EMC Test Report

Project Number: 4185288

Report Number: 4185288EMC03 **Revision Level:** 0

Client: ADTRAN, Inc.

Equipment Under Test: Indoor Wireless Access Point

Model Number: BSAP-3045

FCC ID: HDCBSAP304X

IC ID: 2250A-BSAP304X

Applicable Standards: FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 2, February 2017

RSS-GEN, Issue 4, November 2014

ANSI C63.10: 2013

Report issued on: 03 October 2017

Test Result: Compliant

Tested by: _____
Jeremy Pickens, Senior EMC Engineer

Reviewed by: _____
David Schramm, Operations Manager

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
6dB Bandwidth	15.247(d)	RSS-247 S5.2 (1)	NS(1)
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	NS(1)
Transmitter Output Power	15.247(b) (3)	RSS-247 S5.4 (4)	NS(1)(2)
Radiated Spurious Emissions / Restricted Bands	15.247(d), 15.35(b),15.209	RSS-247 S5.5	Compliant

(1) This evaluation is to support a Class II Permissive Change. Refer to original filing for results.
(2) In order to maintain compliance when using the higher gain antennas, the power must be reduced. These calculations are included in Appendix A.

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	ADTRAN, Inc.
Address:	901 Explorer Blvd.
City, State, Zip, Country:	Huntsville, AL 35806

2.2 *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

2.3 *General Information of EUT*

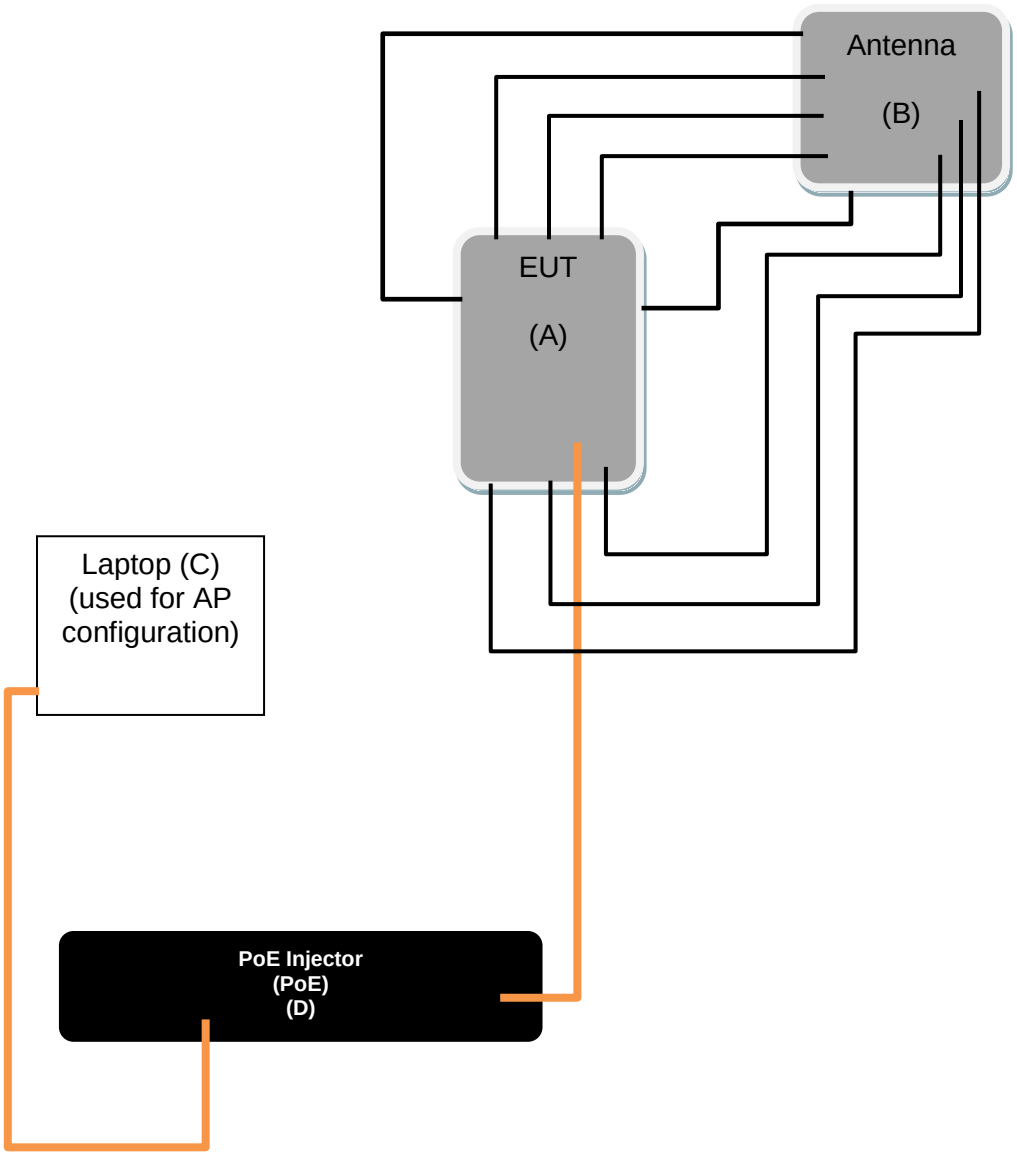
Type of Product:	Indoor Wireless Access Point
Model:	BSAP-3045
Serial Number:	30454316050013
Frequency Range:	2400-2483.5MHz
Data Modes:	802.11b, 802.11g, 802.11n (HT20), 802.11n (HT40),
Antenna:	Ventev, 2.4/5 GHz, 12/13 dBi Directional Antenna (P/N: M6012013O3D36820)
Rated Voltage:	48Vdc (PoE)
Sample Received Date:	01 August 2017
Dates of testing:	08 – 16 August 2017

2.4 *Operating Modes and Conditions*

For spurious emissions measurements, only the worst-case mode with respect to peak power from the original filing was investigated: 802.11b, 1Mbps.

Continuous traffic was generated using test commands which allowed a >98% duty-cycle transmission.

2.5 *EUT Connection Block Diagram*



2.6 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	ADTRAN, Inc.	Indoor Access Point	BSAP-3045	30454316050013
B	Ventev	Dual Band MIMO Patch	M6012013O3D36820	Not Labeled
C	Lenovo	Laptop	ThinkPad E560	PF-0HGUH7 16/12
D	EnGenius	PoE Adapter	EPA5006GAT-B	173287527

3 Field Strength of Spurious Radiation

3.1 *Test Result*

Test Description	Test Specification	Test Result
Spurious Emissions	15.247 (d) and 15.209 RSS-247 S5.5 ANSI C63.10: 2013	Compliant

3.2 *Test Method*

The preliminary scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak detector above 1GHz. For harmonics of the fundamental, Average measurements were made by correcting the peak value with the duty cycle correction factor. For emissions other than harmonics of the fundamental, the Average measurements were made using the Average detector. The receivers resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.
There is a limit on spurious emissions produced by an intentional radiator in any 100 kHz Bandwidth outside the intentional emission band of -20dBc provided the radiator complies with the limits specified in 15.205(c) and 15.209(a).

