



TEST REPORT

Report Number: 102271213DEN-001B

Project Number: G102271213

Report Issue Date: October 27, 2015

Product Designation: Model: 31570014

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:
Ampt
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Fort Collins, CO 80525

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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.

General 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
- A temporary antenna port was utilized for conducted port measurements.
- The EUT incorporates both FHSS and DTS transmission techniques, this report covers only the FHSS requirements.

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 covered under the laboratories scope.

2 Test Summary

Section	Test Specification	Test Description	Test Date	Result
5	15.31(e)	Supply Variation	9/30/2015	Pass
6	15.247(b)(1)/RSS-247 5.4(2)	Maximum Peak Output Power - Conducted	9/30/2015	Pass
7	15.247(a)(1)/RSS-247 5.1(1)	-20dB Bandwidth of the Hopping Channel	9/30/2015	Pass
8	15.247(a)(1)/RSS-247 5.1(2)	Hopping Channel Carrier Frequency Separation	9/30/2015	Pass
9	15.247(b)(1)/RSS-247 5.1(4)	Number of Hopping Channels	9/30/2015	Pass
10	15.247(a)(1)(iii)/RSS-247 5.1(4)	Average Time of Occupancy of the Hopping Channel - DCCF	9/30/2015	Pass
11	15.247(d)/RSS-247 5.5	Spurious and Band Edge Emissions - Conducted	10/1/2015	Pass
12	15.247(d)/15.209/RSS-247 5.5 /RSS-GEN 8.10	Spurious and Band Edge Restricted Band Emissions - Radiated	10/1/2015	Pass
13	15.203	Antenna Requirement	9/30/2015	Pass
14	15.207/RSS-GEN 8.8	Transmitter Power Line Conducted Emissions.	--	NA(1)
15	FCC 15.247(i)/RSS-102	RF Exposure Requirements	9/30/2015	Pass

Notes:

- 1) The product is DC-powered only

3 Description of Equipment Under Test

Model:	31570014
Type of EUT:	DC to DC 1000V String Converter
Serial Number:	0815K000002
FCC ID:	X3R-31570014
Industry Canada ID:	8399A-31570014
Related Submittal(s) Grants:	NA
Company:	Ampt LLC
Customer:	Ampt LLC
Address:	4850 Innovation Drive Fort Collins, CO 80525
Phone:	+1(970)-372-6960
Fax:	+1(970)-225-0483
e-mail:	Robin.richardson@ampt.com
Test Standards:	<input checked="" type="checkbox"/> 47 CFR, Part 15C:§15.247 <input checked="" type="checkbox"/> RSS-247, Issue 1, 2015 <input checked="" type="checkbox"/> RSS-Gen, Issue 4, 2014 <input type="checkbox"/> 47 CFR, Part 15B:§15.107 and §15.109, Class B <input type="checkbox"/> Other ICES-003 issue 5 2012
Type of radio:	<input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	9/22/2015
Test Work Started:	9/30/2015
Test Work Completed:	10/1/2015
Test Sample Conditions:	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good

Product Description:	Combines power from two input strings to one output string while ensuring the output string voltage does not exceed the maximum system voltage. The intentional radiator can operate as a FHSS device with a data rate of 12kbps or as a DTS with a data rate of 500kbps. This test report covers only the FHSS parameters.
Transmitter Type:	<input checked="" type="checkbox"/> FHSS <input type="checkbox"/> Digital Modulation <input type="checkbox"/> WiFi <input type="checkbox"/> Blue Tooth
Operating Frequency Range(s):	2.41 – 2.4745 GHz
Number of Channels:	255 (only 25 used at any given time)
Modulation:	FSK
Antenna(s) Info:	Integral Trace antenna
Rated Power:	1.8 mW (conducted)
Antenna Installation:	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
Transmitter power configuration:	<input type="checkbox"/> Internal battery <input checked="" type="checkbox"/> DC supply from PV array
Special Test Arrangement:	NA
Test Facility Accreditation:	A2LA (Certificate No. 2506.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

Intertek	
Report Number: 102271213DEN-001B	Issued: October 27, 2015

Description of Equipment Under Test (provided by client)
Combines power from two input strings to one output string while ensuring the output string voltage does not exceed the maximum system voltage.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
Input: 700Vdc Output: 1000Vdc	8.0A x 2 (inputs) Output: 11.2kWdc	DC	---

Descriptions of EUT Exercising
<input type="checkbox"/> Standby/Idle Mode
<input checked="" type="checkbox"/> Continuous transmission, un-modulated carrier (CW)
<input checked="" type="checkbox"/> Continuous transmission, modulated carrier (CW)
<input checked="" type="checkbox"/> Continuous Receive Mode

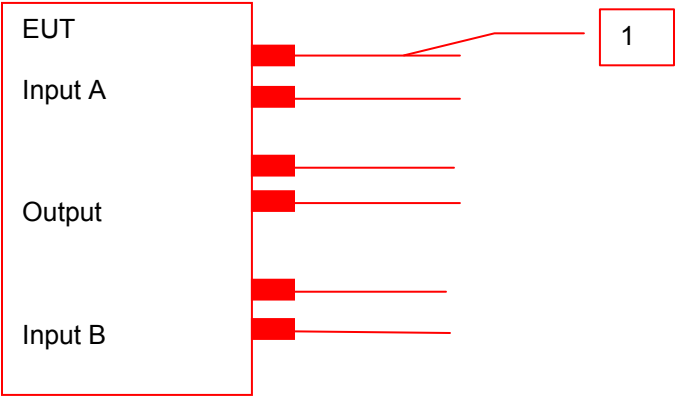
Note: The chosen mode of operation described above is dependent upon the specific test to be performed.

