TEST REPORT

Report Number: 101877809DEN-001
Project Number: G101877809

Report Issue Date: September 29, 2015

Product Designation: **Model: AMBR**

Standards: **FCC Part 15 Subpart C (15.247)**
Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
IC RSS-247, Issue 1: 2015
IC RSS-GEN, Issue 4: 2014

Tested by:
Intertek Testing Services NA, Inc.
1795 Dogwood St. Suite 200
Louisville, CO 80027

Client:
Amatis Controls, LLC.
400 W. Main St. #110
Aspen, CO 81611

Report prepared by

Duan Wei Lin
Project Engineer

Report reviewed by

Michael Spataro
Engineering Team Leader

TABLE OF CONTENTS

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded **the product tested complies with the requirements of the standard(s) indicated.** The results obtained in this test report pertain only to the item(s) tested.

1.1 Test Report Scope

The scope of this report was to qualify the 2.4GHz radio configured within the Amatis Model AMBR product. This radio operates in the following Tx Band: 2400 – 2483.5MHz.

1.2 Test Methodology

All measurements were performed according to the procedures in the following documents:

- ANSI C63.10: 2013 – ANSI Standard for Testing Unlicensed Wireless Devices
- FCC Publication 558074, April 9, 2013 (Guidelines for Compliance Measurements on DTS Operating Under 15.247)

1.3 Test Facility

Intertek Denver's testing facilities are located at 1795 Dogwood St. Suite 200 Louisville, CO 80027. The testing facility is ISO17025:2005 accredited by A2LA, our lab code is 2506.02, our VCCI registration numbers are. R-1643, C-1752 and T-1558, our FCC designation no. US1121 and our IC lab no. 2042N.

Testing contained in this test report may not be covered under the laboratories scope of accreditation. A note will be placed in the specific test section for testing not coved under the laboratories scope.

2 Test Summary

TEST SECTION	TESTS	FCC/IC REFERENCE	TEST DATE	RESULT
5	AC Voltage Variation	FCC 15.31(e)	9/10/2015	Pass
6	Antenna Requirement	FCC 15.203	9/10/2015	Pass
7	DTS Requirement	FCC 15.247(a) RSS-247 5.2	9/10/2015	Pass
8	6dB Bandwidth	FCC 15.247(a)(2) RSS-247 5.2(1)	9/10/2015– 9/11/2015	Pass
9	RF Conducted Output Power (includes requirements for antenna gain > 6dBi)	FCC 15.247(b)(3)(4) RSS-247 5.4(4)	9/22/2015	Pass
10	RF Conducted Spurious Emissions (-20dBc) Includes Band Edge	FCC 15.247(d) RSS-247 5.5	9/22/2015	Pass
11	Transmitter Radiated Spurious Emissions (Restricted Bands – Band Edge)	FCC 15.247(d) FCC 15.209/15.205 RSS-247 5.5 RSS-Gen 8.10	9/10/2015- 9/11/2015	Pass
12	Power Spectral Density (PSD)	FCC 15.247(e) RSS-247 5.2(2)	9/22/2015	Pass
13	Radiated Emissions – Digital Receiver	FCC 15.109 RSS-Gen 7.1	9/17/2015	Pass
14	Tx AC Line Conducted Emissions	FCC 15.207 RSS-Gen 8.8	9/23/2015	Pass
15	RF Exposure Requirement	FCC 15.247(i) FCC 15.1.1307(b)(1) RSS 102	9/10/2015– 9/11/2015	Pass
16	Duty Cycle/ Duty Cycle Correction Factor	FCC 15.35(c) RSS-Gen 6.10	Note 1	NA

Notes:
1) No duty cycle correction was utilized in this report.

Description of Product Under Test

Model:	AMBR
Type of EUT:	Boarder Router
Serial Number:	EMC1
FCC ID:	2ADDY-BR1
Industry Canada ID:	20256-BR1
Related Submittal(s) Grants:	NA
Company:	Amatis Controls, LLC.
Customer:	Amatis Controls, LLC.
Address:	400 W. Main St. #11, Aspen, CO 81611
Phone:	(970) 300-1344
Fax:	N/A
e-mail:	alexh@amatiscontrols.com
Test Standards:	☒ 47 CFR, Part 15C:§15.247 DTS ☒ RSS–247, Issue 1, 2015 ☒ RSS-Gen, Issue 4, 2014 ☐ 47 CFR, Part 15C:§15.207 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	9/8/2015
Test Work Started:	9/8/2015
Test Work Completed:	9/22/2015
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good

Product Description:	
Transmitter Type:	☐ FHSS ☒ Digital Modulation ☐ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	2405MHz – 2475MHz
Number of Channels:	14
Modulation:	O-QPSK
Antenna(s) Info:	2.45 GHz High Gain SMD Chip Antenna Gain: +2.2dBi Connector Type: N/A surface mount chip antenna
Rated Power:	Output Power: 100 mW EIRP: 165 mW
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☐ Internal battery ☒ External power source
Special Test Arrangement:	the EUT was rotated and tested in three orthogonal axes to determine the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 2506.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

2.1 Channel Configurations

CHANNELS IN THE 2400 – 2483.5 MHZ BAND			
Channel Number	**Frequency (MHz)**	**SISO $N_{TX=1}$**	**MIMO $N_{TX=3}$**
11	2405	xt	NA
12	2410	x	NA
13	2415	x	NA
14	2420	x	NA
15	2425	x	NA
16	2430	x	NA
17	2435	x	NA
18	2440	xt	NA
19	2445	x	NA
20	2450	x	NA
21	2455	x	NA
22	2460	x	NA
23	2465	x	NA
24	2470	x	NA
25	2475	xt	NA

Note: x = available channels xt = tested channels

2.2 Product Description - Detailed

Description of Equipment Under Test (provided by client)
The device translates between 802.3 (Ethernet) and 802.15.4 networks.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
120 VAC	0.2 A	60 Hz	1

Descriptions of EUT Exercising
☐ Standby/Idle Mode
☐ Continuous transmission, un-modulated carrier (CW)
☒ Continuous transmission, modulated carrier (CW) utilizing worst-case data rate
☒ Continuous Receive Mode

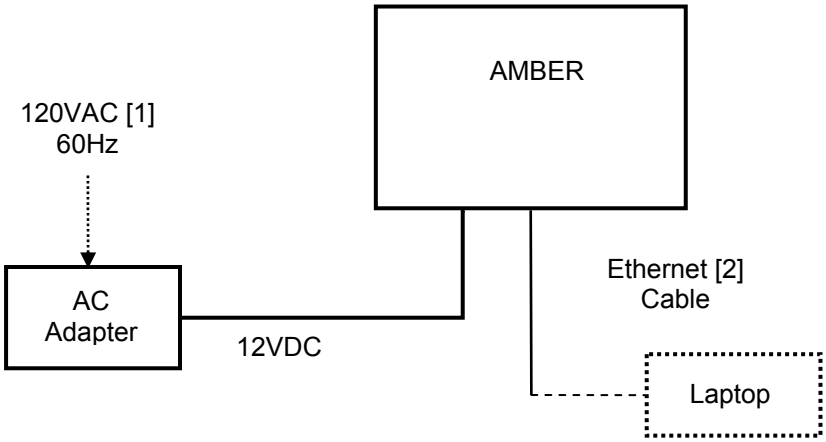
Note: The chosen mode of operation described above is dependent upon the specific test to be performed.

3 System setup including cable interconnection details, support equipment and simplified block diagram

3.1 Method:

Record the details of EUT cabling, document the support equipment, and show the interconnections in a block diagram.

3.2 EUT Block Diagram:



Note: Dashed lines indicate auxiliary/support equipment outside the test area. Ethernet cable was routed partially outside the test chamber with ~ 1-meter inside the test chamber – connected to the Model AMBR Ethernet port.

3.3 Antenna Specifications:

2.4 GHz					
Model	**Type**	**Gain (dBi)**	**Beamwidth (degrees)**	**Polarization**	**Datasheet**
2450AT45A100	SMD Chip Antenna	2.2	NA	Vertical	See Below

3.4 Determination of RF Power supplied to antenna input for testing

Per FCC 15.247(b)(4)(i): Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

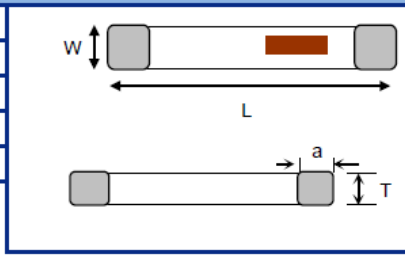
Antenna tested:

2.45 GHz High Gain SMD Chip Antenna **P/N 2450AT45A100**
Detail Specification: 4/21/2015 Page 1 of 10

General Specifications			
Part Number	2450AT45A100	**Input Power**	3W max. (CW)
Frequency Range	2400 - 2500 Mhz	**Impedance**	50 Ω
Operating Temp	-40°C to +125°C	**Reel Quanity**	1,000

Mechanical Specifications

	In	mm
L	0.374 ± 0.008	9.50 ± 0.20
W	0.079 ± 0.008	2.00 ± 0.20
T	0.047 +.004/-.008	1.20 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



Terminal Configuration

No.	Function
1	Feeding Point
2	NC

Typical Electrical Specs for "Vertical Orientation" (T=25°C)			
Frequency Range	2400 - 2500 Mhz	**Peak Gain**	2.2 dBi typ. (XZ-V)
Return Loss	9.5 dB min.	**Average Gain**	1.0 dBi typ. (XZ-V)

Support Data:

ID	Description/ Function	Shield Type	Length	Connector	Connection	Ferrites
1	Power	NA	2 m	-----	-----	NA
2	Ethernet	NA	>3m	RJ-45	Laptop	NA

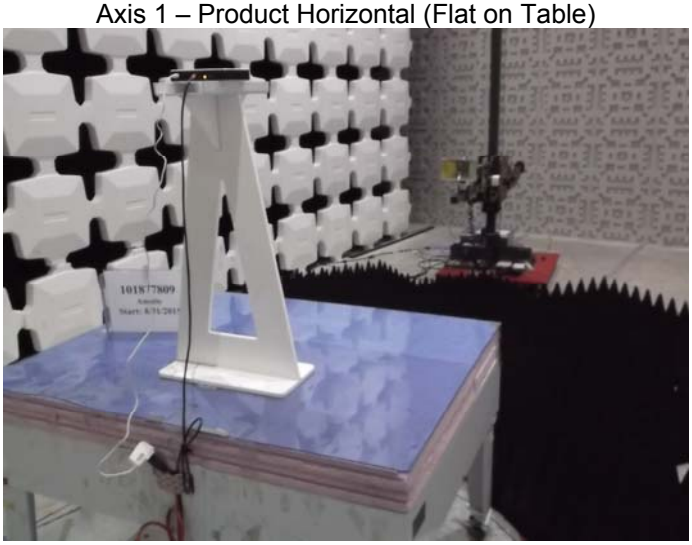
Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	HP	EMC1	EMC1

Notes:

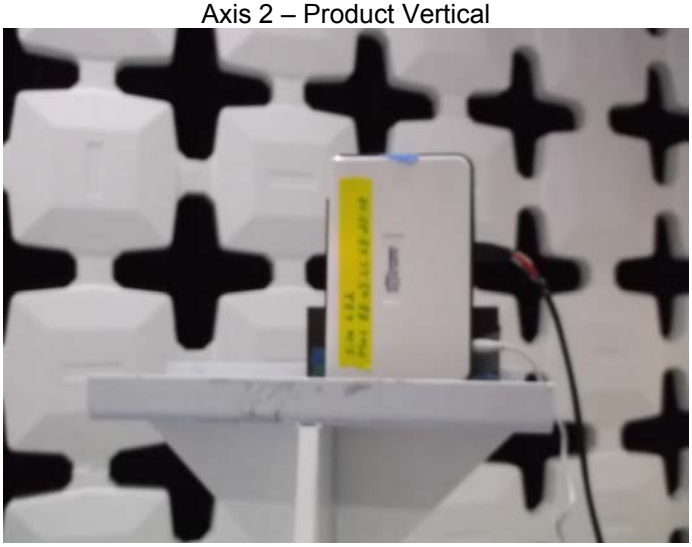
1) Add as needed

3.5 Photograph: Product Tested - Test Axes

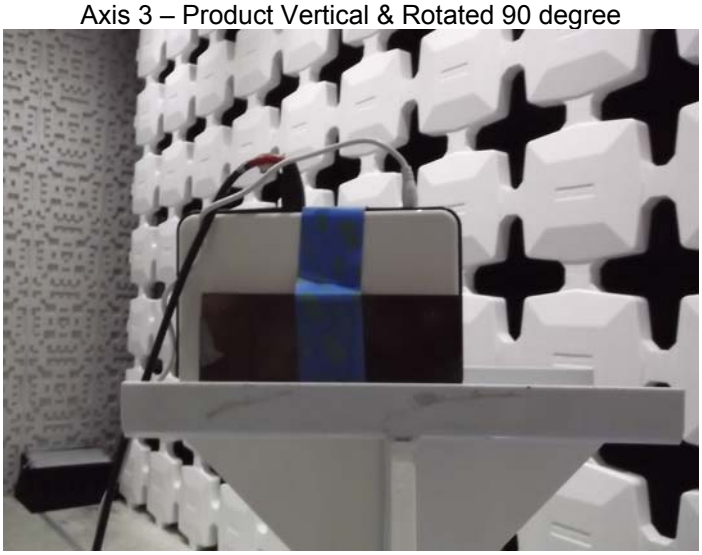
Axis 1 – Product Horizontal (Flat on Table)



Axis 2 – Product Vertical



Axis 3 – Product Vertical & Rotated 90 degree



AC Voltage Variation/ Battery Requirement

3.6 Method:

The test methods used comply with ANSI C63.10.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

3.7 Test Requirement/Specification:

- ANSI C63.10:2013, Section 6.8.2/15.31(e)

3.8 Test Equipment Used:

Asset ID	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-206	RF Conducted Port Cable	-----	True Blue	14-11-401	12/23/2014	12/23/2015
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBU	VBU

3.9 Results:

There is no significant difference in the radiated field strength of the fundamental frequency with respect to varying the ac voltage. Therefore, all measurements will be taken using the nominal rated voltage of the product.

3.10 Test Data:

FREQ	LEVEL	DET	CABLE	FINAL	RBW
MHz	dBm	Qp Av Pk	+ [dB]	= [dBuV]	(MHz)
AC @ Nominal Voltage – 120 VAC / 60 Hz					
2405.0	15.7	**Pk**	2.5	18.2	1
AC @ 115% Nominal Voltage – 138 VAC / 60 Hz					
2405.0	15.8	**Pk**	2.5	18.3	1
AC @ 85% Nominal Voltage – 102 VAC / 60 Hz					
2405.0	15.8	**Pk**	2.5	18.3	1

4 Antenna Requirement

Unless otherwise stated no deviations were made from FCC Part 15.203.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

4.1 Test Requirement/Specification

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.
The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

4.2 Results:

The sample tested was found to comply.

The product incorporates a SMD chip antenna that is installed during production and not accessible to the end user.

The output power runs through only one antenna at a time, left antenna or right antenna. The EUT cannot transmit in MIMO configuration.

5 DTS Requirement

Unless otherwise stated no deviations were made from FCC Part 15.247.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

5.1 Test Requirement/Specification

Operation under the provisions of this Section is limited to digitally-modulated intentional radiators.

- FCC 15.247(a)(2)

5.2 Results:

The sample tested was found to comply.

The product incorporates IEEE standard 802.15.4 protocol using the following digital modulation:

- O-QPSK

6 DTS Bandwidth (6dB Bandwidth)

6.1 Method:

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from FCC 15.247 or RSS-247.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

6.2 Test Requirement/Specification

- 15.247(a)(1)
- RSS-247 5.2(1)

6.3 Test Equipment Used:

Asset ID	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-206	RF Conducted Port Cable	-----	True Blue	14-11-401	12/23/2014	12/23/2015
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBU	VBU

6.4 Results:

The sample tested was found to comply.

6.5 Test Summary:

Antenna	Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz			
	Low Frequency Channel (MHz)	Middle Frequency Channel (MHz)	Upper Frequency Channel (MHz)	Limit (kHz)	Result
Left Antenna	1.54	1.55	1.62	>500kHz	Pass
Right Antenna	1.49	1.55	1.67	>500kHz	Pass
	Span:	5MHz			
	RBW:	☐ 3kHz ☐ 30kHz ☒ 100kHz ☐ other kHz			
	VBW:	☐ 3kHz ☐ 10kHz ☐ 100kHz ☒ other 300kHz			

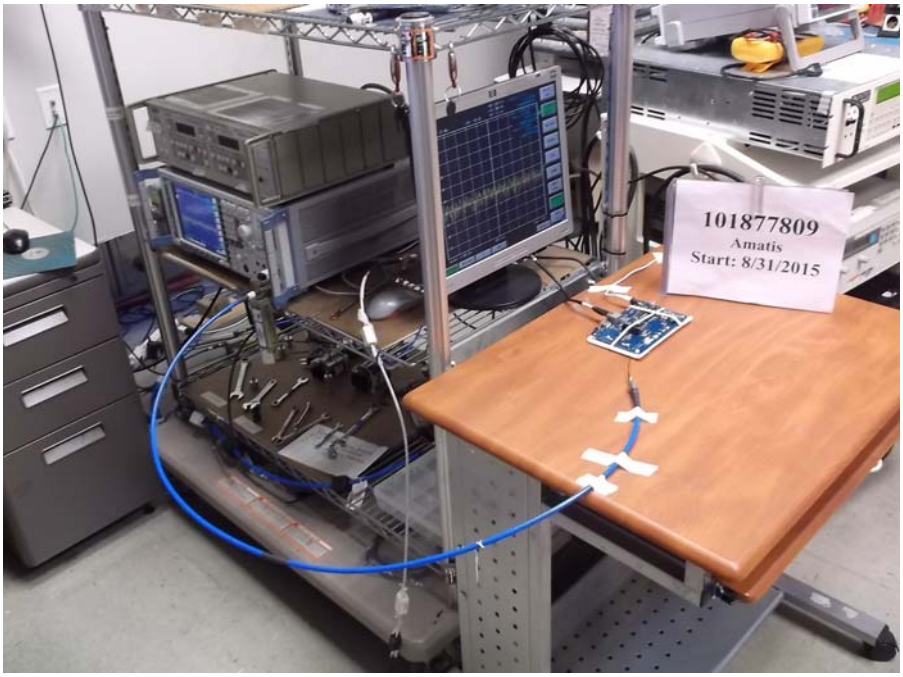
6.6 Test Method:

- ANSI C63.10:2013, Section 11.8

6.7 Notes:

1. The limit for RSS-247 is identical to the limit for FCC 15.247.

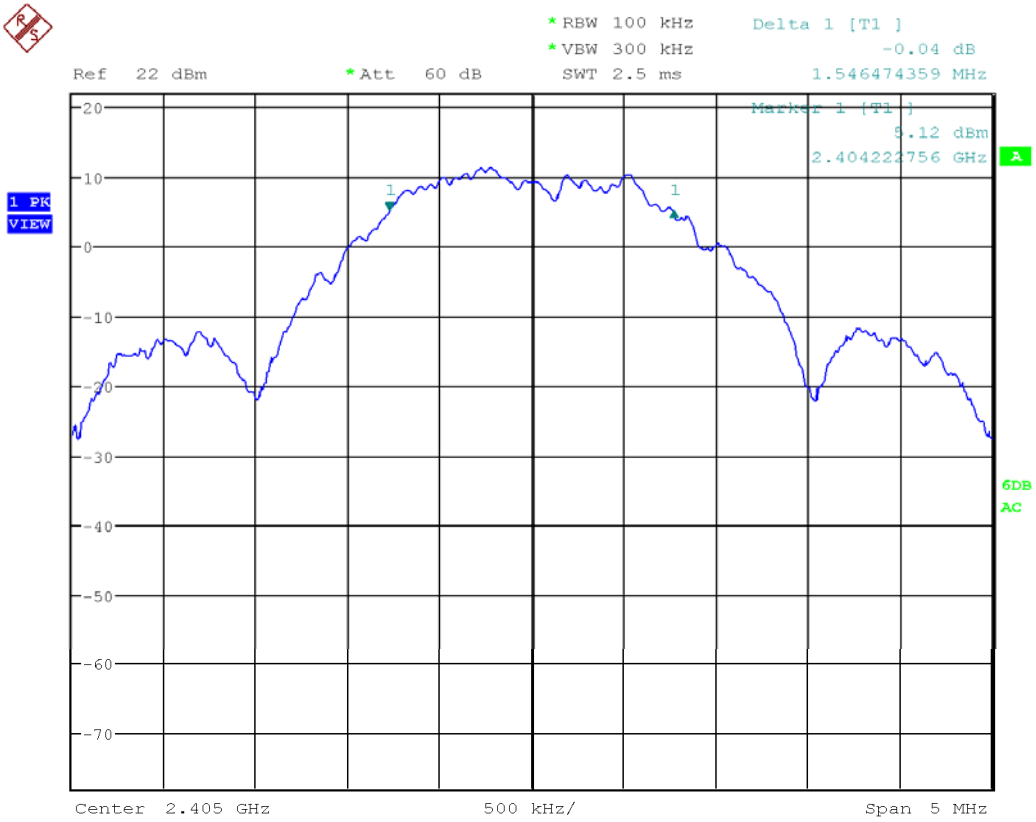
6.8 Setup Photographs: Conducted Port



6.9 Plots: 6 dB Bandwidth

Left Antenna

Low Channel



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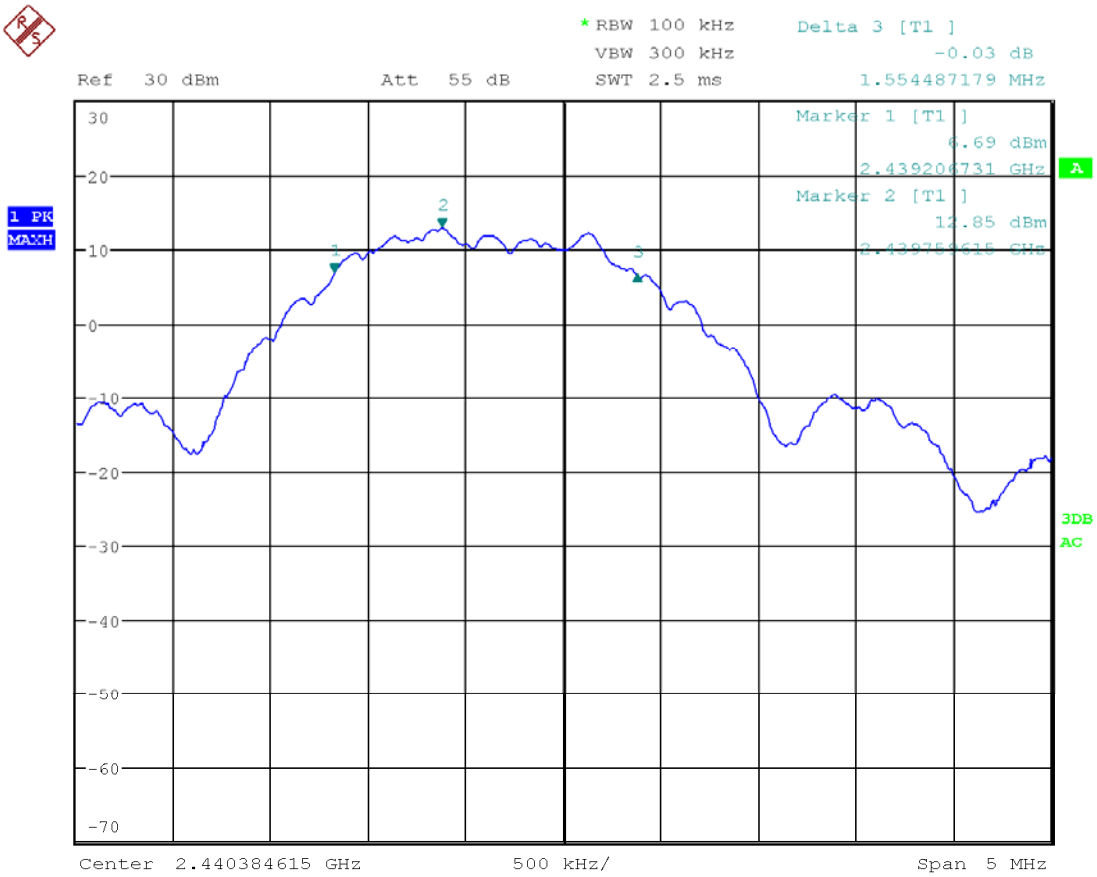
Mid Channel



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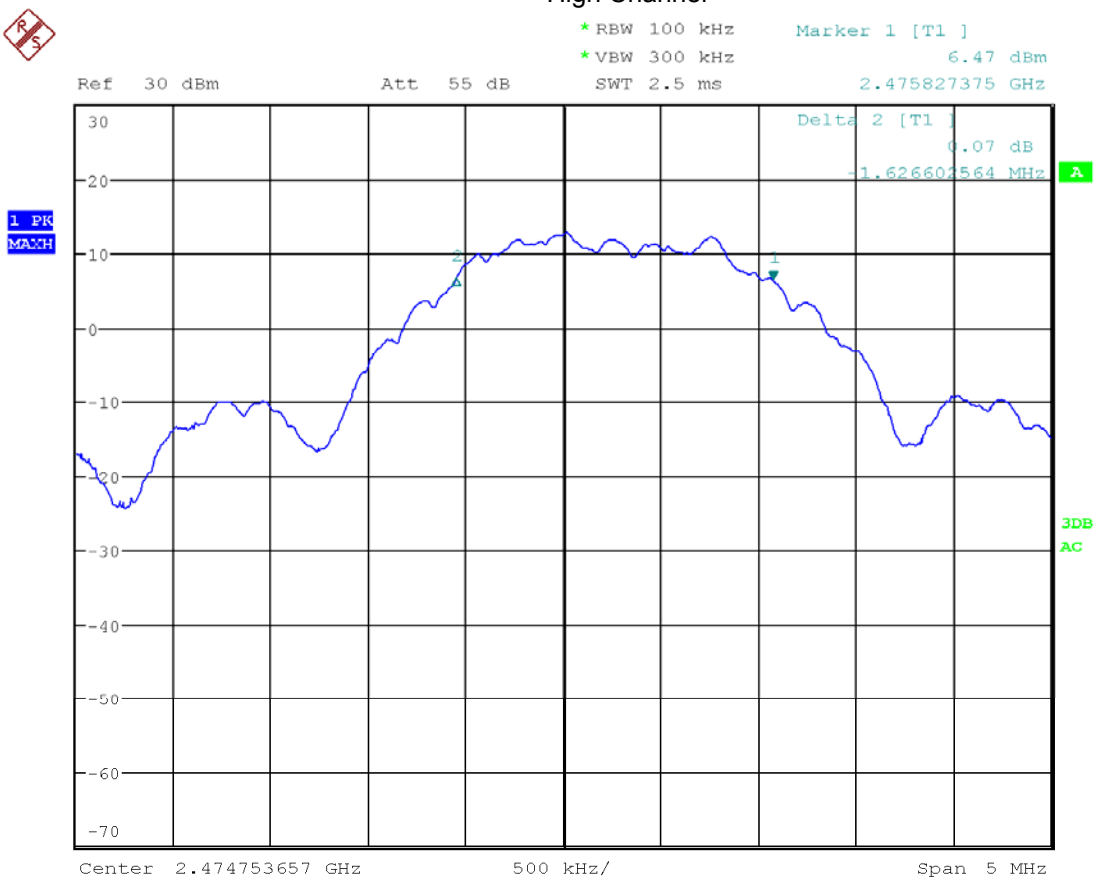
High Channel



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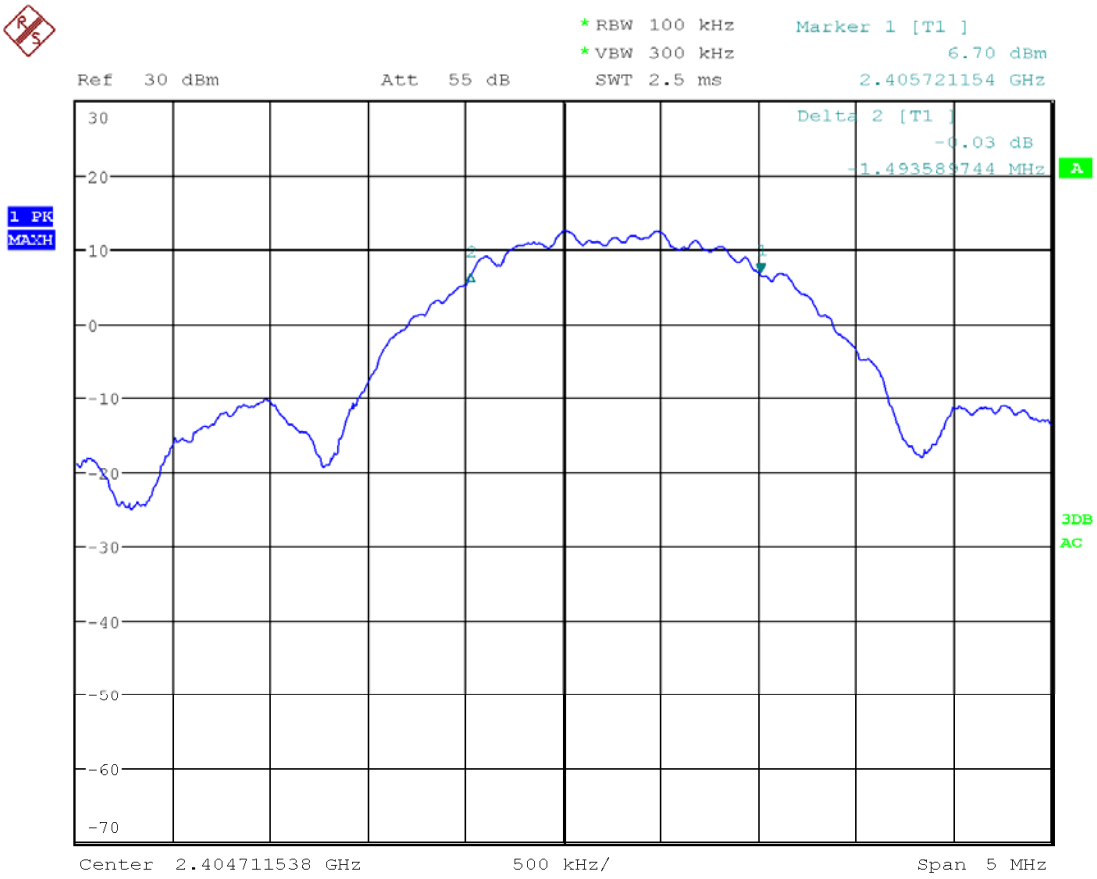
Right Antenna

Low Channel



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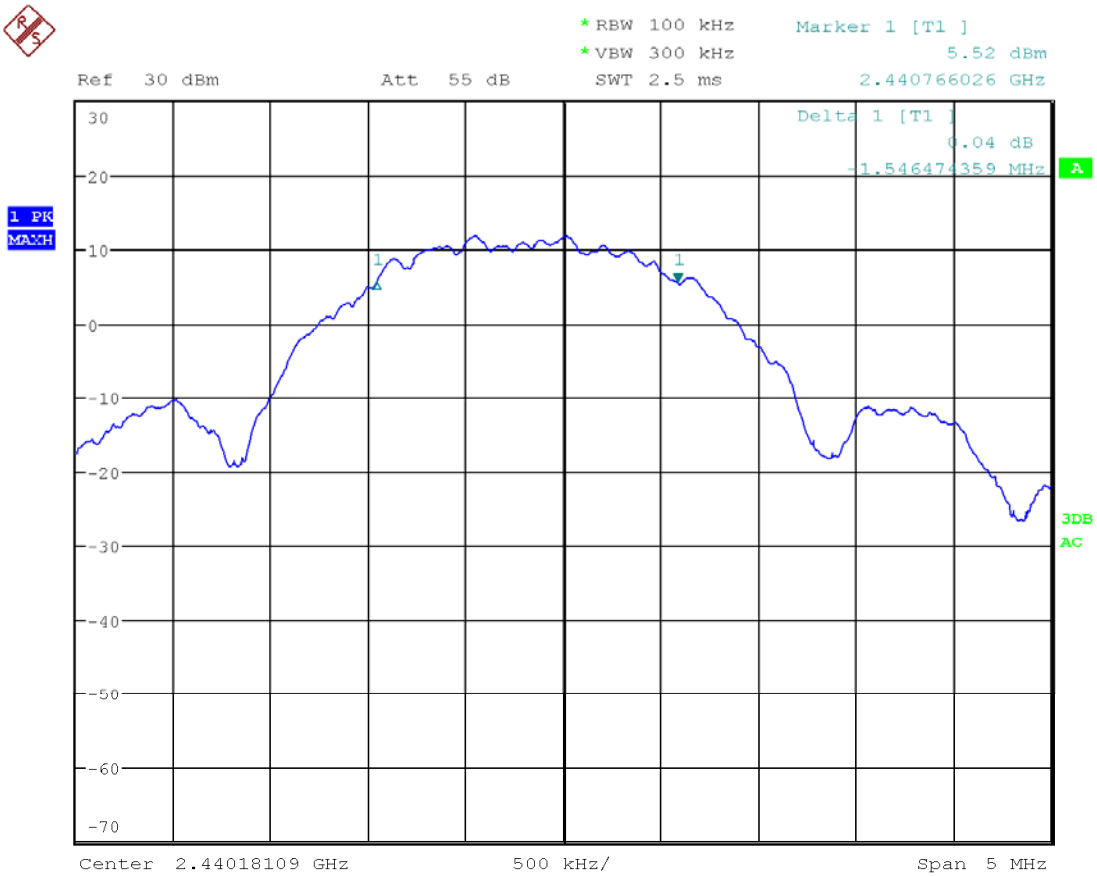
Mid Channel



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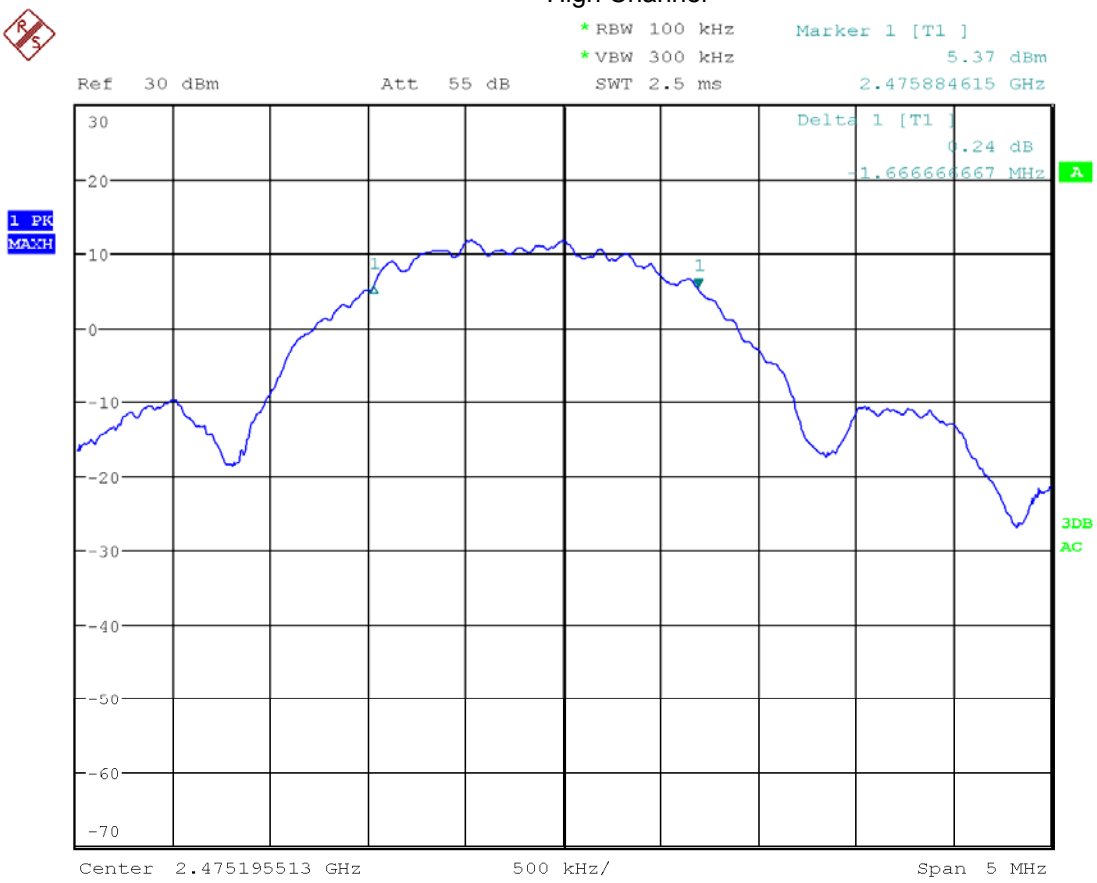
High Channel



Date: 18.SEP.2015 16:30:58

7 RF Conducted Output Power

7.1 Method:

The test methods used comply with ANSI C63.10 section 6.10.1. Unless otherwise stated no deviations were made from FCC 15.247 or RSS-247.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

7.2 Test Requirement/Specification:

The maximum peak conducted output power

Fundamental Frequency	Output power (Watts)
2400-2483.5 MHz	1

- FCC 15.247(b)(1)
- RSS-247 5.4(4)

7.3 Test Equipment Used:

Asset ID	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-206	RF Conducted Port Cable	-----	True Blue	14-11-401	12/23/2014	12/23/2015
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBU	VBU

7.4 Results:

The sample tested was found to comply.