Test distance:

1 to 18 GHz - The EUT to measurement antenna distance is 3 meters
18 to 40 GHz - The EUT to measurement antenna distance is 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

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.1 °C
Relative Humidity: 42.6 %

3.4 *Test Equipment*

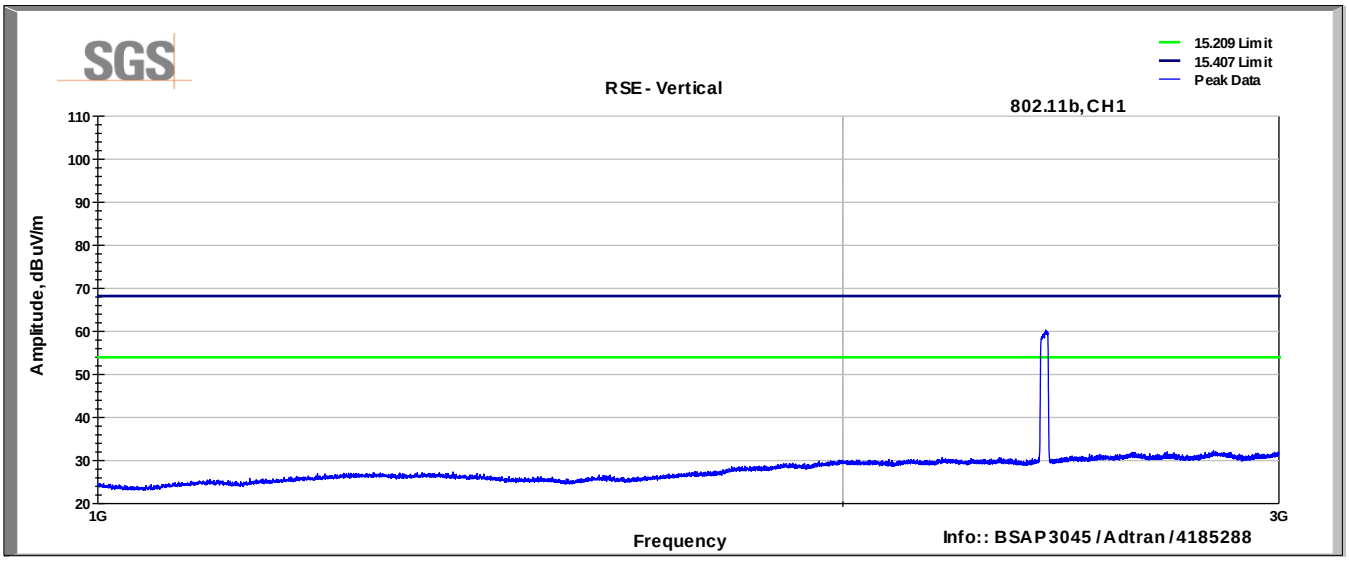
Test End Date: 8-Aug-2017 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	16-May-2018
RF CABLE	HPA190	RF LOGIC	17014	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079659	25-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018
FILTER, BAND REJECT (2450MHZ)	BRM50709	MICRO-TRONICS	B079790	27-Jul-2018
ANTENNA, DRG HORN (SMALL)	3116B	ETS LINDGREN	B079697	21-Mar-2018
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	28-Jul-2018

Note: The equipment calibration period is 1 year.

