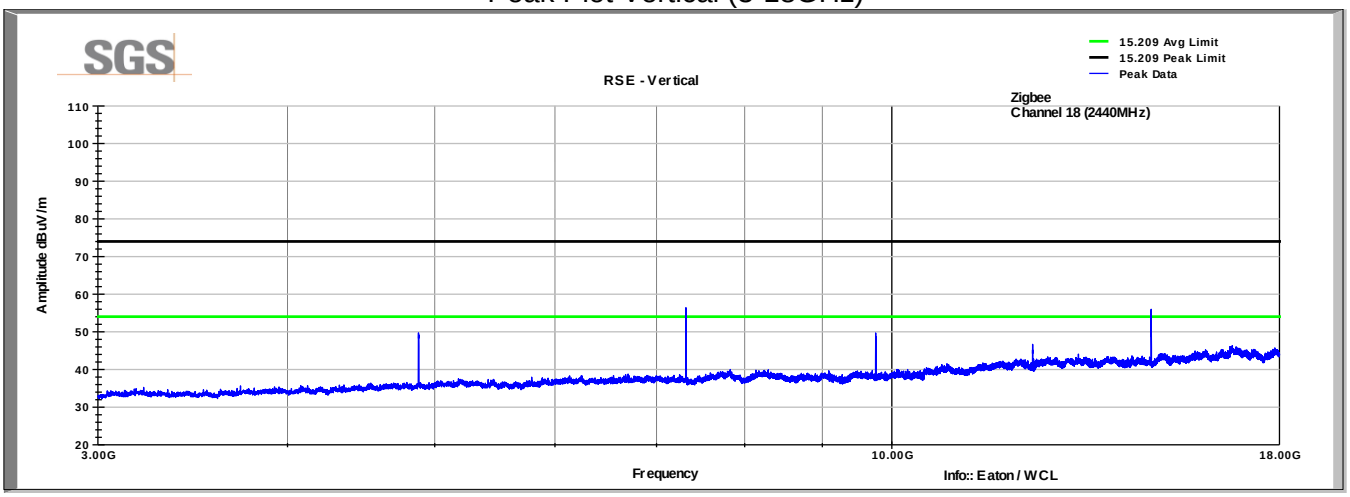
Low Channel (Channel 18, 2440MHz)
Peak Plot Vertical (1-3GHz)



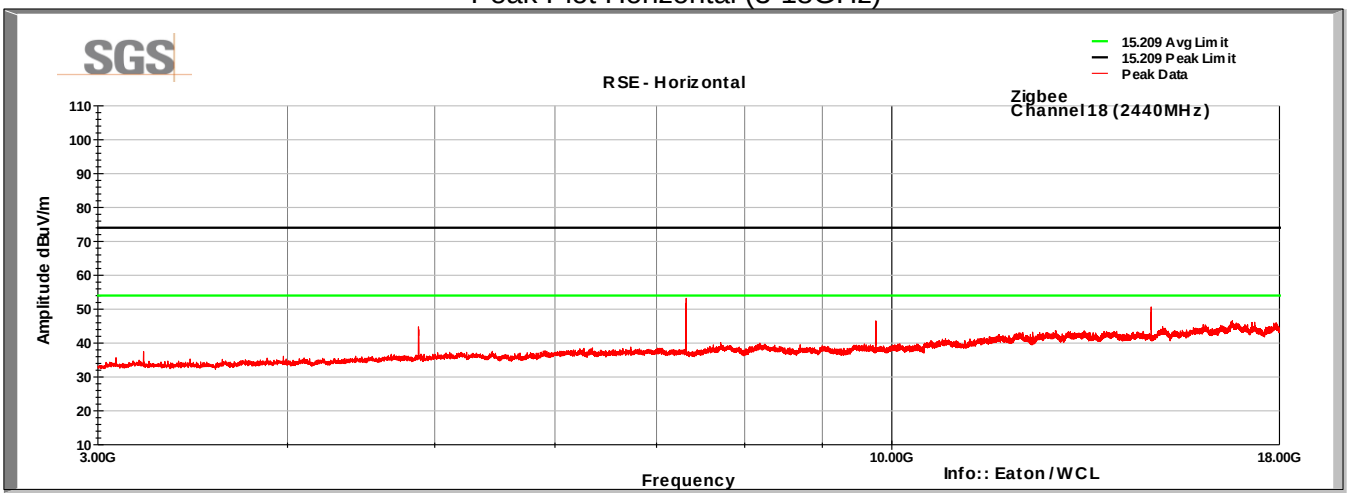
Low Channel (Channel 18, 2440MHz)
Peak Plot Horizontal (1-3GHz)