7.5 Test Summary:

Fundamental	Conducted port Right Antenna					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency MHz	**Measured Power (dBm)**	**Correction Cable/Atten (dB)**	**Final Corrected (dBm)**	**Standard Limit (dBm)**	**Limit Reduction (dB)**	**Margin (dB)**
2405	15.98	2.5	18.48	30	NA	11.52
Mid Frequency MHz						
2440	15.43	2.5	17.93	30	NA	12.07
High Frequency MHz						
2475	15.45	2.6	18.05	30	NA	11.95
Fundamental	**Conducted port Left Antenna**					
Low Frequency MHz	**Measured Power (dBm)**	**Correction Cable/Atten (dB)**	**Final Corrected (dBm)**	**Standard Limit (dBm)**	**Limit Reduction (dB)**	**Margin (dB)**
2405	16.2	2.5	18.7	30	NA	11.3
Mid Frequency MHz						
2440	16.2	2.5	18.7	30	NA	11.3
High Frequency MHz						
2475	17.15	2.6	19.75	30	NA	10.25
RBW:	☐ 3kHz	☐ 300kHz	☐ 500kHz	☐ 1MHz	☒ 3MHz	☐ 10MHz
VBW:	☐ 30kHz	☐ 1MHz	☐ 1MHz	☐ 3 MHz	☒ 10MHz	☐ 10MHz
Antenna Gain:	☒ < 6dBi	☐ >6dBi and = dBi, Output power reduction = dB				

7.6 Test Method:

- ANSI C63.10:2013, Section 11.9

7.7 Notes:

1. The limit for RSS-247 is identical to the limit for FCC 15.247.

Limit is 1W

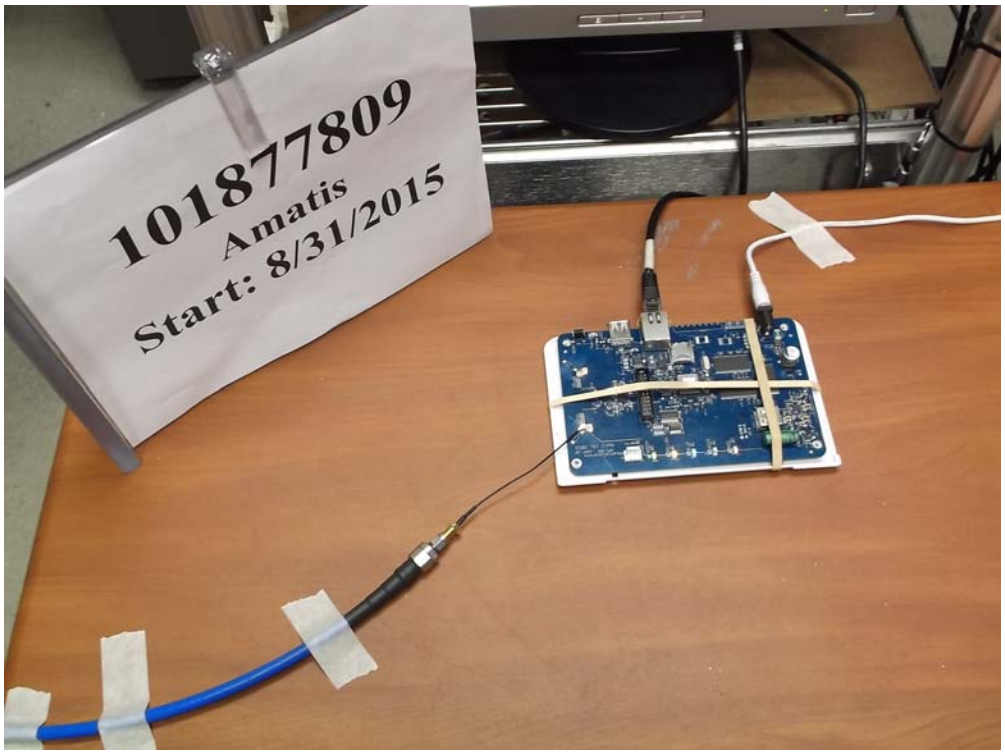
Worst Case Fundamental

19.75 dBm = 0.095W

Delta

0.095 – 1 = -0.905W

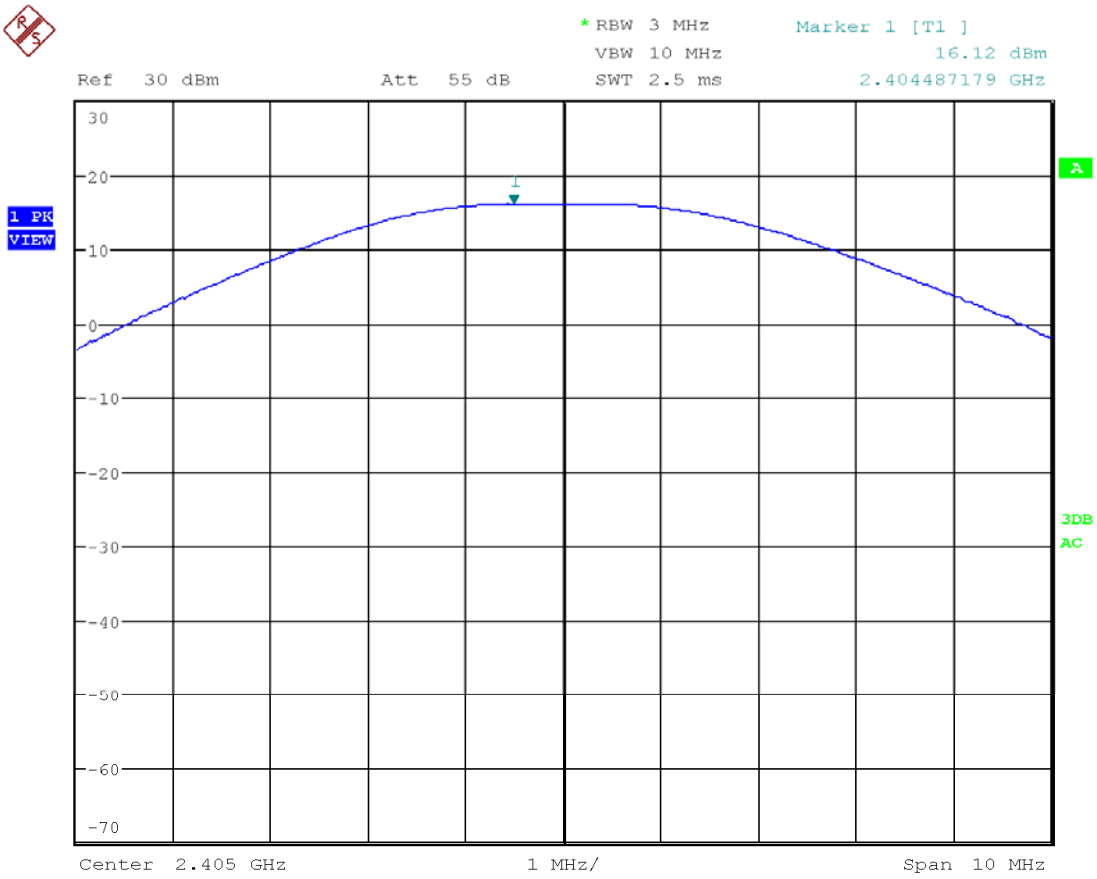
7.8 Setup Photographs: Conducted Port



7.9 Plots:

Left Antenna

Low Channel



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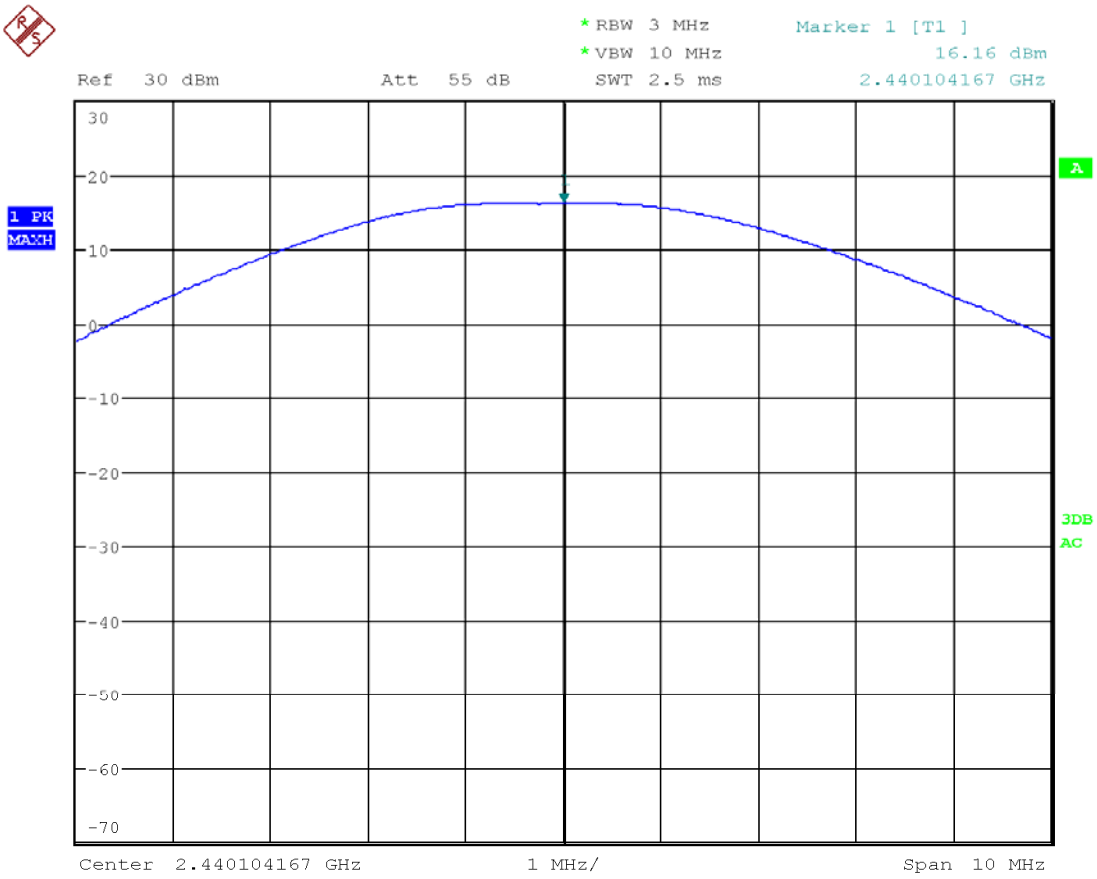
Mid Channel



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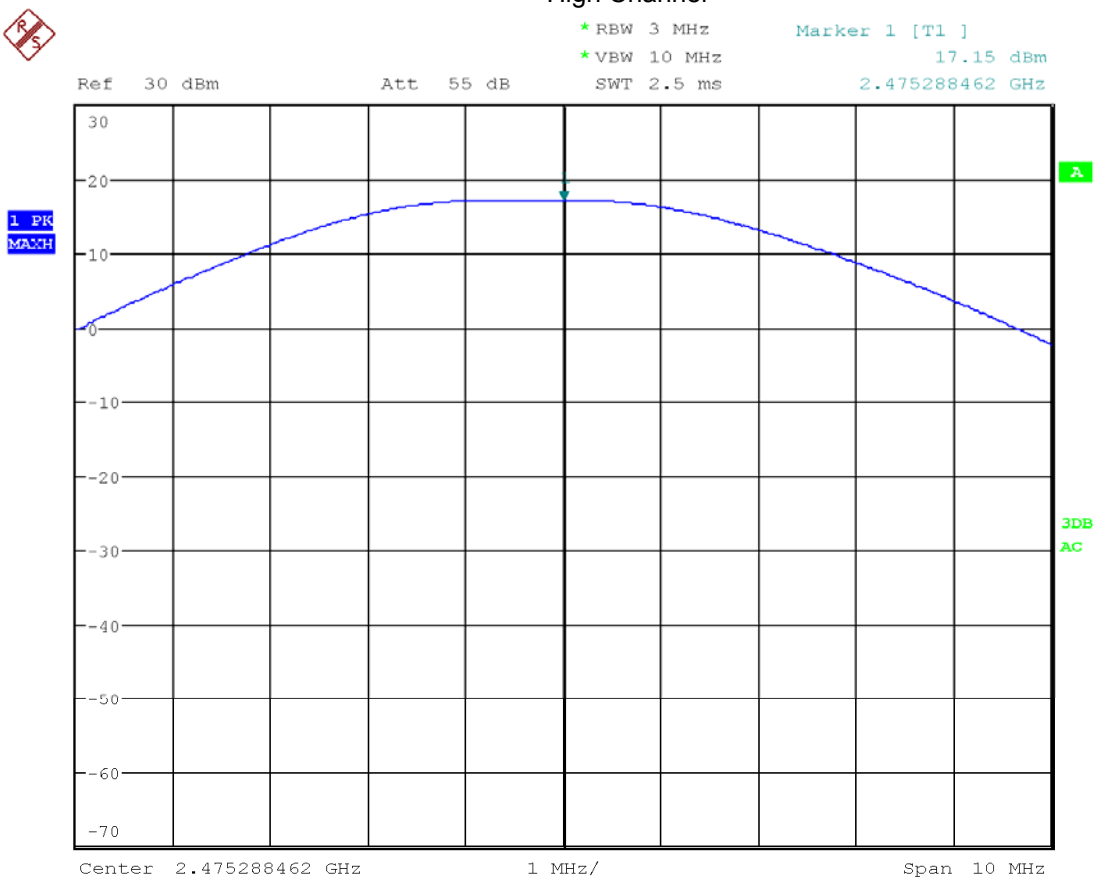
High Channel



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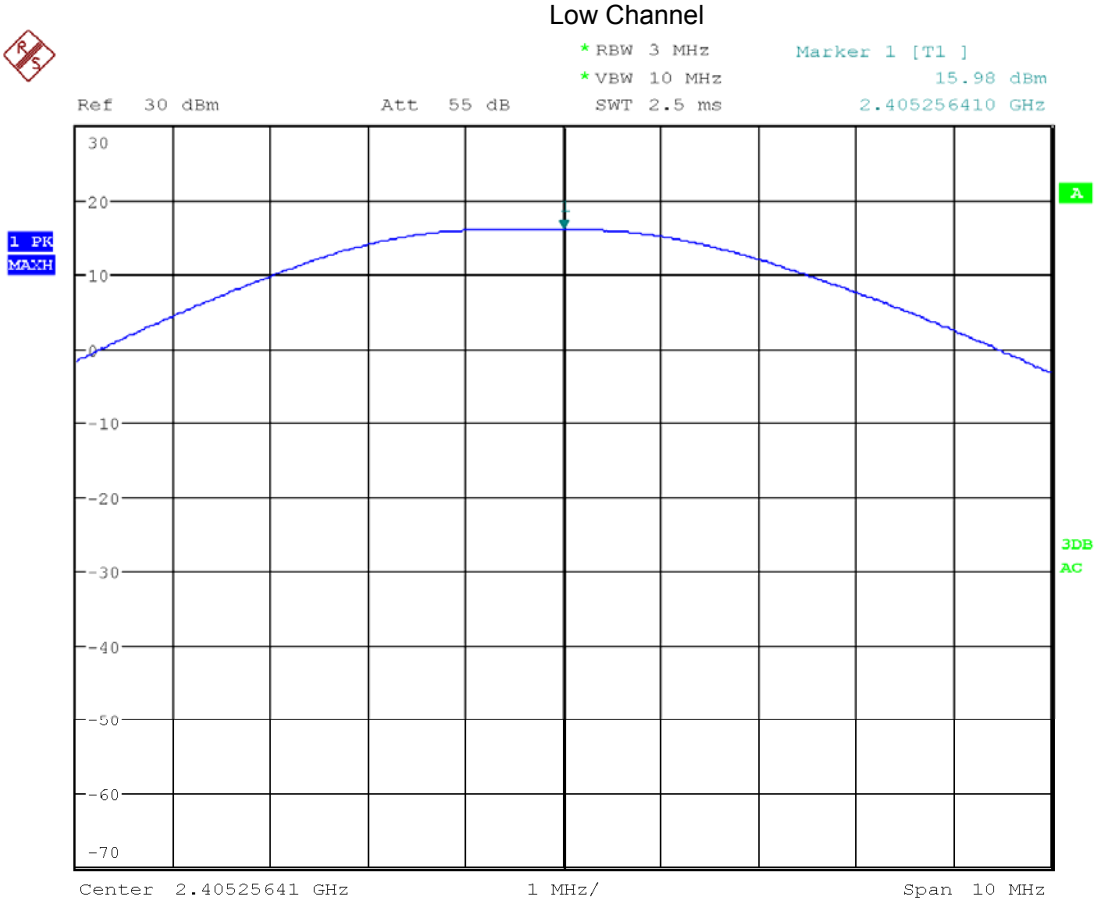
Right Antenna

Low Channel



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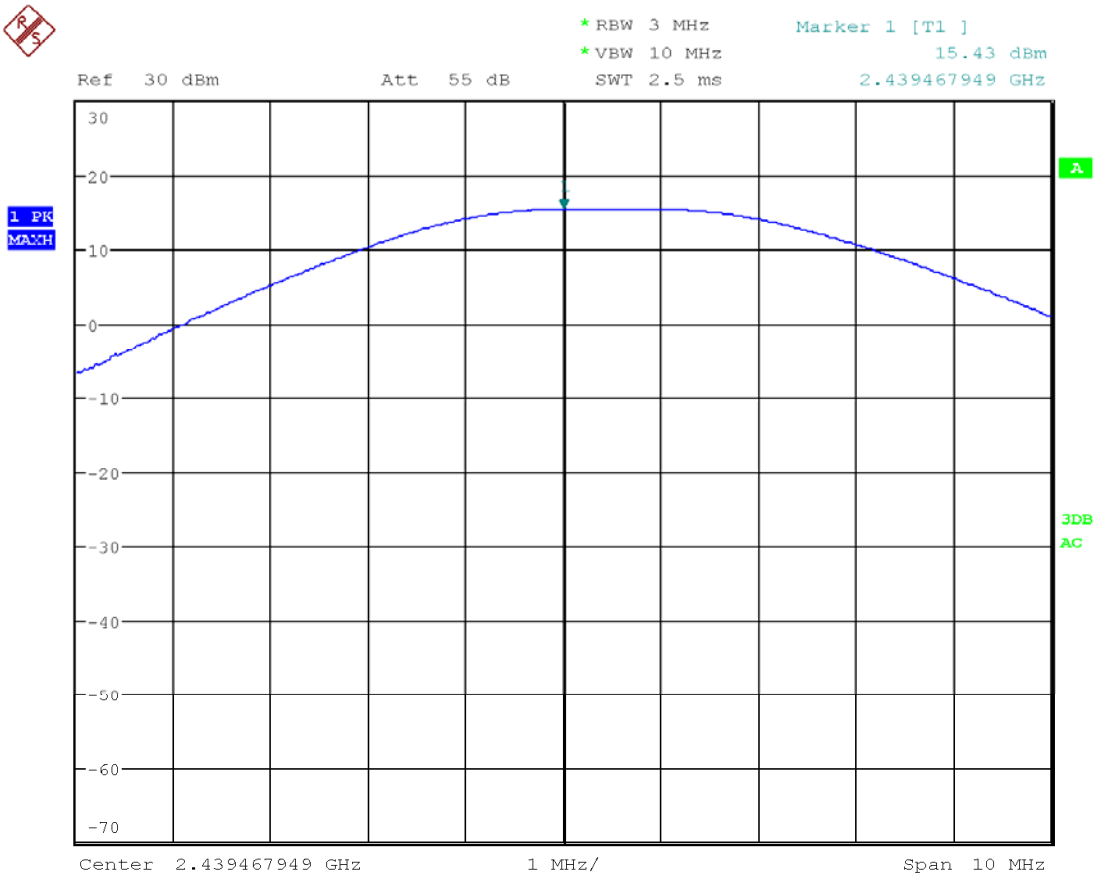
Mid Channel



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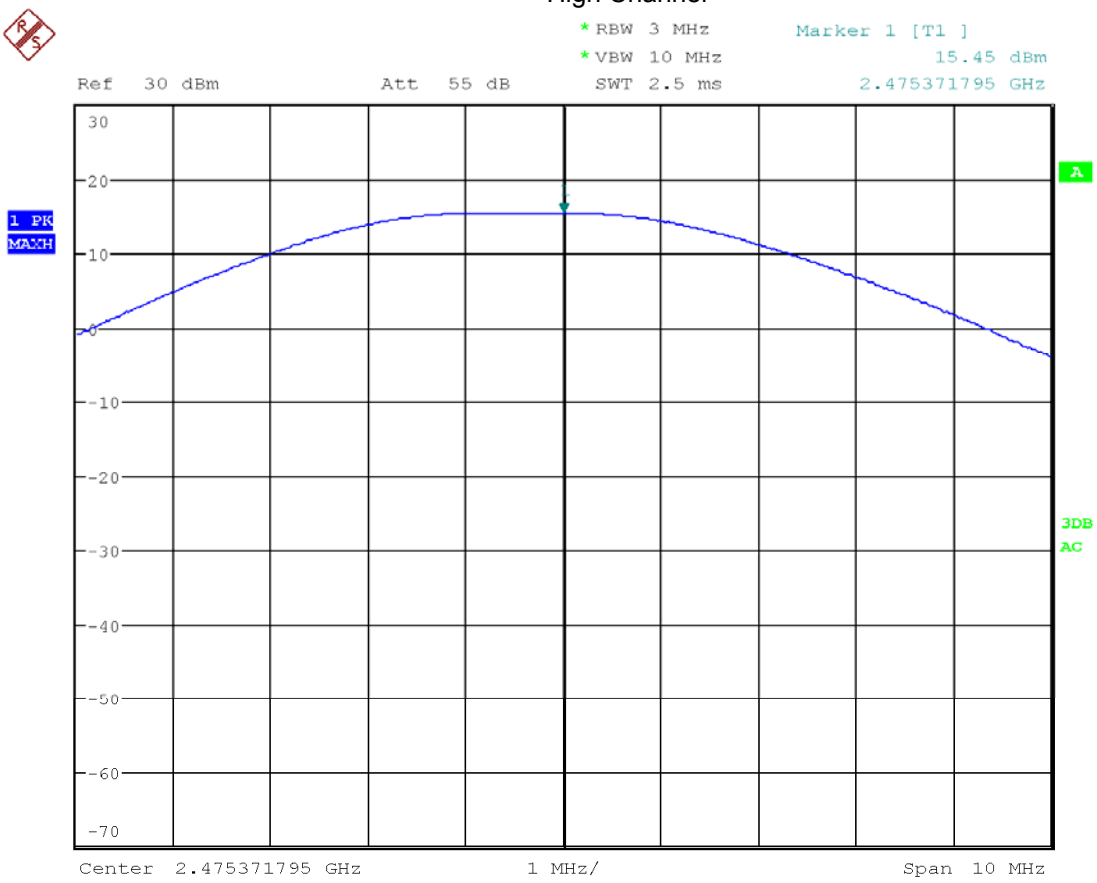
High Channel



Date: 18.SEP.2015 16:25:43

8 RF Conducted Spurious Emissions (-20dBc) – Including Band Edge

8.1 Method:

The test methods used comply with ANSI C63.4. Unless otherwise stated no deviations were made from FCC 15.247 & RSS-247.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

8.2 Test Requirement/Specification:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

- 15.247(d)
- RSS-247 5.5

Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz		
Left Antenna	**Output Power with 100 kHz Bandwidth dBm**	**Minimum Allowed Attenuation dB**	**Limit dB**
Low Frequency Channel	12.6	20	-7.4
Upper Frequency Channel	12.8	20	-7.2
Right Antenna	**Output Power with 100 kHz Bandwidth dBm**	**Minimum Allowed Attenuation dB**	**Limit dB**
Low Frequency Channel	12.7	20	-7.3
Upper Frequency Channel	11.6	20	-8.8
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

8.3 Test Equipment Used:

Asset ID	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-206	RF Conducted Port Cable	-----	True Blue	14-11-401	12/23/2014	12/23/2015
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBU	VBU

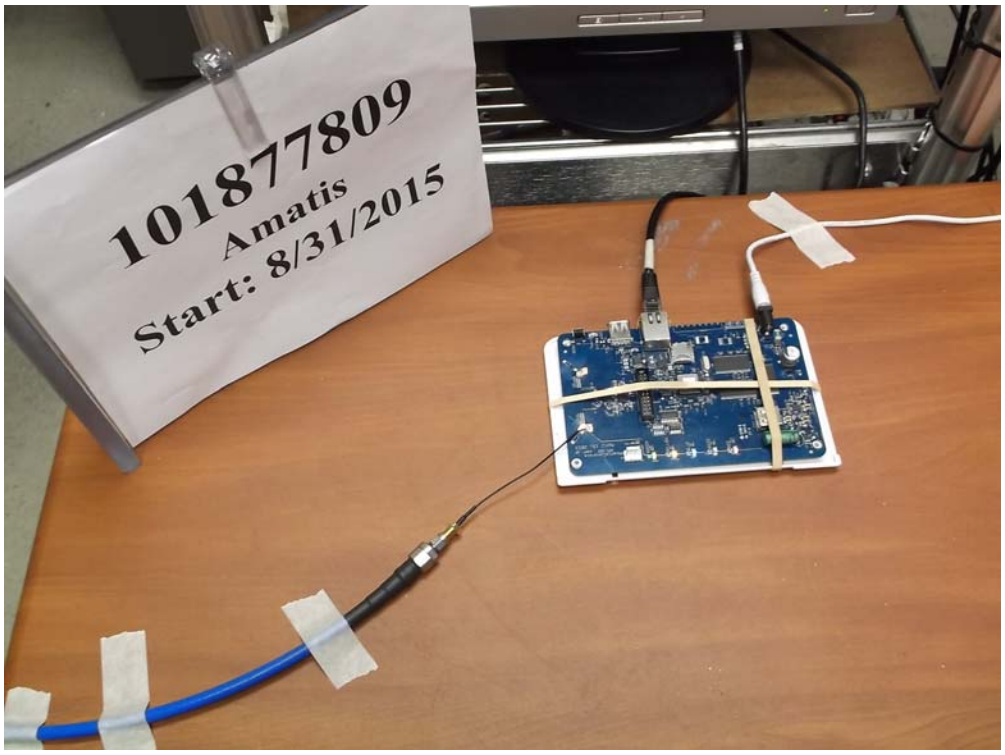
8.4 Results:

The sample tested was found to comply.