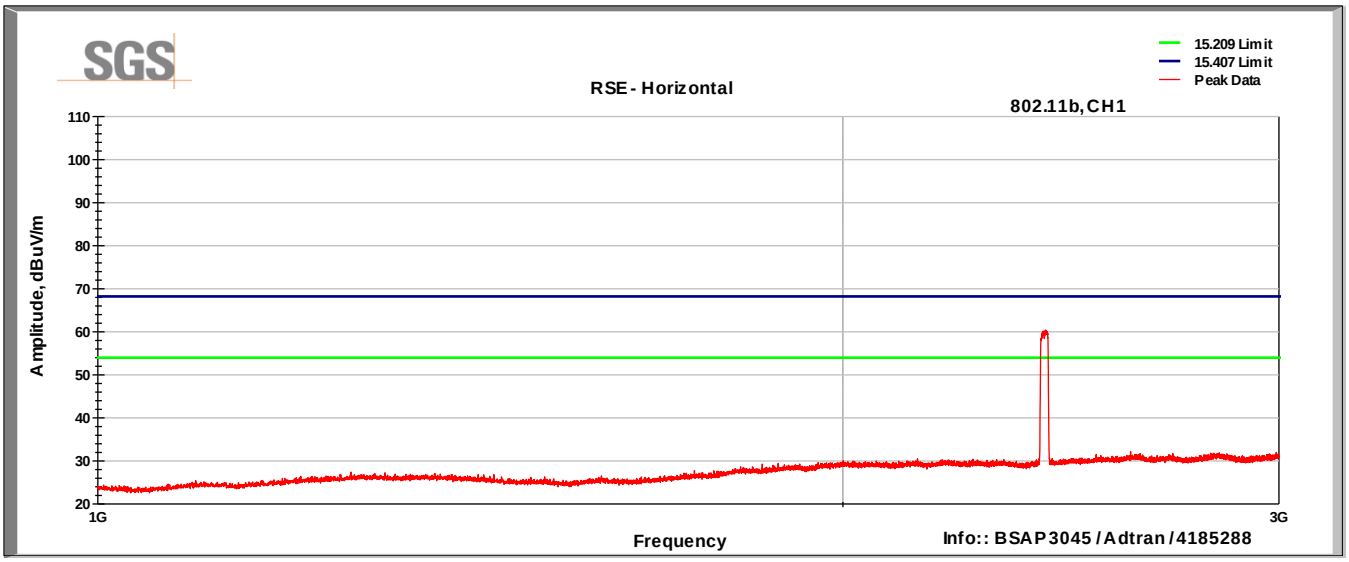
3.5 *Test Data (1-3GHz)*

CH 1 802.11b, 6Mbps
Vertical



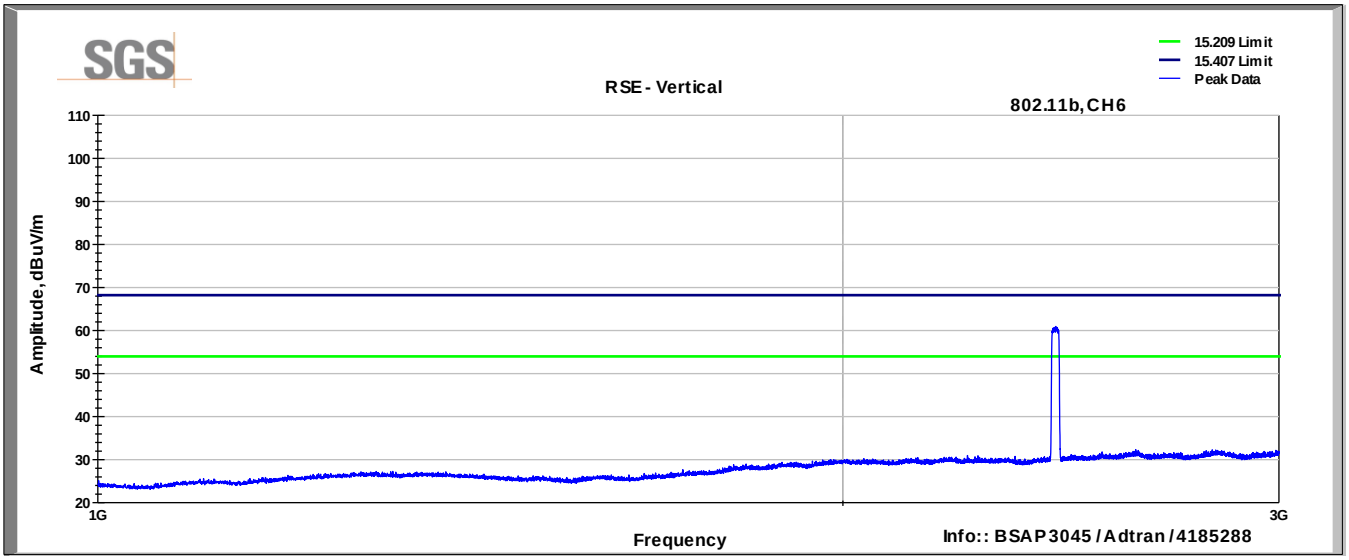
Note: Band-reject filter installed

Horizontal



Note: Band-reject filter installed

CH 6 802.11b, 6Mbps
Vertical



Note: Band-reject filter installed

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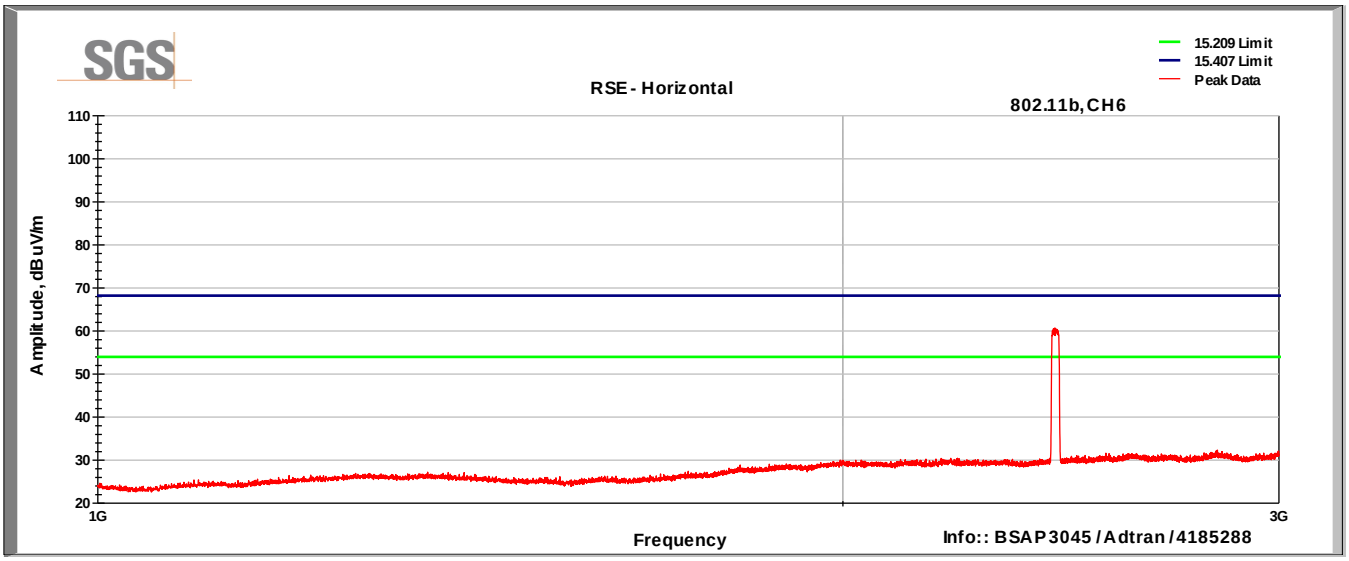
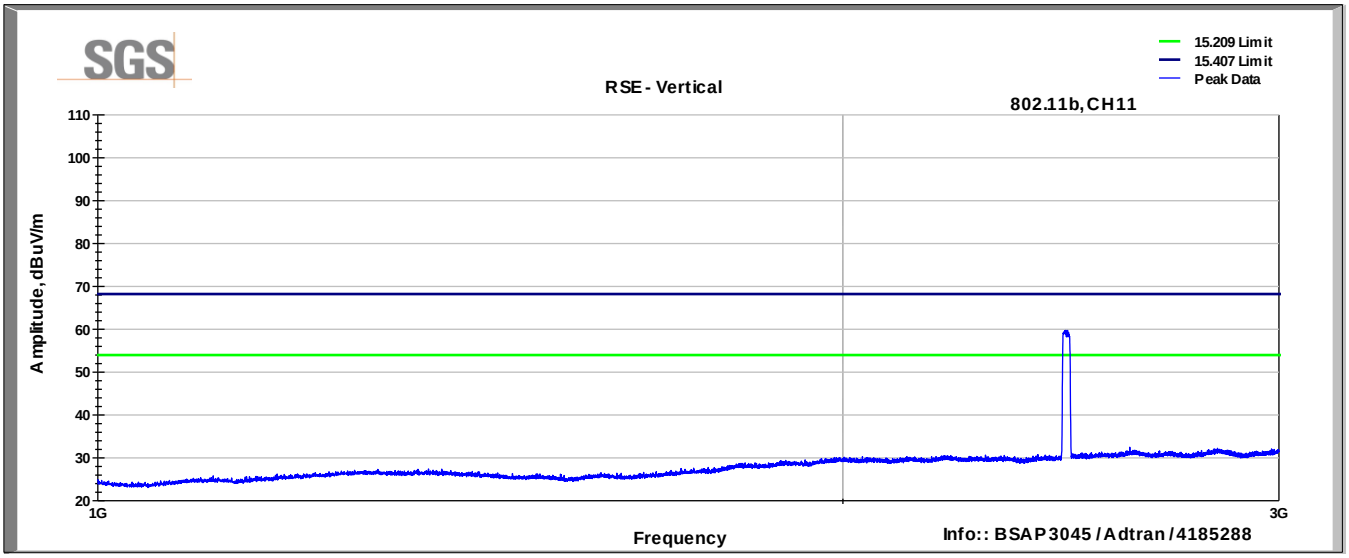