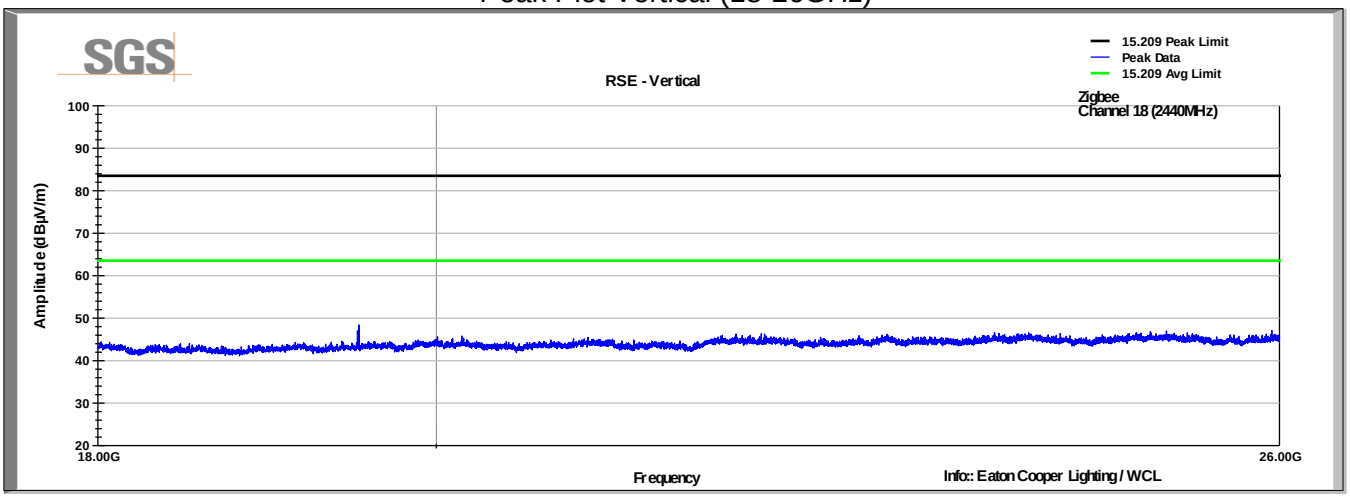
Low Channel (Channel 18, 2440MHz)
Peak Plot Vertical (3-18GHz)



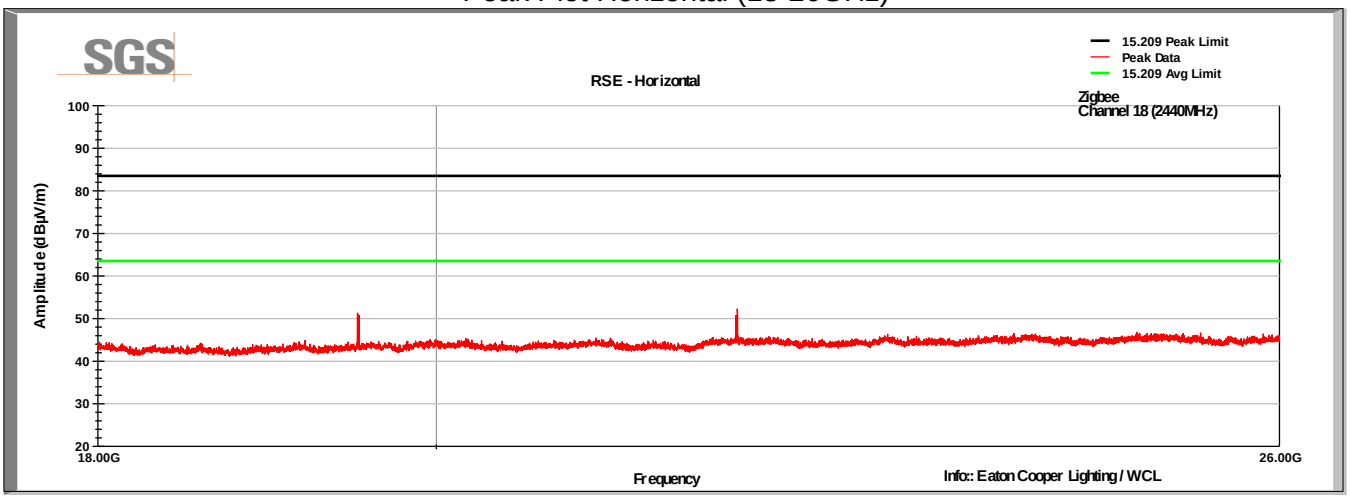
Low Channel (Channel 18, 2440MHz)
Peak Plot Horizontal (3-18GHz)