8.5 Test Method:

- ANSI C63.10: 2013, Clause 11.13

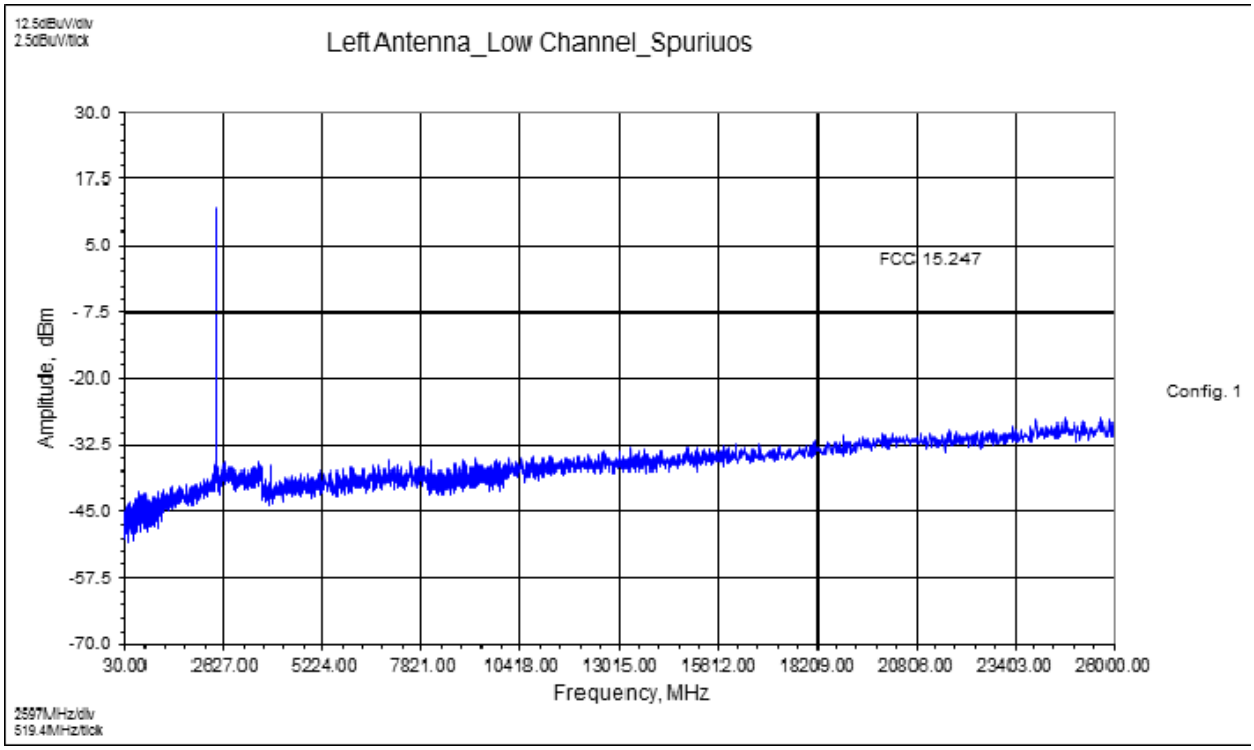
8.6 Setup Photographs:


101877809
Amatis
Start: 8/31/2015

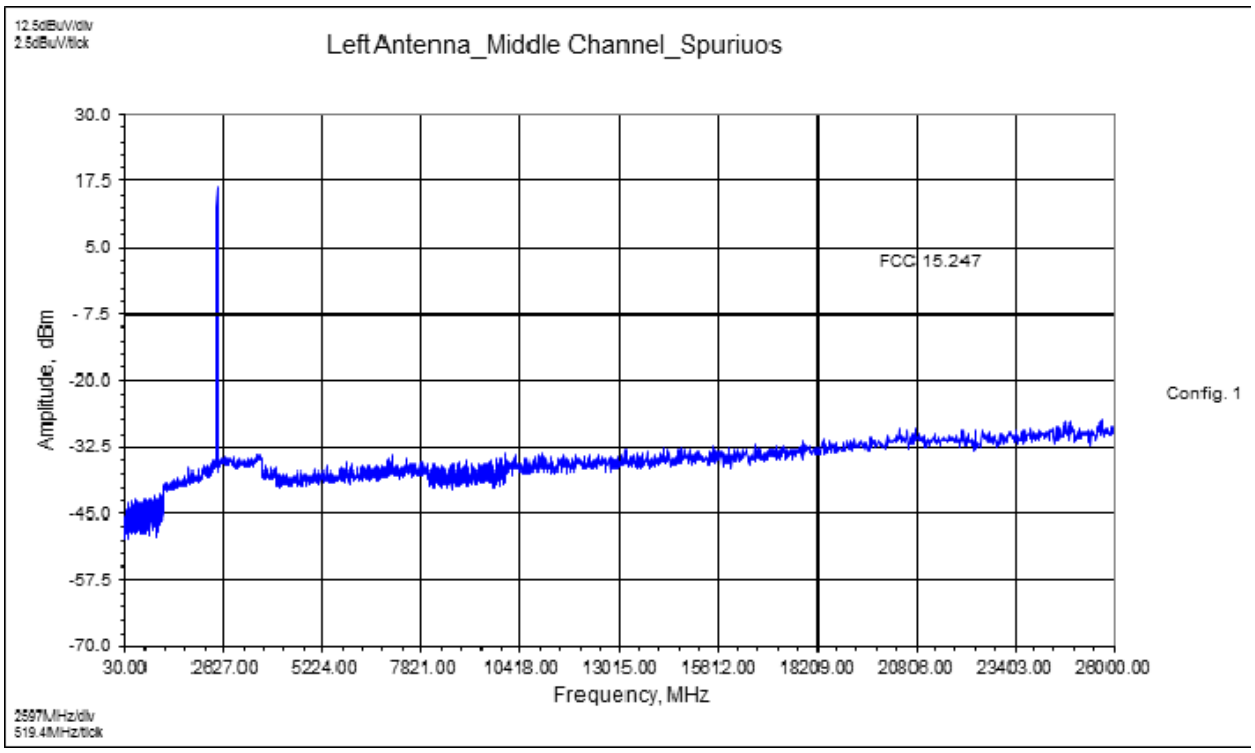
8.7 Plots:

Left Antenna

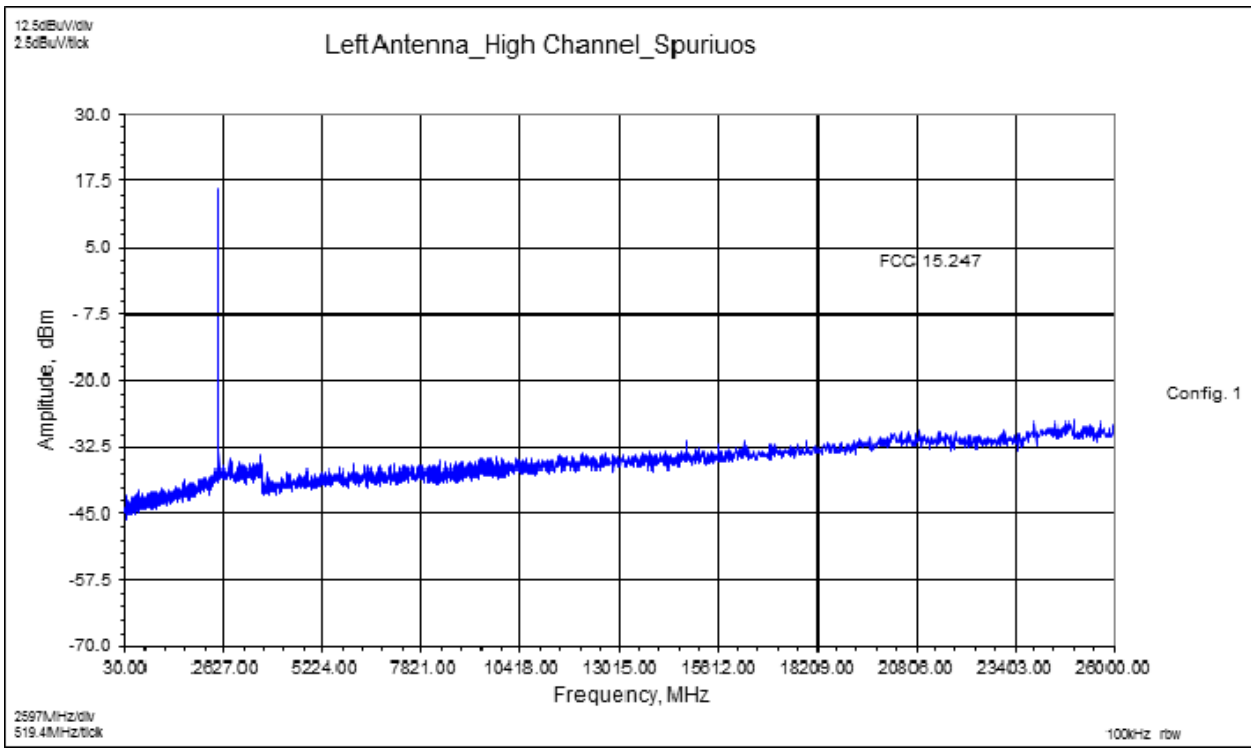
Low Channel (30MHz – 26GHz)



Mid Channel (30MHz – 26GHz)

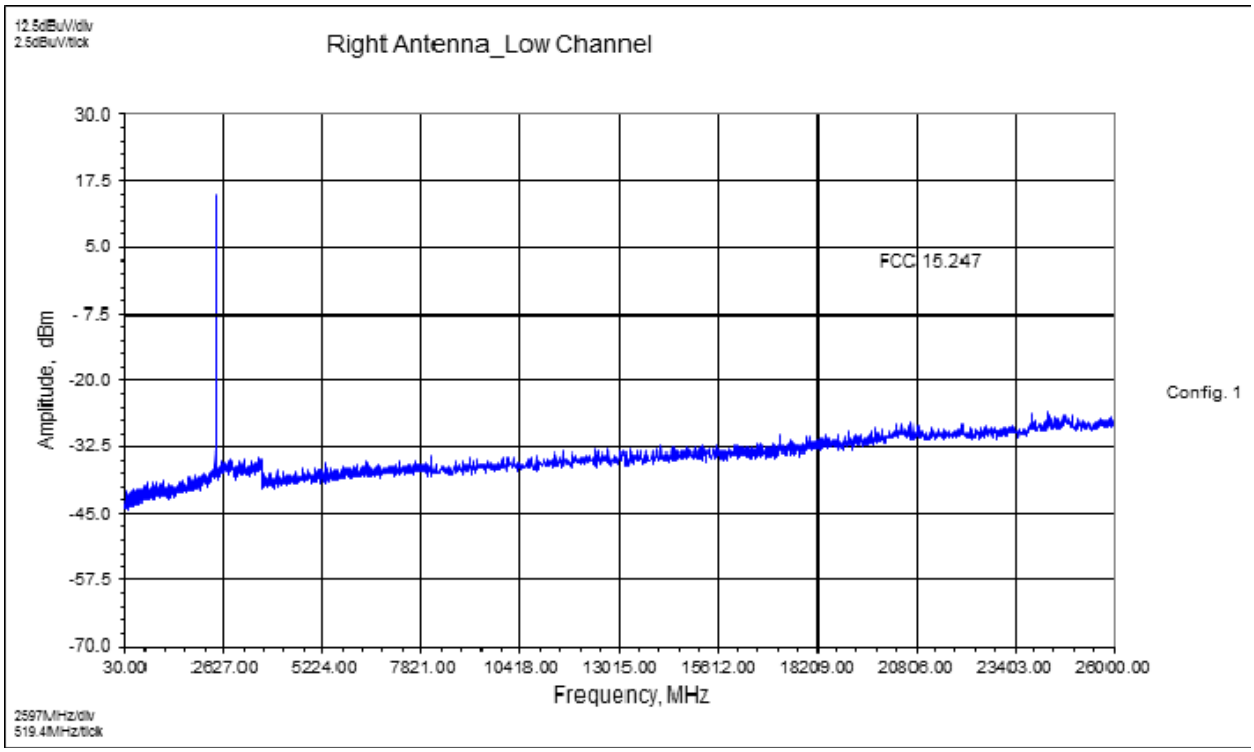


High Channel (30MHz – 26GHz)

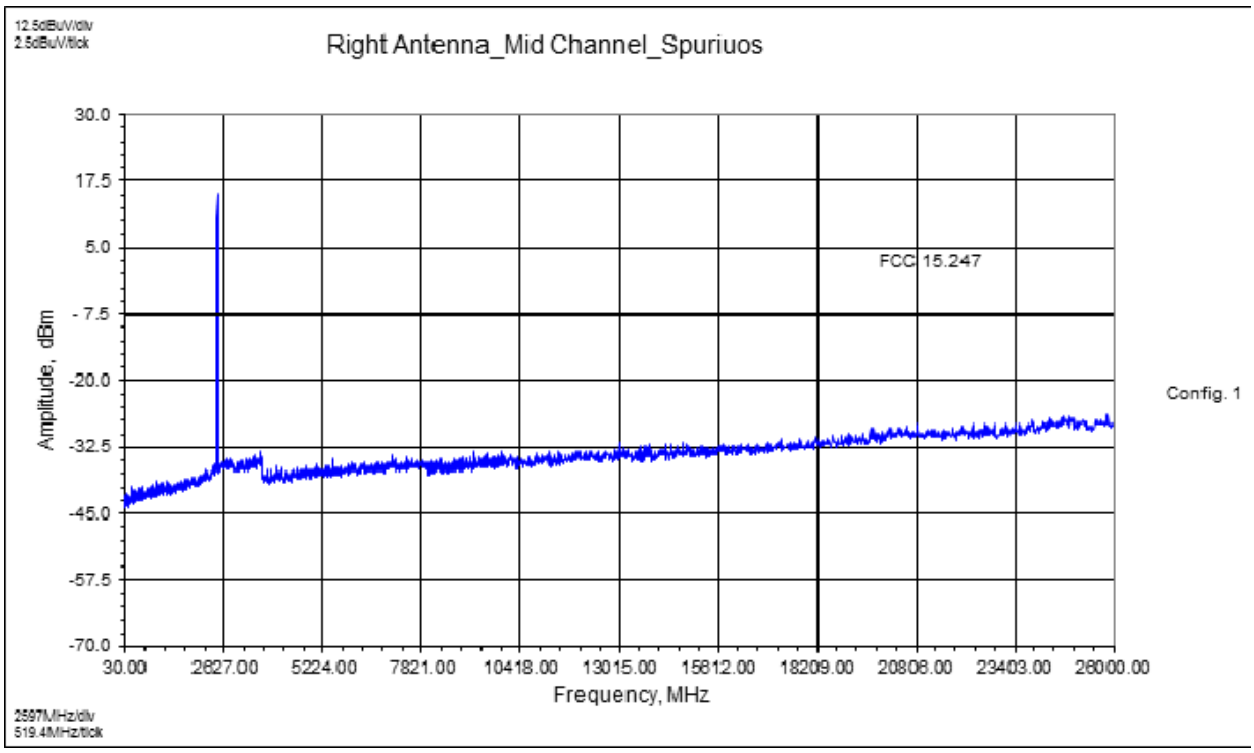


Right Antenna

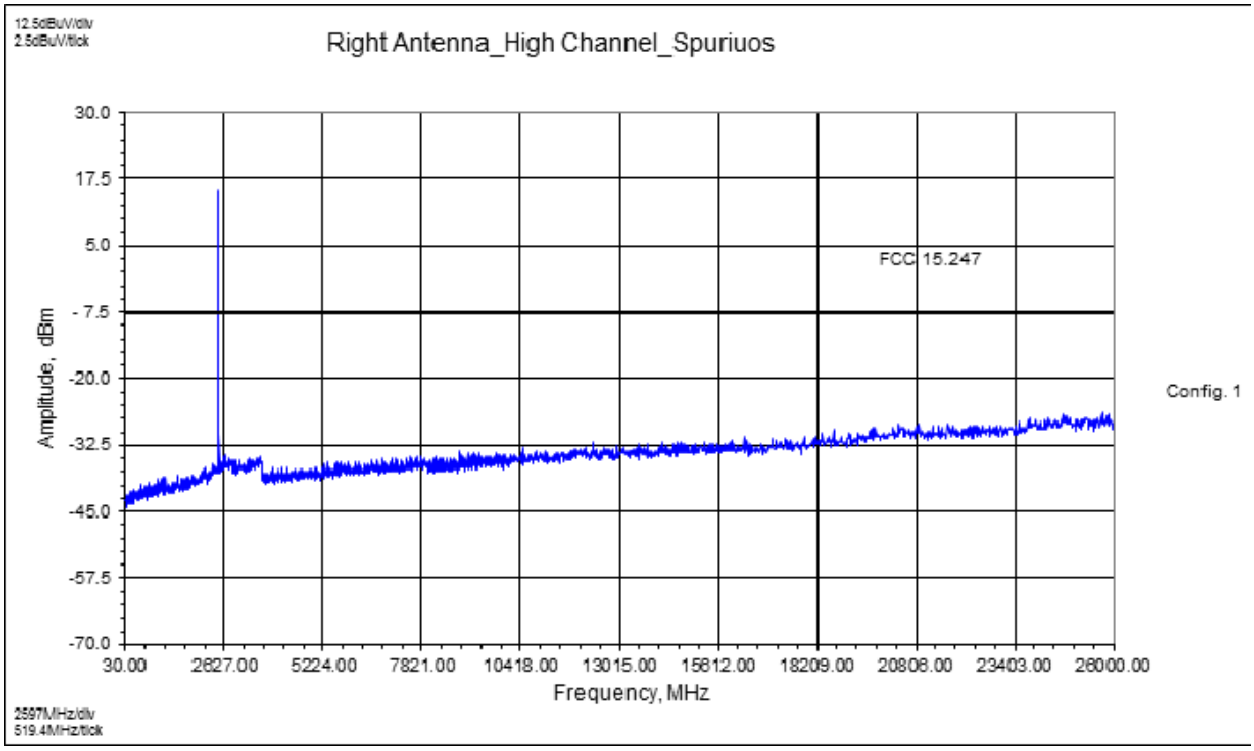
Low Channel (30MHz – 26GHz)



Mid Channel (30MHz – 26GHz)



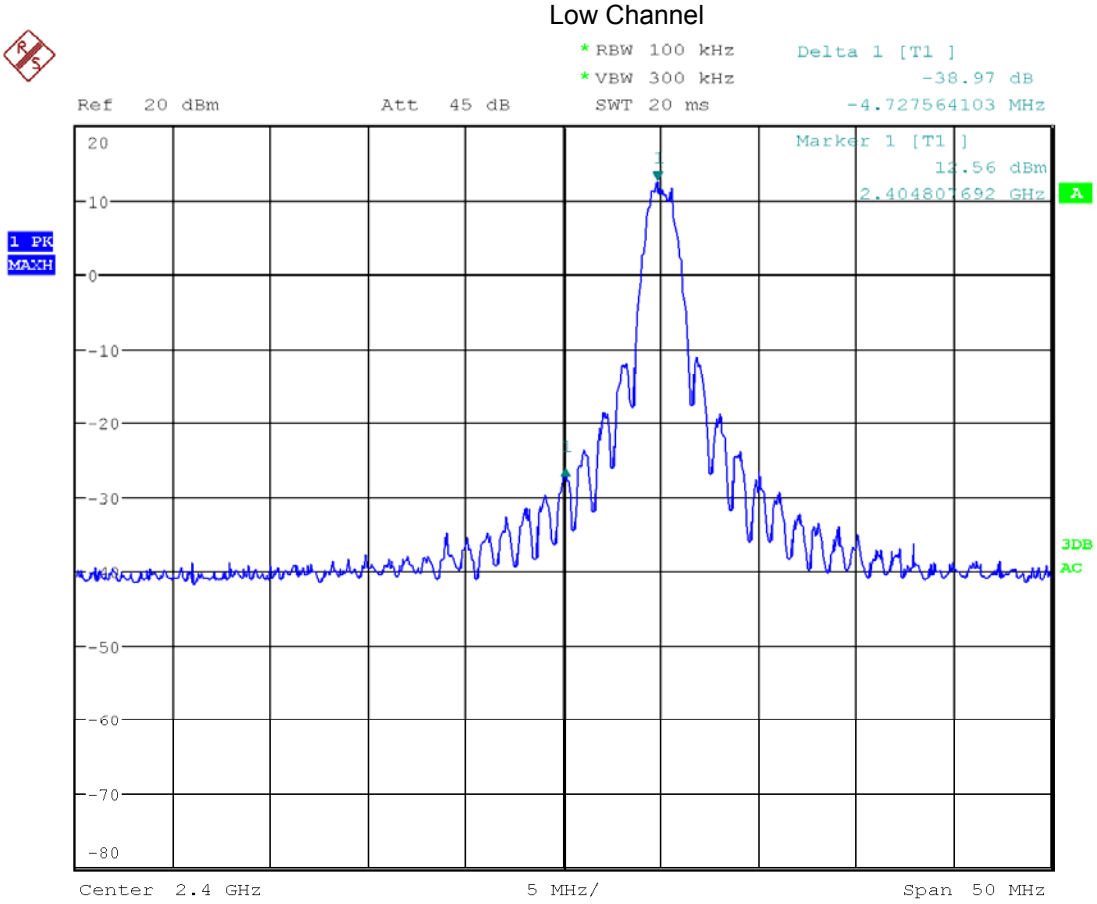
High Channel (30MHz – 26GHz)



8.8 Band Edge

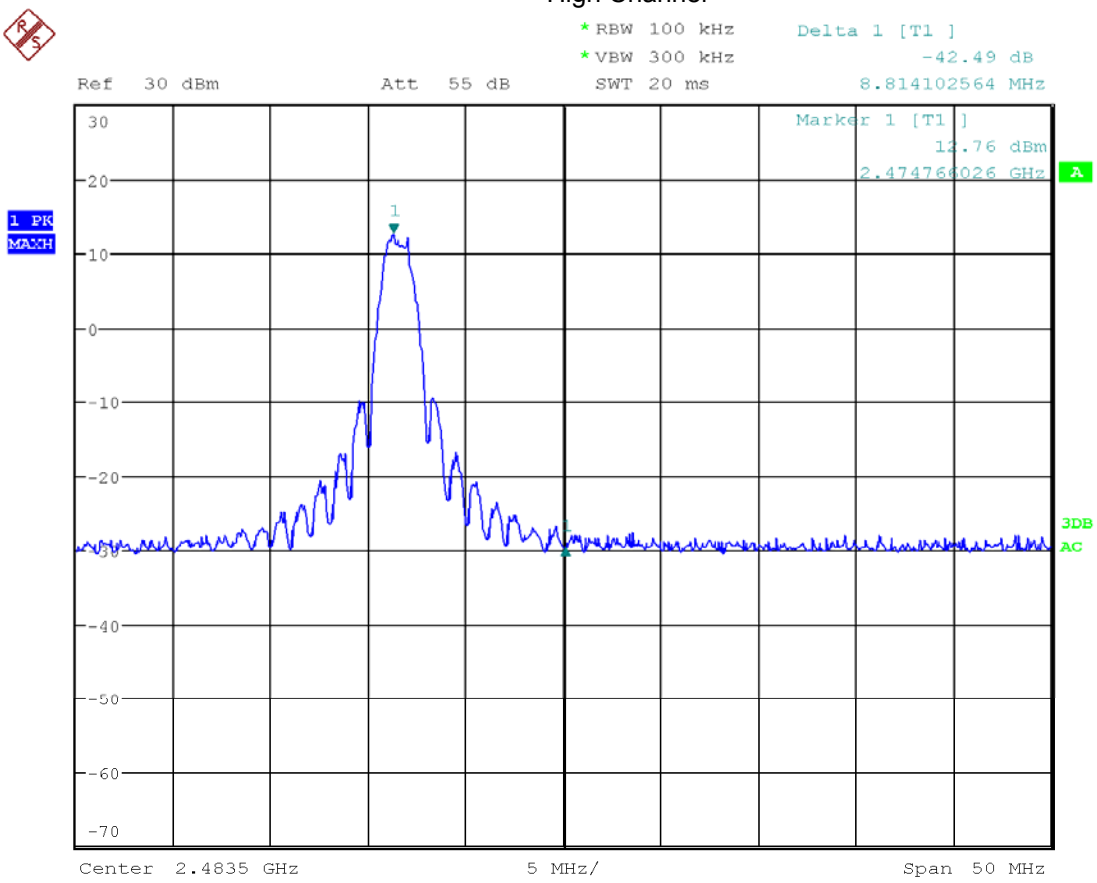
Left Antenna

Low Channel



Date: 15.SEP.2015 17:02:34

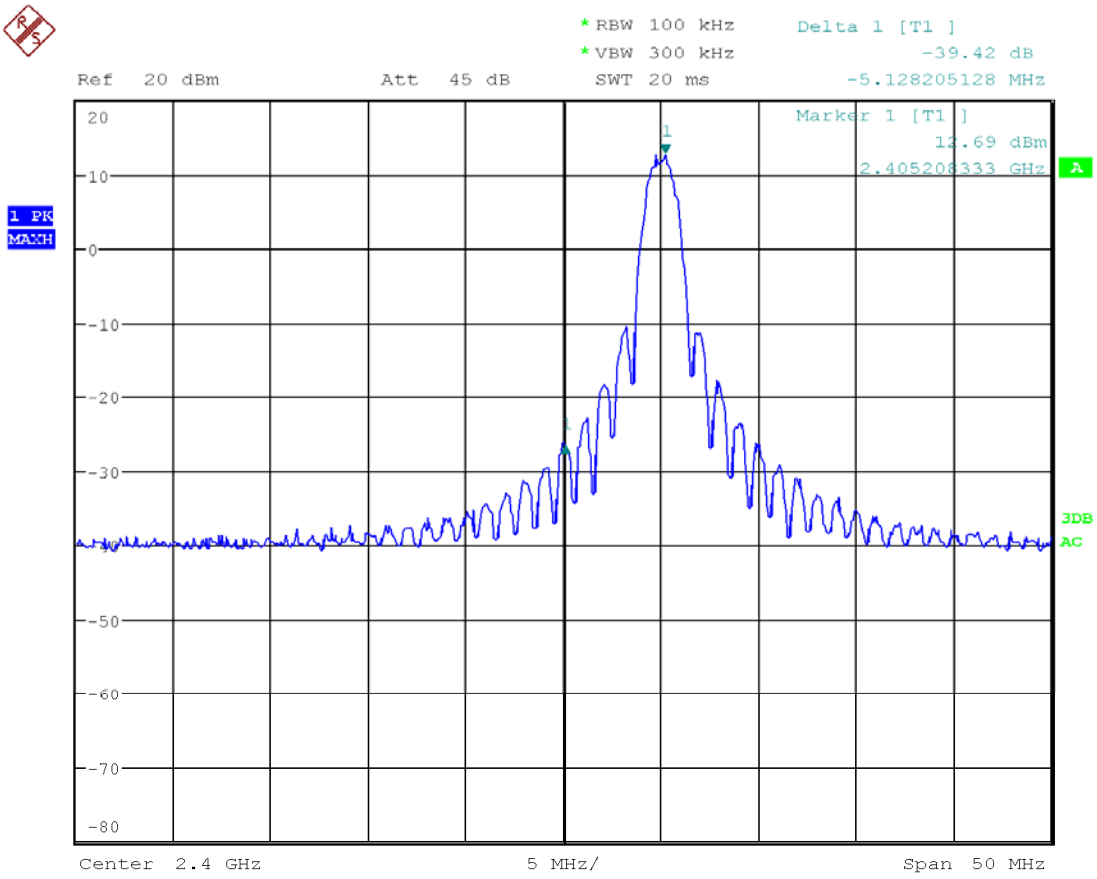
High Channel



Date: 15.SEP.2015 16:54:55

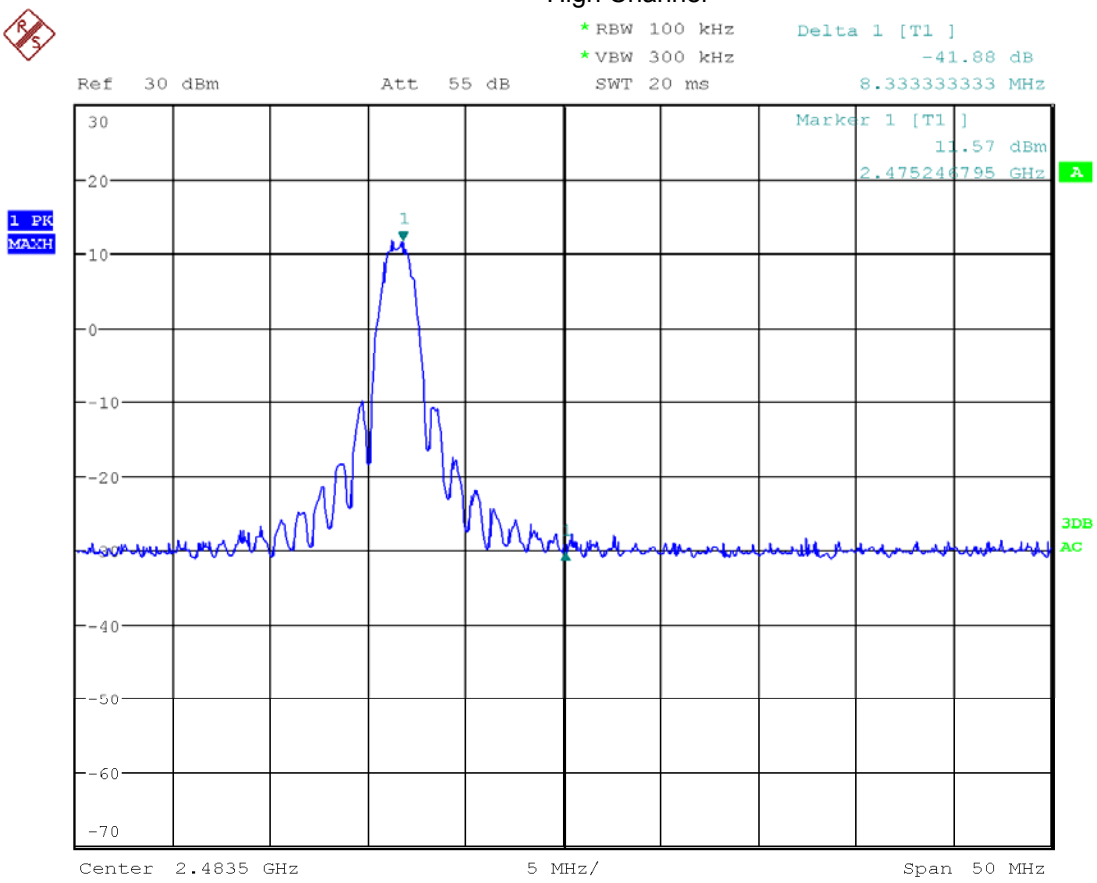
Right Antenna

Low Channel



Date: 18.SEP.2015 16:06:59

High Channel



Date: 18.SEP.2015 16:34:00

9 Spurious and Band Edge/Restricted Band Emissions - Radiated

9.1 Method

The test methods used comply with ANSI C63.4. Unless otherwise stated no deviations were made from FCC 15.247 and RSS-247.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

9.2 Test Requirement/ Specification:

Radiated emissions which fall in the restricted bands, as defined in FCC Part 15.205(a), must also comply with the radiated emission limits specified in Part 15.209(a) and Part 15.205(c). Measurements in the restricted bands include both peak detector and average detector measurements.
Measurements in non-restricted bands include peak detector measurements.

Unwanted emissions below 1GHz must comply with the general field strength limits defined in FCC Part 15.209, when measured with a quasi-peak detector.

FCC part 15.209	
Freq. MHz	Amp. dBuV/m @ 3 m
30	40
88	40
88	43.5
216	43.5
216	46
960	46
960	54
40000	54

9.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	8447F	3113A05545	5/19/2015	5/18/2016
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	12/29/2014	12/29/2015
DEN-073	EMI Receiver	ROHDE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-203	Radiated Cable (1)	Teledyne	90-206-072	14-11-402	12/23/2014	12/23/2015
DEN-204	Radiated Cable (2)	Teledyne	90-206-072	14-11-401	12/23/2014	12/23/2015
DEN-205	Radiated Cable (3)	Teledyne	14-11-401	14-11-401	12/23/2014	12/23/2015
DEN-032	4-18 GHz LNA	NARDA	DBL-0618N615	031	04/29/2015	04/29/2016
18887	Horn Antenna 1-18GHz	EMCO	3115	9205-3886	03/26/2015	03/26/2016
DEN-207	10GHz – 40GHz Amplifier	Miteq	JS44-18004000-40-8P	1909634	09/14/2015	09/14/2016
DEN-200	10-40GHz DRG Horn Antenna	ETS Lindgren	3116C	00168529	9/22/2014	9/22/2015
18906	Amplifier	Mini-Circuits Lab	ZHL-42	N052792-2	05/01/2015	05/01/2016

9.4 Test Procedure:

The Resolution Bandwidth is 120 kHz or greater for frequencies 30 MHz -1000 MHz and 1 MHz for frequencies above 1000 MHz. The Video Bandwidth was at least 3x the RBW.

The EUT is placed on a plastic turntable that is 80 cm in height for testing <1GHz and 150cm for testing >1GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables are manipulated to produce worst-case emissions. The signal is maximized by rotating the turntable through a 360º rotation. The antenna height is varied from 1-4 meters. Both vertical and horizontal antenna configurations are utilized in the testing.

Radiated emissions 30MHz to 18GHz are taken at 3-meter antenna-to-product test distance.

Radiated emissions 18 to 40 GHz are taken at 1.5-meter antenna-to-product test distance. All emissions are extrapolated to 3 meters using the extrapolation factor of 20 dB/decade of distance.

Data is included for the worst-case configuration - the configuration which resulted in the highest emission levels.

ANSI C63.10: 2013 – Clause 11.13

9.5 Test Results:

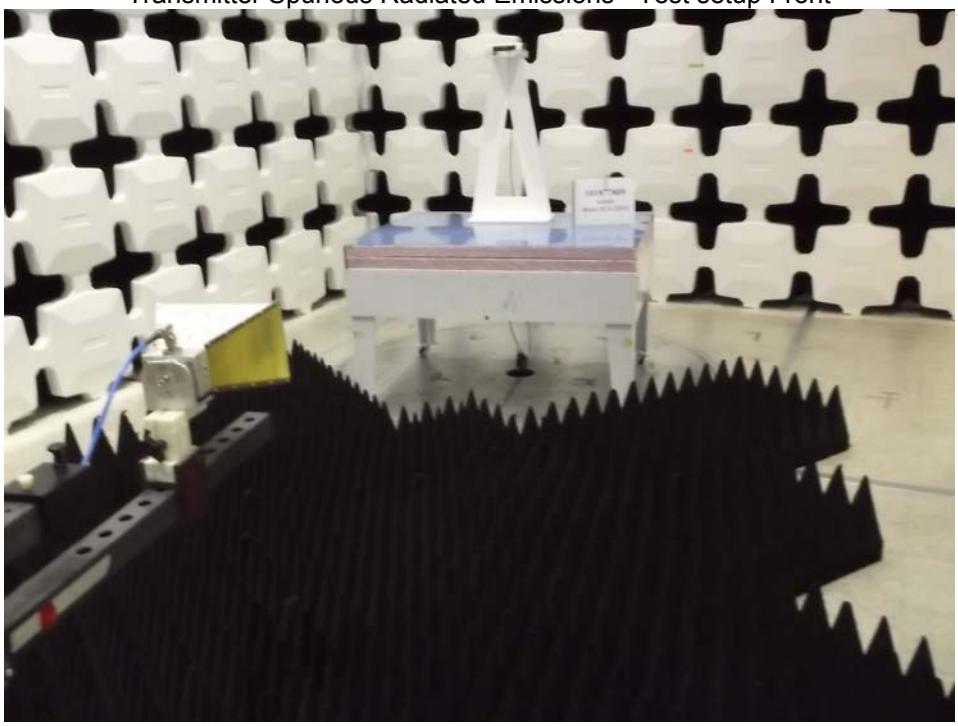
The sample tested was found to Comply.