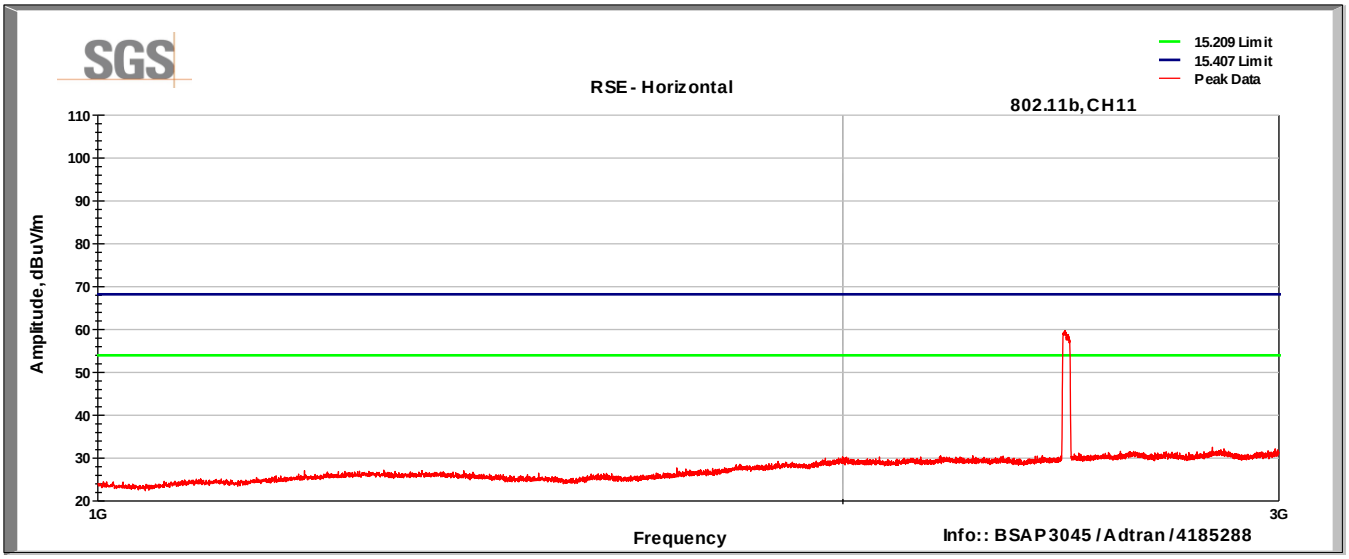
Note: Band-reject filter installed

CH 11 802.11b, 6Mbps
Vertical



Note: Band-reject filter installed

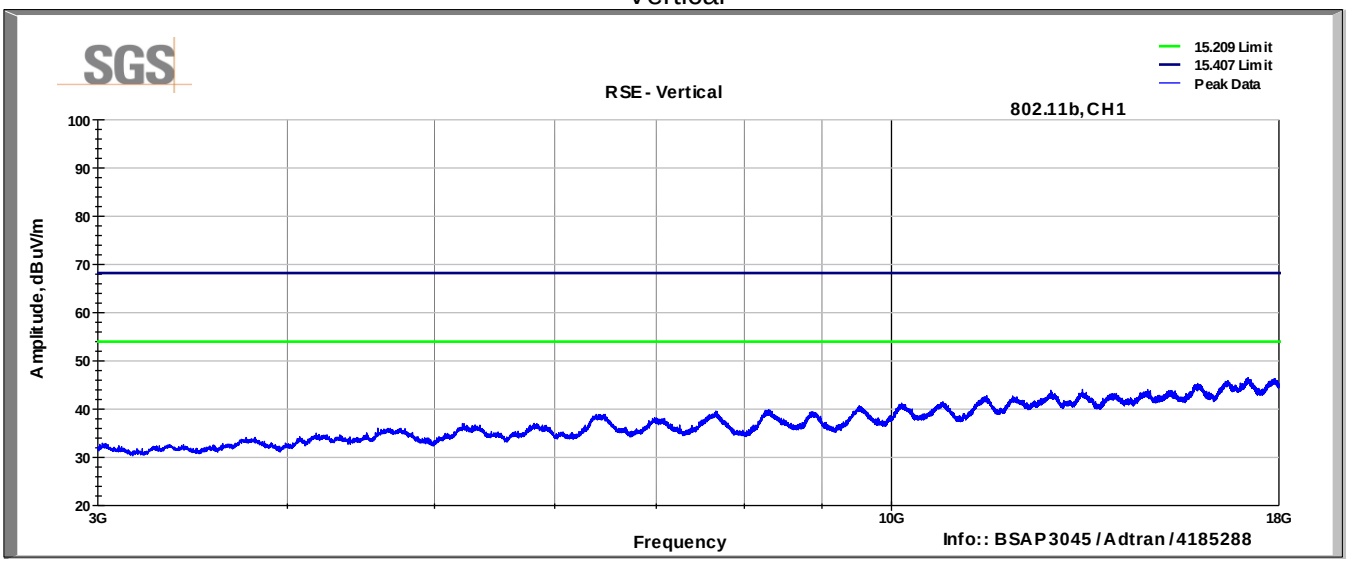
Horizontal



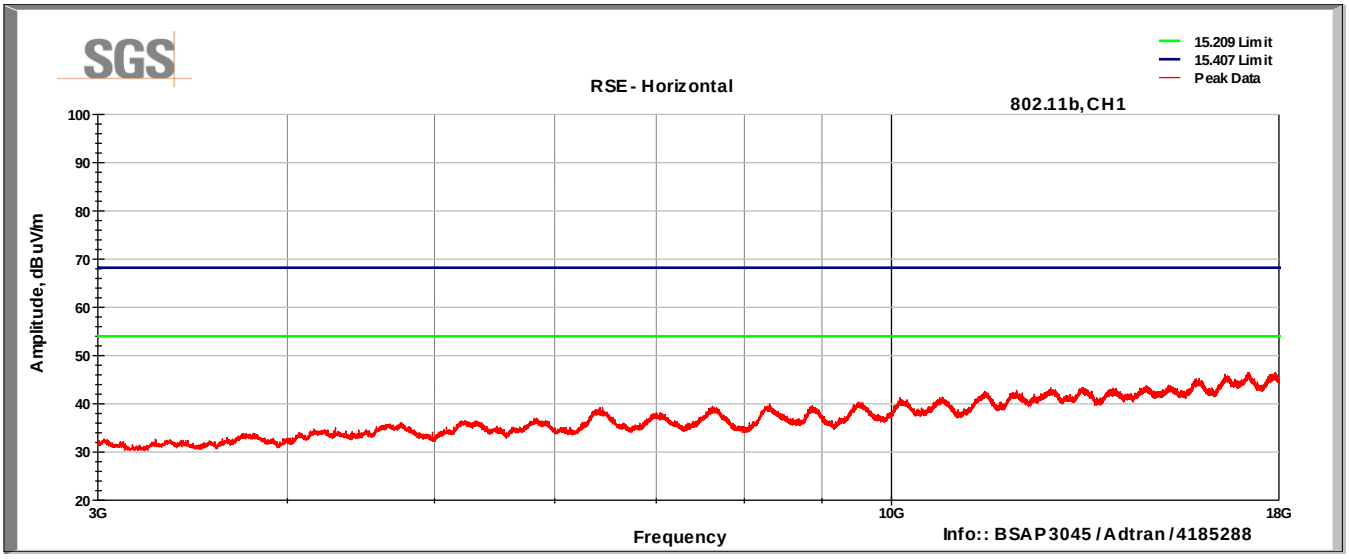
Note: Band-reject filter installed

3.6 *Test Data – (3-18GHz)*

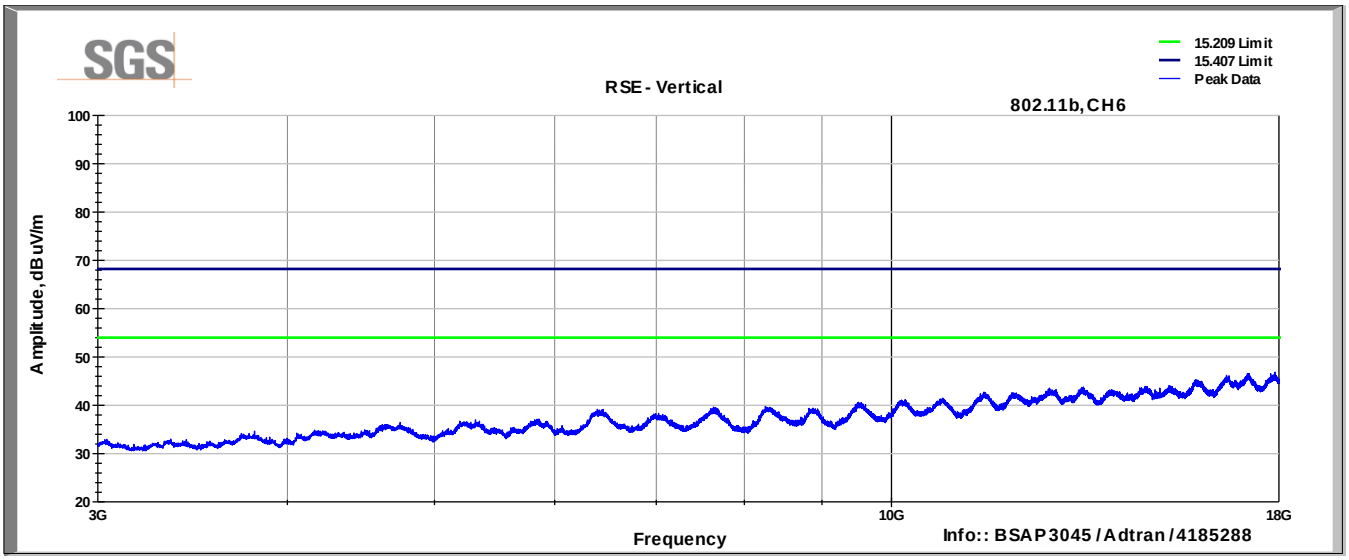
CH 1 802.11b, 1Mbps