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

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

EUT Block Diagram: EMC Perspective

Note: none



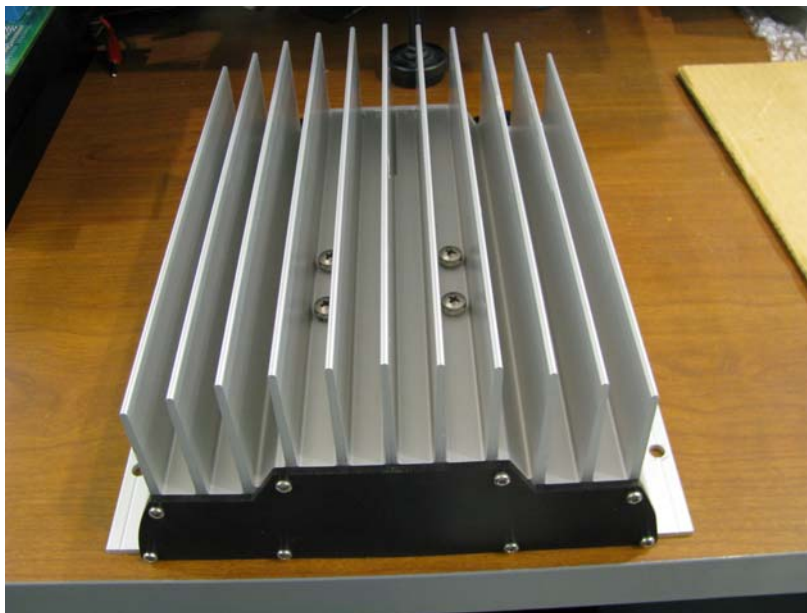
Intertek	
Report Number: 102271213DEN-001B	Issued: October 27, 2015

Support Data:

ID	Description/ Function	Shield Type	Length	Connector	Connection	Ferrites
1	DC power	NA	>3m	NA	DC	NA

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Dell	NA	NA

Notes: Only DC power needed to power the radio was supplied for this testing.

Photograph: Product Tested

AC Supply Variation NA – not AC powered

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.

Test Requirement/Specification:

- ANSI C63.10: 2009, Section 6.8.2/15.31(e)

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
18891	AC Power Supply	Pacific Power	360AMXT	0165	VBU	VBU
DEN-136	DMM	Fluke	87 V	20100152	5/18/2015	5/18/2016

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.

Test Data:

FREQ	LEVEL	DET	CABLE	FINAL	RBW
MHz	dBm	Qp Av Pk	+ [dB]	= [dBuV]	(MHz)
AC @ Nominal Voltage – 120 VAC / 60 Hz					
2410.0	0.00	Pk	2.5	2.5	1
AC @ 115% Nominal Voltage – 138 VAC / 60 Hz					
2410.0	0.00	Pk	2.5	2.5	1
AC @ 85% Nominal Voltage – 102 VAC / 60 Hz					
2410.0	-0.01	Pk	2.5	2.49	1

For testing of the intentional transmitter the EUT was supplied with power from an external power adapter connected to the AC mains.

5 Maximum Peak Output Power - Conducted

Method:

The test methods used comply with ANSI C63.10 section 6.7. 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.

Test Requirement/Specification:

The maximum peak conducted output power

Fundamental Frequency	Number of Hopping Channels	Output power (Watts)
2400-2483.5 MHz	≥ 75	1
2400-2483.5 MHz	≤ 75	0.125

- FCC 15.247(b)(1)
- RSS-247 5.4(2)

Test Equipment Used:

<u>Asset ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Serial</u>	<u>Cal Date</u>	<u>Cal Due</u>
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

Results:

The sample tested was found to comply.

Test Summary:

Fundamental	Conducted port					
Frequency Range:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz					
Low Frequency MHz	Measured Power (dBm)	Correction Cable/Atten (dB)	Final Corrected (dBm)	Standard Limit (dBm)	Limit Reduction (dB)	Margin (dB)
2410.0	0.01	2.5	2.51	21.0	0	18.49
Mid Frequency MHz						
2442.0	-0.96	2.6	1.64	21.0	0	19.36
High Frequency MHz						
2474.5	-1.55	2.6	1.05	21.0	0	19.95
RBW:	<input type="checkbox"/> 100kHz <input type="checkbox"/> 300kHz <input checked="" type="checkbox"/> 500kHz <input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input type="checkbox"/> 10MHz					
VBW:	<input type="checkbox"/> 300kHz <input type="checkbox"/> 1MHz <input type="checkbox"/> 1MHz <input checked="" type="checkbox"/> 3 MHz <input checked="" type="checkbox"/> 10MHz <input type="checkbox"/> 10MHz					
Antenna Gain:	<input checked="" type="checkbox"/> < 6dBi <input type="checkbox"/> >6dBi and = dBi, Output power reduction = dB					

Test Method:

- ANSI C63.10:2013, Section 6.7

Notes:

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

Limit is 0.125W

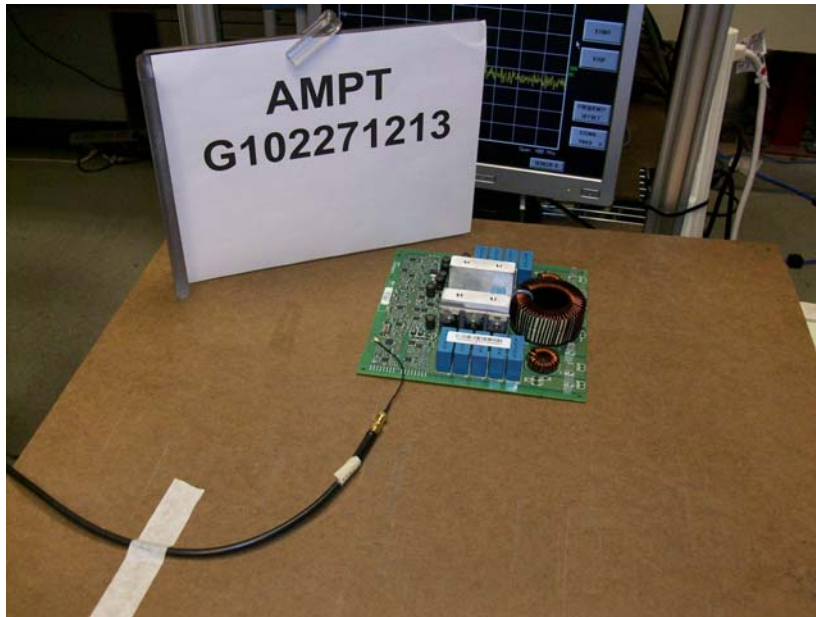
Worst Case Fundamental

2.51 dBm = 0.00178W

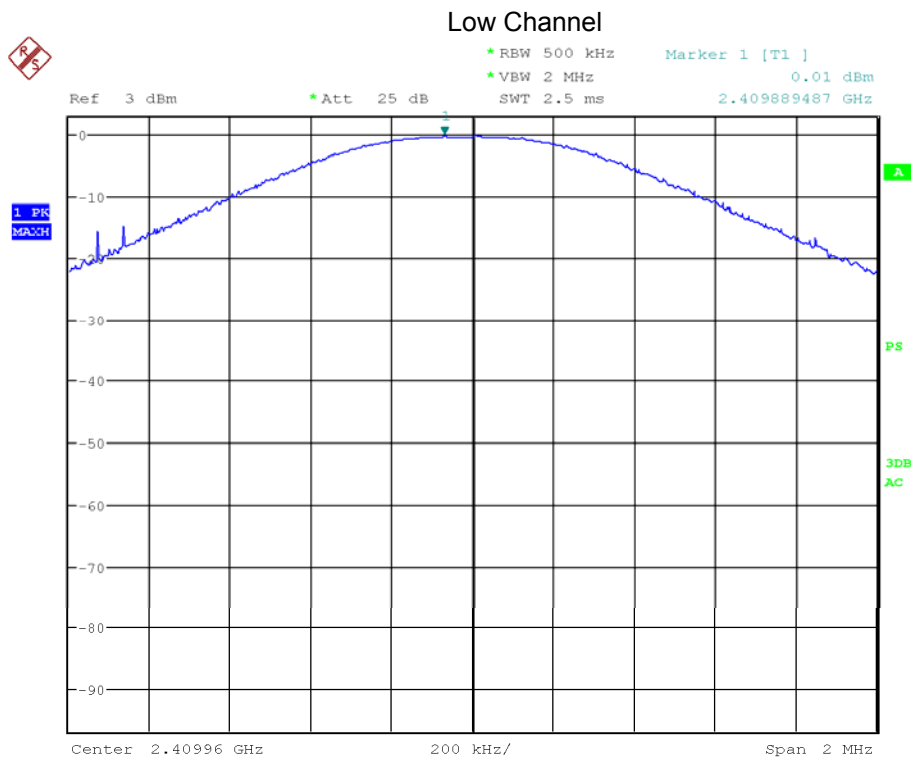
Delta

0.00178 – 0.125 = -0.123W

Setup Photographs: Conducted Port

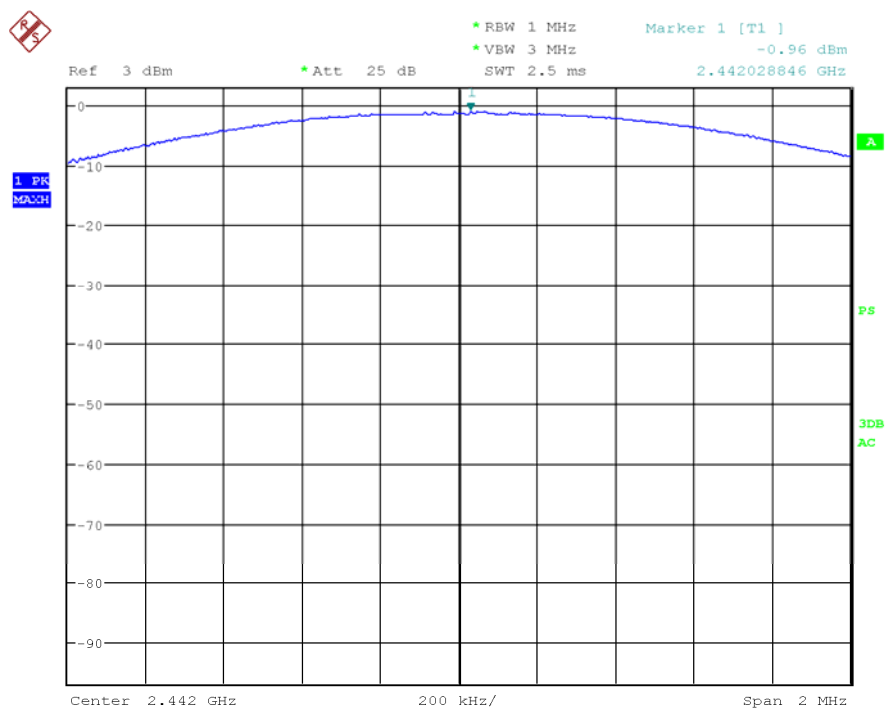


Plots:



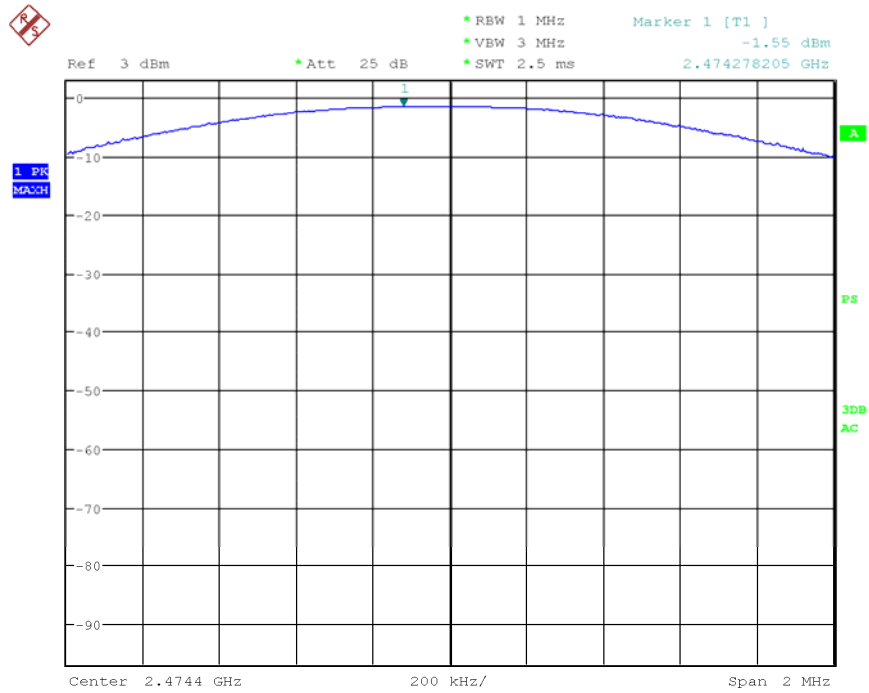
Date: 30.SEP.2015 10:07:54

Mid Channel



Date: 30.SEP.2015 10:30:49

High Channel



Date: 30.SEP.2015 10:34:22

Intertek	
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6 -20dB Bandwidth of the Hopping Channel

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.