9.6 Test Summary – Worst-Case Measurements

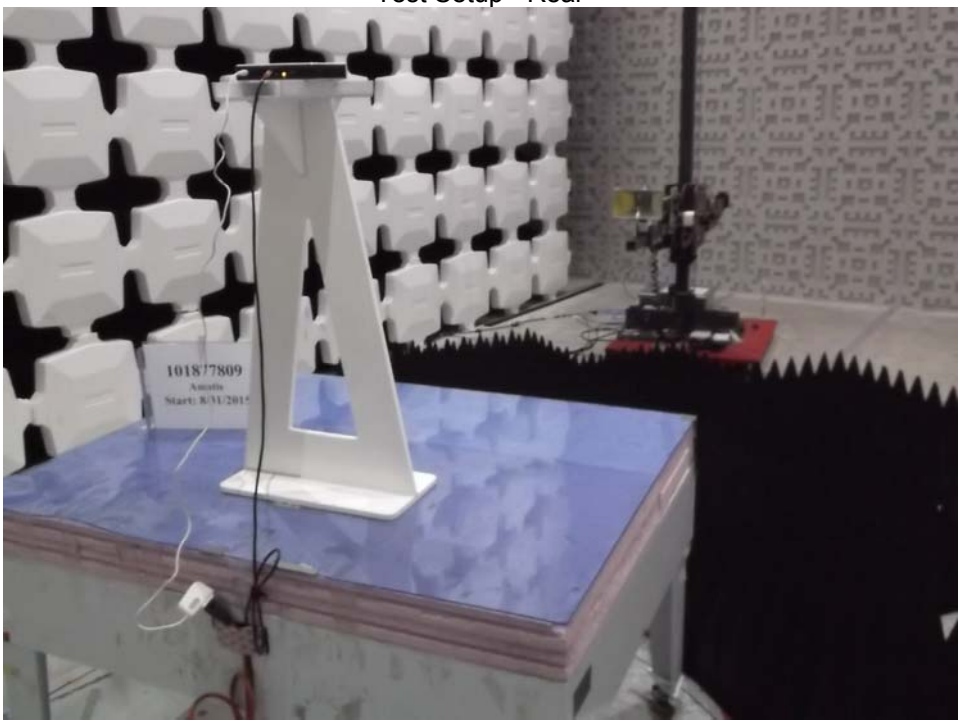
Test Data Summary: Tx Radiated Spurious Emissions in Restricted Band

Setup Photographs: Product Axis 1

Transmitter Spurious Radiated Emissions - Test setup Front

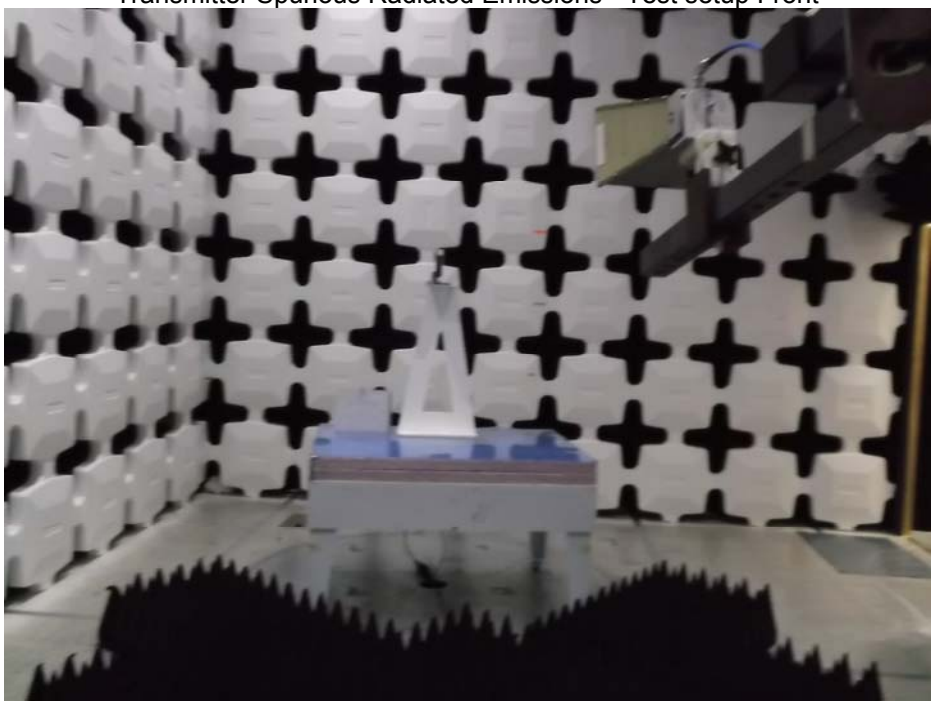


Test Setup - Rear

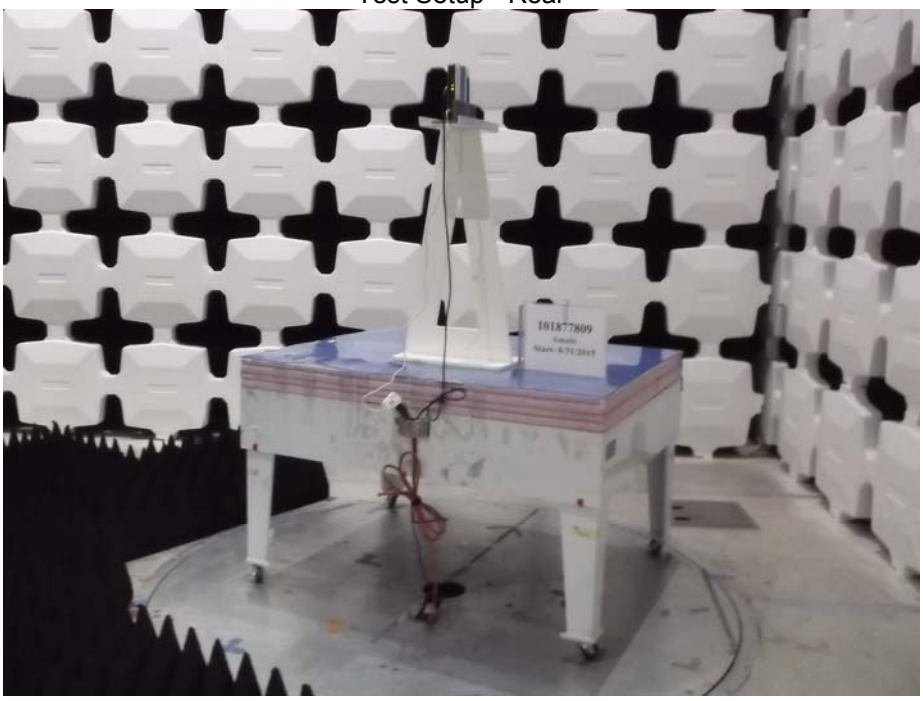


Product Axis 2

Transmitter Spurious Radiated Emissions - Test setup Front

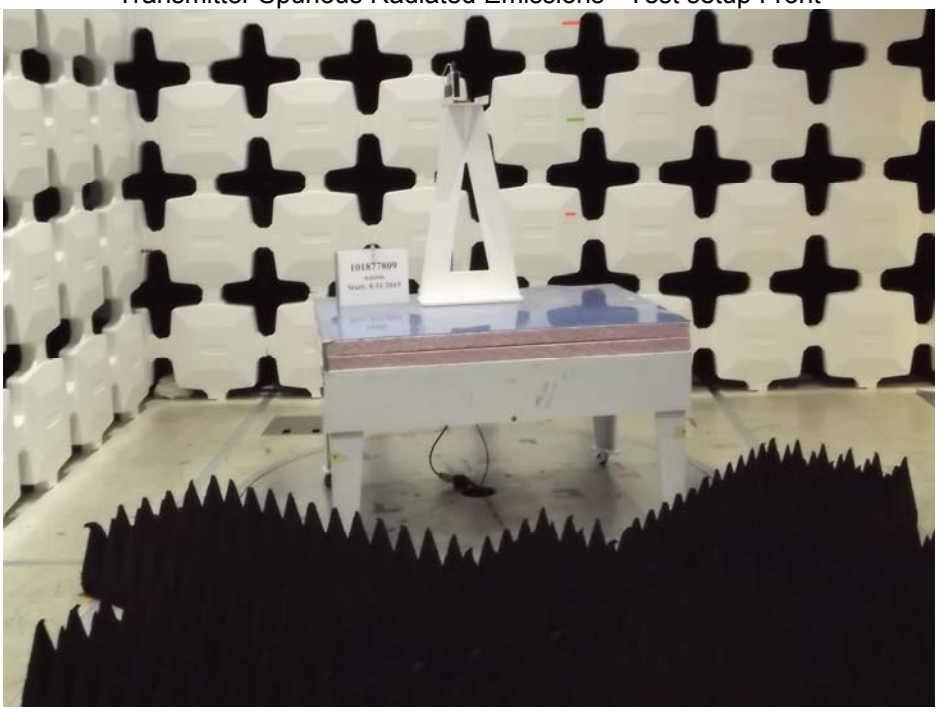


Test Setup - Rear

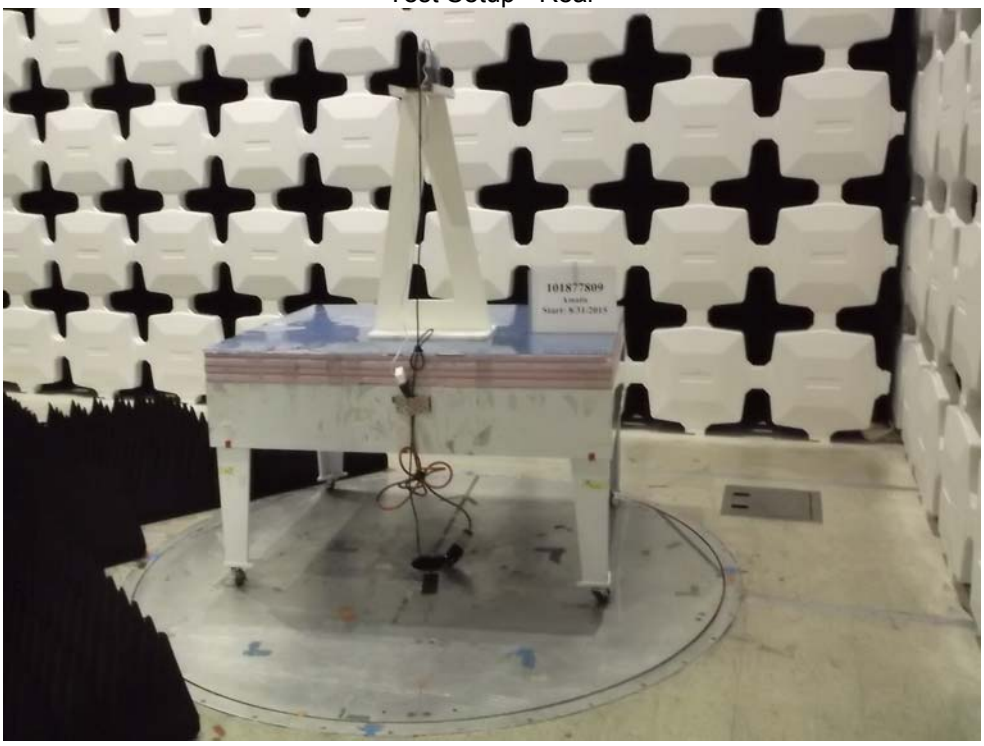


Product Axis 3

Transmitter Spurious Radiated Emissions - Test setup Front

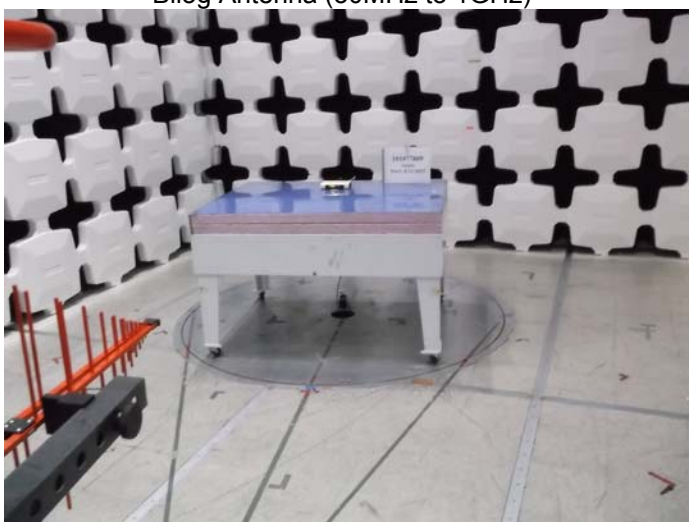


Test Setup - Rear

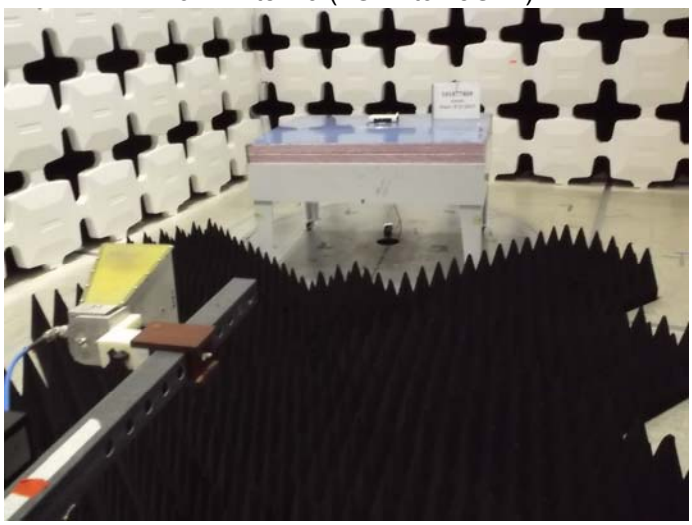


9.7 Antenna Setups:

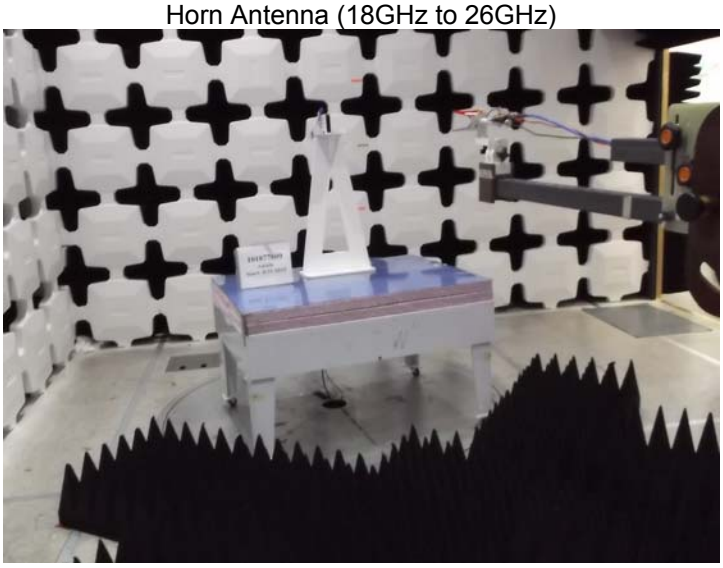
Bilog Antenna (30MHz to 1GHz)



Horn Antenna (1GHz to 18GHz)

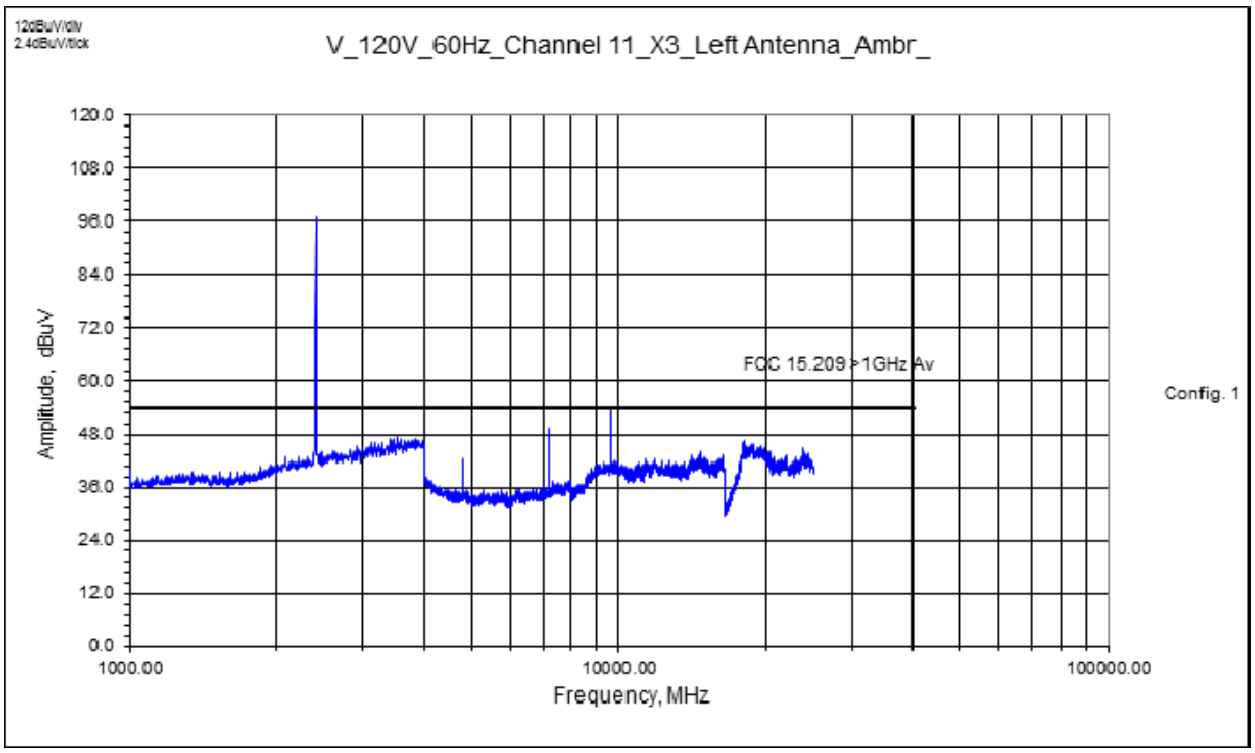


Horn Antenna (18GHz to 26GHz)