Vertical



Horizontal



CH 6 802.11b, 1Mbps
Vertical



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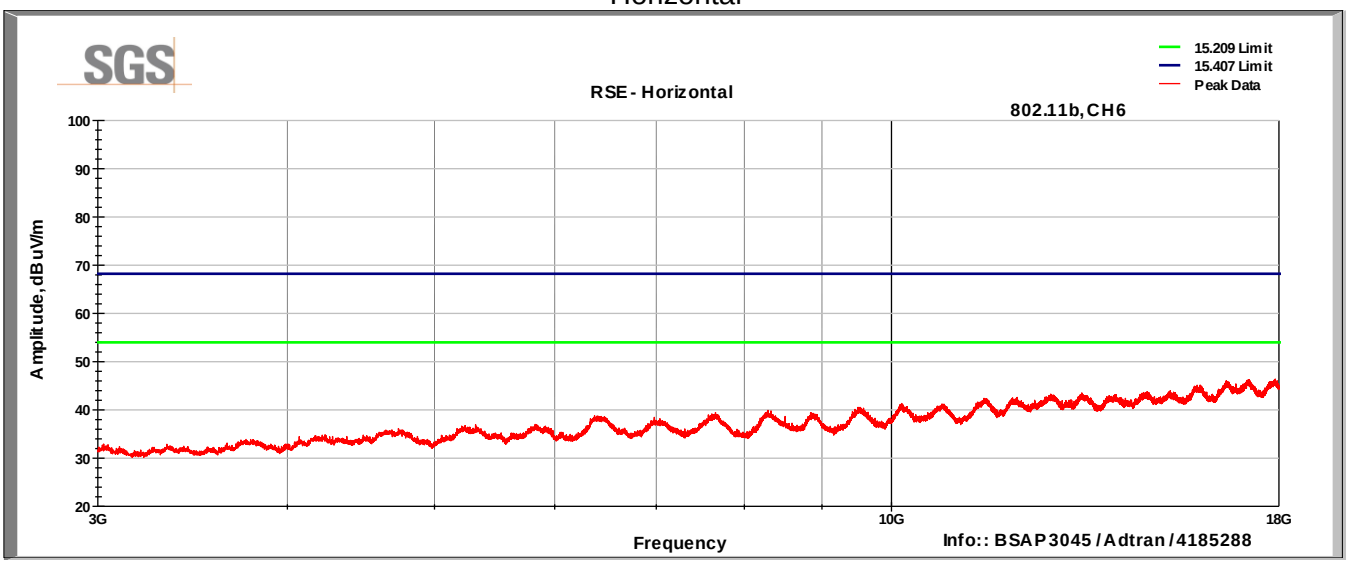
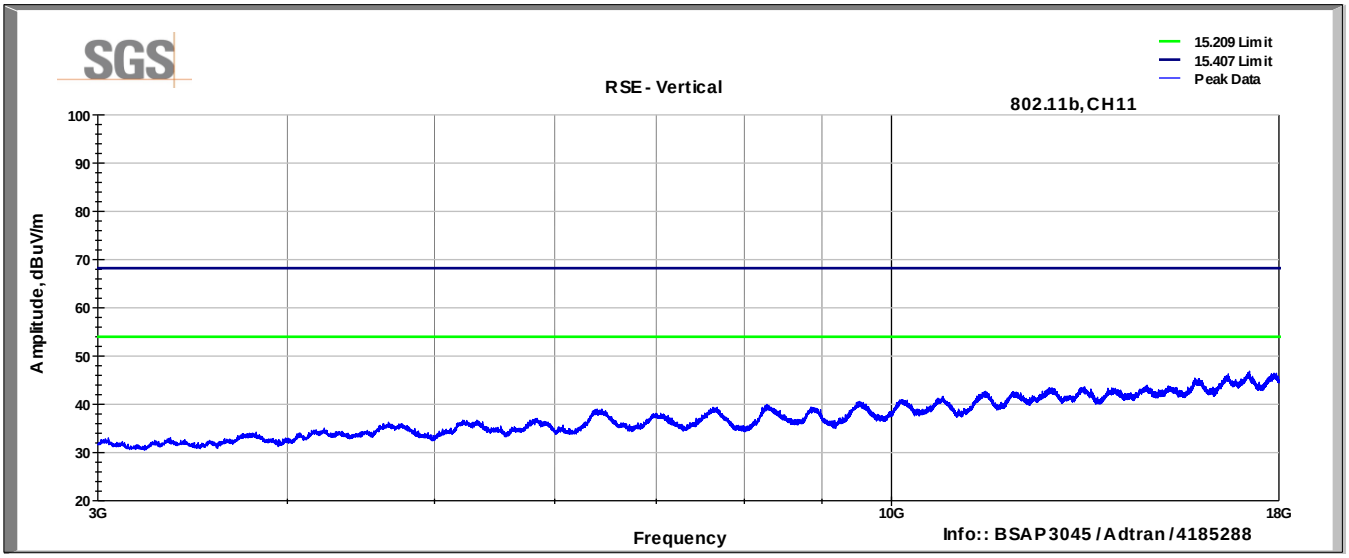


CH 11 802.11b, 1Mbps
Vertical



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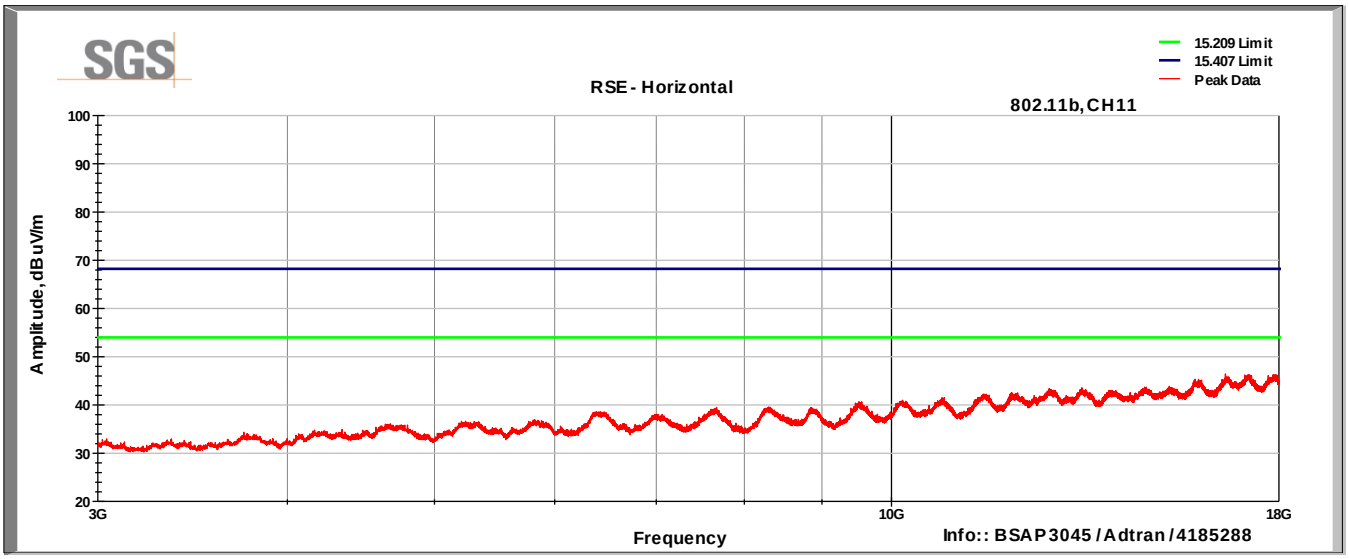
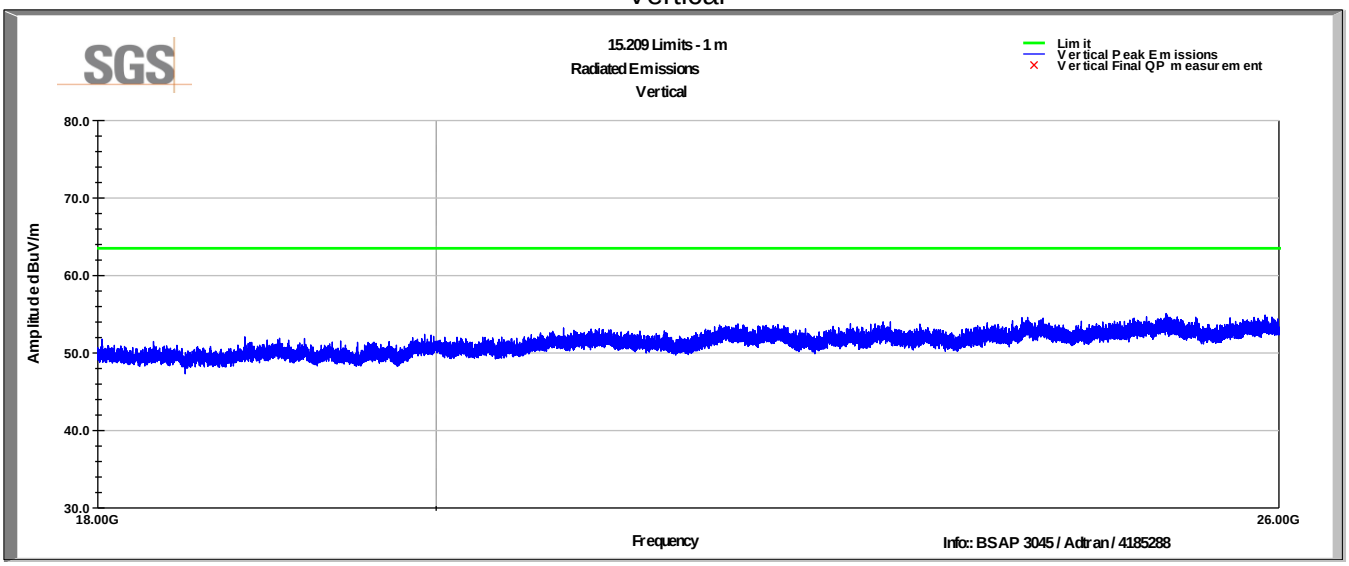