Test Requirement/Specification

- 15.247(a)(1)
- RSS-247 5.1(1)

Test Equipment Used:

<u>Asset ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Serial</u>	<u>Cal Date</u>	<u>Cal Due</u>
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

Results:

The sample tested was found to comply.

Test Summary:

Frequency Range:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz			
Low Frequency Channel (kHz)	Middle Frequency Channel (kHz)	Upper Frequency Channel (kHz)	Limit (kHz)	Result
137.0	137.0	138.6	--	Pass
Span: 500kHz RBW: <input type="checkbox"/> 3kHz <input checked="" type="checkbox"/> 10kHz <input type="checkbox"/> 30kHz <input type="checkbox"/> other kHz VBW: <input type="checkbox"/> 3kHz <input type="checkbox"/> 10kHz <input checked="" type="checkbox"/> 30kHz <input type="checkbox"/> other kHz				

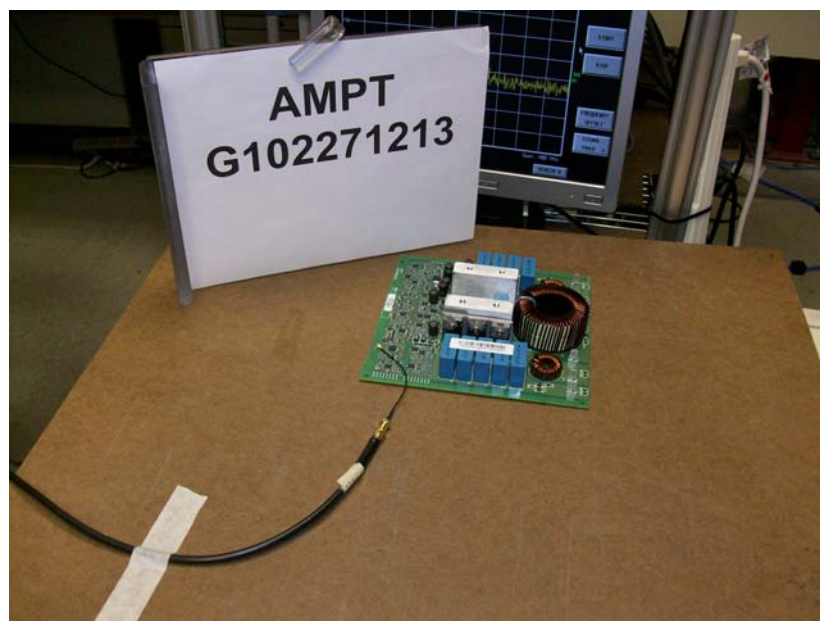
Test Method:

- ANSI C63.10:2013, Section 6.9

Notes:

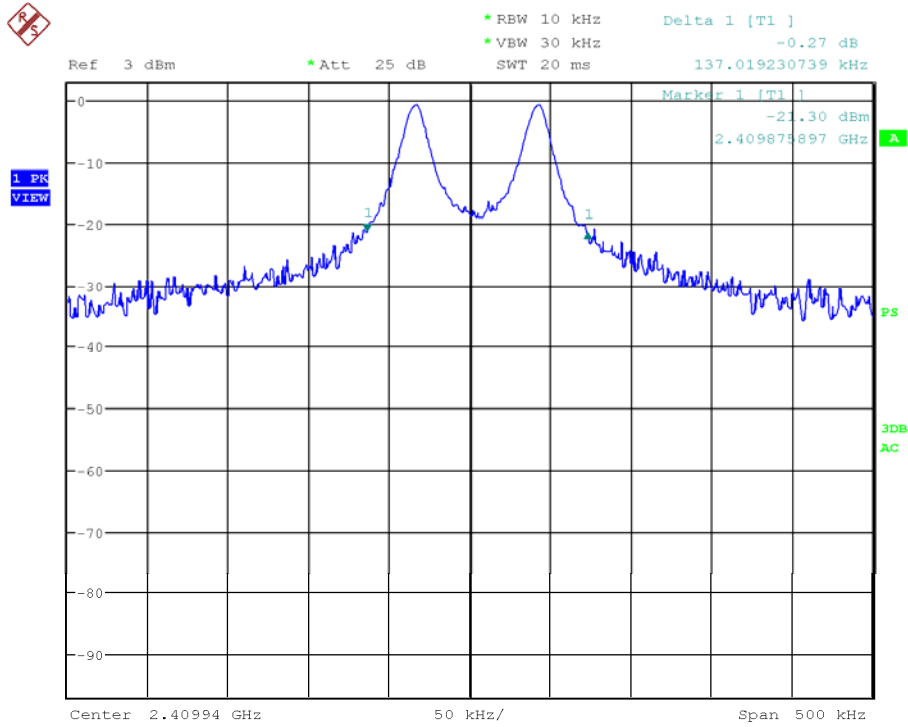
1. The limit for RSS-247 is identical to the limit for FCC 15.247.