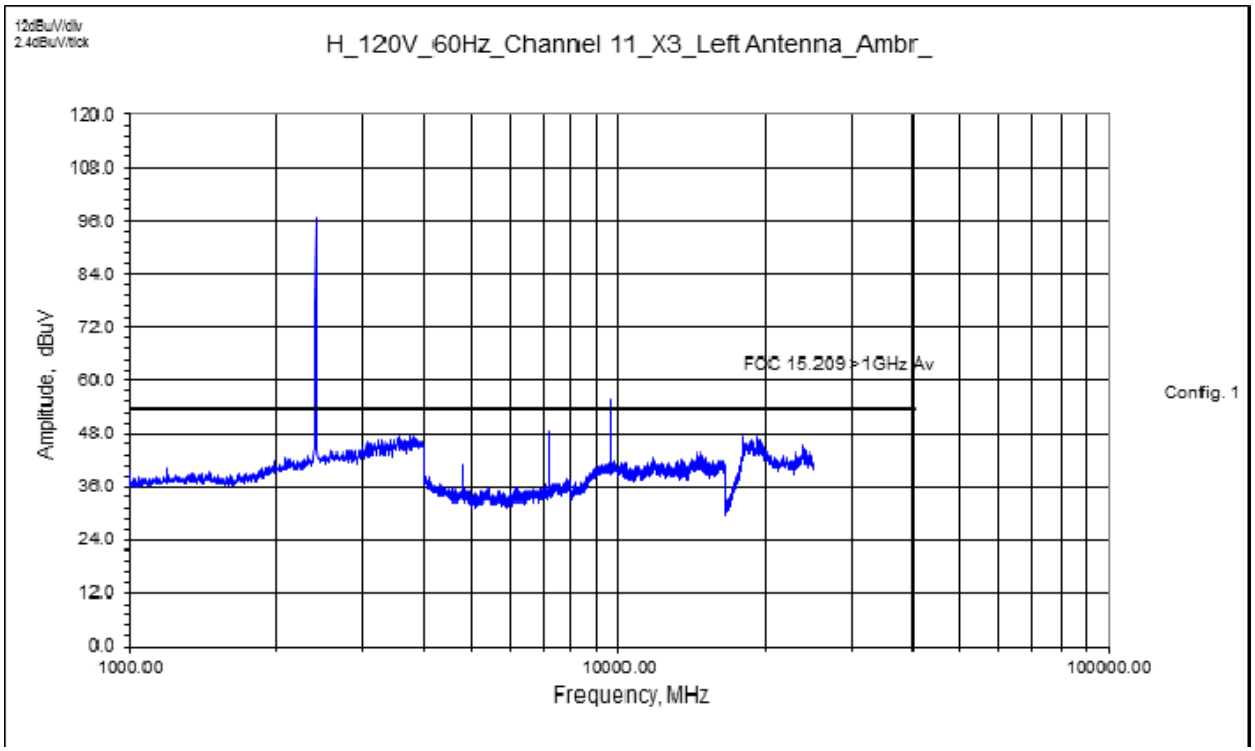


9.8 Plots:

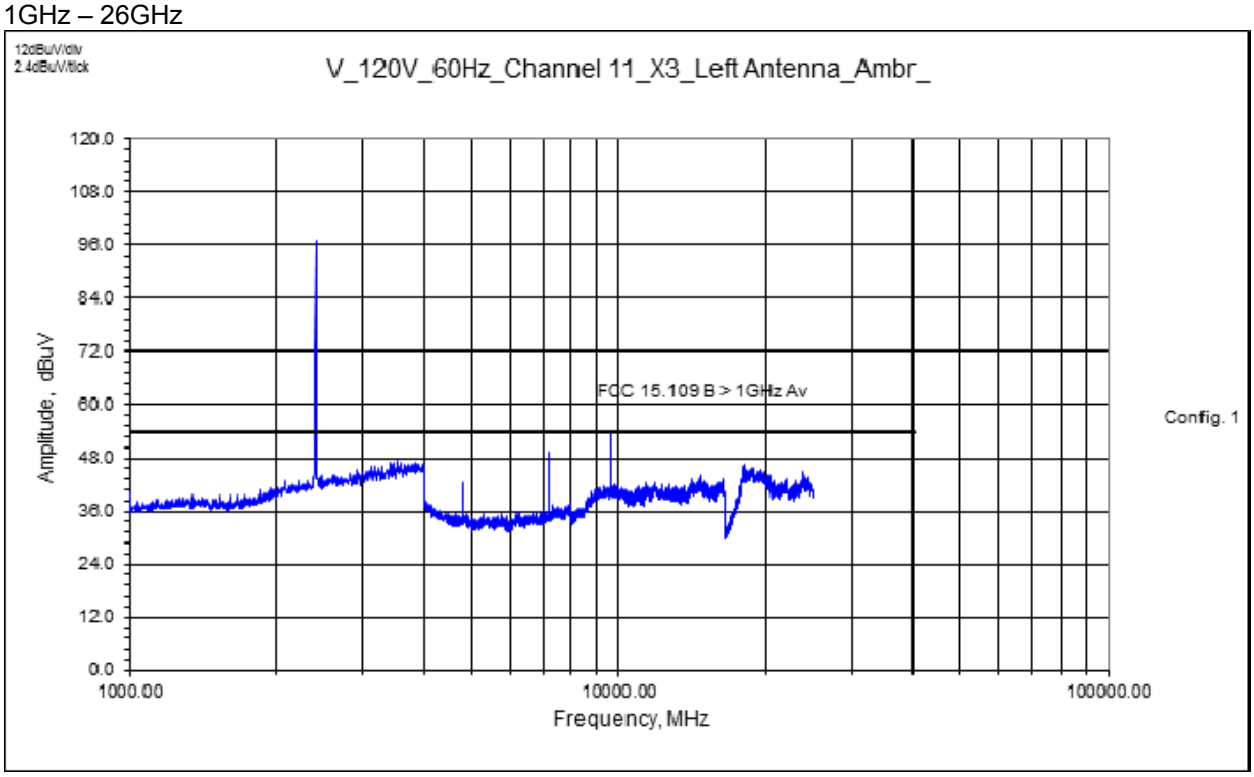
1GHz – 26GHz



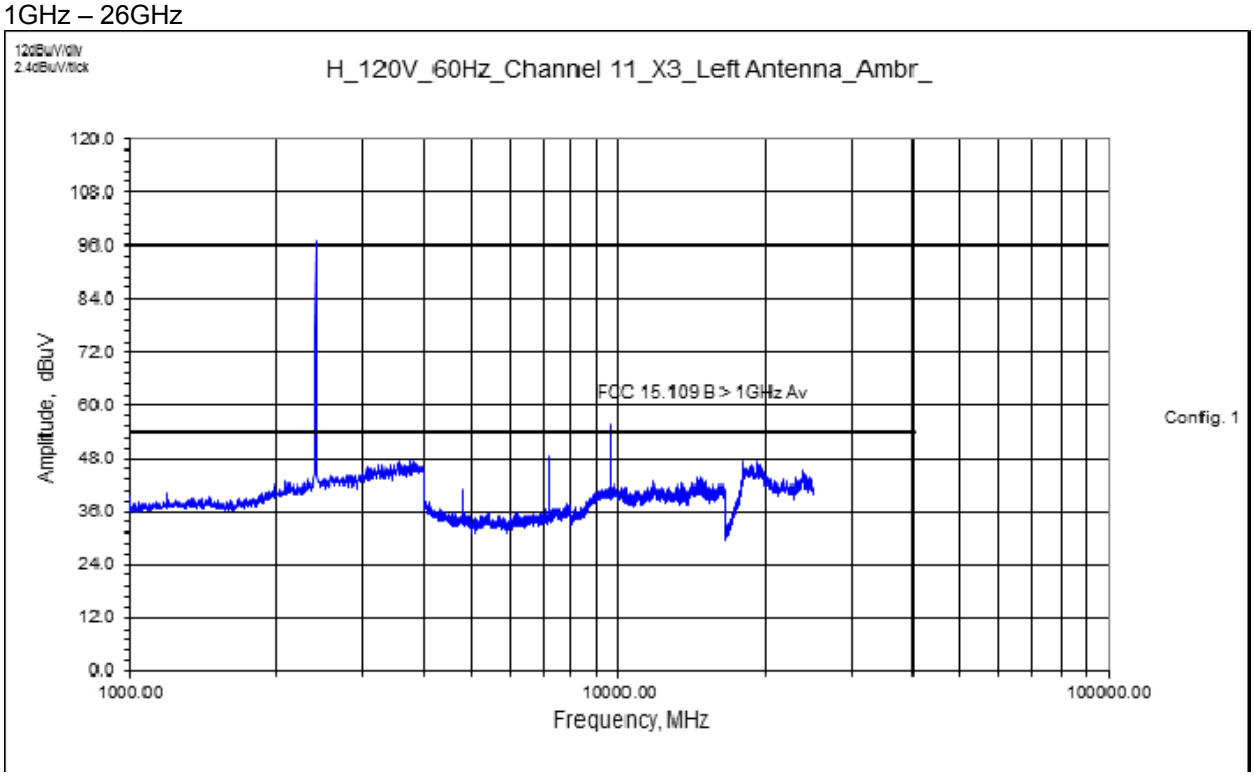
1GHz – 26GHz



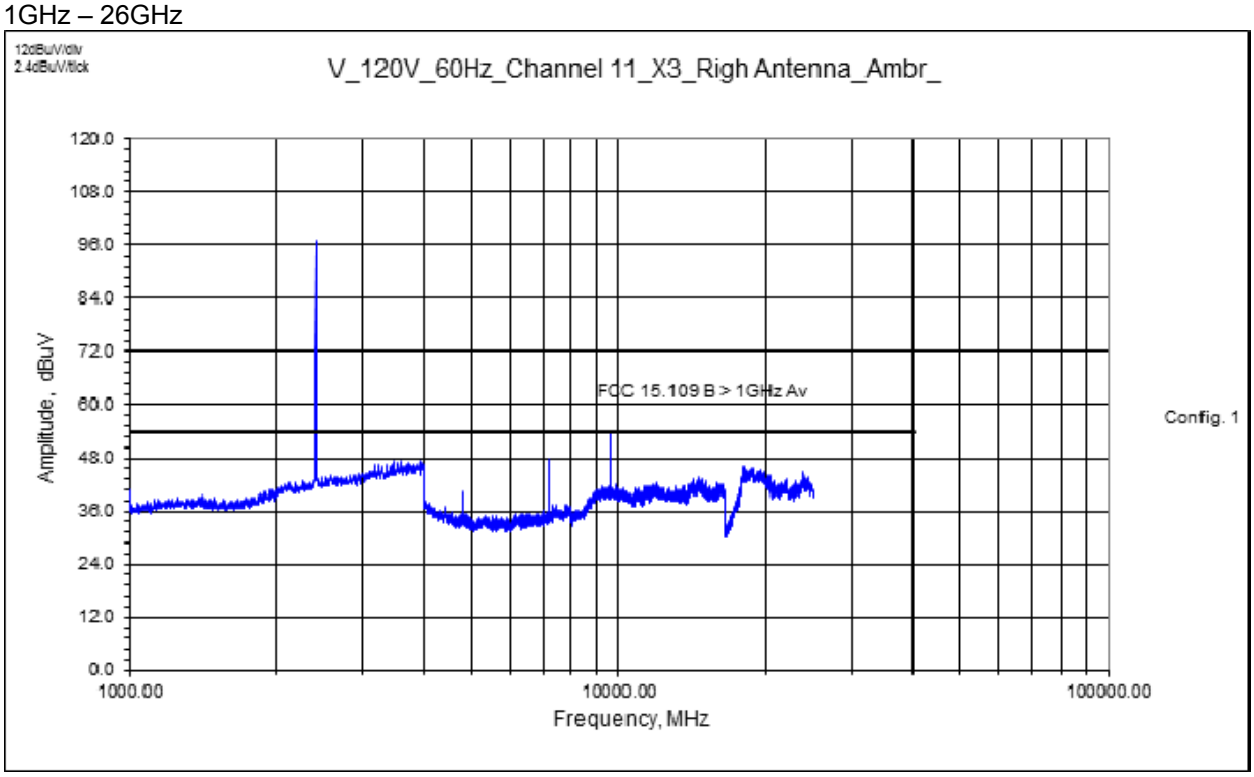
1GHz – 26GHz



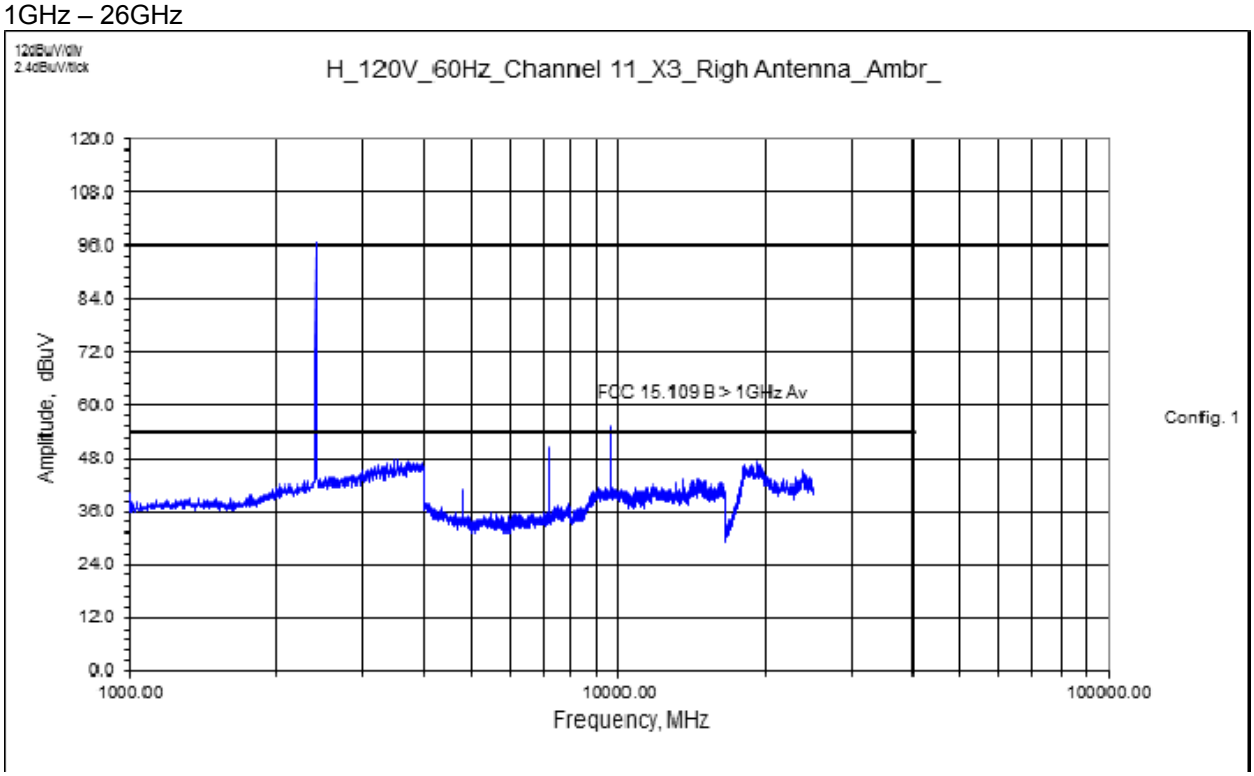
1GHz – 26GHz



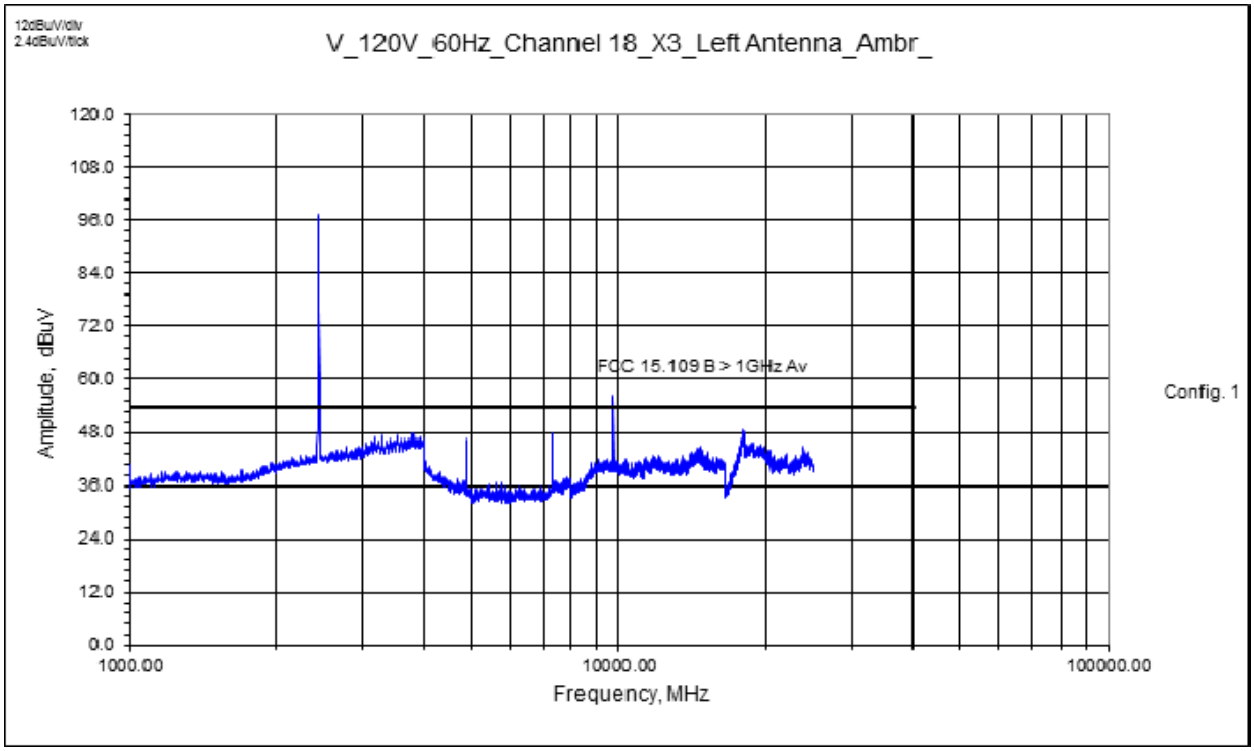
1GHz – 26GHz



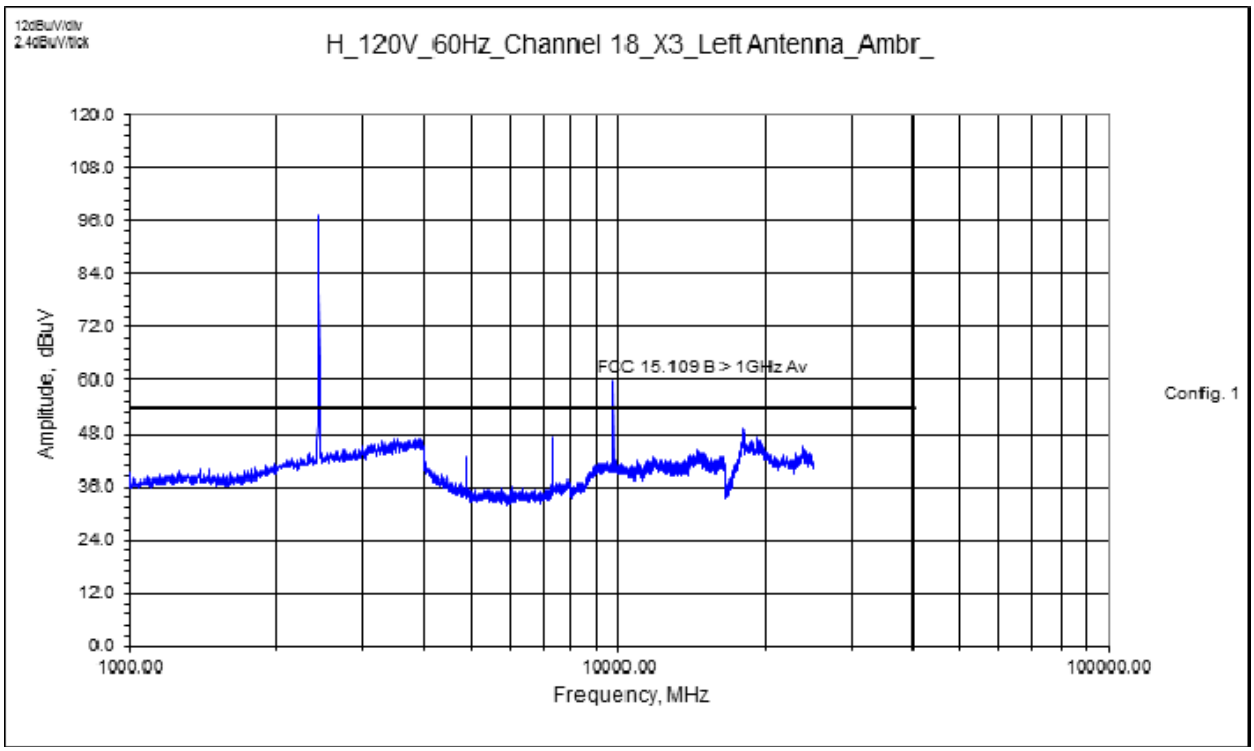
1GHz – 26GHz



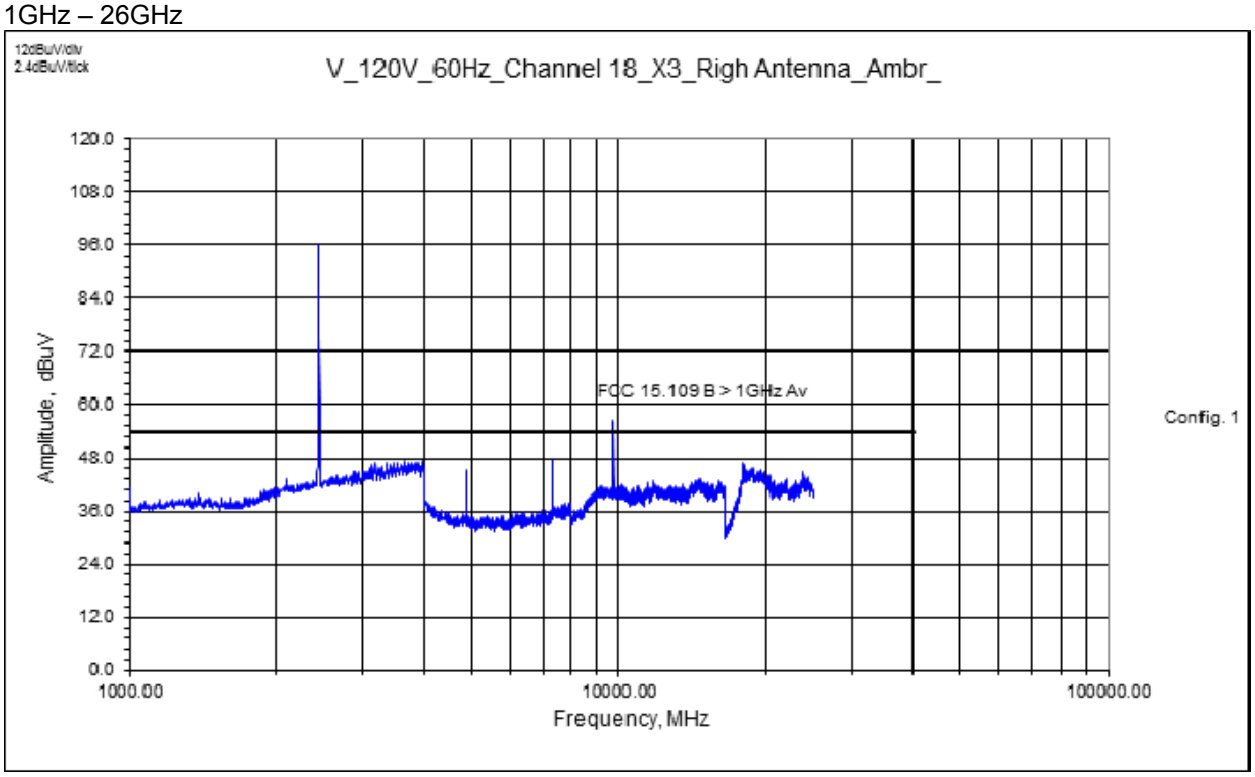
1GHz – 26GHz



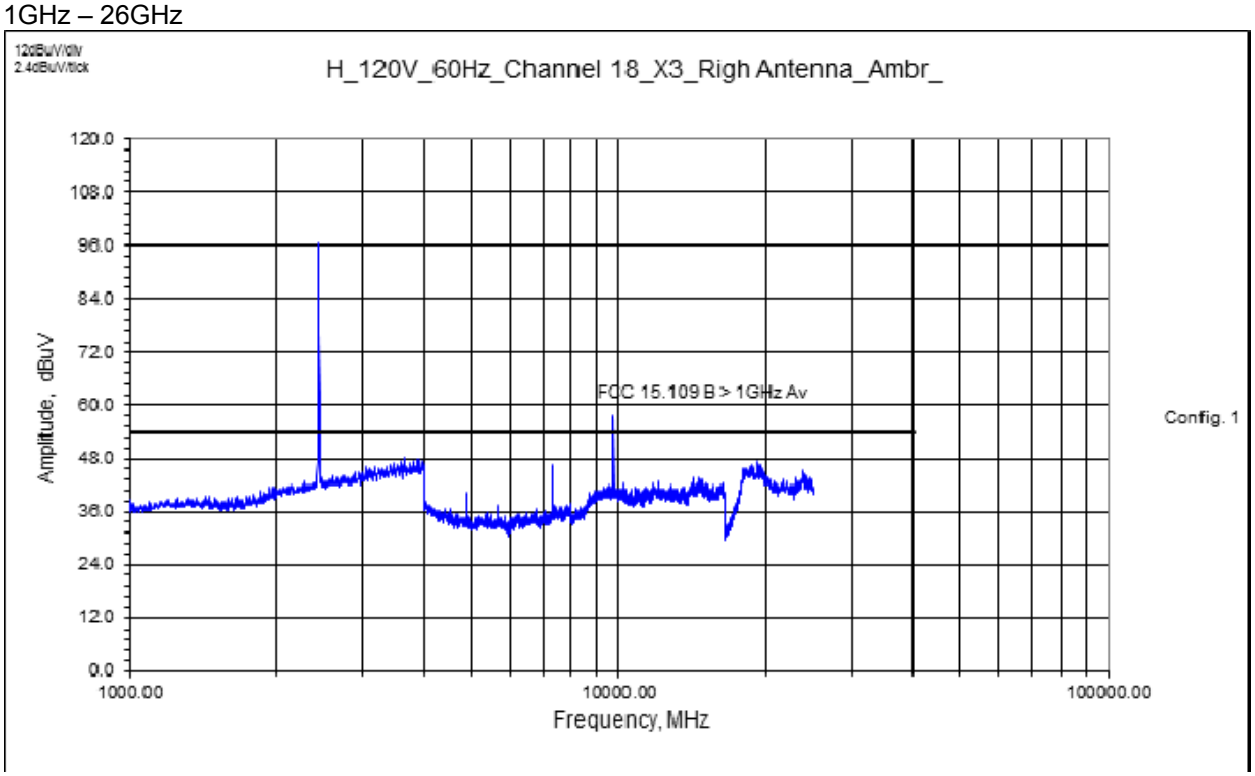
1GHz – 26GHz



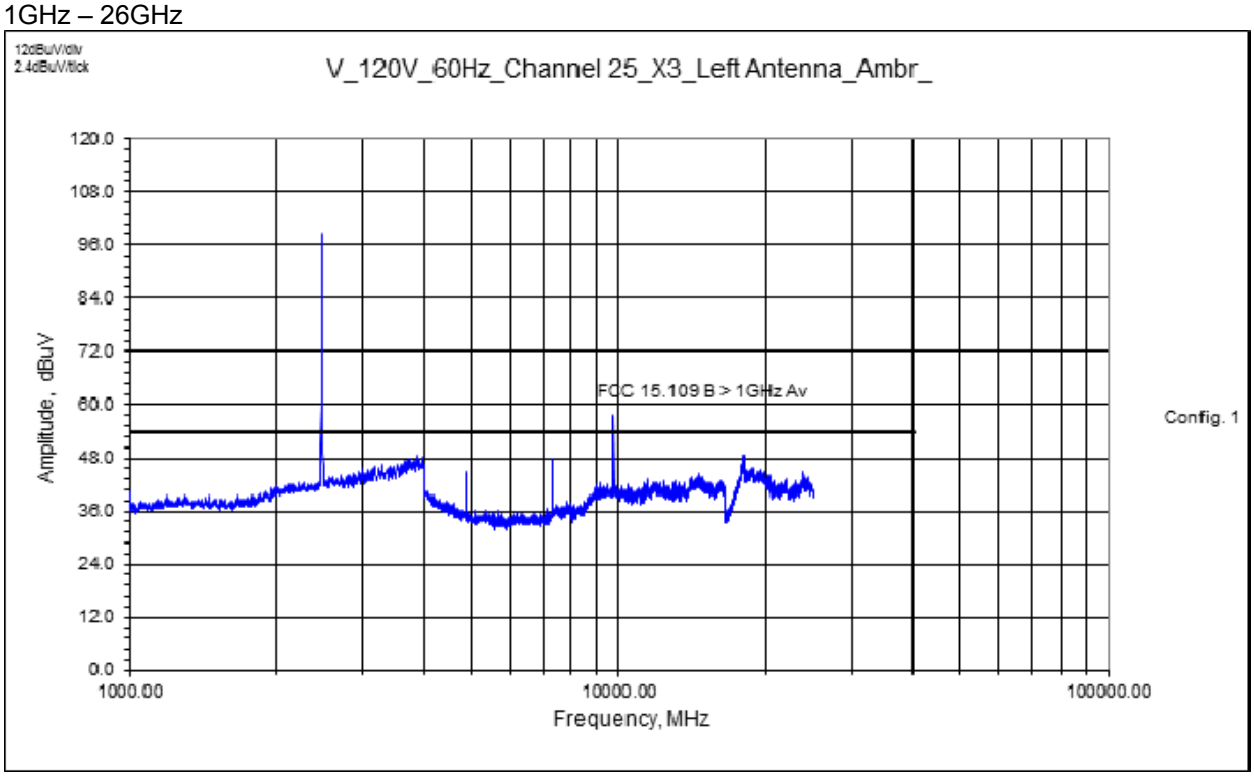
1GHz – 26GHz



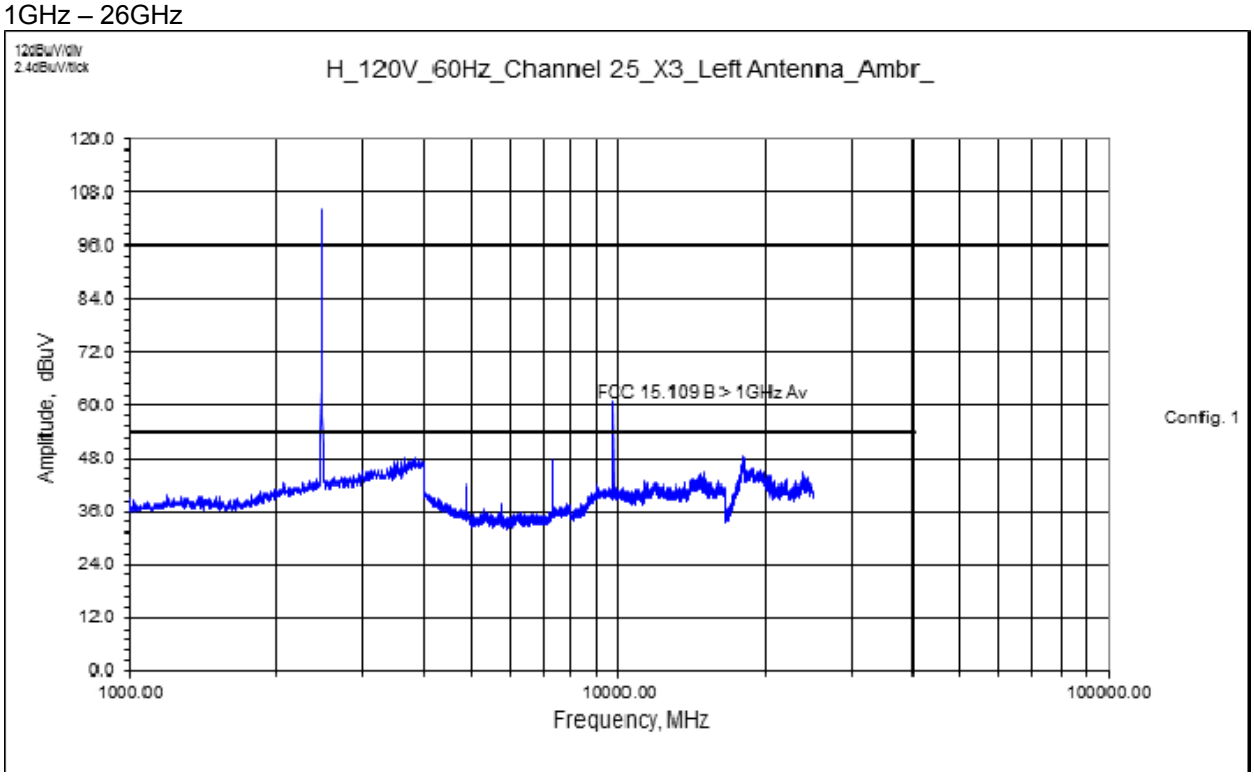
1GHz – 26GHz



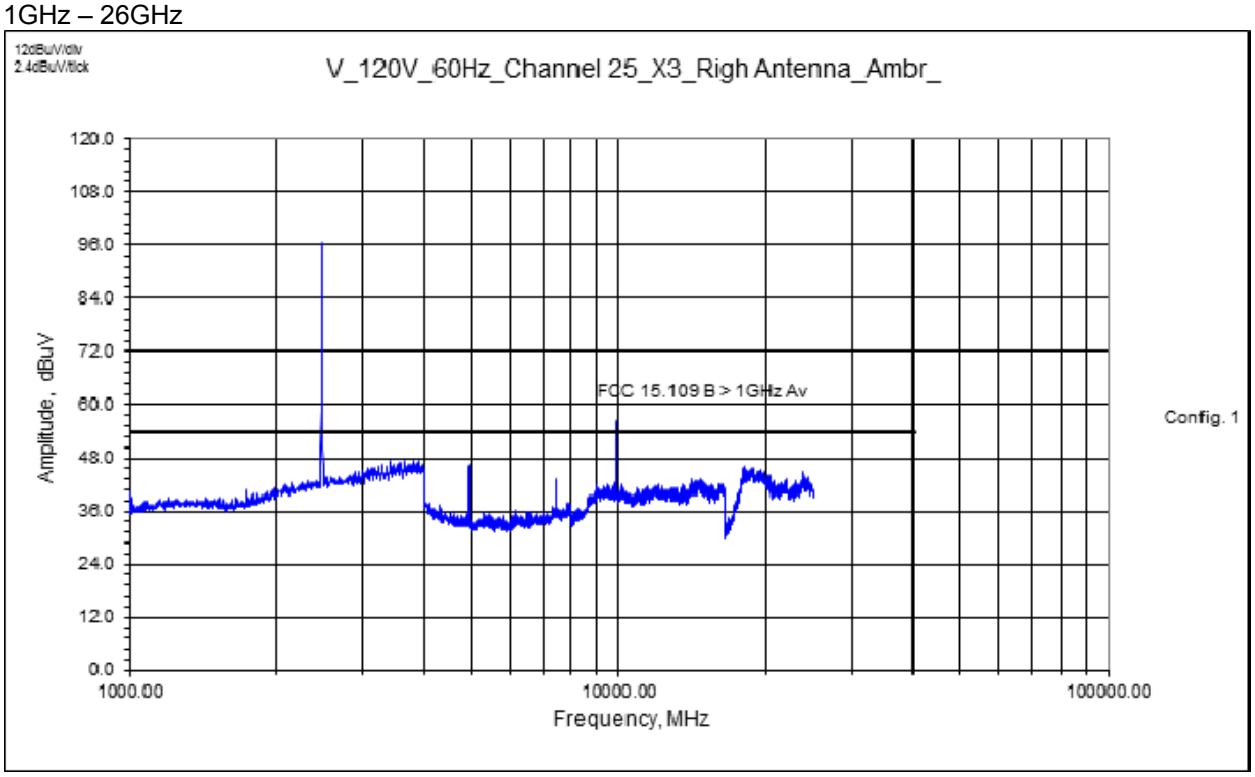
1GHz – 26GHz



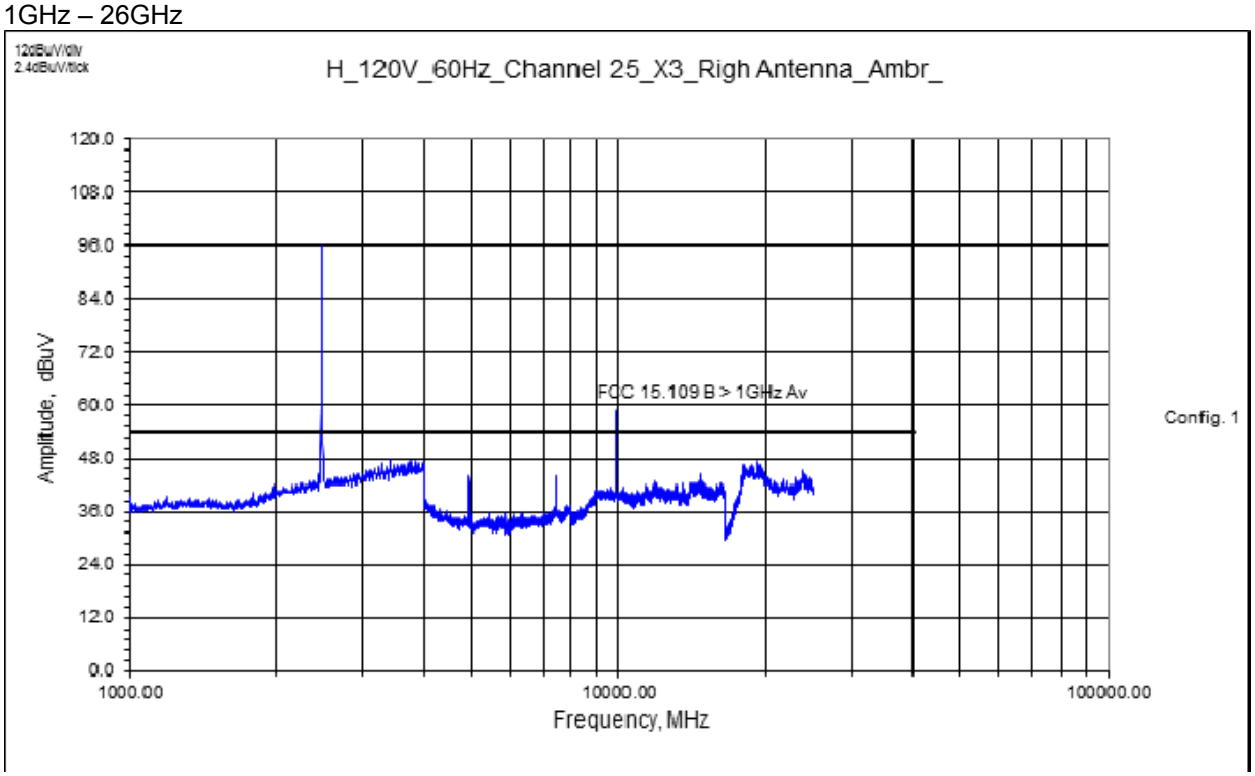
1GHz – 26GHz



1GHz – 26GHz



1GHz – 26GHz



9.9 Test Data:

Tx Spurious Radiated Electromagnetic Emissions

Test Report #:	**101877809DEN-001**	Test Area:	CC1 Radiated	Temperature:	23 °C
Test Method:	FCC 15.209/ 15.205/ 15.35(b)	Test Date:	9/22/2015-9/23-2015	Relative Humidity:	36.8 %
EUT Model #:	AMBR#100645	EUT Power:	120VAC/60Hz	Air Pressure:	83.5 kPa
EUT Serial #:	EMC1				

Manufacturer:	Amatis Controls, LLC.
EUT Description:	The device translates between 802.3 (Ethernet) and 802.15.4 networks.
Notes:	Product continuously transmitting during all testing – worst-case modulation/data
	No TX spurious signal found blew 1GHz.

Level Key
Pk – Peak
Qp – Quasi Peak
Av - Average

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	POL	HGT	AZ	DELTA1	DELTA2	RBW
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.35(b)> 1GHz Pk+20dB from Av	(MHz)
V_Low Channel_X1_left antenna_													
4809.0224	58.50	**Pk**	5.18	32.86	38.14	0.00	58.40	V	2.08	294.8	NA	- 15.60	1.000
4809.0224	46.39	**Av**	5.18	32.86	38.14	0.00	46.29	V	2.08	294.8	- 7.69	NA	1.000
12025.0000	56.79	**Pk**	8.48	39.27	47.13	0.00	57.41	H	1.00	359.9	NA	- 16.59	1.000
12025.0000	43.88	**Av**	8.48	39.27	47.13	0.00	44.50	H	1.00	359.9	- 9.48	NA	1.000
H_Low Channel_X1_left antenna_													
4809.0224	57.53	**Pk**	5.18	32.86	38.14	0.00	57.43	H	1.00	359.9	NA	- 16.57	1.000
4809.0224	43.63	**Av**	5.18	32.86	38.14	0.00	43.53	H	1.00	359.9	- 10.45	NA	1.000
12025.0000	56.20	**Pk**	8.48	39.27	47.13	0.00	56.82	H	1.00	359.9	NA	- 17.18	1.000
12025.0000	43.85	**Av**	8.48	39.27	47.13	0.00	44.47	H	1.00	359.9	- 9.51	NA	1.000
V_Low Channel_X2_left antenna_													
4810.0000	56.85	**Pk**	5.18	32.86	38.15	0.00	56.74	V	1.00	234.9	NA	- 17.26	1.000
4810.0000	43.15	**Av**	5.18	32.86	38.15	0.00	43.04	V	1.00	234.9	- 10.94	NA	1.000
12025.0000	58.30	**Pk**	8.48	39.27	47.13	0.00	58.92	V	1.00	- 0.1	NA	- 15.08	1.000
12025.0000	43.82	**Av**	8.48	39.27	47.13	0.00	44.44	V	1.00	- 0.1	- 9.54	NA	1.000
H_Low Channel_X2_left antenna_													
4810.0000	57.07	**Pk**	5.18	32.86	38.15	0.00	56.96	H	1.50	125.8	NA	- 17.04	1.000
4810.0000	43.49	**Av**	5.18	32.86	38.15	0.00	43.38	H	1.50	125.8	- 10.60	NA	1.000
12025.0000	57.69	**Pk**	8.48	39.27	47.13	0.00	58.31	H	1.50	359.9	NA	- 15.69	1.000
12025.0000	43.81	**Av**	8.48	39.27	47.13	0.00	44.43	H	1.50	359.9	- 9.55	NA	1.000
V_Low Channel_X3_left antenna_													
4810.0000	61.49	**Pk**	5.18	32.86	38.15	0.00	61.38	V	1.00	359.9	NA	- 12.62	1.000
4810.0000	48.23	**Av**	5.18	32.86	38.15	0.00	48.12	V	1.00	359.9	- 5.86	NA	1.000
12025.0000	61.83	**Pk**	8.48	39.27	47.13	0.00	62.45	V	1.00	0.0	NA	- 11.55	1.000
12025.0000	48.06	**Av**	8.48	39.27	47.13	0.00	48.68	V	1.00	0.0	- 5.30	NA	1.000
H_Low Channel_X3_left antenna_													
4810.0000	61.90	**Pk**	5.18	32.86	38.15	0.00	61.79	H	1.50	- 0.1	NA	- 12.21	1.000
4810.0000	48.28	**Av**	5.18	32.86	38.15	0.00	48.17	H	1.50	- 0.1	- 5.81	NA	1.000
12025.0000	61.63	**Pk**	8.48	39.27	47.13	0.00	62.25	H	1.50	0.0	NA	- 11.75	1.000
12025.0000	48.06	**Av**	8.48	39.27	47.13	0.00	48.68	H	1.50	0.0	- 5.30	NA	1.000

V_Middle Channel_X3_left antenna_													
4881.0192	54.23	**Pk**	5.22	32.96	38.98	0.00	53.43	V	1.00	45.4	NA	- 20.57	1.000
4881.0192	45.59	**Av**	5.22	32.96	38.98	0.00	44.79	V	1.00	45.4	- 9.19	NA	1.000
7325.9997	50.13	**Pk**	6.50	36.71	47.40	0.00	45.94	V	1.00	0.0	NA	- 28.06	1.000
7325.9997	36.48	**Av**	6.50	36.71	47.40	0.00	32.29	V	1.00	0.0	- 21.69	NA	1.000
12214.0000	51.20	**Pk**	8.57	39.00	47.07	0.00	51.70	V	1.00	359.9	NA	- 22.30	1.000
12214.0000	37.43	**Av**	8.57	39.00	47.07	0.00	37.93	V	1.00	359.9	- 16.05	NA	1.000
H_Middle Channel_X3_left antenna_													
4881.0192	51.82	**Pk**	5.22	32.96	38.98	0.00	51.02	H	1.50	17.0	NA	- 22.98	1.000
4881.0192	41.81	**Av**	5.22	32.96	38.98	0.00	41.01	H	1.50	17.0	- 12.97	NA	1.000
7321.5611	60.21	**Pk**	6.50	36.70	47.41	0.00	56.00	H	1.50	305.0	NA	- 18.00	1.000
7321.5611	51.60	**Av**	6.50	36.70	47.41	0.00	47.39	H	1.50	305.0	- 6.59	NA	1.000
12212.9647	51.15	**Pk**	8.57	39.00	47.07	0.00	51.65	H	1.50	57.0	NA	- 22.35	1.000
12212.9647	37.41	**Av**	8.57	39.00	47.07	0.00	37.91	H	1.50	57.0	- 16.07	NA	1.000
V_Middle Channel_X2_left antenna_													
4881.0288	51.55	**Pk**	5.22	32.96	38.98	0.00	50.75	V	1.58	239.0	NA	- 23.25	1.000
4881.0288	41.87	**Av**	5.22	32.96	38.98	0.00	41.07	V	1.58	239.0	- 12.91	NA	1.000
7321.5607	61.23	**Pk**	6.50	36.70	47.41	0.00	57.02	V	1.00	332.0	NA	- 16.98	1.000
7321.5607	52.68	**Av**	6.50	36.70	47.41	0.00	48.47	V	1.00	332.0	- 5.51	NA	1.000
12210.0062	50.99	**Pk**	8.57	39.01	47.08	0.00	51.49	V	1.00	359.9	NA	- 22.51	1.000
12210.0062	37.20	**Av**	8.57	39.01	47.08	0.00	37.70	V	1.00	359.9	- 16.28	NA	1.000
H_Middle Channel_X2_left antenna_													
4881.0313	53.03	**Pk**	5.22	32.96	38.98	0.00	52.23	H	1.50	107.0	NA	- 21.77	1.000
4881.0313	43.54	**Av**	5.22	32.96	38.98	0.00	42.74	H	1.50	107.0	- 11.24	NA	1.000
7318.6971	62.19	**Pk**	6.49	36.70	47.41	0.00	57.97	H	1.50	295.0	NA	- 16.03	1.000
7318.6971	54.10	**Av**	6.49	36.70	47.41	0.00	49.88	H	1.50	295.0	- 4.10	NA	1.000
12209.8686	50.76	**Pk**	8.57	39.01	47.08	0.00	51.26	H	1.50	156.0	NA	- 22.74	1.000
12209.8686	37.19	**Av**	8.57	39.01	47.08	0.00	37.69	H	1.50	156.0	- 16.29	NA	1.000
V_Middle Channel_X1_left antenna_													
4881.0304	54.09	**Pk**	5.22	32.96	38.98	0.00	53.29	V	1.00	246.0	NA	- 20.71	1.000
4881.0304	45.35	**Av**	5.22	32.96	38.98	0.00	44.55	V	1.00	246.0	- 9.43	NA	1.000
7321.5721	57.89	**Pk**	6.50	36.70	47.41	0.00	53.68	V	1.00	0.0	NA	- 20.32	1.000
7321.5721	48.66	**Av**	6.50	36.70	47.41	0.00	44.45	V	1.00	0.0	- 9.53	NA	1.000
12209.9680	51.13	**Pk**	8.57	39.01	47.08	0.00	51.63	V	1.00	0.0	NA	- 22.37	1.000
12209.9680	37.19	**Av**	8.57	39.01	47.08	0.00	37.69	V	1.00	0.0	- 16.29	NA	1.000
H_Middle Channel_X1_left antenna_													
4881.0304	49.65	**Pk**	5.22	32.96	38.98	0.00	48.85	H	1.50	64.0	NA	- 25.15	1.000
4881.0304	38.80	**Av**	5.22	32.96	38.98	0.00	38.00	H	1.50	64.0	- 15.98	NA	1.000
7321.2482	60.11	**Pk**	6.50	36.70	47.41	0.00	55.90	H	1.50	101.0	NA	- 18.10	1.000
7321.2482	52.49	**Av**	6.50	36.70	47.41	0.00	48.28	H	1.50	101.0	- 5.70	NA	1.000
12206.0577	51.68	**Pk**	8.56	39.01	47.08	0.00	52.17	H	1.50	0.0	NA	- 21.83	1.000
12206.0577	37.43	**Av**	8.56	39.01	47.08	0.00	37.92	H	1.50	0.0	- 16.06	NA	1.000
V_High Channel_X1_left antenna_													
4951.0288	55.36	**Pk**	5.26	33.09	39.80	0.00	53.91	V	2.20	290.0	NA	- 20.09	1.000
4951.0288	47.43	**Av**	5.26	33.09	39.80	0.00	45.98	V	2.20	290.0	- 8.00	NA	1.000
7426.2532	56.23	**Pk**	6.55	36.81	47.24	0.00	52.35	V	1.23	278.0	NA	- 21.65	1.000
7426.2532	46.86	**Av**	6.55	36.81	47.24	0.00	42.98	V	1.23	278.0	- 11.00	NA	1.000
12380.0000	49.29	**Pk**	8.66	38.89	46.84	0.00	50.01	V	1.00	359.9	NA	- 23.99	1.000
12380.0000	36.38	**Av**	8.66	38.89	46.84	0.00	37.10	V	1.00	359.9	- 16.88	NA	1.000
H_High Channel_X1_left antenna_													
4951.0288	52.63	**Pk**	5.26	33.09	39.80	0.00	51.18	H	2.41	318.0	NA	- 22.82	1.000