3.7 *Test Data – (18-26GHz)*

CH 1 802.11b, 6Mbps
Vertical



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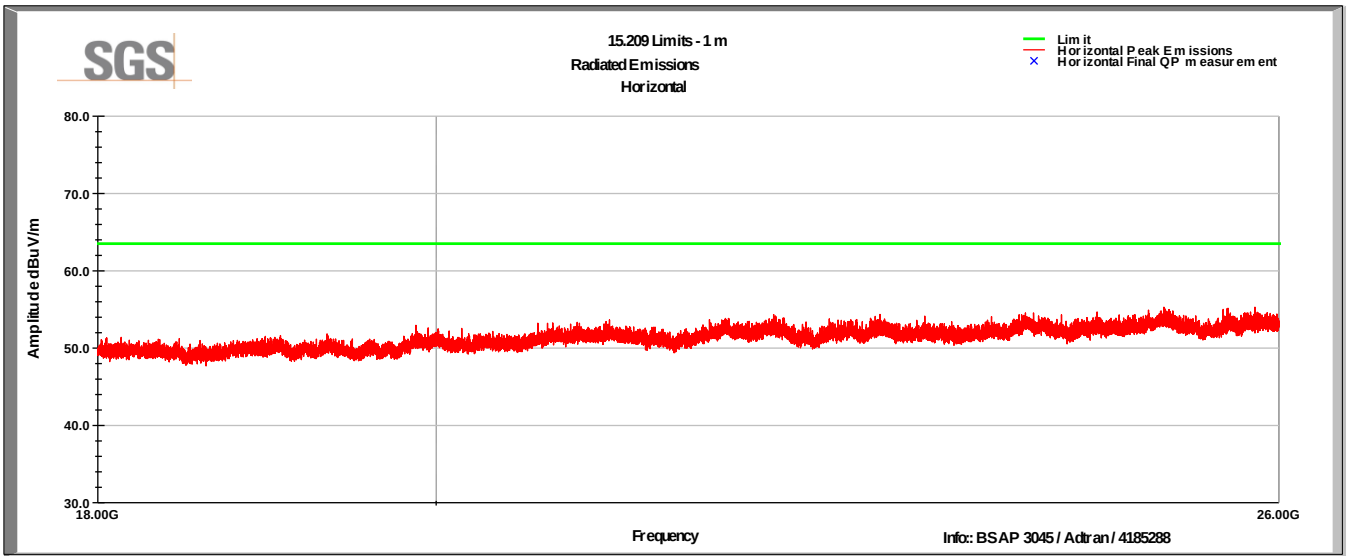
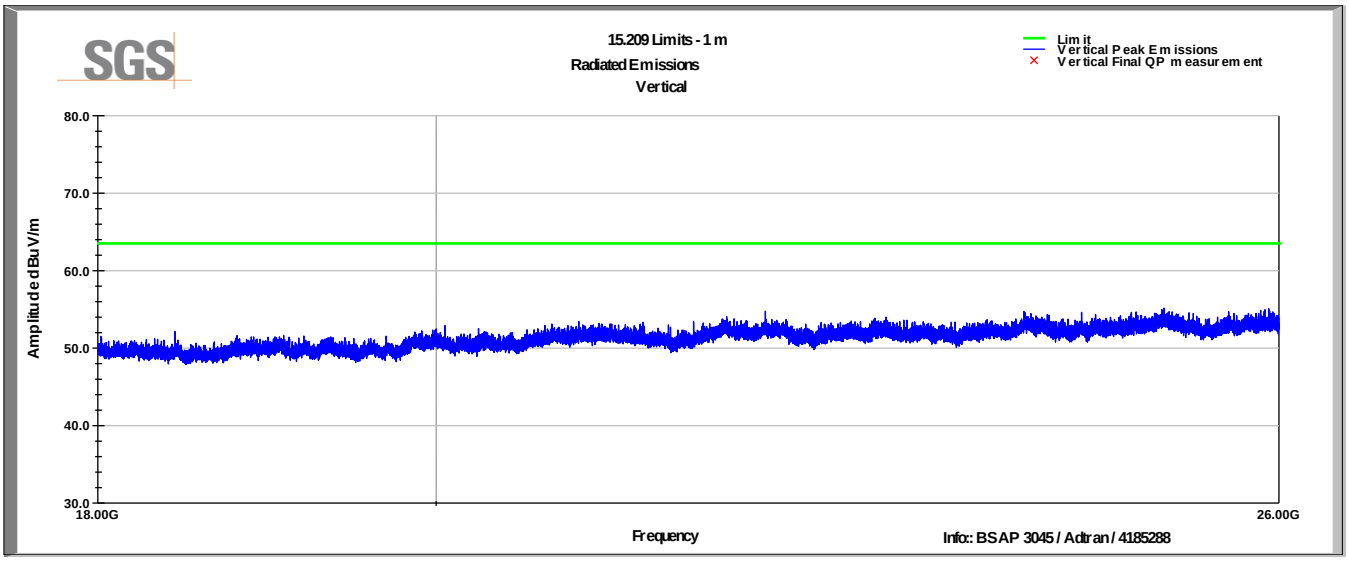
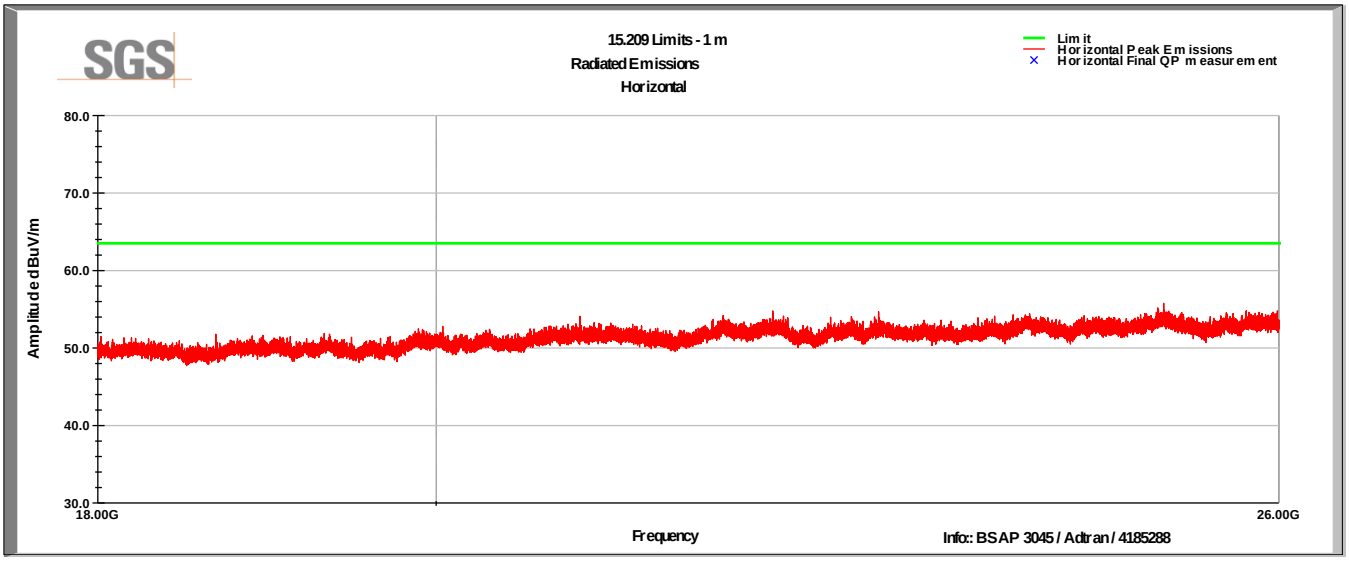