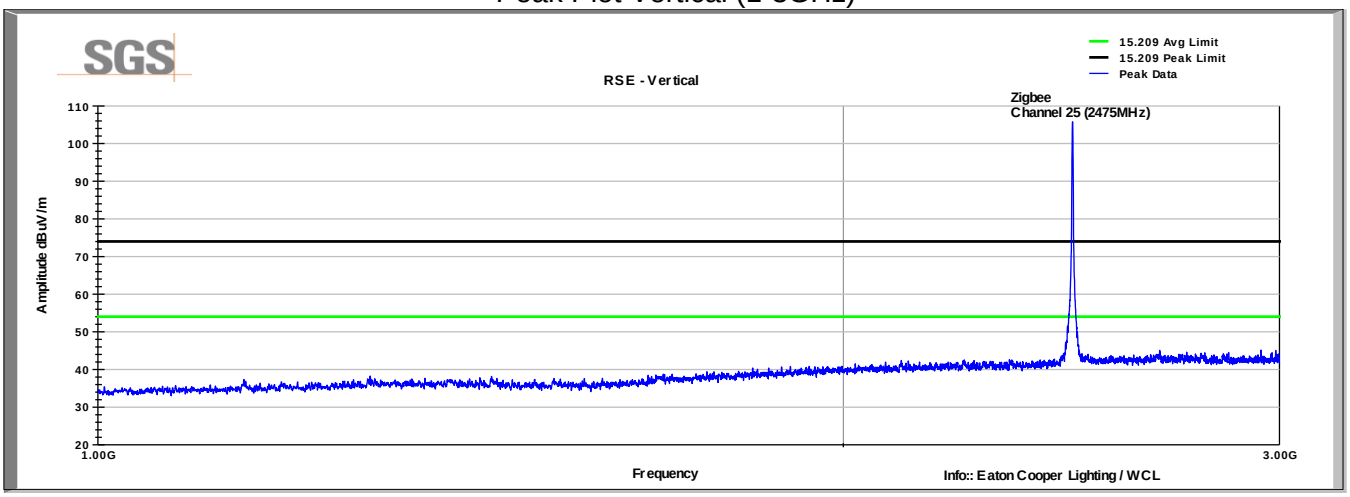
Mid Channel (Channel 18, 2440MHz)
Peak Plot Vertical (18-26GHz)