4951.0288	43.98	**Av**	5.26	33.09	39.80	0.00	42.53	H	2.41	318.0	- 11.45	NA	1.000
7423.6250	60.06	**Pk**	6.55	36.82	47.24	0.00	56.18	H	1.00	253.0	NA	- 17.82	1.000
7423.6250	50.73	**Av**	6.55	36.82	47.24	0.00	46.85	H	1.00	253.0	- 7.13	NA	1.000
12380.0000	49.11	**Pk**	8.66	38.89	46.84	0.00	49.83	H	1.53	241.0	NA	- 24.17	1.000
12380.0000	36.41	**Av**	8.66	38.89	46.84	0.00	37.13	H	1.53	241.0	- 16.85	NA	1.000
V_High Channel_X2_left antenna_													
4951.0224	53.36	**Pk**	5.26	33.09	39.80	0.00	51.91	V	1.51	72.4	NA	- 22.09	1.000
4951.0224	44.82	**Av**	5.26	33.09	39.80	0.00	43.37	V	1.51	72.4	- 10.61	NA	1.000
7423.6891	56.11	**Pk**	6.55	36.82	47.24	0.00	52.23	V	1.19	98.3	NA	- 21.77	1.000
7423.6891	45.93	**Av**	6.55	36.82	47.24	0.00	42.05	V	1.19	98.3	- 11.93	NA	1.000
12380.0000	49.34	**Pk**	8.66	38.89	46.84	0.00	50.06	V	1.00	0.0	NA	- 23.94	1.000
12380.0000	36.34	**Av**	8.66	38.89	46.84	0.00	37.06	V	1.00	0.0	- 16.92	NA	1.000
H_High Channel_X2_left antenna_													
4951.0301	55.30	**Pk**	5.26	33.09	39.80	0.00	53.85	H	2.66	260.4	NA	- 20.15	1.000
4951.0301	47.50	**Av**	5.26	33.09	39.80	0.00	46.05	H	2.66	260.4	- 7.93	NA	1.000
7423.6410	58.71	**Pk**	6.55	36.82	47.24	0.00	54.83	H	2.51	123.1	NA	- 19.17	1.000
7423.6410	49.04	**Av**	6.55	36.82	47.24	0.00	45.16	H	2.51	123.1	- 8.82	NA	1.000
12380.0000	49.25	**Pk**	8.66	38.89	46.84	0.00	49.97	H	1.65	138.9	NA	- 24.03	1.000
12380.0000	36.35	**Av**	8.66	38.89	46.84	0.00	37.07	H	1.65	138.9	- 16.91	NA	1.000
V_High Channel_X3_left antenna_													
4951.0224	55.66	**Pk**	5.26	33.09	39.80	0.00	54.21	V	1.41	233.4	NA	- 19.79	1.000
4951.0224	46.79	**Av**	5.26	33.09	39.80	0.00	45.34	V	1.41	233.4	- 8.64	NA	1.000
7423.4487	57.08	**Pk**	6.55	36.82	47.24	0.00	53.20	V	1.00	47.9	NA	- 20.80	1.000
7423.4487	46.20	**Av**	6.55	36.82	47.24	0.00	42.32	V	1.00	47.9	- 11.66	NA	1.000
12380.0000	48.96	**Pk**	8.66	38.89	46.84	0.00	49.68	V	1.00	0.0	NA	- 24.32	1.000
12380.0000	36.33	**Av**	8.66	38.89	46.84	0.00	37.05	V	1.00	0.0	- 16.93	NA	1.000
H_High Channel_X3_left antenna_													
4951.0224	53.42	**Pk**	5.26	33.09	39.80	0.00	51.97	H	1.00	164.4	NA	- 22.03	1.000
4951.0224	44.68	**Av**	5.26	33.09	39.80	0.00	43.23	H	1.00	164.4	- 10.75	NA	1.000
7423.5128	58.53	**Pk**	6.55	36.82	47.24	0.00	54.65	H	1.88	97.6	NA	- 19.35	1.000
7423.5128	49.25	**Av**	6.55	36.82	47.24	0.00	45.37	H	1.88	97.6	- 8.61	NA	1.000
12380.0000	49.47	**Pk**	8.66	38.89	46.84	0.00	50.19	H	1.61	122.5	NA	- 23.81	1.000
12380.0000	36.35	**Av**	8.66	38.89	46.84	0.00	37.07	H	1.61	122.5	- 16.91	NA	1.000
V_Low Channel_X2_Right Antenna_													
4811.0286	50.42	**Pk**	5.18	32.86	38.16	0.00	50.30	V	2.70	310.9	NA	- 23.70	1.000
4811.0286	40.21	**Av**	5.18	32.86	38.16	0.00	40.09	V	2.70	310.9	- 13.89	NA	1.000
12025.0000	51.46	**Pk**	8.48	39.27	47.13	0.00	52.08	V	1.88	254.3	NA	- 21.92	1.000
12025.0000	37.29	**Av**	8.48	39.27	47.13	0.00	37.91	V	1.88	254.3	- 16.07	NA	1.000
H_Low Channel_X2_Right Antenna_													
4811.0287	50.10	**Pk**	5.18	32.86	38.16	0.00	49.98	H	3.62	111.6	NA	- 24.02	1.000
4811.0287	39.64	**Av**	5.18	32.86	38.16	0.00	39.52	H	3.62	111.6	- 14.46	NA	1.000
12025.0000	50.75	**Pk**	8.48	39.27	47.13	0.00	51.37	H	1.44	0.0	NA	- 22.63	1.000
12025.0000	37.34	**Av**	8.48	39.27	47.13	0.00	37.96	H	1.44	0.0	- 16.02	NA	1.000
V_Low Channel_X3_Right Antenna_													
4811.0288	53.83	**Pk**	5.18	32.86	38.16	0.00	53.71	V	2.29	46.0	NA	- 20.29	1.000
4811.0288	41.13	**Av**	5.18	32.86	38.16	0.00	41.01	V	2.29	46.0	- 12.97	NA	1.000
12027.1955	50.59	**Pk**	8.48	39.26	47.13	0.00	51.20	V	2.29	46.0	NA	- 22.80	1.000
12027.1955	37.51	**Av**	8.48	39.26	47.13	0.00	38.12	V	2.29	46.0	- 15.86	NA	1.000
H_Low Channel_X3_Right Antenna_													
4811.0288	50.82	**Pk**	5.18	32.86	38.16	0.00	50.70	H	1.00	22.6	NA	- 23.30	1.000
4811.0288	40.31	**Av**	5.18	32.86	38.16	0.00	40.19	H	1.00	22.6	- 13.79	NA	1.000

12025.0000	50.20	**Pk**	8.48	39.27	47.13	0.00	50.82	H	1.69	0.0	NA	- 23.18	1.000
12025.0000	37.25	**Av**	8.48	39.27	47.13	0.00	37.87	H	1.69	0.0	- 16.11	NA	1.000
V_Low Channel_X1_Right Antenna_													
4811.0290	52.41	**Pk**	5.18	32.86	38.16	0.00	52.29	V	2.96	325.0	NA	- 21.71	1.000
4811.0290	43.43	**Av**	5.18	32.86	38.16	0.00	43.31	V	2.96	325.0	- 10.67	NA	1.000
12025.0000	50.50	**Pk**	8.48	39.27	47.13	0.00	51.12	V	2.96	325.0	NA	- 22.88	1.000
12025.0000	37.25	**Av**	8.48	39.27	47.13	0.00	37.87	V	2.96	325.0	- 16.11	NA	1.000
H_Low Channel_X1_Right Antenna_													
12025.0000	50.65	**Pk**	8.48	39.27	47.13	0.00	51.27	H	1.00	259.5	NA	- 22.73	1.000
12025.0000	37.21	**Av**	8.48	39.27	47.13	0.00	37.83	H	1.00	259.5	- 16.15	NA	1.000
4811.0290	48.85	**Pk**	5.18	32.86	38.16	0.00	48.73	H	1.00	337.7	NA	- 25.27	1.000
4811.0290	37.34	**Av**	5.18	32.86	38.16	0.00	37.22	H	1.00	337.7	- 16.76	NA	1.000
V_Middle Channel_X1_right antenna_													
4881.0296	54.04	**Pk**	5.22	32.96	38.98	0.00	53.24	V	1.96	301.3	NA	- 20.76	1.000
4881.0296	45.35	**Av**	5.22	32.96	38.98	0.00	44.55	V	1.96	301.3	- 9.43	NA	1.000
7318.9263	57.55	**Pk**	6.50	36.70	47.41	0.00	53.33	V	1.08	283.5	NA	- 20.67	1.000
7318.9263	48.82	**Av**	6.50	36.70	47.41	0.00	44.60	V	1.08	283.5	- 9.38	NA	1.000
12198.8462	50.06	**Pk**	8.56	39.02	47.08	0.00	50.55	V	1.08	283.5	NA	- 23.45	1.000
12198.8462	37.28	**Av**	8.56	39.02	47.08	0.00	37.77	V	1.08	283.5	- 16.21	NA	1.000
H_Middle Channel_X1_right antenna_													
4881.0300	52.72	**Pk**	5.22	32.96	38.98	0.00	51.92	H	2.86	64.1	NA	- 22.08	1.000
4881.0300	43.56	**Av**	5.22	32.96	38.98	0.00	42.76	H	2.86	64.1	- 11.22	NA	1.000
7318.8459	61.40	**Pk**	6.50	36.70	47.41	0.00	57.18	H	2.61	39.3	NA	- 16.82	1.000
7318.8459	54.13	**Av**	6.50	36.70	47.41	0.00	49.91	H	2.61	39.3	- 4.07	NA	1.000
12198.8500	50.53	**Pk**	8.56	39.02	47.08	0.00	51.02	H	2.61	39.3	NA	- 22.98	1.000
12198.8500	37.26	**Av**	8.56	39.02	47.08	0.00	37.75	H	2.61	39.3	- 16.23	NA	1.000
V_Middle Channel_X2_right antenna_													
4879.0268	52.12	**Pk**	5.22	32.96	38.95	0.00	51.34	V	1.35	307.8	NA	- 22.66	1.000
4879.0268	41.72	**Av**	5.22	32.96	38.95	0.00	40.94	V	1.35	307.8	- 13.04	NA	1.000
7318.9260	59.51	**Pk**	6.50	36.70	47.41	0.00	55.29	V	1.00	323.4	NA	- 18.71	1.000
7318.9260	51.36	**Av**	6.50	36.70	47.41	0.00	47.14	V	1.00	323.4	- 6.84	NA	1.000
12198.8500	51.23	**Pk**	8.56	39.02	47.08	0.00	51.72	V	3.23	275.6	NA	- 22.28	1.000
12198.8500	37.06	**Av**	8.56	39.02	47.08	0.00	37.55	V	3.23	275.6	- 16.43	NA	1.000
H_Middle Channel_X2_right antenna_													
4881.0286	52.29	**Pk**	5.22	32.96	38.98	0.00	51.49	H	3.19	103.8	NA	- 22.51	1.000
4881.0286	42.94	**Av**	5.22	32.96	38.98	0.00	42.14	H	3.19	103.8	- 11.84	NA	1.000
7318.9260	60.71	**Pk**	6.50	36.70	47.41	0.00	56.49	H	1.56	291.6	NA	- 17.51	1.000
7318.9260	53.32	**Av**	6.50	36.70	47.41	0.00	49.10	H	1.56	291.6	- 4.88	NA	1.000
12197.2795	50.54	**Pk**	8.56	39.02	47.08	0.00	51.03	H	1.56	291.6	NA	- 22.97	1.000
12197.2795	37.46	**Av**	8.56	39.02	47.08	0.00	37.95	H	1.56	291.6	- 16.03	NA	1.000
V_Middle Channel_X3_right antenna_													
4881.0302	53.75	**Pk**	5.22	32.96	38.98	0.00	52.95	V	2.76	58.4	NA	- 21.05	1.000
4881.0302	45.09	**Av**	5.22	32.96	38.98	0.00	44.29	V	2.76	58.4	- 9.69	NA	1.000
7318.9260	57.60	**Pk**	6.50	36.70	47.41	0.00	53.38	V	1.04	216.2	NA	- 20.62	1.000
7318.9260	49.29	**Av**	6.50	36.70	47.41	0.00	45.07	V	1.04	216.2	- 8.91	NA	1.000
12198.8500	50.80	**Pk**	8.56	39.02	47.08	0.00	51.29	V	1.04	216.2	NA	- 22.71	1.000
12198.8500	37.26	**Av**	8.56	39.02	47.08	0.00	37.75	V	1.04	216.2	- 16.23	NA	1.000
H_Middle Channel_X3_right antenna_													
4881.0290	53.10	**Pk**	5.22	32.96	38.98	0.00	52.30	H	1.00	25.0	NA	- 21.70	1.000
4881.0290	44.26	**Av**	5.22	32.96	38.98	0.00	43.46	H	1.00	25.0	- 10.52	NA	1.000
7318.9260	58.15	**Pk**	6.50	36.70	47.41	0.00	53.93	H	1.06	286.1	NA	- 20.07	1.000

7318.9260	50.25	**Av**	6.50	36.70	47.41	0.00	46.03	H	1.06	286.1	- 7.95	NA	1.000
12198.8500	50.11	**Pk**	8.56	39.02	47.08	0.00	50.60	H	1.00	0.0	NA	- 23.40	1.000
12198.8500	37.16	**Av**	8.56	39.02	47.08	0.00	37.65	H	1.00	0.0	- 16.33	NA	1.000
V_High Channel_X1_right antenna_													
4951.0290	56.60	**Pk**	5.26	33.09	39.80	0.00	55.15	V	2.12	302.4	NA	- 18.85	1.000
4951.0290	46.31	**Av**	5.26	33.09	39.80	0.00	44.86	V	2.12	302.4	- 9.12	NA	1.000
7426.5385	57.63	**Pk**	6.55	36.81	47.24	0.00	53.75	V	1.06	272.0	NA	- 20.25	1.000
7426.5385	46.39	**Av**	6.55	36.81	47.24	0.00	42.51	V	1.06	272.0	- 11.47	NA	1.000
12375.0000	52.69	**Pk**	8.66	38.89	46.84	0.00	53.40	V	1.00	359.9	NA	- 20.60	1.000
12375.0000	39.99	**Av**	8.66	38.89	46.84	0.00	40.70	V	1.00	359.9	- 13.28	NA	1.000
H_High Channel_X1_right antenna_													
4951.0290	55.74	**Pk**	5.26	33.09	39.80	0.00	54.29	H	2.82	310.1	NA	- 19.71	1.000
4951.0290	44.79	**Av**	5.26	33.09	39.80	0.00	43.34	H	2.82	310.1	- 10.64	NA	1.000
7426.5390	60.18	**Pk**	6.55	36.81	47.24	0.00	56.30	H	1.09	255.8	NA	- 17.70	1.000
7426.5390	50.40	**Av**	6.55	36.81	47.24	0.00	46.52	H	1.09	255.8	- 7.46	NA	1.000
12375.0000	52.73	**Pk**	8.66	38.89	46.84	0.00	53.44	H	1.00	0.0	NA	- 20.56	1.000
12375.0000	39.96	**Av**	8.66	38.89	46.84	0.00	40.67	H	1.00	0.0	- 13.31	NA	1.000
V_High Channel_X2_right antenna_													
4951.0290	55.03	**Pk**	5.26	33.09	39.80	0.00	53.58	V	3.32	303.5	NA	- 20.42	1.000
4951.0290	43.46	**Av**	5.26	33.09	39.80	0.00	42.01	V	3.32	303.5	- 11.97	NA	1.000
7423.9268	58.28	**Pk**	6.55	36.82	47.24	0.00	54.40	V	1.81	309.1	NA	- 19.60	1.000
7423.9268	48.24	**Av**	6.55	36.82	47.24	0.00	44.36	V	1.81	309.1	- 9.62	NA	1.000
12375.0000	52.87	**Pk**	8.66	38.89	46.84	0.00	53.58	V	1.00	359.9	NA	- 20.42	1.000
12375.0000	39.97	**Av**	8.66	38.89	46.84	0.00	40.68	V	1.00	359.9	- 13.30	NA	1.000
H_High Channel_X2_right antenna_													
4951.0290	56.16	**Pk**	5.26	33.09	39.80	0.00	54.71	H	3.22	105.8	NA	- 19.29	1.000
4951.0290	45.63	**Av**	5.26	33.09	39.80	0.00	44.18	H	3.22	105.8	- 9.80	NA	1.000
7423.5582	60.44	**Pk**	6.55	36.82	47.24	0.00	56.56	H	1.27	291.6	NA	- 17.44	1.000
7423.5582	50.21	**Av**	6.55	36.82	47.24	0.00	46.33	H	1.27	291.6	- 7.65	NA	1.000
12375.0000	52.75	**Pk**	8.66	38.89	46.84	0.00	53.46	H	1.27	291.6	NA	- 20.54	1.000
12375.0000	39.98	**Av**	8.66	38.89	46.84	0.00	40.69	H	1.27	291.6	- 13.29	NA	1.000
V_High Channel_X3_right antenna_													
4949.0258	55.61	**Pk**	5.26	33.09	39.78	0.00	54.18	V	1.98	58.6	NA	- 19.82	1.000
4949.0258	47.85	**Av**	5.26	33.09	39.78	0.00	46.42	V	1.98	58.6	- 7.56	NA	1.000
7423.5264	58.37	**Pk**	6.55	36.82	47.24	0.00	54.49	V	1.57	305.2	NA	- 19.51	1.000
7423.5264	49.56	**Av**	6.55	36.82	47.24	0.00	45.68	V	1.57	305.2	- 8.30	NA	1.000
12375.0000	49.45	**Pk**	8.66	38.89	46.84	0.00	50.16	V	1.00	359.9	NA	- 23.84	1.000
12375.0000	36.55	**Av**	8.66	38.89	46.84	0.00	37.26	V	1.00	359.9	- 16.72	NA	1.000
H_High Channel_X3_right antenna_													
4949.0258	53.63	**Pk**	5.26	33.09	39.78	0.00	52.20	H	2.61	18.8	NA	- 21.80	1.000
4949.0258	45.18	**Av**	5.26	33.09	39.78	0.00	43.75	H	2.61	18.8	- 10.23	NA	1.000
7423.5259	57.71	**Pk**	6.55	36.82	47.24	0.00	53.83	H	3.42	293.4	NA	- 20.17	1.000
7423.5259	48.66	**Av**	6.55	36.82	47.24	0.00	44.78	H	3.42	293.4	- 9.20	NA	1.000
12375.0000	50.45	**Pk**	8.66	38.89	46.84	0.00	51.16	H	3.42	293.4	NA	- 22.84	1.000
12375.0000	36.53	**Av**	8.66	38.89	46.84	0.00	37.24	H	3.42	293.4	- 16.74	NA	1.000

Notes:

1) The highest signals – as determined from pre-scan plots – were fully-maximized and measured.

Deviations, Additions, or Exclusions: None

9.10 Test Data:

Tx Spurious Radiated Emissions – Band Edge

Test Report #:	**101877809DEN-001**	Test Area:	CC1 Radiated	Temperature:	23 °C
Test Method:	FCC 15.209/ 15.205/ 15.35(b)	Test Date:	9/22/2015-9/23-2015	Relative Humidity:	36.8 %
EUT Model #:	AMBR#100645	EUT Power:	120VAC/60Hz	Air Pressure:	83.5 kPa
EUT Serial #:	EMC1				
Manufacturer:	Amatis Controls, LLC.				
EUT Description:	The device translates between 802.3 (Ethernet) and 802.15.4 networks.				
Notes:	Product continuously transmitting during all testing – worst-case modulation/data				

Level Key
Pk – Peak
Qp – Quasi Peak
Av - Average

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	POL	HGT	AZ	DELTA1	DELTA2	RBW
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.35(b)> 1GH z_Pk+20dB from Av	(MHz)
H_Low Channel_X1_left antenna_													
2390.0000	55.61	**Pk**	3.56	28.18	38.04	9.60	58.91	H	3.25	201.7	NA	- 15.09	1.000
2390.0000	43.27	**Av**	3.56	28.18	38.04	9.60	46.57	H	3.25	201.7	- 7.41	NA	1.000
V_Low Channel_X1_left antenna_													
2390.0000	57.19	**Pk**	3.56	28.18	38.04	9.60	60.49	V	1.75	235.2	NA	- 13.51	1.000
2390.0000	45.71	**Av**	3.56	28.18	38.04	9.60	49.01	V	1.75	235.2	- 4.97	NA	1.000
H_High Channel_X1_left antenna_													
2483.5000	58.39	**Pk**	3.63	28.38	38.04	9.60	61.97	H	3.06	94.4	NA	- 12.03	1.000
2483.5000	48.04	**Av**	3.63	28.38	38.04	9.60	51.62	H	3.06	94.4	- 2.36	NA	1.000
V_High Channel_X1_left antenna_													
2483.5000	59.07	**Pk**	3.63	28.38	38.04	9.60	62.65	V	2.56	208.0	NA	- 11.35	1.000
2483.5000	48.83	**Av**	3.63	28.38	38.04	9.60	52.41	V	2.56	208.0	- 1.57	NA	1.000
V_High Channel_X2_left antenna_													
2483.5000	57.85	**Pk**	3.63	28.38	38.04	9.60	61.43	V	1.84	242.4	NA	- 12.57	1.000
2483.5000	47.32	**Av**	3.63	28.38	38.04	9.60	50.90	V	1.84	242.4	- 3.08	NA	1.000
H_High Channel_X2_left antenna_													
2483.5000	60.10	**Pk**	3.63	28.38	38.04	9.60	63.68	H	1.00	204.5	NA	- 10.32	1.000
2483.5000	49.71	**Av**	3.63	28.38	38.04	9.60	53.29	H	1.00	204.5	- 0.69	NA	1.000
V_High Channel_X3_left antenna_													
2483.5000	57.16	**Pk**	3.63	28.38	38.04	9.60	60.74	V	1.87	34.3	NA	- 13.26	1.000
2483.5000	46.06	**Av**	3.63	28.38	38.04	9.60	49.64	V	1.87	34.3	- 4.34	NA	1.000
H_High Channel_X3_left antenna_													
2483.5000	59.70	**Pk**	3.63	28.38	38.04	9.60	63.28	H	1.50	337.6	NA	- 10.72	1.000
2483.5000	49.38	**Av**	3.63	28.38	38.04	9.60	52.96	H	1.50	337.6	- 1.02	NA	1.000
V_Low Channel_X2_left antenna_													
2390.0000	56.23	**Pk**	3.56	28.18	38.04	9.60	59.53	V	2.35	130.0	NA	- 14.47	1.000
2390.0000	43.28	**Av**	3.56	28.18	38.04	9.60	46.58	V	2.35	130.0	- 7.40	NA	1.000
H_Low Channel_X2_left antenna_													
2390.0000	54.56	**Pk**	3.56	28.18	38.04	9.60	57.86	H	3.03	177.2	NA	- 16.14	1.000

2390.0000	43.98	**Av**	3.56	28.18	38.04	9.60	47.28	H	3.03	177.2	- 6.70	NA	1.000
V_Low Channel_X3_left antenna_													
2390.0000	55.79	**Pk**	3.56	28.18	38.04	9.60	59.09	V	1.39	163.6	NA	- 14.91	1.000
2390.0000	41.11	**Av**	3.56	28.18	38.04	9.60	44.41	V	1.39	163.6	- 9.57	NA	1.000
H_Low Channel_X3_left antenna_													
2390.0000	55.74	**Pk**	3.56	28.18	38.04	9.60	59.04	H	1.99	269.1	NA	- 14.96	1.000
2390.0000	44.54	**Av**	3.56	28.18	38.04	9.60	47.84	H	1.99	269.1	- 6.14	NA	1.000
V_Low Channel_X1_right antenna_													
2390.0000	55.94	**Pk**	3.56	28.18	38.04	9.60	59.24	V	1.58	322.8	NA	- 14.76	1.000
2390.0000	42.97	**Av**	3.56	28.18	38.04	9.60	46.27	V	1.58	322.8	- 7.71	NA	1.000
H_Low Channel__X1_right antenna_													
2390.0000	58.37	**Pk**	3.56	28.18	38.04	9.60	61.67	H	2.87	38.2	NA	- 12.33	1.000
2390.0000	42.74	**Av**	3.56	28.18	38.04	9.60	46.04	H	2.87	38.2	- 7.94	NA	1.000
V_Low Channel_X3_right antenna_													
2390.0000	55.19	**Pk**	3.56	28.18	38.04	9.60	58.49	V	1.26	147.3	NA	- 15.51	1.000
2390.0000	40.91	**Av**	3.56	28.18	38.04	9.60	44.21	V	1.26	147.3	- 9.77	NA	1.000
H_Low Channel__X3_right antenna_													
2390.0000	54.47	**Pk**	3.56	28.18	38.04	9.60	57.77	H	1.00	22.4	NA	- 16.23	1.000
2390.0000	41.26	**Av**	3.56	28.18	38.04	9.60	44.56	H	1.00	22.4	- 9.42	NA	1.000
V_Low Channel__X2_right antenna_													
2390.0000	55.99	**Pk**	3.56	28.18	38.04	9.60	59.29	V	1.45	58.4	NA	- 14.71	1.000
2390.0000	43.60	**Av**	3.56	28.18	38.04	9.60	46.90	V	1.45	58.4	- 7.08	NA	1.000
H_Low Channel__X2_right antenna_													
2390.0000	56.57	**Pk**	3.56	28.18	38.04	9.60	59.87	H	2.68	357.1	NA	- 14.13	1.000
2390.0000	43.76	**Av**	3.56	28.18	38.04	9.60	47.06	H	2.68	357.1	- 6.92	NA	1.000
V_High Channel_X3_right antenna_													
2483.5000	55.62	**Pk**	3.63	28.38	38.04	9.60	59.20	V	1.00	129.1	NA	- 14.80	1.000
2483.5000	43.98	**Av**	3.63	28.38	38.04	9.60	47.56	V	1.00	129.1	- 6.42	NA	1.000
H_High Channel_X3_right antenna_													
2483.5000	57.78	**Pk**	3.63	28.38	38.04	9.60	61.36	H	1.00	324.4	NA	- 12.64	1.000
2483.5000	46.56	**Av**	3.63	28.38	38.04	9.60	50.14	H	1.00	324.4	- 3.84	NA	1.000
V_High Channel_X2_right antenna_													
2483.5000	60.57	**Pk**	3.63	28.38	38.04	9.60	64.15	V	1.00	49.3	NA	- 9.85	1.000
2483.5000	48.34	**Av**	3.63	28.38	38.04	9.60	51.92	V	1.00	49.3	- 2.06	NA	1.000
H_High Channel_X2_right antenna_													
2483.5000	58.20	**Pk**	3.63	28.38	38.04	9.60	61.78	H	2.27	355.2	NA	- 12.22	1.000
2483.5000	47.39	**Av**	3.63	28.38	38.04	9.60	50.97	H	2.27	355.2	- 3.01	NA	1.000
H_High Channel_X1_right antenna_													
2483.5000	57.85	**Pk**	3.63	28.38	38.04	9.60	61.43	H	3.71	0.0	NA	- 12.57	1.000
2483.5000	47.24	**Av**	3.63	28.38	38.04	9.60	50.82	H	3.71	0.0	- 3.16	NA	1.000
V_High Channel_X1_right antenna_													
2483.5000	58.49	**Pk**	3.63	28.38	38.04	9.60	62.07	V	1.41	348.3	NA	- 11.93	1.000
2483.5000	47.73	**Av**	3.63	28.38	38.04	9.60	51.31	V	1.41	348.3	- 2.67	NA	1.000

Notes:

1) The highest signals – as determined from pre-scan plots – were fully-maximized and measured.
2) The notch filter was <u>not used</u> during band edge plots/measurements.

Deviations, Additions, or Exclusions: None

10 Power Spectral Density – PSD

10.1 Method:

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from FCC 15.247 or RSS-247.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

10.2 Test Requirement/Specification:

For the band 2400 – 2483.5 GHz within digitally modulated systems (DTS) products, the power spectral density conducted from the intentional radiator to the antenna should not be greater than +8 dBm in any 3 kHz to 100kHz band during any time interval of continuous transmission.

Such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density.

- FCC 15.247(e)
- RSS-247 5.2(2)

10.3 Test Equipment Used:

Asset ID	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-206	RF Conducted Port Cable	-----	True Blue	14-11-401	12/23/2014	12/23/2015
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBU	VBU

10.4 Results:

The sample tested was found to comply.

10.5 Test Summary:

Fundamental	Conducted port Right Antenna					
Frequency Range:	☐ 902-928MHz	☒ 2400-2483.5MHz		☐ 5725-5850MHz		
Low Frequency MHz	**Measured Power (dBm)**	**Correction Cable/Atten (dB)**	**Final Corrected (dBm)**	**Standard Limit (dBm)**	**Limit Reduction (dB)**	**Margin (dB)**
2405	0.09	2.5	2.59	8	NA	5.41
Mid Frequency MHz						
2440	-0.97	2.5	1.43	8	NA	6.57
High Frequency MHz						
2475	-0.8	2.6	1.8	8	NA	6.2
Fundamental	**Conducted port Left Antenna**					
Low Frequency MHz	**Measured Power (dBm)**	**Correction Cable/Atten (dB)**	**Final Corrected (dBm)**	**Standard Limit (dBm)**	**Limit Reduction (dB)**	**Margin (dB)**
2405	3.11	2.5	5.61	8	NA	2.39
Mid Frequency MHz						
2440	2.38	2.5	4.88	8	NA	3.12
High Frequency MHz						
2475	3.49	2.6	6.09	8	NA	1.91
RBW:	☒ 3kHz	☐ 10kHz	☐ 30kHz	☐ 100kHz		
VBW:	☒ 10kHz	☐ 30kHz	☐ 100kHz	☐ 300kHz		

10.6 Test Method:

- ANSI C63.10:2013, Section 11.10

10.7 Notes:

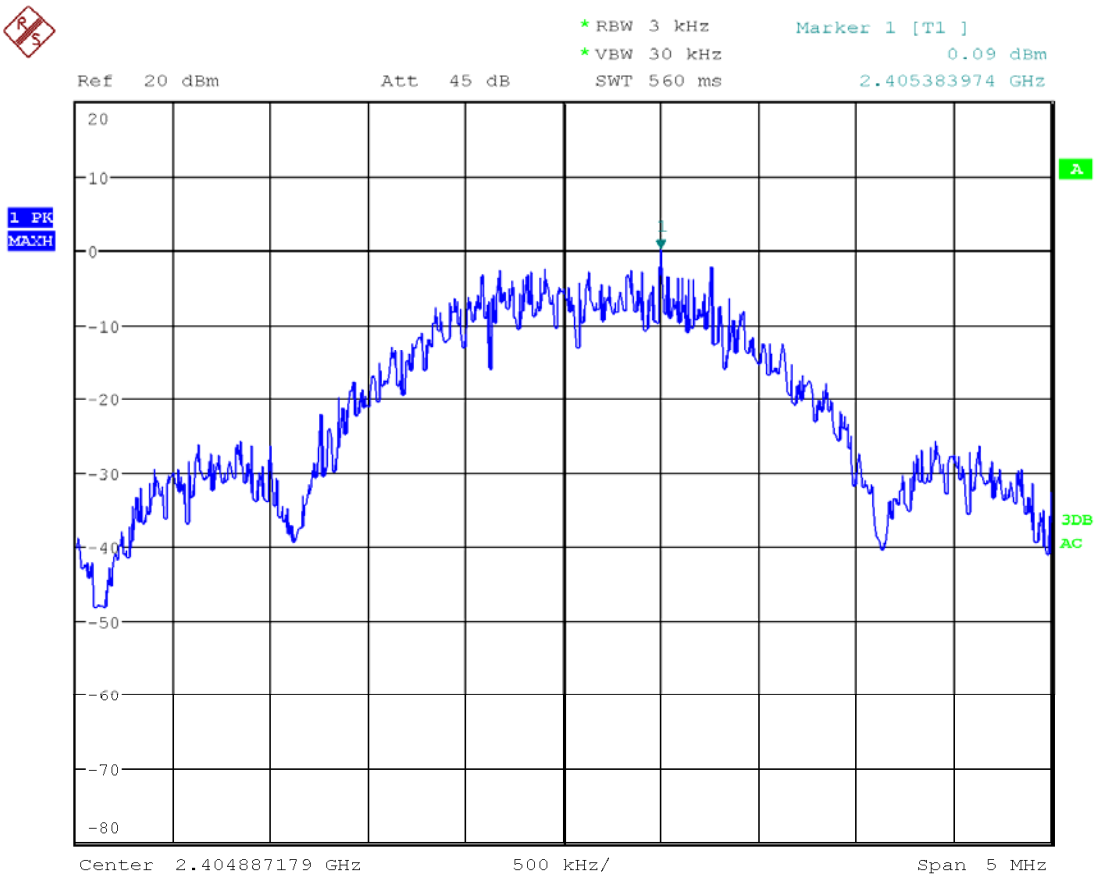
2. The limit for RSS-247 is identical to the limit for FCC 15.247.