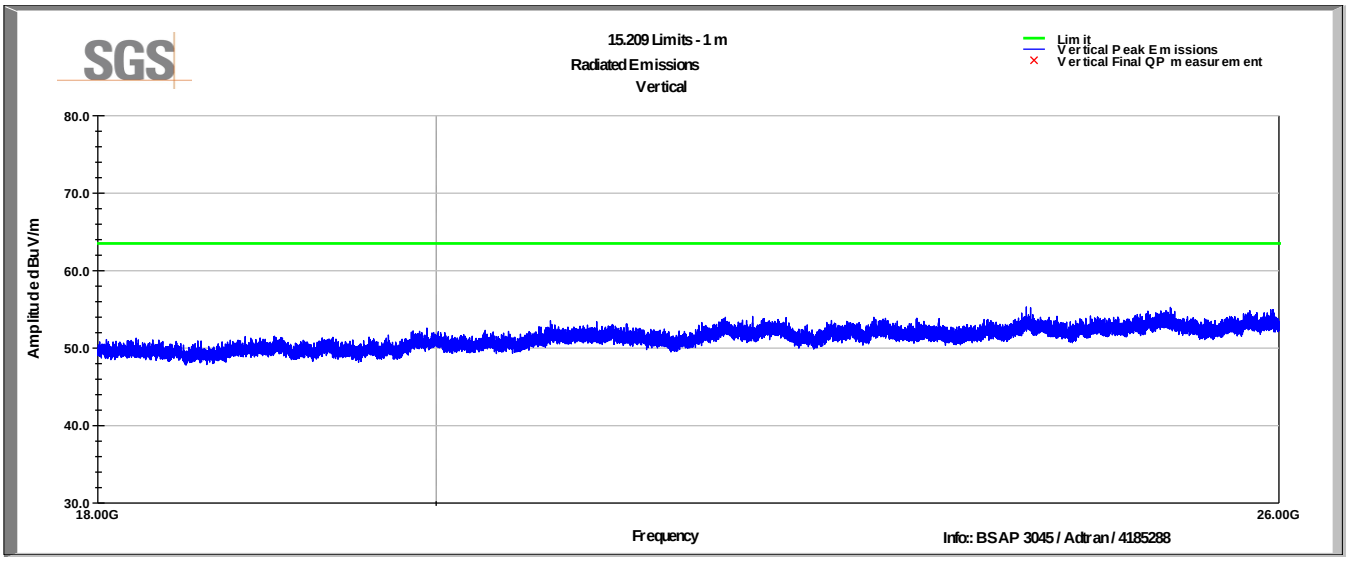
CH 6 802.11b, 6Mbps
Vertical



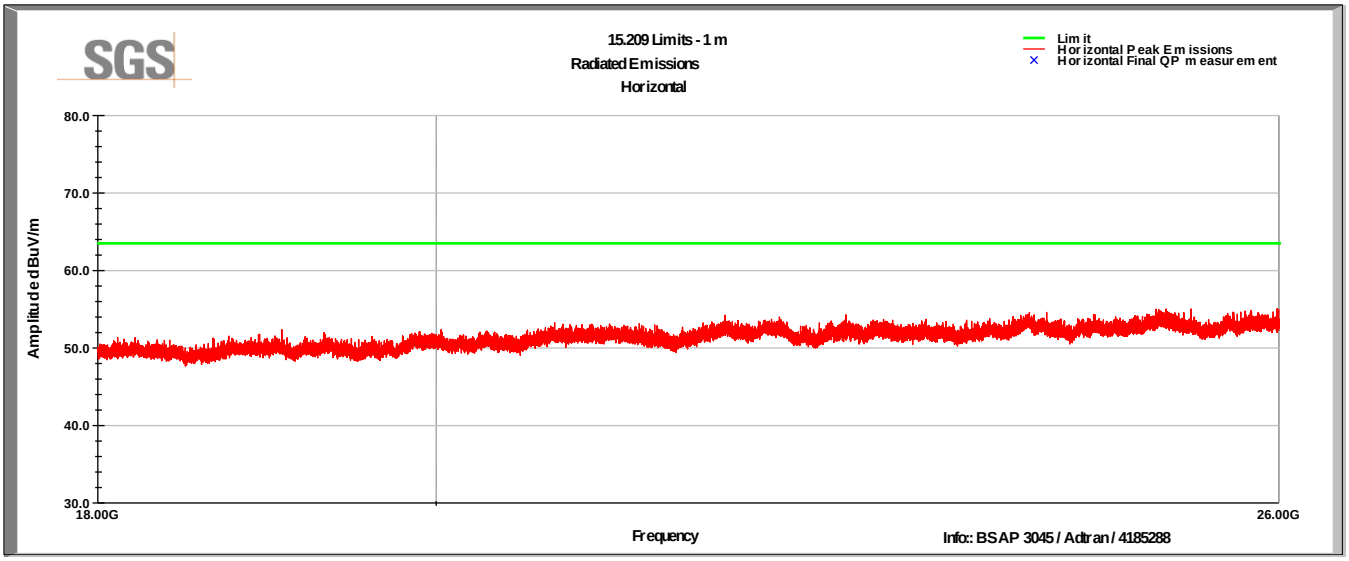
Horizontal



CH 11 802.11b, 6Mbps
Vertical



Horizontal



4 Radiated Emissions at Band Edge / Restricted Band

4.1 *Test Result*

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.247 (d) and 15.209	Compliant

4.2 *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 radiated methods defined in Sections 12 and 13 of FCC publication D01 DTS Meas Guidance v04.

4.3 *Test Site*

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

Environmental Conditions

Temperature: 22.2 – 24.1 °C
Relative Humidity: 32.4 - 42.6 %

4.4 *Test Equipment*

Test End Date: 16-Aug-2017 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	16-May-2018
RF CABLE	HPA190	RF LOGIC	17014	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079659	25-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018

Note: The equipment calibration period is 1 year.