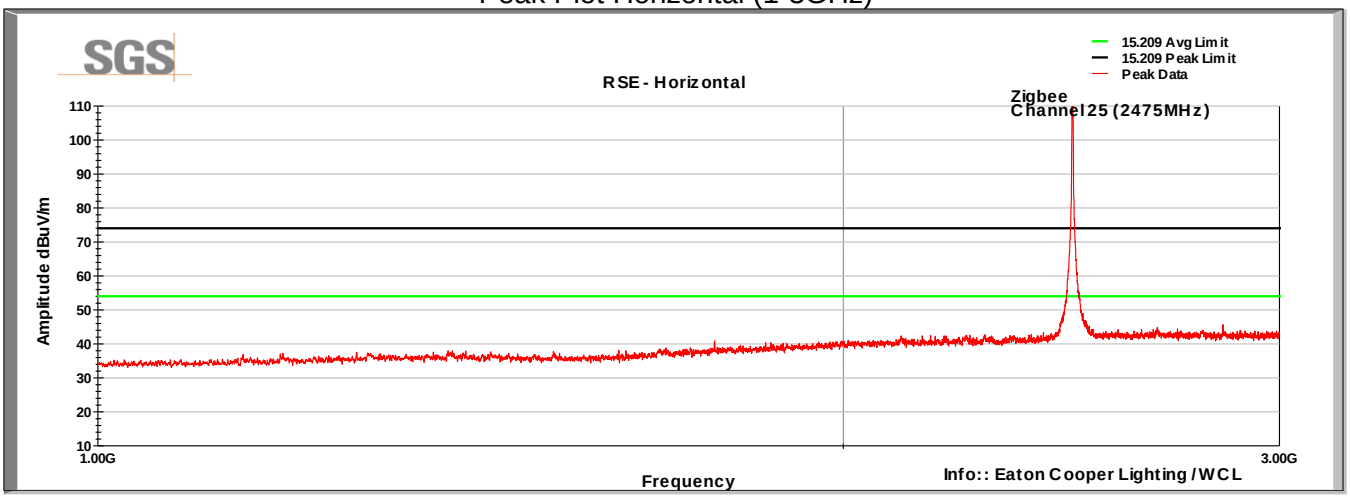
Mid Channel (Channel 18, 2440MHz)
Peak Plot Horizontal (18-26GHz)



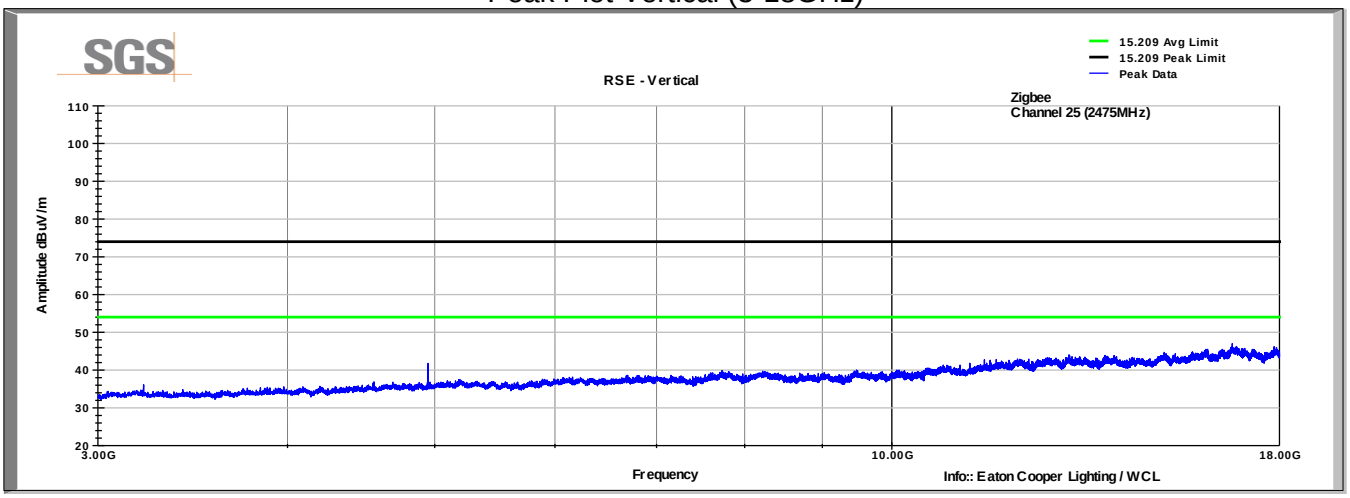
Low Channel (Channel 25, 2475MHz)
Peak Plot Vertical (1-3GHz)