10.8 Setup Photographs: Conducted Port

10.9 Plots:

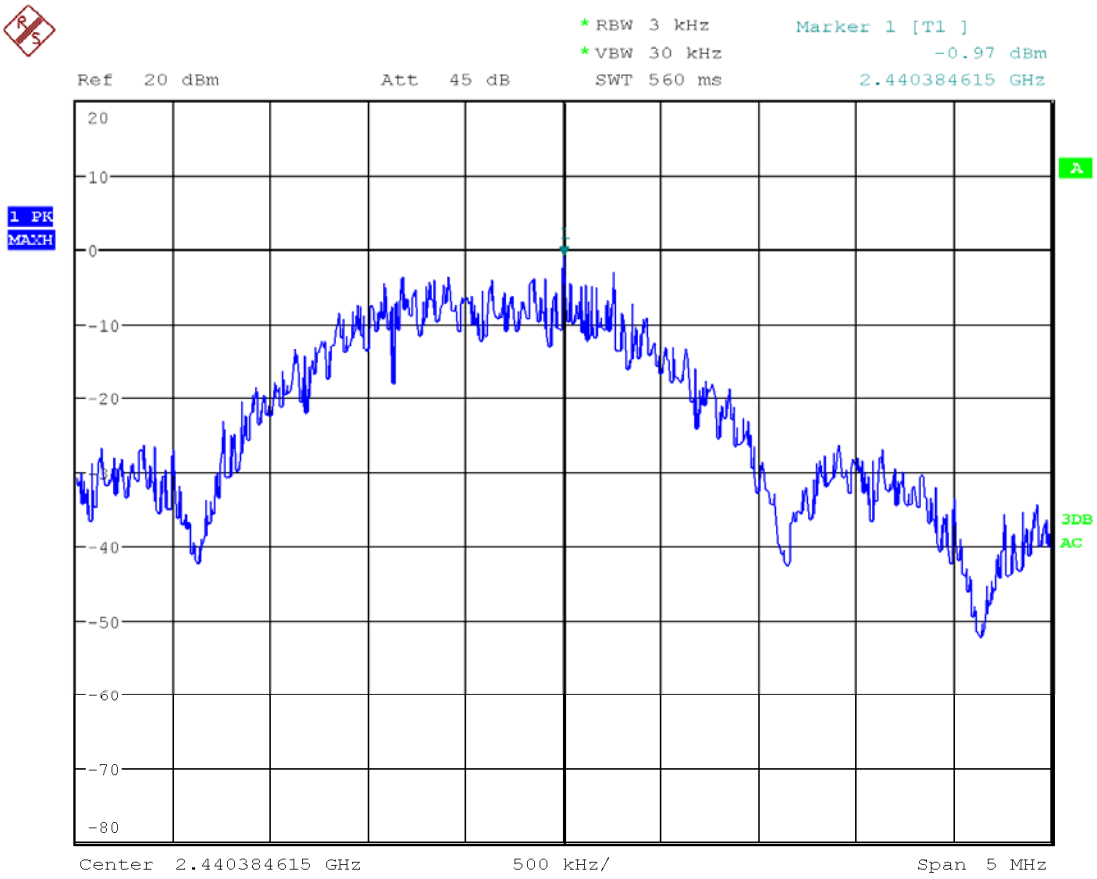
Right Antenna

Low Channel



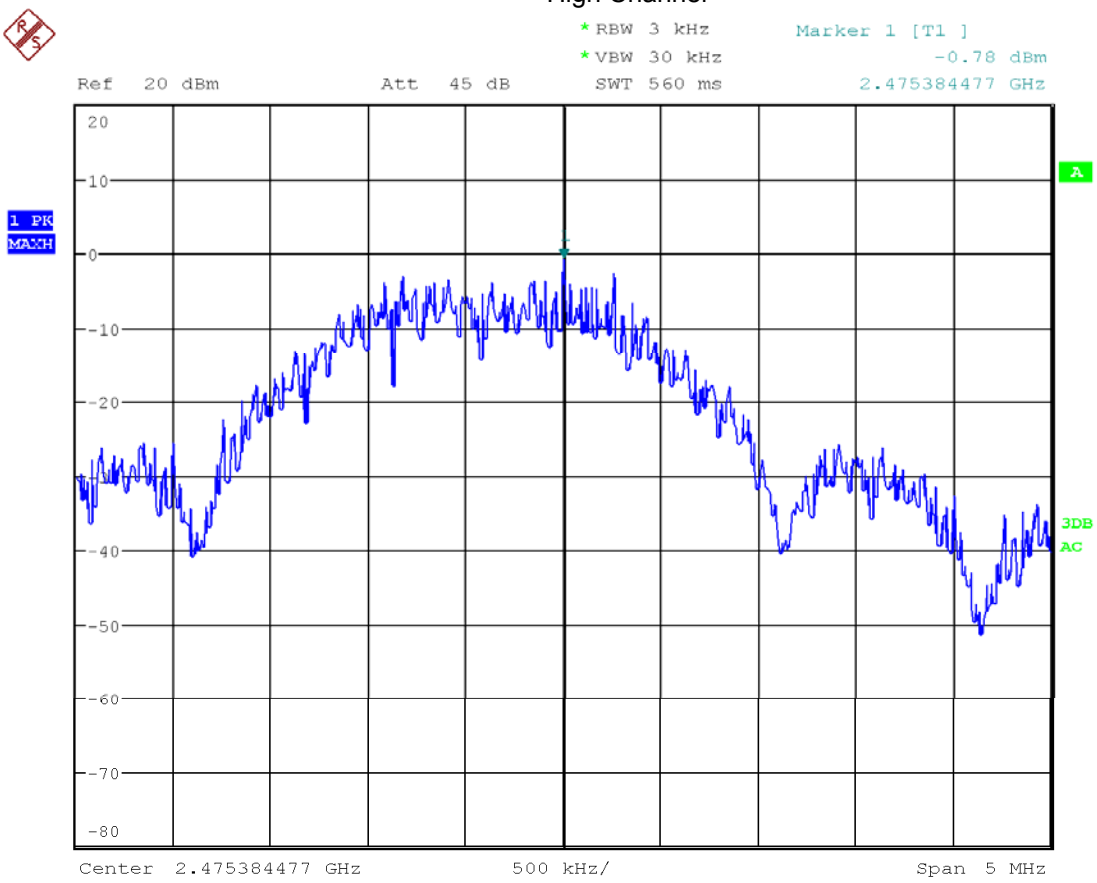
Date: 23.SEP.2015 09:53:53

Mid Channel



Date: 23.SEP.2015 09:59:10

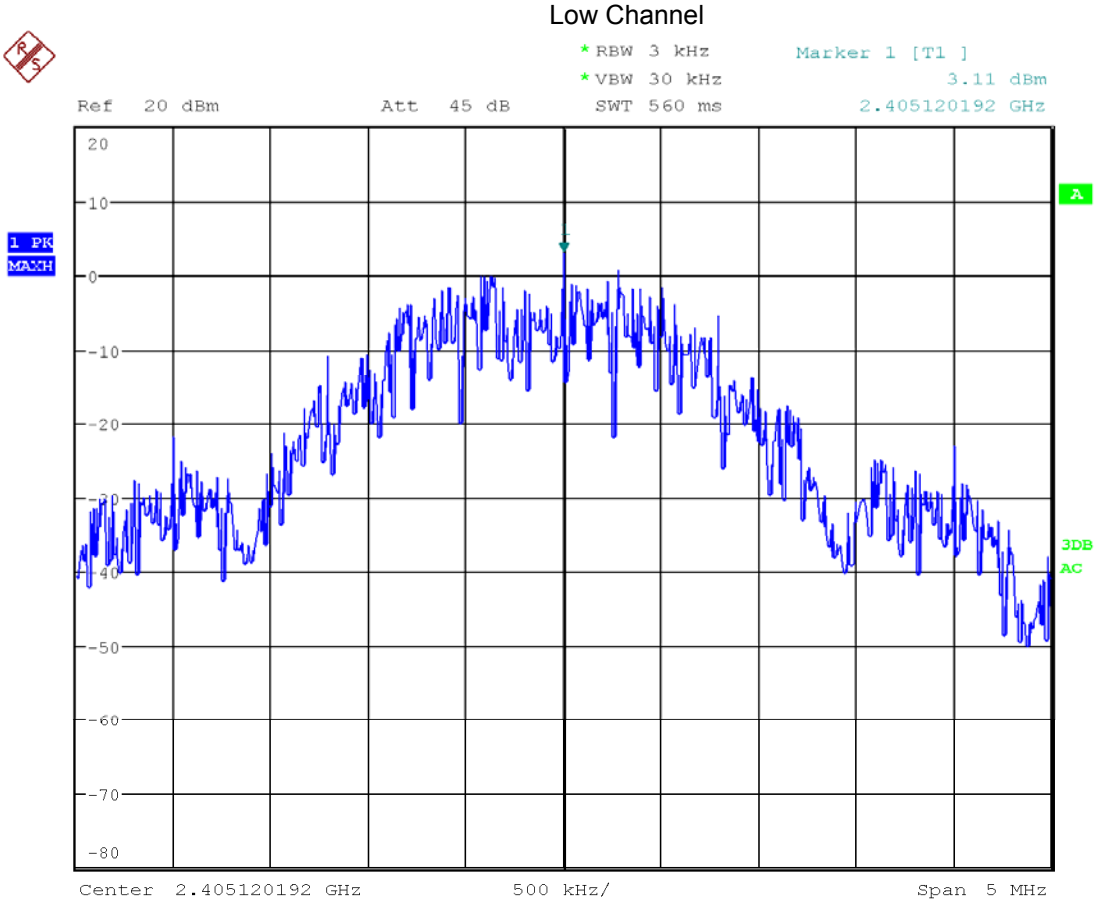
High Channel



Date: 23.SEP.2015 10:07:40

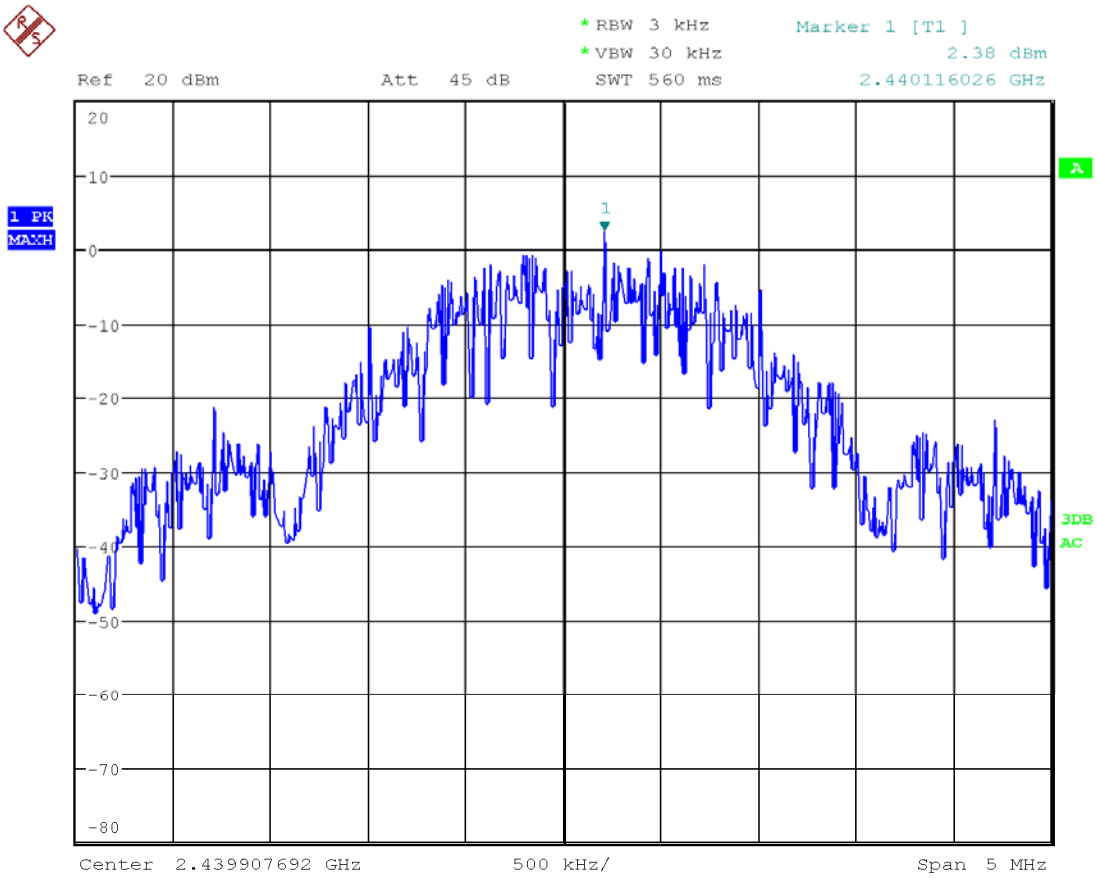
Left Antenna

Low Channel

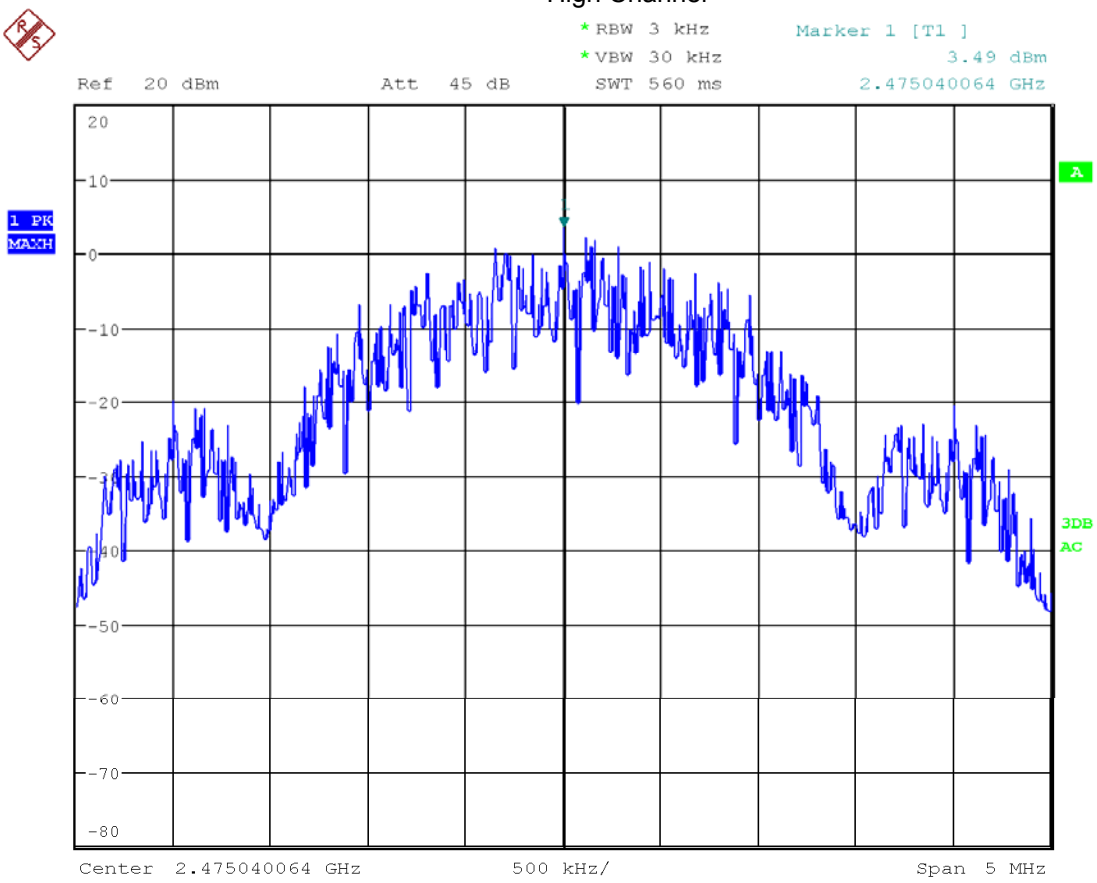


Date: 23.SEP.2015 14:43:40

Mid Channel


RBW 3 kHz
VBW 30 kHz
SWT 560 ms
Marker 1 [T1]
2.38 dBm
2.440116026 GHz
Ref 20 dBm
Att 45 dB
1 PK
MAXH
A
3DB
AC
Center 2.439907692 GHz
500 kHz/
Span 5 MHz
Date: 23.SEP.2015 14:40:21

High Channel



Date: 23.SEP.2015 14:30:21

11 Radiated Emissions (Digital Part of Receiver + Rx Spurious)

11.1 Method:

Unless otherwise stated no deviations were made from FCC Part 15.109 – Class B.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	8447F	3113A05545	5/19/2015	5/18/2016
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	12/29/2014	12/29/2015
DEN-073	EMI Receiver	ROHDE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
DEN-203	Radiated Cable (1)	Teledyne	90-206-072	14-11-402	12/23/2014	12/23/2015
DEN-204	Radiated Cable (2)	Teledyne	90-206-072	14-11-401	12/23/2014	12/23/2015
DEN-205	Radiated Cable (3)	Teledyne	14-11-401	14-11-401	12/23/2014	12/23/2015
18887	Horn Antenna 1-18GHz	EMCO	3115	9205-3886	03/26/2015	03/26/2016
18906	Amplifier	Mini-Circuits Lab	ZHL-42	N052792-2	05/01/2015	05/01/2016

11.3 Test Requirement/ Specification:

Receive Mode - the product must pass Unintentional Radiated Emissions – Class B, per the limits specified in FCC 15.109(a). Unwanted emissions below 1GHz must comply with the general field strength limits defined in FCC Part 15.109, when measured with a quasi-peak detector. Unwanted emissions above 1GHz are measured with an average detector.

11.4 Test Procedure:

The Resolution Bandwidth is 120 kHz for frequencies 30 MHz -1000 MHz and 1 MHz for frequencies above 1000 MHz.

The EUT is placed on a plastic turntable that is 80 cm in height. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables are manipulated to produce worst-case emissions. The signal is maximized by rotating the turntable through a 360º rotation. The antenna height is varied from 1-4 meters. Both vertical and horizontal antenna configurations are utilized in the testing.

Radiated emissions are taken at 3-meter antenna-to-product test distance for all measurements.

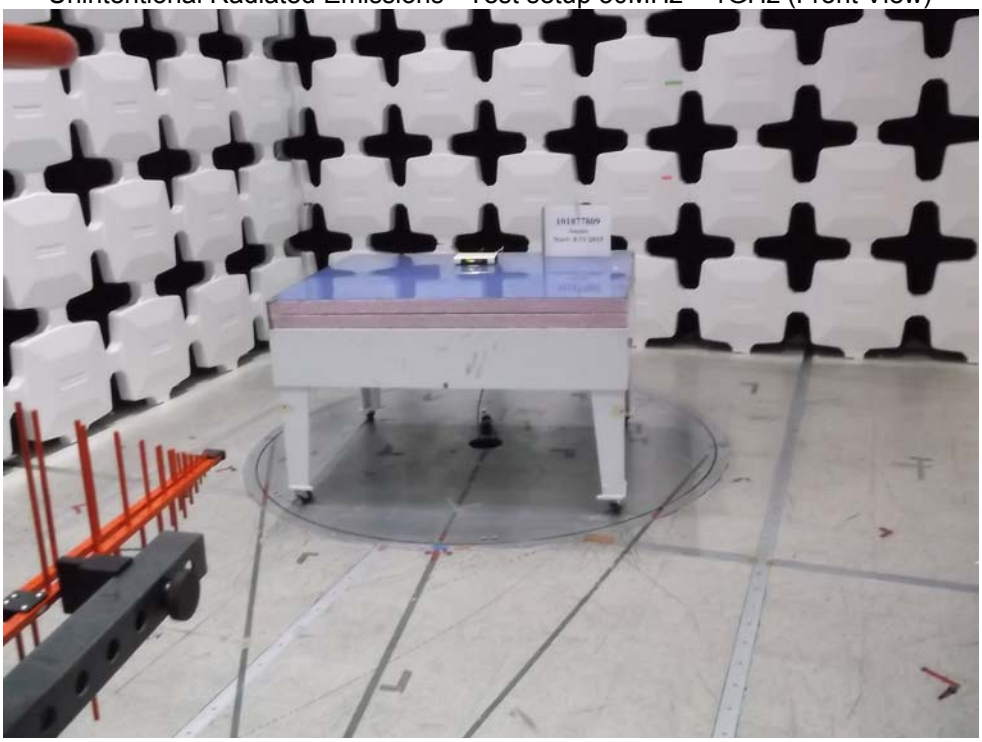
Data is included for the worst-case configuration - the configuration which resulted in the highest radiated emission levels.

11.5 Test Results:

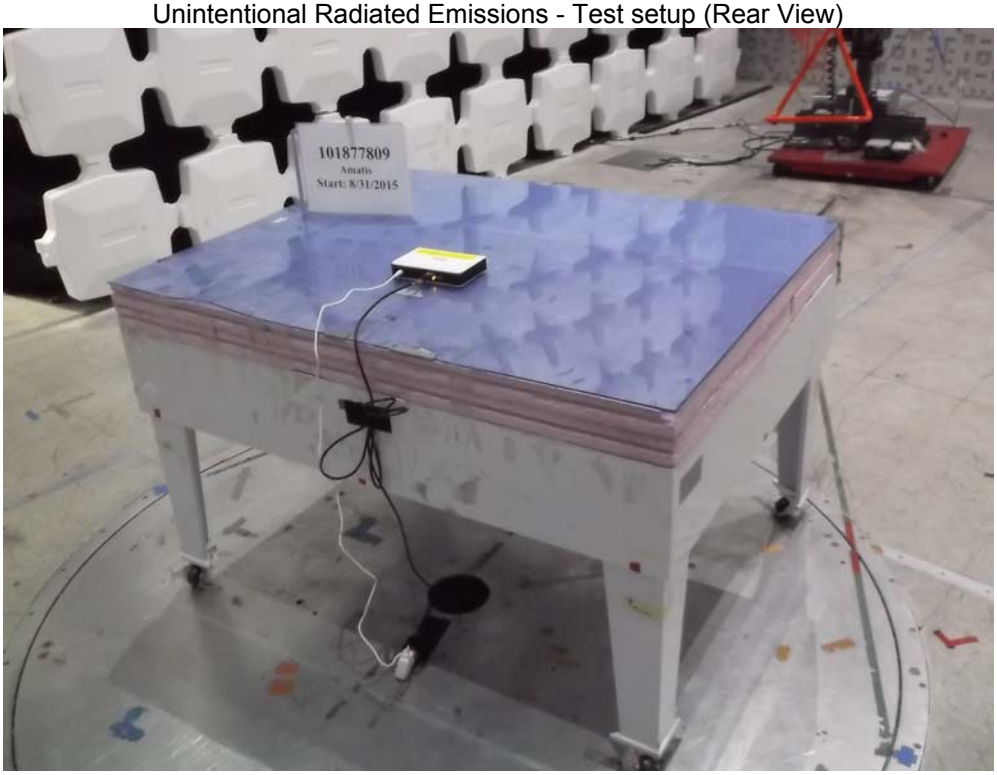
The sample tested was found to Comply

11.6 Setup Photographs:

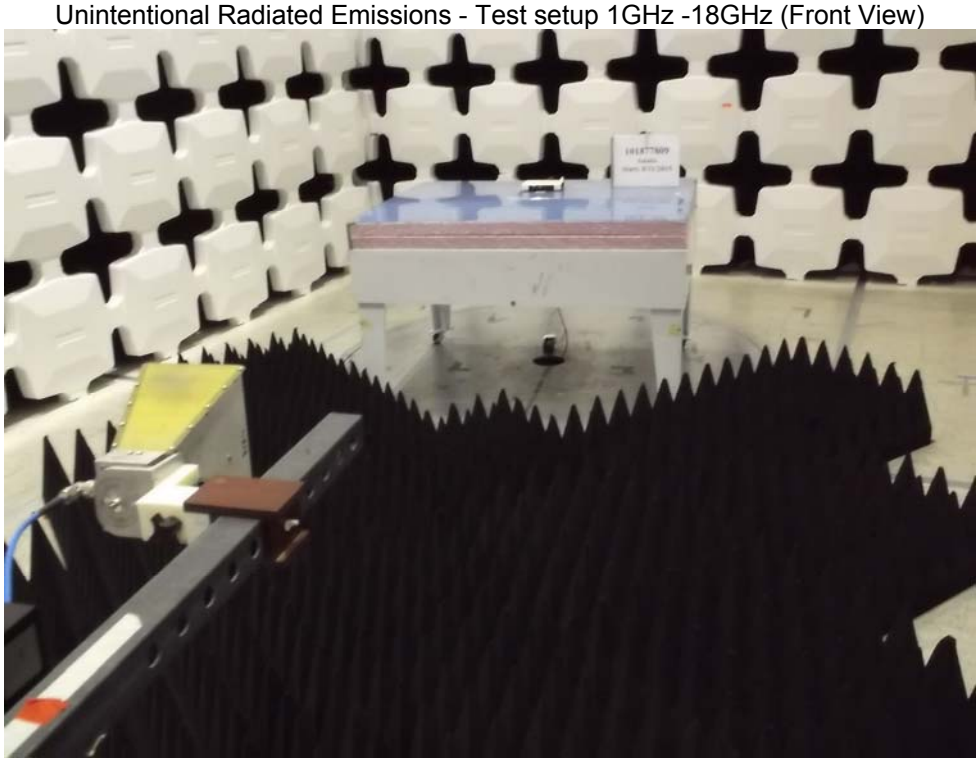
Unintentional Radiated Emissions - Test setup 30MHz – 1GHz (Front View)



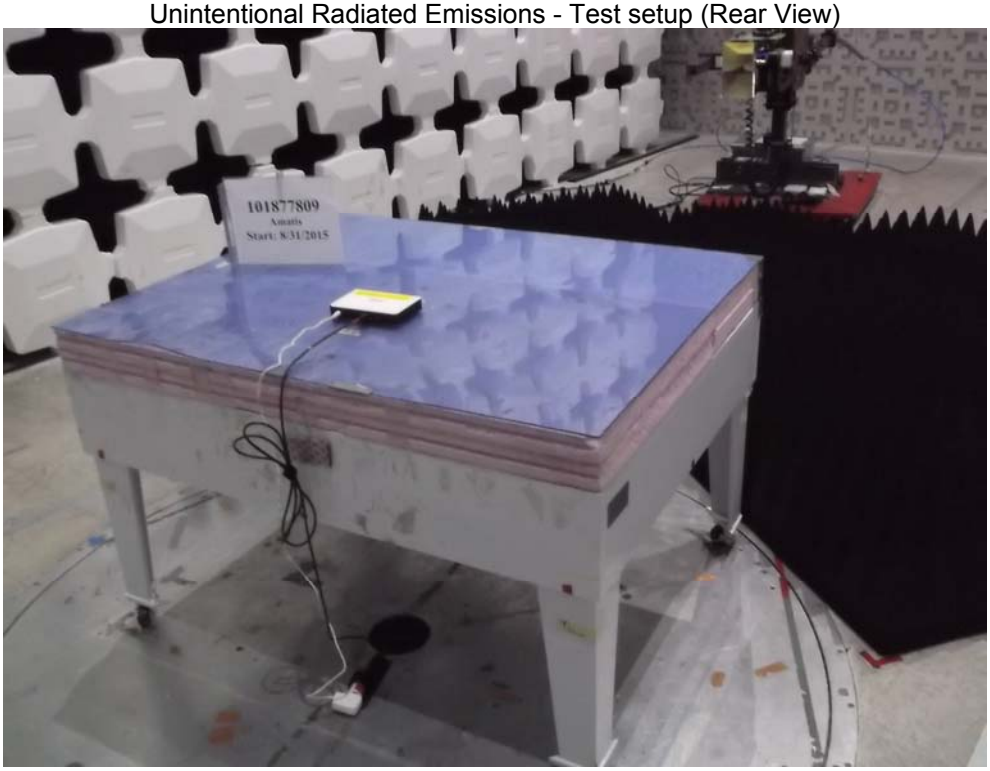
Unintentional Radiated Emissions - Test setup (Rear View)



Unintentional Radiated Emissions - Test setup 1GHz -18GHz (Front View)

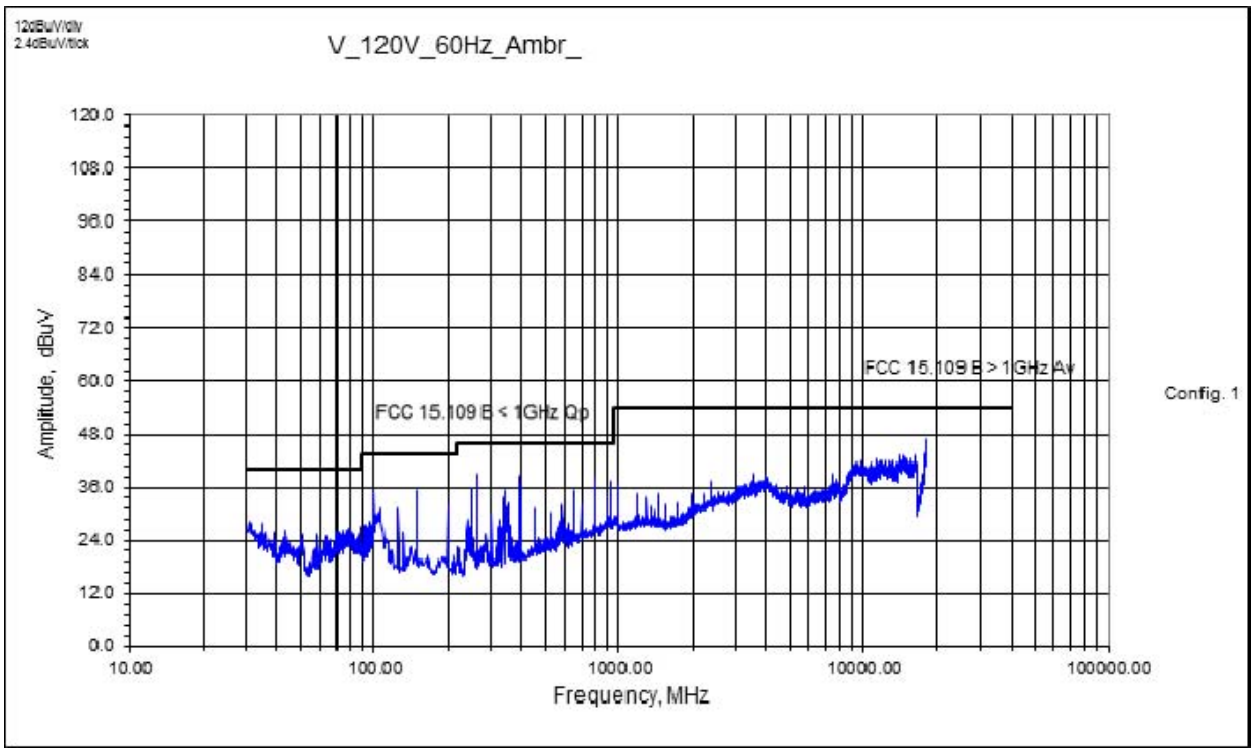


Unintentional Radiated Emissions - Test setup (Rear View)