4.5 *Test Data*

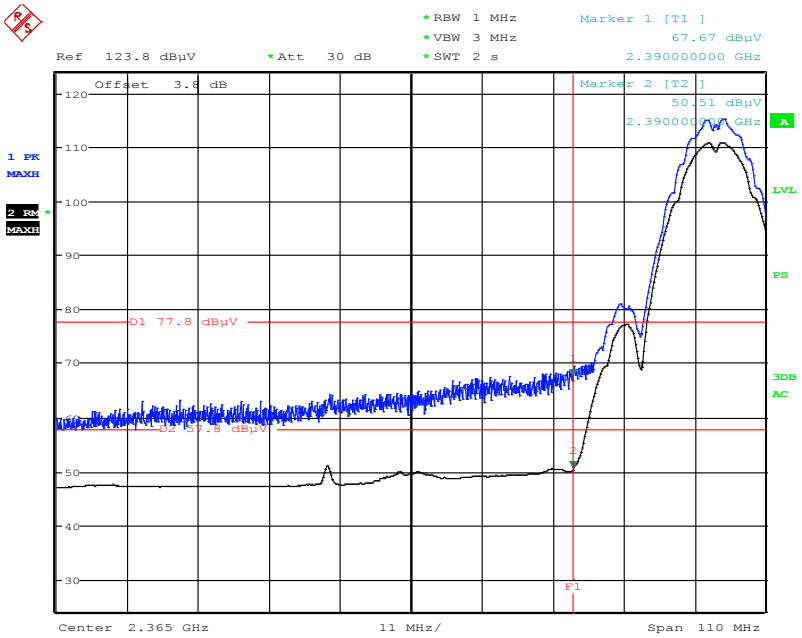
Frequency MHz	Raw Meas (dBuV)	Polarity (V/H)	Correction (dB/m)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
802.11b							
Channel 1							
2390.00	63.9	V	3.8	67.7	74.0	-6.3	Peak
2390.00	46.7	V	3.8	50.5	54.0	-3.5	Average
Channel 11							
2483.50	65.5	V	4.5	70.0	74.0	-4.0	Peak
2483.50	47.3	V	4.5	51.8	54.0	-2.2	Average
802.11g							
Channel 1							
2390.00	64.0	V	3.8	67.8	74.0	-6.2	Peak
2390.00	50.1	V	3.8	53.9	54.0	-0.1	Average
Channel 11							
2483.50	60.2	V	4.5	64.7	74.0	-9.3	Peak
2483.50	48.6	V	4.5	53.1	54.0	-0.9	Average
802.11n (HT20)							
Channel 1							
2390.00	62.5	V	3.8	66.3	74.0	-7.7	Peak
2390.00	49.5	V	3.8	53.3	54.0	-0.7	Average
Channel 11							
2483.50	61.6	V	4.5	66.1	74.0	-7.9	Peak
2483.50	49.1	V	4.5	53.6	54.0	-0.4	Average
802.11n (HT40)							
Channel 3							
2390.00	62.6	V	3.8	66.4	74.0	-7.6	Peak
2390.00	49.7	V	3.8	53.5	54.0	-0.5	Average
Channel 9							
2483.50	61.3	V	4.5	65.8	74.0	-8.2	Peak
2483.50	48.5	V	4.5	53.0	54.0	-1.0	Average

To comply with the band edge requirements, the target power levels had to be adjusted as follows:

Modulation	Channel	Certified Target Power	Compliant Target Power	Power Reduction
802.11b	1	18	18	0
802.11b	11	15.5	15.5	0
802.11g	1	15	15	0
802.11g	11	13.5	10	3.5
802.11n(HT20)	1	15	10	5
802.11n(HT20)	11	14	8.5	5.5
802.11n(HT40)	1	11.8	7.5	4.3
802.11n(HT40)	11	11.1	7.5	3.6

Sample plots

802.11b, Channel 1



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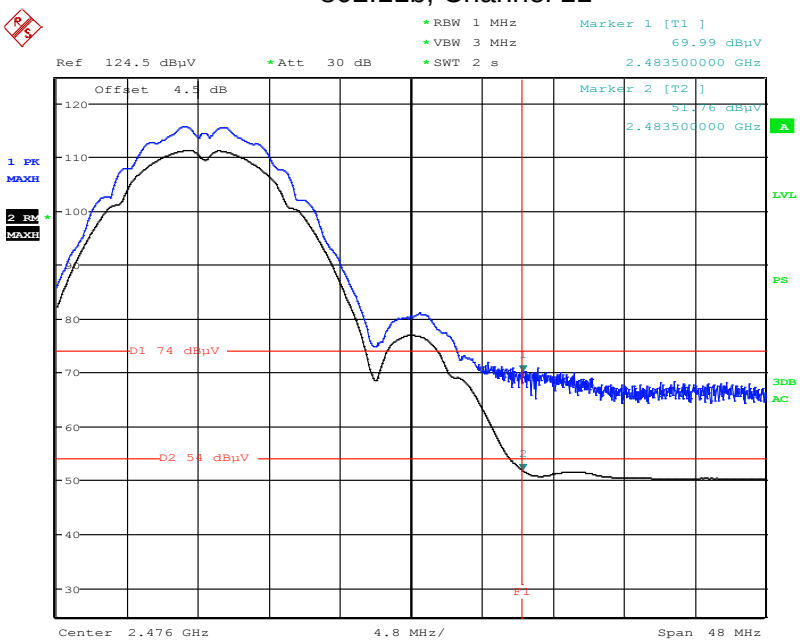
802.11b, Channel 11



Date: 16.AUG.2017 08:33:02

5 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	03 October 2017

Appendix A: Power Adjustment Requirements

To maintain compliance with the power and PSD limits defined in Section 15.247 of the FCC rules and RSS-247, the following guidance will be used for reducing the power settings relative to the original certification measurements.

Note: Because the directional gain of the antenna was > 6dB, the limits were adjusted by the following equation:
Limit-(Gain-6)

So, for the 12dBi gain antenna, the limits were reduced by 6dB

CDD Mode 802.11b
Conducted Power

Channel	Freq (MHz)	Total Power (dBm)	Limit (dBm)	Required Reduction (dB)
1	2412	24.99	24	0.99
6	2437	24.82	24	0.82
11	2462	22.22	24	0

CDD Mode 802.11g
Conducted Power

Channel	Freq (MHz)	Total Power (dBm)	Limit (dBm)	Required Reduction (dB)
1	2412	20.93	24	0.93
6	2437	24.74	24	0.74
11	2462	19.31	24	0

CDD Mode 802.11n (HT20)
Conducted Power

Channel	Freq (MHz)	Total Power (dBm)	Limit (dBm)	Required Reduction (dB)
1	2412	21.03	24	0
6	2437	24.79	24	0.79
11	2462	19.36	24	0

CDD Mode 802.11n (HT40)
Conducted Power

Channel	Freq (MHz)	Total Power (dBm)	Limit (dBm)	Required Reduction (dB)
3	2422	17.52	24	0
6	2437	19.56	24	0
9	2452	16.95	24	0

Beamforming Mode 802.11n (HT20)
Conducted Power

Channel	Freq (MHz)	Total Power (dBm)	Limit (dBm)	Required Reduction (dB)
1	2412	15.01	24	0
6	2437	18.77	24	0
11	2462	13.34	24	0

Beamforming Mode 802.11n (HT40)
Conducted Power

Channel	Freq (MHz)	Total Power (dBm)	Limit (dBm)	Required Reduction (dB)
3	2422	11.50	24	0
6	2437	13.54	24	0
9	2452	10.93	24	0

For PSD, the measurements in the original filing still comply with the increased gain of the antenna.