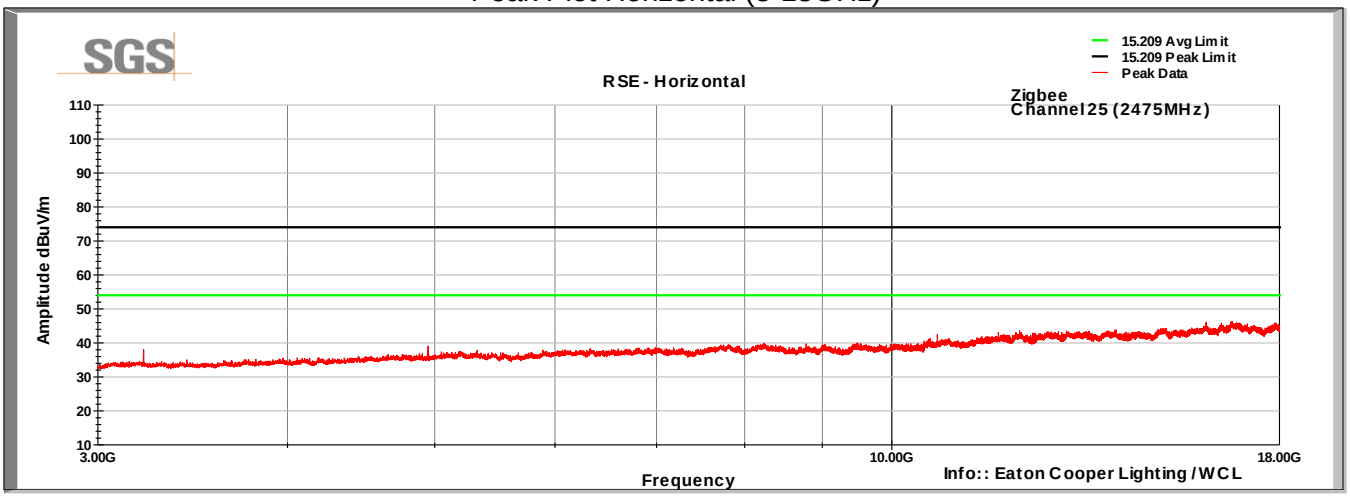
Low Channel (Channel 25, 2475MHz)
Peak Plot Horizontal (1-3GHz)



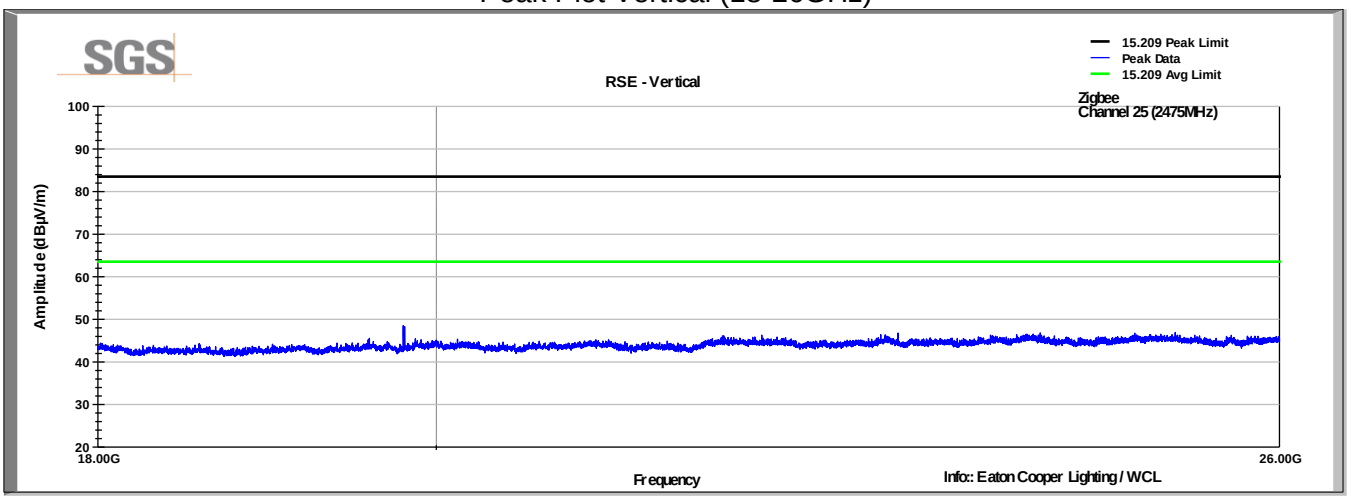
Low Channel (Channel 25, 2475MHz)
Peak Plot Vertical (3-18GHz)