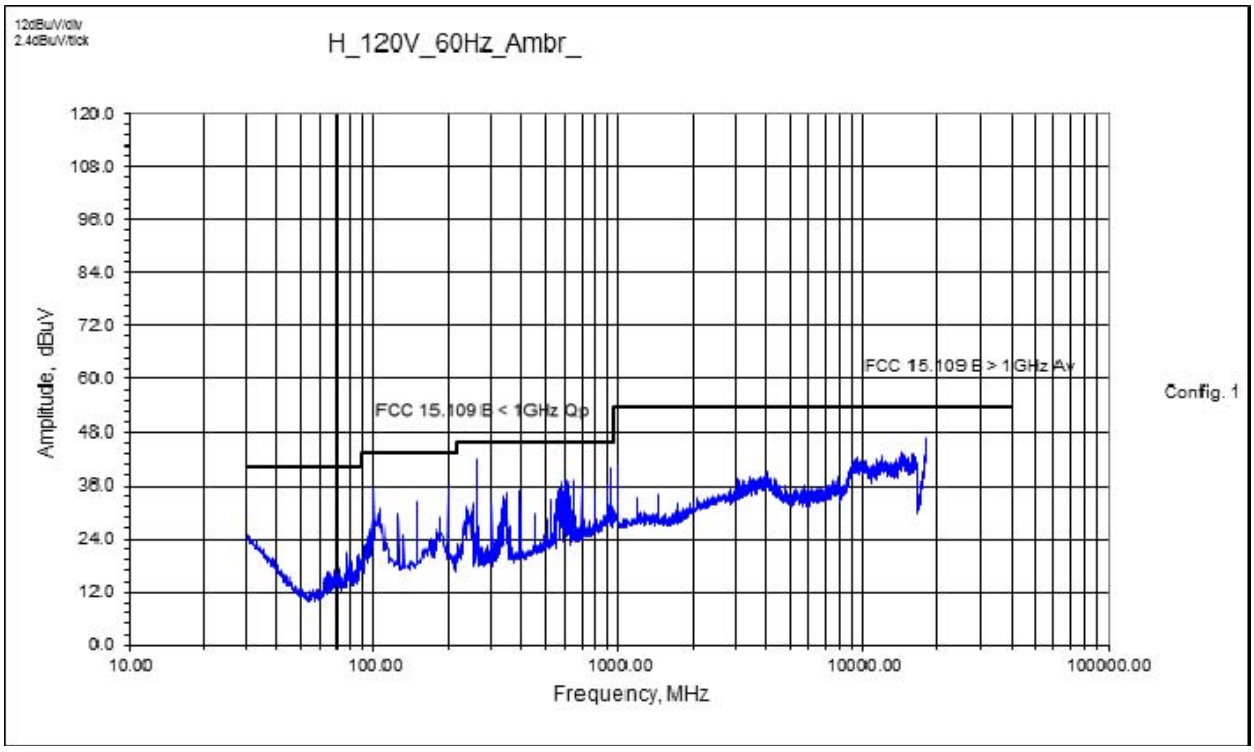


11.7 Plots:

Vertical



Horizontal



11.8 Test Data: Radiated Emissions Axis 1 – Horizontal (Product Flat on Table)

Radiated Electromagnetic Emissions

Test Report #:	**101877809DEN-001**	Test Area:	CC1 Radiated	Temperature:	23 °C
Test Method:	FCC 15.209/ 15.205/ 15.35(b)	Test Date:	9/22/2015-9/23-2015	Relative Humidity:	36.8 %
EUT Model #:	AMBR#100645	EUT Power:	120VAC/60Hz	Air Pressure:	83.5 kPa
EUT Serial #:	EMC1				
Manufacturer:	Amatis Controls, LLC.				
EUT Description:	The device translates between 802.3 (Ethernet) and 802.15.4 networks.				
Notes:	Product continuously transmitting during all testing – worst-case modulation/data				

Level Key
Pk – Peak
Qp – Quasi Peak
Av - Average

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	POL	HGT	AZ	DELTA1	RBW
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.109 B < 1GHz Qp	(MHz)
V_120V_60Hz_			Ambr_									
100.0000	51.81	**Qp**	0.72	10.30	27.81	0.00	35.02	V	1.00	359.9	- 8.50	0.120
150.0000	48.55	**Qp**	0.88	12.60	27.57	0.00	34.46	V	1.00	0.0	- 9.06	0.120
249.9987	49.48	**Qp**	1.13	12.00	26.99	0.00	35.62	V	1.00	185.9	- 10.40	0.120
264.2256	50.71	**Qp**	1.17	13.01	26.95	0.00	37.94	V	1.00	278.9	- 8.08	0.120
396.3384	50.68	**Qp**	1.42	15.73	27.62	0.00	40.20	V	1.28	189.3	- 5.82	0.120
799.9961	43.36	**Qp**	2.02	21.60	27.86	0.00	39.11	V	1.16	159.5	- 6.91	0.120
H_120V_60Hz_			Ambr_									
99.9995	51.64	**Qp**	0.72	10.30	27.81	0.00	34.85	H	2.03	270.3	- 8.67	0.120
149.9993	46.88	**Qp**	0.88	12.60	27.57	0.00	32.79	H	1.98	84.2	- 10.73	0.120
199.9990	49.81	**Qp**	1.03	12.20	27.26	0.00	35.78	H	1.68	272.9	- 7.74	0.120
264.2256	55.59	**Qp**	1.17	13.01	26.95	0.00	42.82	H	1.16	93.6	- 3.20	0.120
605.5145	34.71	**Qp**	1.75	18.80	28.28	0.00	26.98	H	1.50	113.5	- 19.04	0.120
924.7885	42.71	**Qp**	2.17	21.92	27.43	0.00	39.37	H	1.01	213.0	- 6.65	0.120

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	POL	HGT	AZ	DELTA1	RBW
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.109 B > 1GHz Av	(MHz)
V_120V_60Hz_			Ambr_									
1189.0165	48.44	**Av**	2.46	24.81	37.71	0.00	38.00	V	2.98	287.4	- 15.98	1.000
1299.9931	41.02	**Av**	2.59	25.12	37.59	0.00	31.14	V	1.07	143.0	- 22.84	1.000
1453.2423	50.60	**Av**	2.73	25.07	37.56	0.00	40.84	V	2.24	71.4	- 13.14	1.000
1549.9923	42.03	**Av**	2.82	25.20	38.17	0.00	31.88	V	2.70	214.4	- 22.10	1.000
1981.6989	44.76	**Av**	3.22	27.10	38.26	0.00	36.83	V	1.42	41.7	- 17.15	1.000
2403.0127	45.96	**Av**	3.57	28.23	38.05	0.00	39.71	V	1.46	257.6	- 14.27	1.000
H_120V_60Hz_			Ambr_									
1189.0229	43.76	**Av**	2.46	24.81	37.71	0.00	33.32	H	1.62	239.9	- 20.66	1.000
1449.9843	38.70	**Av**	2.73	25.06	37.54	0.00	28.95	H	1.00	3.4	- 25.03	1.000
1717.4682	43.39	**Av**	2.97	26.08	39.00	0.00	33.44	H	1.79	183.8	- 20.54	1.000
1956.7465	35.25	**Av**	3.21	27.14	38.44	0.00	27.15	H	1.00	193.5	- 26.83	1.000
2637.8210	35.10	**Av**	3.74	28.83	37.97	0.00	29.69	H	1.00	193.5	- 24.29	1.000
3054.4870	35.13	**Av**	4.05	30.42	37.89	0.00	31.71	H	1.00	193.5	- 22.27	1.000

12 AC Mains Conducted Emissions - Transmitter

12.1 Method

Unless otherwise stated no deviations were made from FCC Part 15.207.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
18896	LISN	SCHWARZBECK	NNLK 8129	8129126	07/20/2015	07/20/2016
18729	Transient Limiter	Hewlett-Packard	11947A	3107A01975	5/11/2015	5/10/2016
18914	Single Phase LISN	EMCO	3816/NM	9408-1003	04/13/2015	04/13/2016
DEN-073	EMI Receiver	ROHDE & SCHWARZ	ESU 26	100265	12/10/2014	12/10/2015
CC1-001A	50 Ohm Cable	Pasternak Enterprise	RG-223/U	N/A	5/27/2015	5/27/2016
CC1-001B	50 Ohm Cable	Pasternak Enterprise	RG-223/U	N/A	5/27/2015	5/27/2016

12.3 Test Requirement/ Specification:

The product must pass the AC Conducted average and quasi-peak Class B Limits defined in FCC Part 15.207. The product is operated with all radios enabled and active.

12.4 Test Procedure:

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at all frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.
The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.
The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Equipment setup for conducted disturbance tests followed the guidelines of:

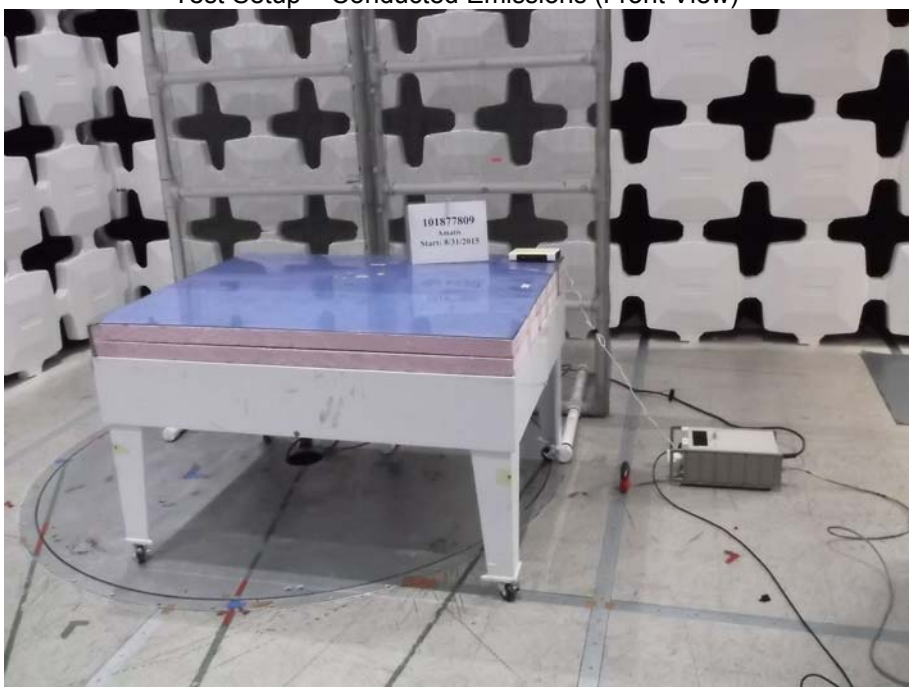
- ANSI C63.10: 2009, Section 6.2.

12.5 Test Results:

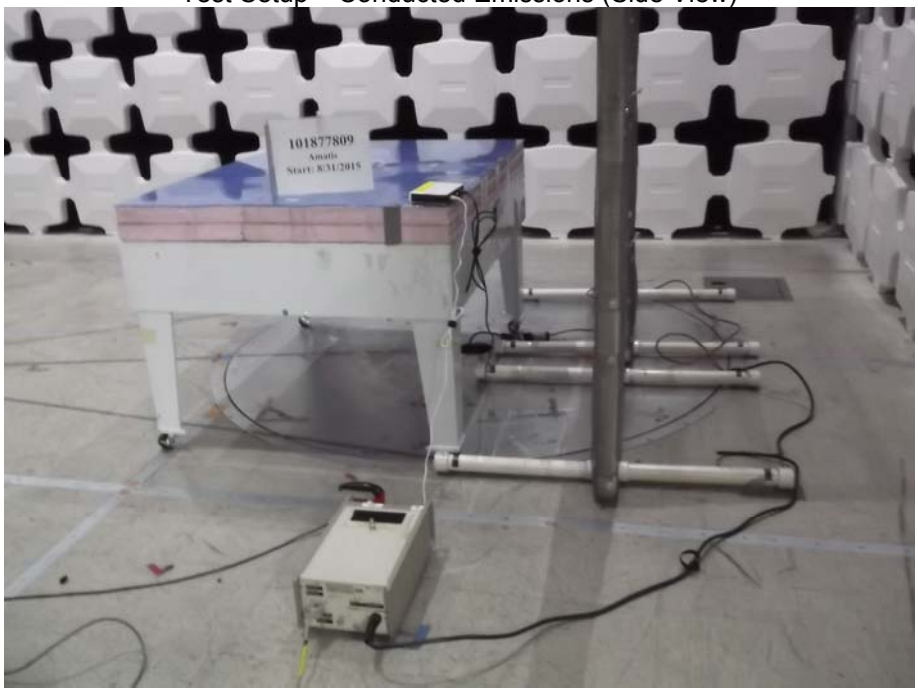
The sample tested was found to Comply.

12.6 Setup Photographs:

Test Setup – Conducted Emissions (Front View)

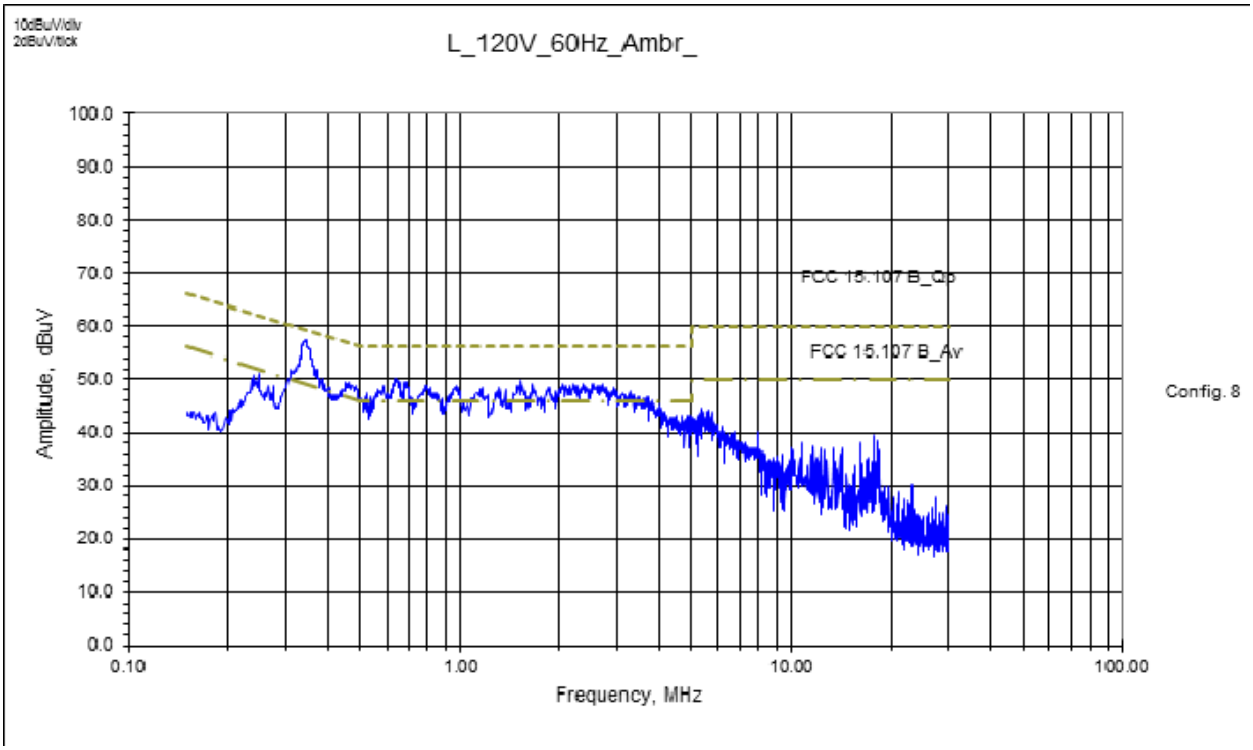


Test Setup – Conducted Emissions (Side View)

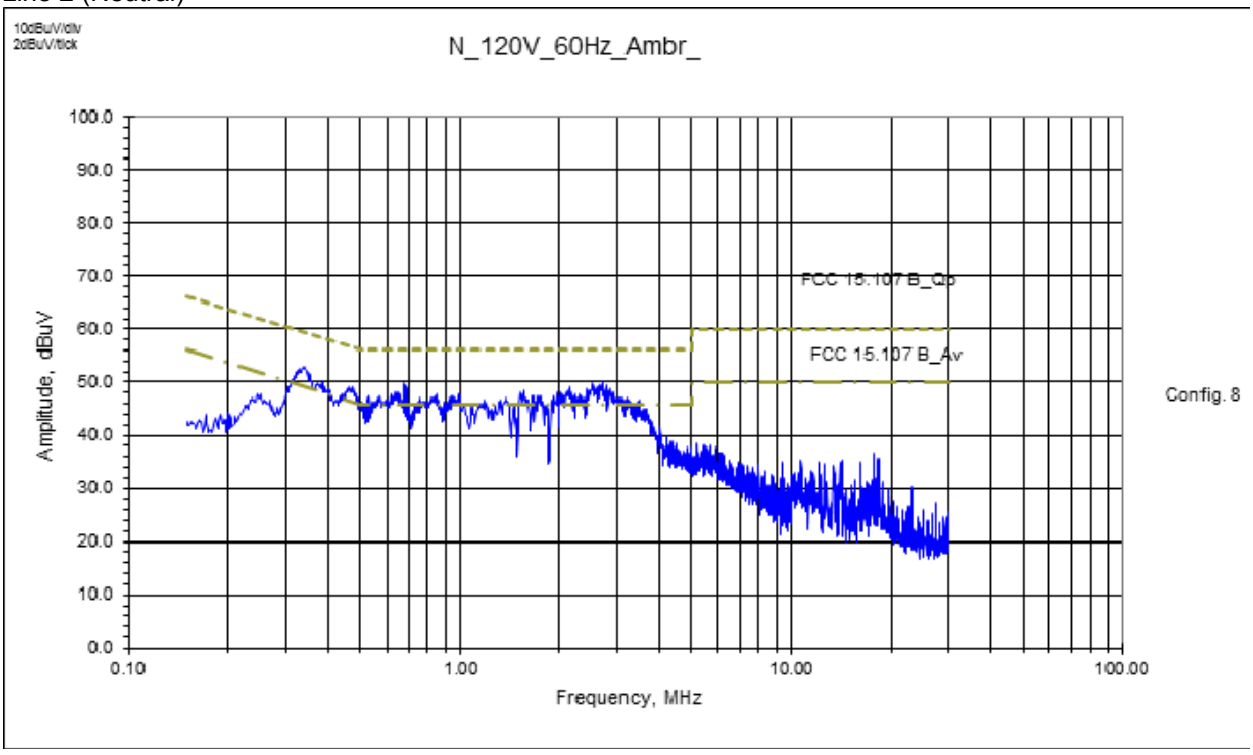


12.7 Plots:

Line 1



Line 2 (Neutral)



12.8 Test Data: AC Mains Conducted Emissions – Transmitter

Tx AC Conducted Electromagnetic Emissions

Test Report #:	101877809DEN-001	Test Area:	CC1 Conducted		Temperature:	23.6	C
Test Method:	FCC 15.207	Test Date:	09/23/2015		Relative Humidity:	27.4	%
EUT Model #:	AMBR#100645	EUT Power:	**120V/ 60Hz**		Air Pressure:	82.8	kPa
EUT Serial #:	EMC1						
Manufacturer:	Amatis Controls, LLC.				Level Key		
EUT Description:	The device translates between 802.3 (Ethernet) and 802.15.4 networks.				Pk - Peak	Nb - Narrow Band	
Notes:	EUT in constant Tx mode during testing.				Qp - QuasiPeak	Bb - Broad Band	
					Av - Average		

FREQ	LEVEL	DET	CABLE	LISN	PREAMP	ATTEN	FINAL	TEST POINT	DELTA1	DELTA2	RBW
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	Other - N - L1 - L2 - L3	FCC 15.107 B_Qp	FCC 15.107 B_Av	(MHz)
L_120V_60Hz_			Ambr_								
0.248	35.44	**Qp**	0.12	0.08	0.00	9.95	45.58	Line 1	- 16.26	NA	0.009
0.341	45.73	**Qp**	0.12	0.07	0.00	9.95	55.87	Line 1	- 3.31	NA	0.009
0.465	35.17	**Qp**	0.13	0.06	0.00	9.95	45.31	Line 1	- 11.30	NA	0.009
1.550	35.37	**Qp**	0.18	0.09	0.00	9.95	45.60	Line 1	- 10.40	NA	0.009
2.759	33.64	**Qp**	0.25	0.11	0.00	9.96	43.96	Line 1	- 12.04	NA	0.009
17.695	29.31	**Qp**	0.68	0.81	0.00	10.02	40.83	Line 1	- 19.17	NA	0.009
0.248	28.29	**Av**	0.12	0.08	0.00	9.95	38.43	Line 1	NA	- 13.41	0.009
0.341	37.18	**Av**	0.12	0.07	0.00	9.95	47.32	Line 1	NA	- 1.86	0.009
0.465	26.42	**Av**	0.13	0.06	0.00	9.95	36.56	Line 1	NA	- 10.05	0.009
1.550	25.40	**Av**	0.18	0.09	0.00	9.95	35.63	Line 1	NA	- 10.37	0.009
2.759	21.72	**Av**	0.25	0.11	0.00	9.96	32.04	Line 1	NA	- 13.96	0.009
17.695	22.14	**Av**	0.68	0.81	0.00	10.02	33.66	Line 1	NA	- 16.34	0.009
N_120V_60Hz_			Ambr_								
0.248	34.64	**Qp**	0.12	0.07	0.00	9.95	44.78	Line 2	- 17.05	NA	0.009
0.341	39.93	**Qp**	0.12	0.07	0.00	9.95	50.07	Line 2	- 9.10	NA	0.009
0.467	34.48	**Qp**	0.13	0.06	0.00	9.95	44.61	Line 2	- 11.96	NA	0.009
0.674	31.49	**Qp**	0.14	0.06	0.00	9.95	41.64	Line 2	- 14.36	NA	0.009
1.583	33.08	**Qp**	0.19	0.09	0.00	9.95	43.31	Line 2	- 12.69	NA	0.009
2.680	34.82	**Qp**	0.24	0.12	0.00	9.96	45.14	Line 2	- 10.86	NA	0.009
0.248	27.03	**Av**	0.12	0.07	0.00	9.95	37.17	Line 2	NA	- 14.66	0.009
0.341	35.52	**Av**	0.12	0.07	0.00	9.95	45.66	Line 2	NA	- 3.51	0.009
0.467	24.95	**Av**	0.13	0.06	0.00	9.95	35.08	Line 2	NA	- 11.49	0.009
0.674	19.09	**Av**	0.14	0.06	0.00	9.95	29.24	Line 2	NA	- 16.76	0.009
1.583	20.24	**Av**	0.19	0.09	0.00	9.95	30.47	Line 2	NA	- 15.53	0.009
2.680	22.03	**Av**	0.24	0.12	0.00	9.96	32.35	Line 2	NA	- 13.65	0.009

13 RF Exposure Requirement

13.1 Method

Unless otherwise stated no deviations were made from FCC Part 1.1310 or 2.1091.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

13.2 Test Requirement/ Specification:

- Power Density Limit for Frequency Range: 1500 to 100,000 MHz = 1.0mW//cm²

13.3 Test Results:

The sample tested was found to comply.

13.4 Test Data:

RF Exposure Requirements - MPE

Project #:	**G101877809**	Test Area:	Intertek Louisville
Test Method:	FCC CFR47 Part 1.1310	Test Date:	9/10/2015
EUT Model #:	AMBR		
EUT Serial #:	EMC1		
Manufacturer:	Amits		
EUT Description:	The device translates between 802.3 (Ethernet) and 802.15.4 networks.		
Notes:			

The following limit is from table 1 (B) Limits for General Population/Uncontrolled Exposure in FCC part 1.1310:

Power Density Limit for Frequency Range: 1500 to 100,000 MHz = 1.0 mW/cm^2

The following calculation was used to determine compliance to the above limit. The calculation is from FCC OET bulletin 65.

Power Density(S) =$PG/4\pi R^2$ or $S=EIRP/4\pi R^2$

Where:
S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (mW).
G = numeric power gain of the antenna in the direction of interest relative to an isotropic radiator.
R = distance to the center of radiation of the antenna (cm)

In this case, 20cm will be used.
==========

Maximum measured rf conducted port power input to antenna = 19.8dBm = 95.5mW

Maximum typical gain declared by the manufacture = +2.2 dBi = 1.66 (numeric gain)

Power Density

Power (mW)	Gain (dbi)	Gain numeric	Distance (cm)	Power Density (mW/cm^2)
95.5	+2.2	1.66	20	0.03

Therefore: Power Density Margin (Δ Limit) = 0.03 – 1.0 = - 0.97 mW/cm^2

To determine what minimum distance the product can satisfy the Power Density Limit:

R(cm) = SQRT[(P*G)/(4*π*S)] = 3.6 cm

Therefore: Distance Margin (Δ Limit) = 3.6 cm – 20 cm = -16.4 cm

==========

Reference Conversion Equations:

1. Gain numeric = $10^{(dBi/10)}$

2. Gain (dBi) = 10 log(Gain numeric)

3. dBm = dBuV/m – 107 (50 ohm system)

4. dBm to Watts (W) = $10^{((dBm - 30)/10)}$

14 Duty Cycle/ Duty Cycle Correction Factor

No duty cycle correction factor was utilized during this testing – therefore, product duty cycle verification was not applicable.

14.1 Method:

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from FCC CFR47 15.35(c).

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

14.2 Test Requirement/Specification:

Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

Determine the period of the pulse train, T, in mSec and record the results. T is defined as the time from the beginning of one pulse train to the beginning of the next pulse train.
Count the number of different types of pulses, N and record the results.
For each of the different types of pulses, count the number of occurrences within one pulse train.
Use the Duty Cycle Correction Factor, DCCF, from the results table and use it to adjust the field strength measurements recorded for radiated emissions.

- FCC 15.35(c)

14.3 Test Equipment Used:

14.4 Results:

Not applicable

14.5 Test Method:

- ANSI C63.10: 2013, Clause 11.6

14.6 Test Summary:

Duty Cycle Measurements	

14.7 Plots:

14.8 Test Data:

15 Appendix A: Antenna Specifications

"High Frequency Ceramic Solutions"

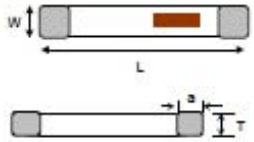
2.45 GHz High Gain SMD Chip Antenna — **P/N 2450AT45A100**

Detail Specification: 4/21/2015 — Page 1 of 10

General Specifications			
Part Number	2450AT45A100	Input Power	3W max. (CW)
Frequency Range	2400 - 2500 Mhz	Impedance	50 Ω
Operating Temp	-40°C to +125°C	Reel Quanity	1,000

Mechanical Specifications

	In	mm
L	0.374 ± 0.008	9.50 ± 0.20
W	0.079 ± 0.008	2.00 ± 0.20
T	0.047 +.004/-.008	1.20 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



Terminal Configuration

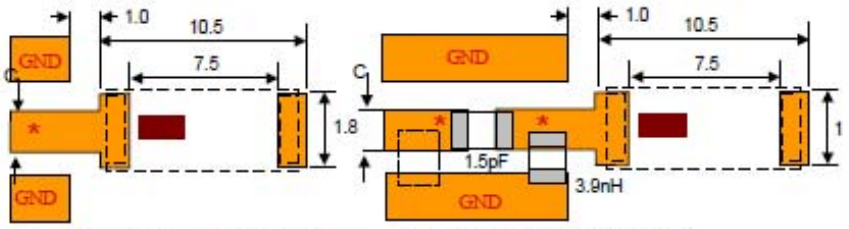
No.	Function
1	Feeding Point
2	NC

Typical Electrical Specs for "Vertical Orientation" (T=25°C)			
Frequency Range	2400 - 2500 Mhz	Peak Gain	2.2 dBi typ. (XZ-V)
Return Loss	9.5 dB min.	Average Gain	1.0 dBi typ. (XZ-V)

Mounting Considerations 1: "Vertical Orientation"

Mount these devices with red mark facing up. Units: mm

* Line width should be designed to provide 50Ω impedance matching characteristics.



a) Without Matching Circuit (moderate bandwidth)

b) With Matching Circuit* (wide bandwidth)
These matching circuit values only apply to Johanson's evluation board, they will be different on the client's PCB, see pages 2 and 10 for details.

"C" Dimmension will depend on the width of the trace required for it to have a 50ohm characteristic impedance (i.e. coplanar waveguide theory)

JOHANSON TECHNOLOGY

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Ver 2.2

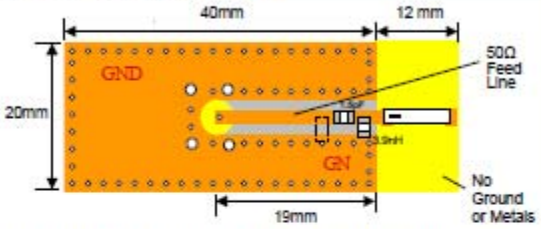
"High Frequency Ceramic Solutions"

2.45 GHz High Gain SMD Chip Antenna — P/N 2450AT45A100
Detail Specification: 4/21/2015 — Page 2 of 10

Typical Electrical Characteristics for "Vertical Orientation" (T=25°C)

Test Board

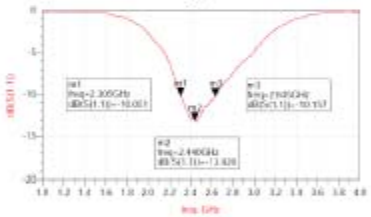
Orderable Evaluation board:
p/n: 2450AT45A100-EB1SMA
"Vertical Orientation"



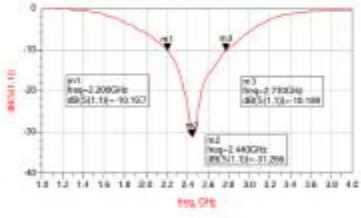
Note: It is recommended that the designer leave available slots for a "pi" (or shunt-series-shunt) network. The antenna matching network values above are used when antenna is monted on Johanson's evaluation board. The matching values on clinet's PCB will be different, go to: http://johansontechnology.com/tuning and see how to obtain the new values. If you need further help, contact our RF Applications Eng Team at: http://www.johansontechnology.com/en/ask-a-technical-question.html

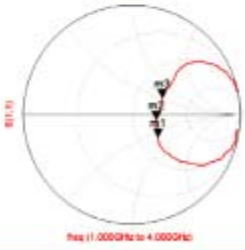
Return Loss

a) Without a Matching Circuit



a) With a Matching Circuit





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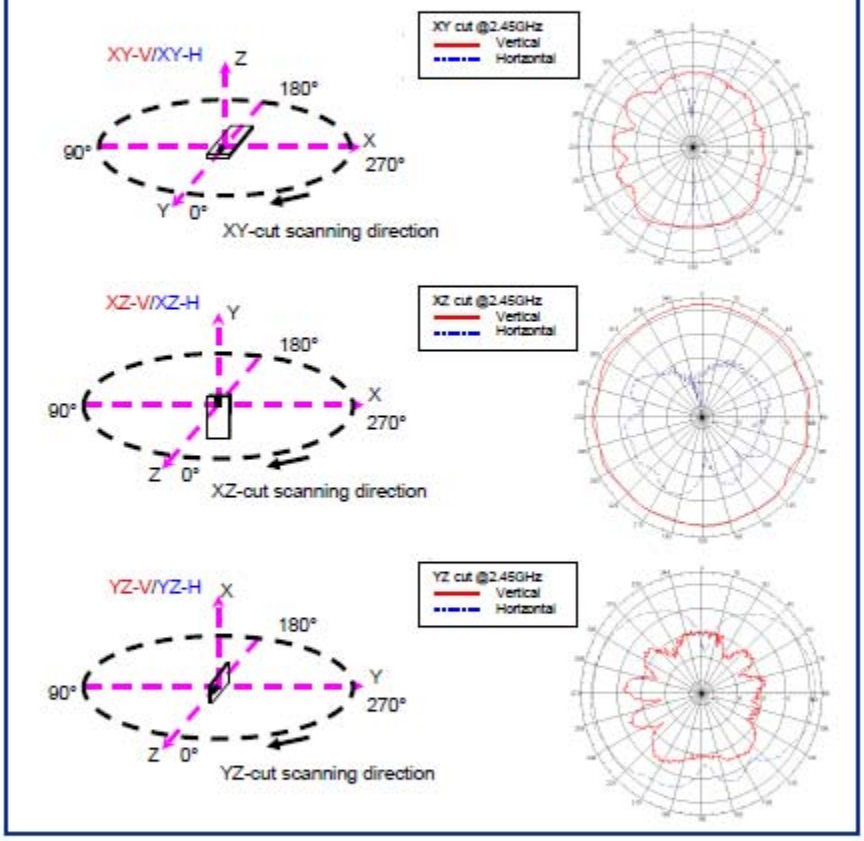
Typical Radiation Patterns for "Vertical Orientation" (@25C)



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16 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of k = 2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty ±	Notes
Radiated emissions, 10kHz to 30 MHz	3.4 dB	
Radiated emissions, 30 to 200 MHz HP	2.2 dB	
Radiated emissions, 30 to 200 MHz VP	3.8 dB	
Radiated emissions, 200 to 1000 MHz HP	2.8 dB	
Radiated emissions, 200 to 1000 MHz VP	2.7 dB	
Radiated emissions, 1 to 18 GHz	5.2 dB	
Conducted port emissions 10kHz to 1000 MHz	1.0 dB	
Conducted port emissions 1 – 26.5 GHz	1.6 dB	
AC mains Conducted emissions, 9kHz to 30 MHz	3.14 dB	

17 Revision History

Revision Level	Date	Report Number	Notes
0	9/29/2015	101877809DEN-001	Original Issue
1	12/1/2015	101877809DEN-001	Changes made per TCB reviewer Page 5 – changed RSS-Gen Issue and date Page 23 – updated output power summary table for mid channel correction and changed measured power to match the plots Page 61 - Changed Pk delta to NA for the average limit. Page 65 – Changed PSD summary table to match the plots. Page 91 – added original issue date. Made By: Michael Spataro MS Reviewed By: Son La SL