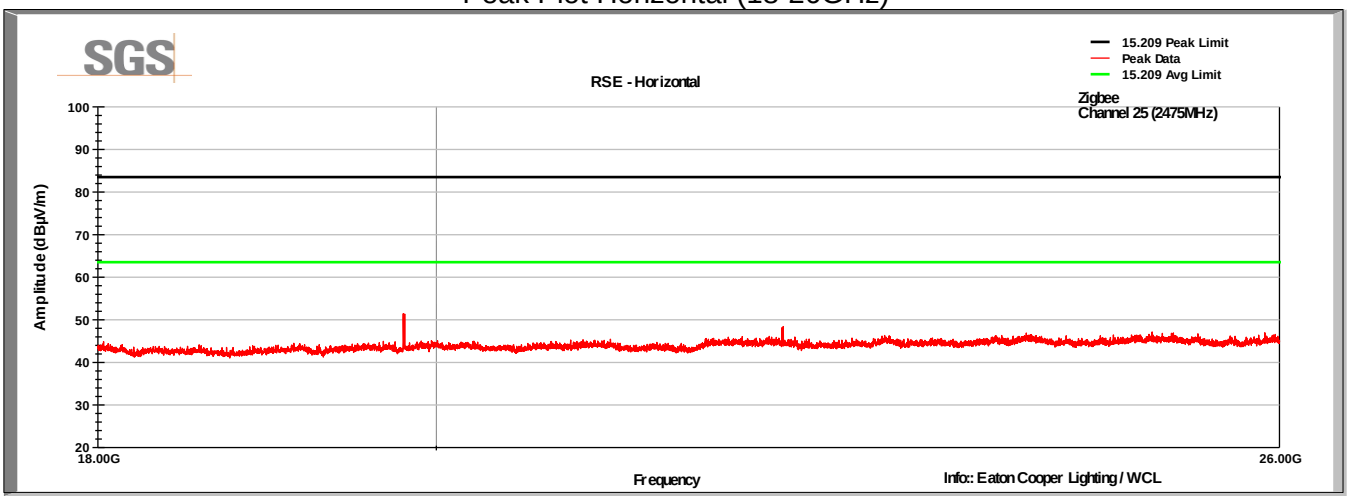
Low Channel (Channel 25, 2475MHz)
Peak Plot Horizontal (3-18GHz)



High Channel (Channel 25, 2475MHz)
Peak Plot Vertical (18-26GHz)



High Channel (Channel 25, 2475MHz)
Peak Plot 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 11 (2405MHz)							
4810.00	48.1	V	3.8	51.9	74.0	-22.1	Peak
4810.00	40.6	V	3.8	44.4	54.0	-9.6	Average
4810.00	41.1	H	3.8	44.9	74.0	-29.1	Peak
4810.00	33.6	H	3.8	37.4	54.0	-16.6	Average
Channel 18 (2440MHz)							
4880.00	45.9	V	3.8	49.7	74.0	-24.3	Peak
4880.00	38.4	V	3.8	42.2	54.0	-11.8	Average
4880.00	41.0	H	3.8	44.8	74.0	-29.2	Peak
4880.00	33.5	H	3.8	37.3	54.0	-16.7	Average
7320.00	50.3	V	6.1	56.4	74.0	-17.6	Peak
7320.00	42.8	V	6.1	48.9	54.0	-5.1	Average
7320.00	47.1	H	6.1	53.2	74.0	-20.8	Peak
7320.00	39.6	H	6.1	45.7	54.0	-8.3	Average
Channel 25 (2475MHz)							
4950.00	37.9	V	3.8	41.7	74.0	-32.3	Peak
4950.00	32.9	V	3.8	36.7	54.0	-17.3	Average

- No other measurable harmonics were in a restricted band.

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*

Peak and average field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz.Measurements were made using the conducted methods defined in FCC KDB publication 558074 D01 DTS Meas Guidance v03r05.

9.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C
Relative Humidity: 51.5 %

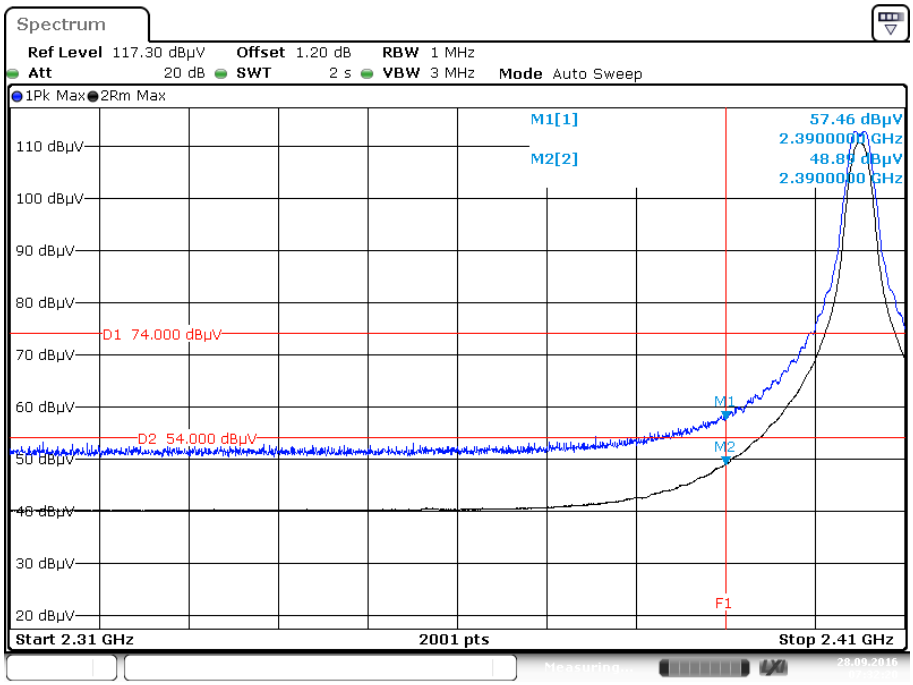
9.4 *Test Equipment*

Test Date: 28-Sep-2016 Tester: JOP

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

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

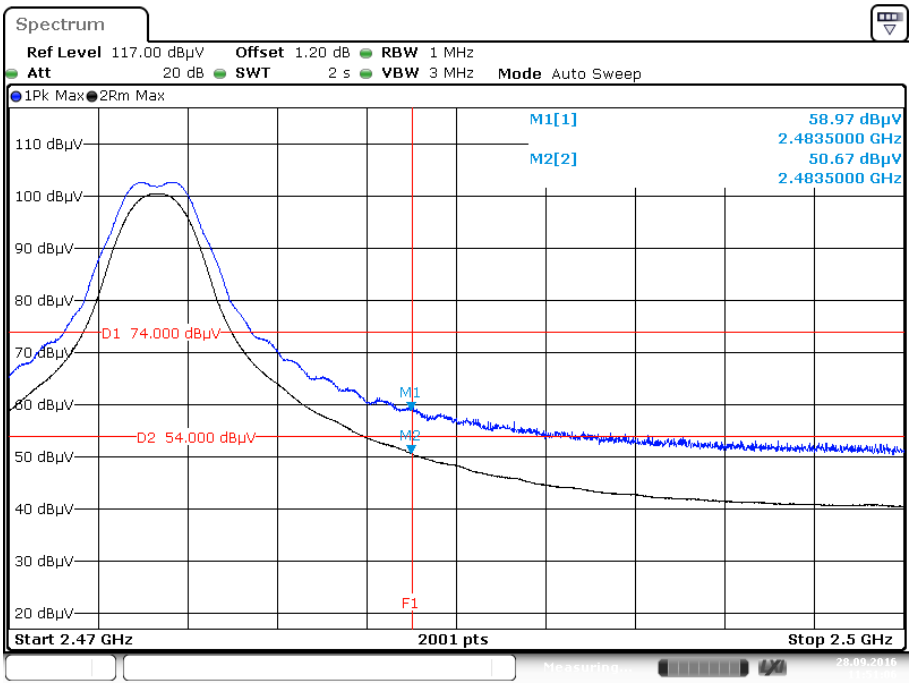
Test Data
Channel 11



Date: 28.SEP.2016 07:32:20

Channel	Frequency (MHz)	Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measuremnt Detector
11	2390	57.46	74	-16.54	Peak
11	2390	48.89	54	-5.11	RMS

Channel 25



Date: 28.SEP.2016 11:51:07

Channel	Frequency (MHz)	Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measuremnt Detector
25	2483.5	58.97	74	-15.03	Peak
25	2483.5	50.67	54	-3.33	RMS

10 Revision History

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