Setup Photographs: Conducted Port



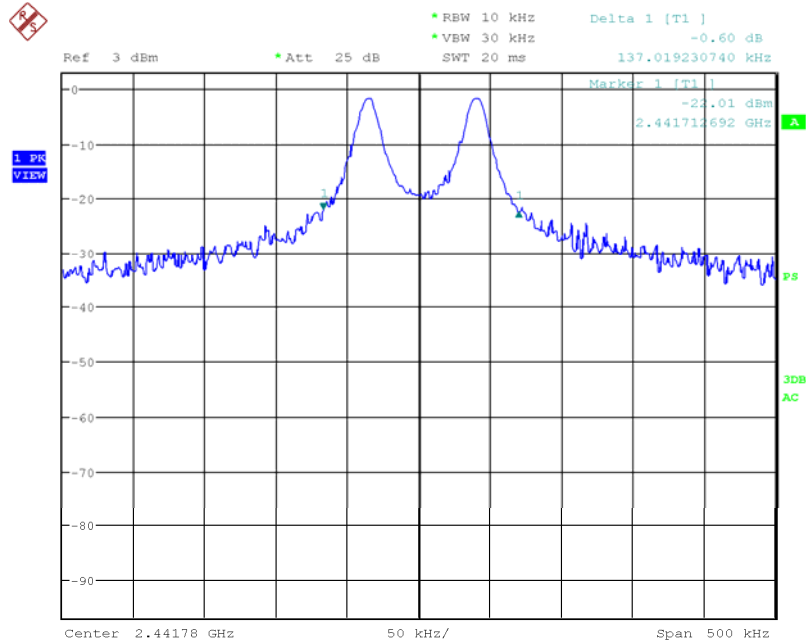
Plots: 20 dB Bandwidth

Low Channel



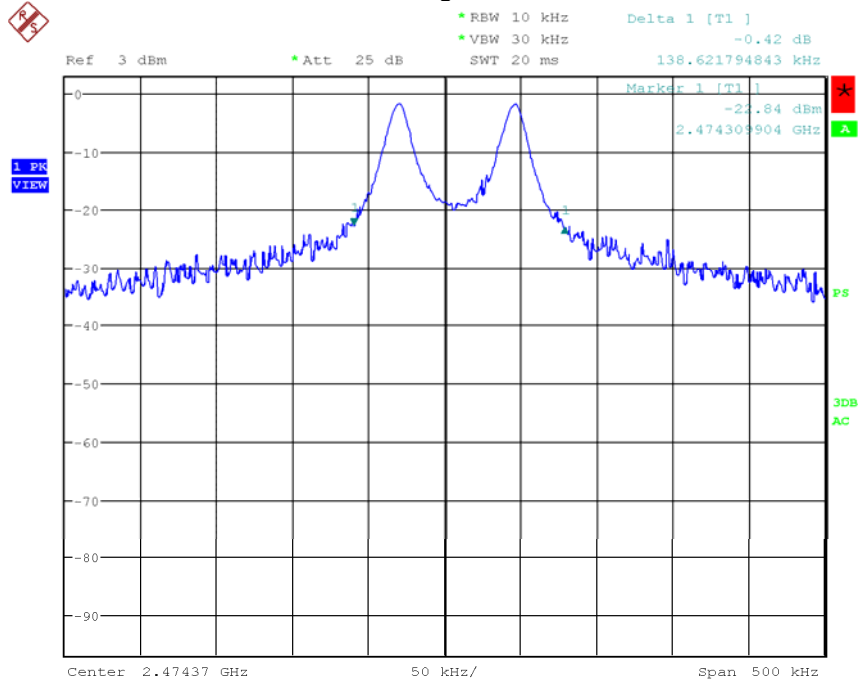
Date: 30.SEP.2015 12:37:40

Mid Channel



Date: 30.SEP.2015 12:40:18

High Channel



Date: 30.SEP.2015 12:35:44

7 Hopping Channel Carrier Frequency Separation

Method:

The test methods used comply with ANSI C63.10. 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.

Test Requirement/Specification:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

- FCC 15.247(a)(1)
- RSS-247 5.1(2)

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

Results:

The sample tested was found to comply.

Test Summary:

Frequency Range:	<input type="checkbox"/> 902-928MHz	<input checked="" type="checkbox"/> 2400-2483.5MHz	<input type="checkbox"/> 5725-5850MHz
Measured Separation (MHz)	Limit (kHz)		Result
2.5	>95.0		Pass
Limit:	<input type="checkbox"/> 25kHz <input type="checkbox"/> 20dB channel bandwidth <input checked="" type="checkbox"/> 2/3 of 20dB channel bandwidth		
Span:	15MHz		
RBW:	<input type="checkbox"/> 3kHz <input type="checkbox"/> 10kHz <input type="checkbox"/> 100kHz <input checked="" type="checkbox"/> other 1MHz		
VBW:	<input type="checkbox"/> 3kHz <input type="checkbox"/> 10kHz <input type="checkbox"/> 100kHz <input checked="" type="checkbox"/> other 3MHz		

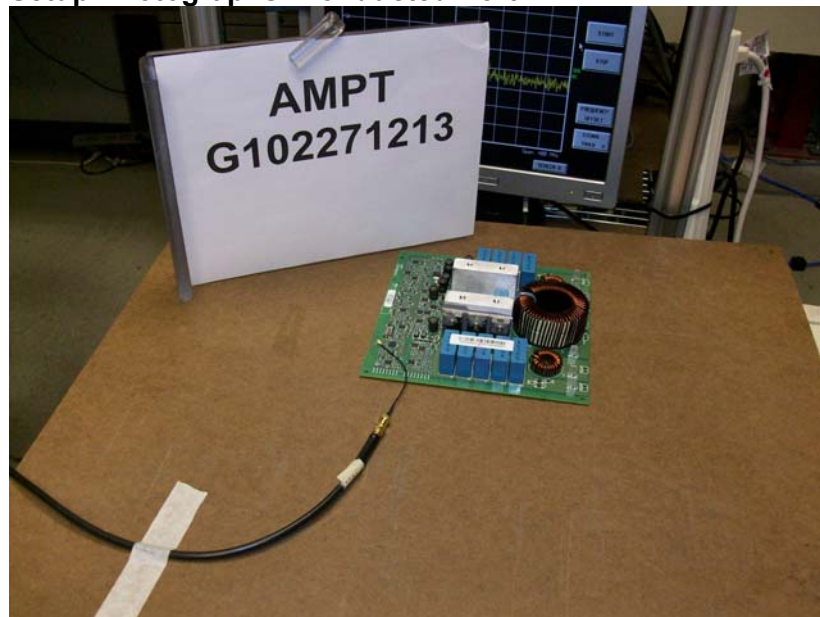
Test Method:

- ANSI C63.10:2013, Section 7.8.2

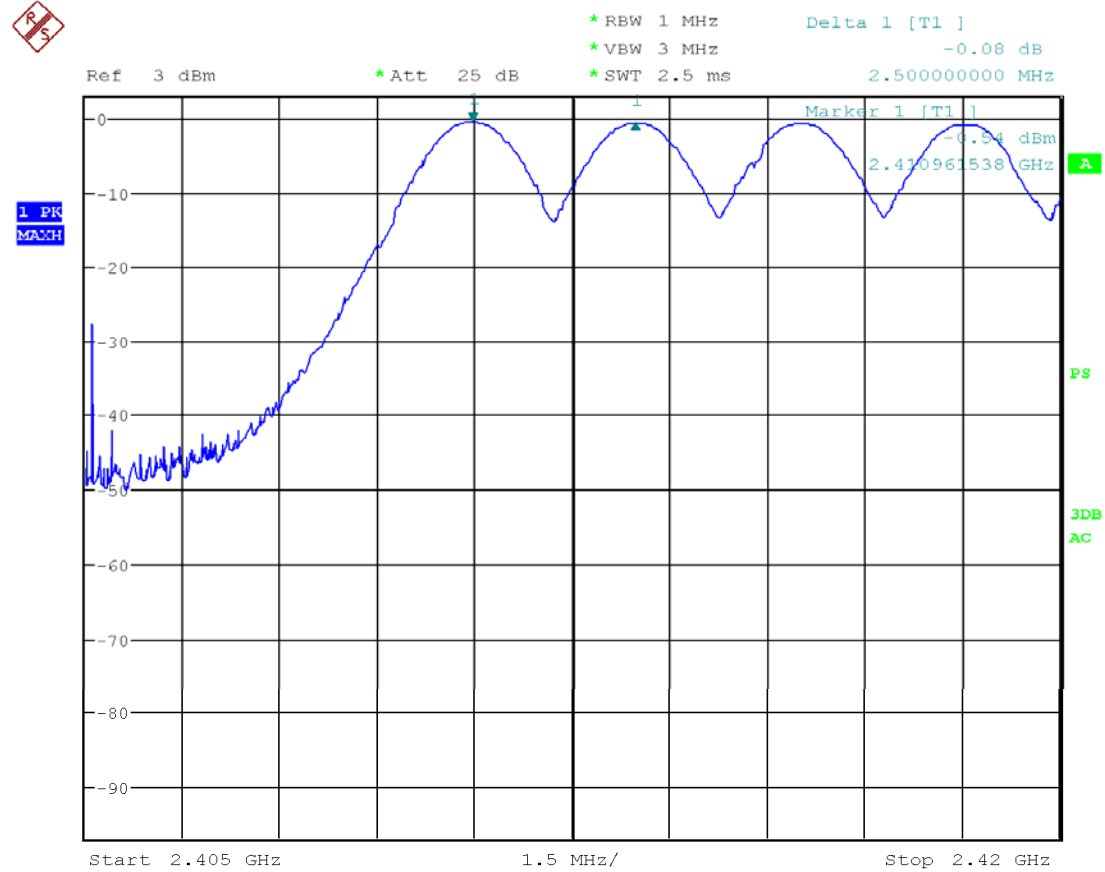
Notes:

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

Setup Photographs: Conducted Port



Plots:



Date: 30.SEP.2015 10:41:41

8 Number of Hopping Channels

Method:

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

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

Test Requirement/Specification:

- 15.247(b)(1)
- RSS-247 5.1(4)

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

Results:

The sample tested was found to comply.

Test Summary:

Frequency Range:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz	
Measured Number	Requirements	Result
25	≥15	Pass
Channel 20dB Bandwidth:	<input type="checkbox"/> <250kHz <input type="checkbox"/> ≥250kHz <input checked="" type="checkbox"/> NA	

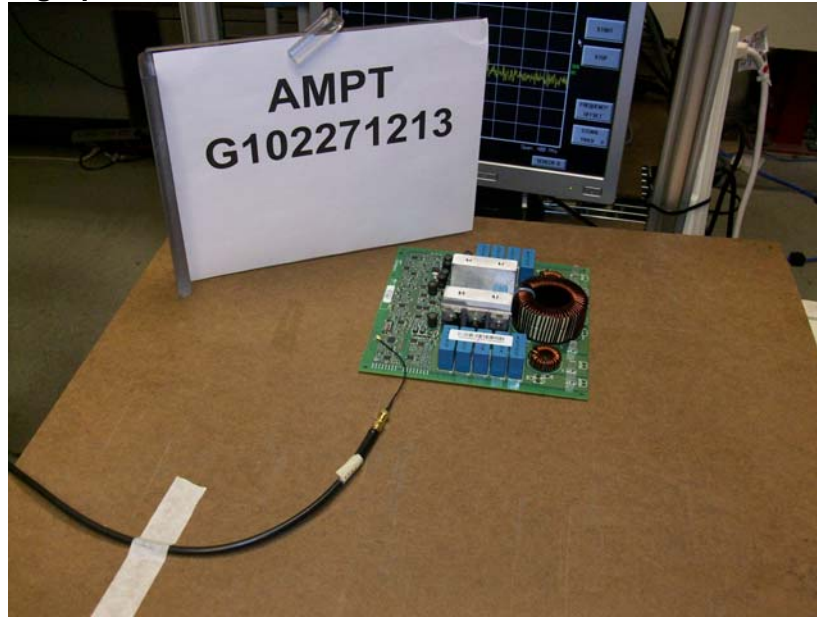
Test Method:

- ANSI C63.10:2013, Section 7.8.3

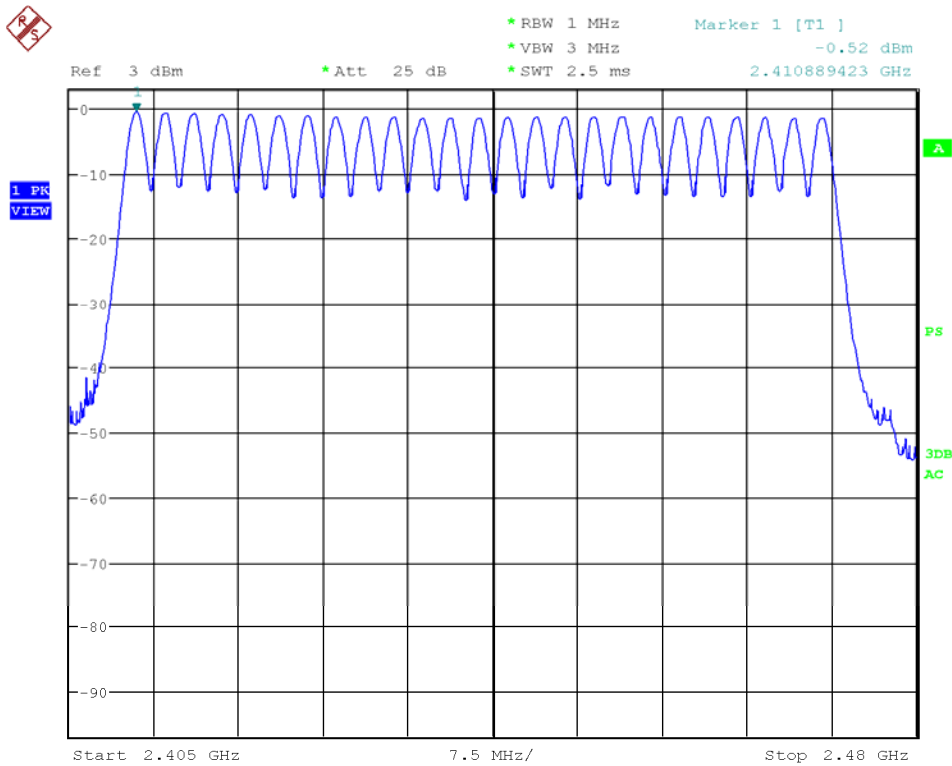
Notes:

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

Test Setup Photographs:



Plots:



Date: 30.SEP.2015 10:43:10

9 Average Time of Occupancy of the Hopping Channel - DCCF

Method:

The test methods used comply with ANSI C63.4. Unless otherwise stated no deviations were made from FCC 15.247 & RSS-210.

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

Test Requirement/Specification:

- 15.247(a)(1)(iii)
- RSS-247 5.1(4)

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

Results:

The sample tested was found to comply.

Test Summary:

Frequency Range:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz		
Measured / Calculated Time sec	Period sec	Limit sec	Result
0.028	10	0.4	Pass
Period:	<input type="checkbox"/> 10s <input type="checkbox"/> 20s <input type="checkbox"/> 30s <input checked="" type="checkbox"/> 0.4s multiplied by the channel number		
Channel 20dB Bandwidth:	<input type="checkbox"/> <250kHz <input type="checkbox"/> ≥250kHz <input checked="" type="checkbox"/> NA		

Time of occupancy calculation:

The minimum measured repetition of the channel occupancy (repetition) = 10 sec

Single occupancy duration (single duration) = .028 sec

Period = 10 sec

Time of occupancy = (single duration) x (period) / (repetition) = .028 x 10 / 10 (sec) = 0.016 sec

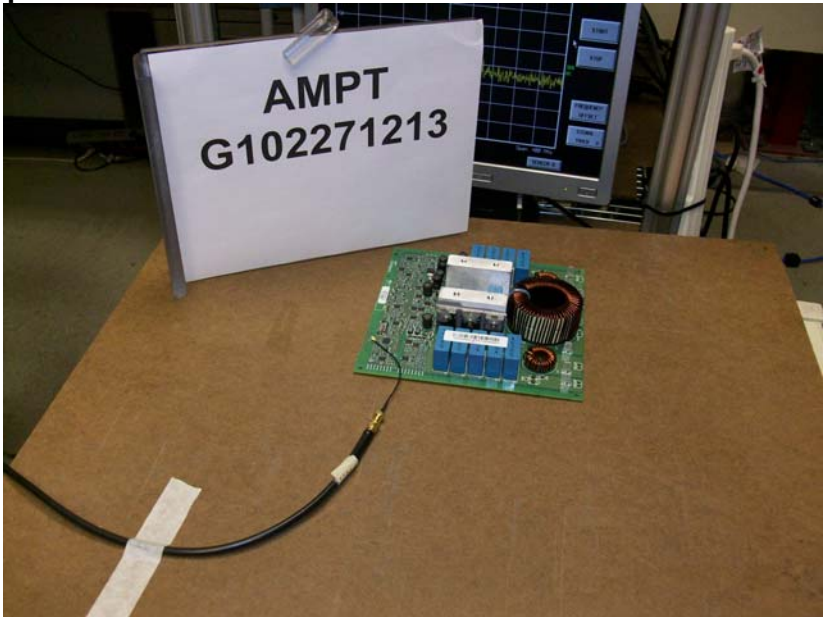
Test Method:

- ANSI C63.10:2013, Section 7.8.4

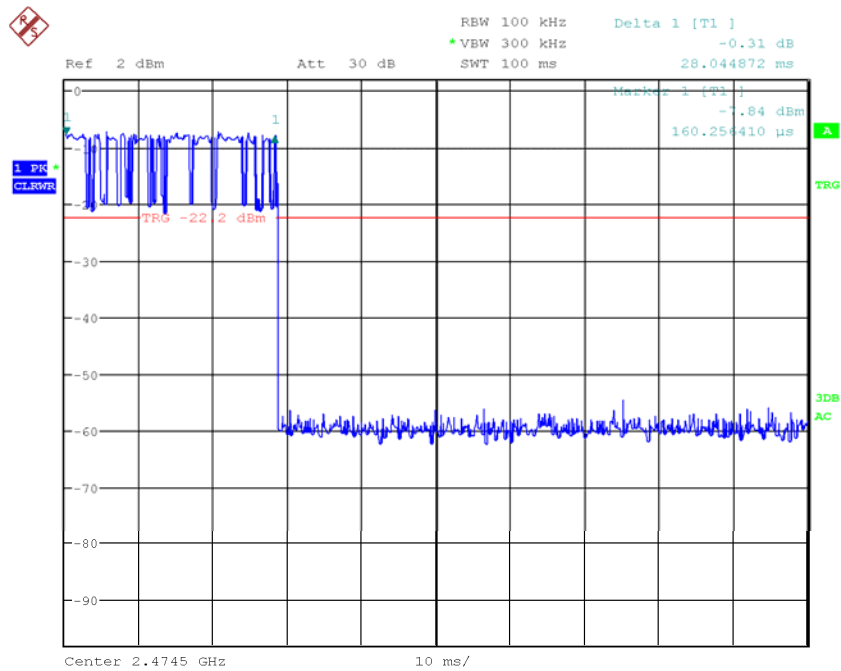
Notes:

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

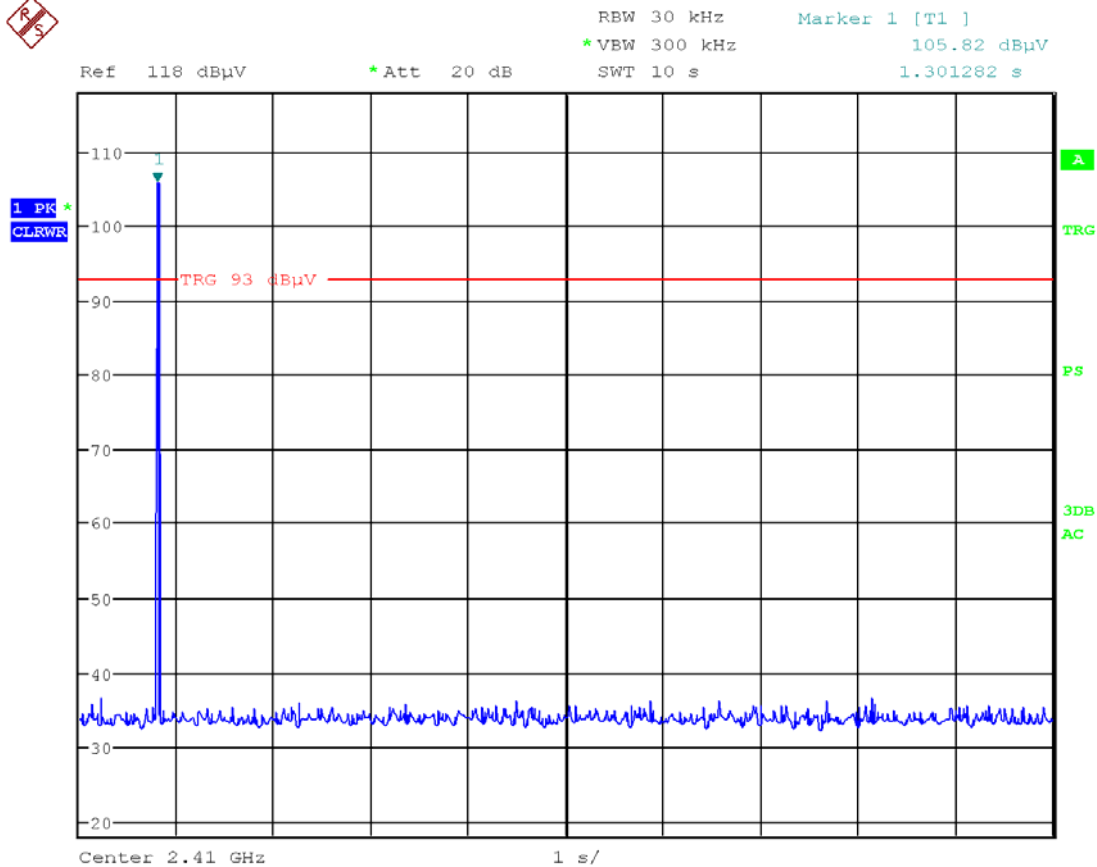
Setup Photographs:



Plots:



Date: 30.SEP.2015 15:17:15



DCCF Calculation: No duty cycle correction was utilized during the testing.

$$20 \log (t/100\text{mS})$$

Where t is the transmission time in a 100mS window.

$$t = 0.x \text{ } 0 = \text{mS}$$

$$20 \log (0) = 0 \text{ dB}$$

Maximum allowable DCCF correction is -0dB.

10 Spurious and Band Edge Emissions - Conducted

The test methods used comply with ANSI C63.4. Unless otherwise stated no deviations were made from FCC 15.247 & RSS-210.

Method:

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

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

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:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz		
	Output Power with 100 kHz Bandwidth dBm	Minimum Allowed Attenuation dB	Limit dB
Low Frequency Channel	-0.68	20	-20.68
Middle Frequency Channel	-1.23	20	-21.23
Upper Frequency Channel	-1.55	20	-21.55
Analyzer Settings:	<input checked="" type="checkbox"/> RBW=100KHz		
Minimum Allowed Attenuation:	<input checked="" type="checkbox"/> 20dB <input type="checkbox"/> 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

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

Intertek	
Report Number: 102271213DEN-001B	Issued: October 27, 2015

Results:

The sample tested was found to comply.

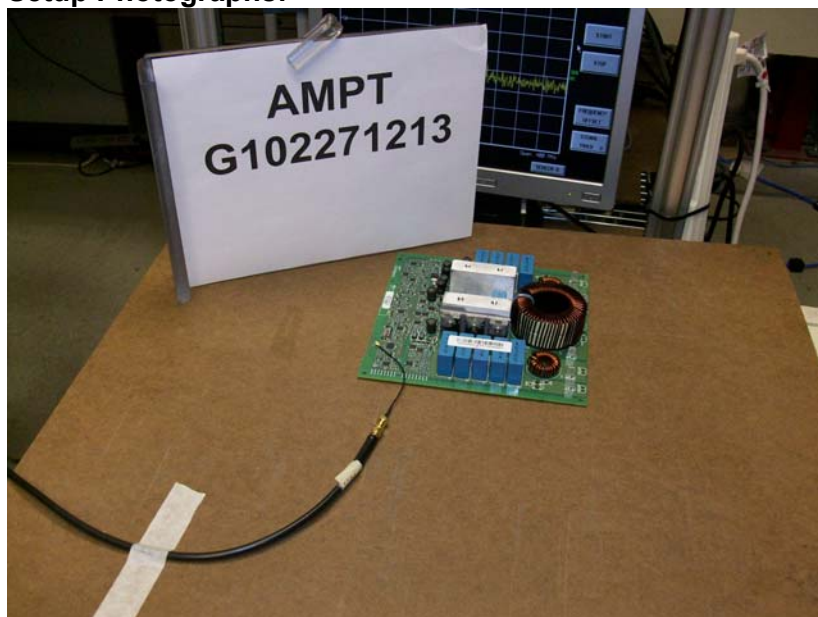
Test Method:

- ANSI C63.10: 2013, Clause 7.8.8

Test Data:

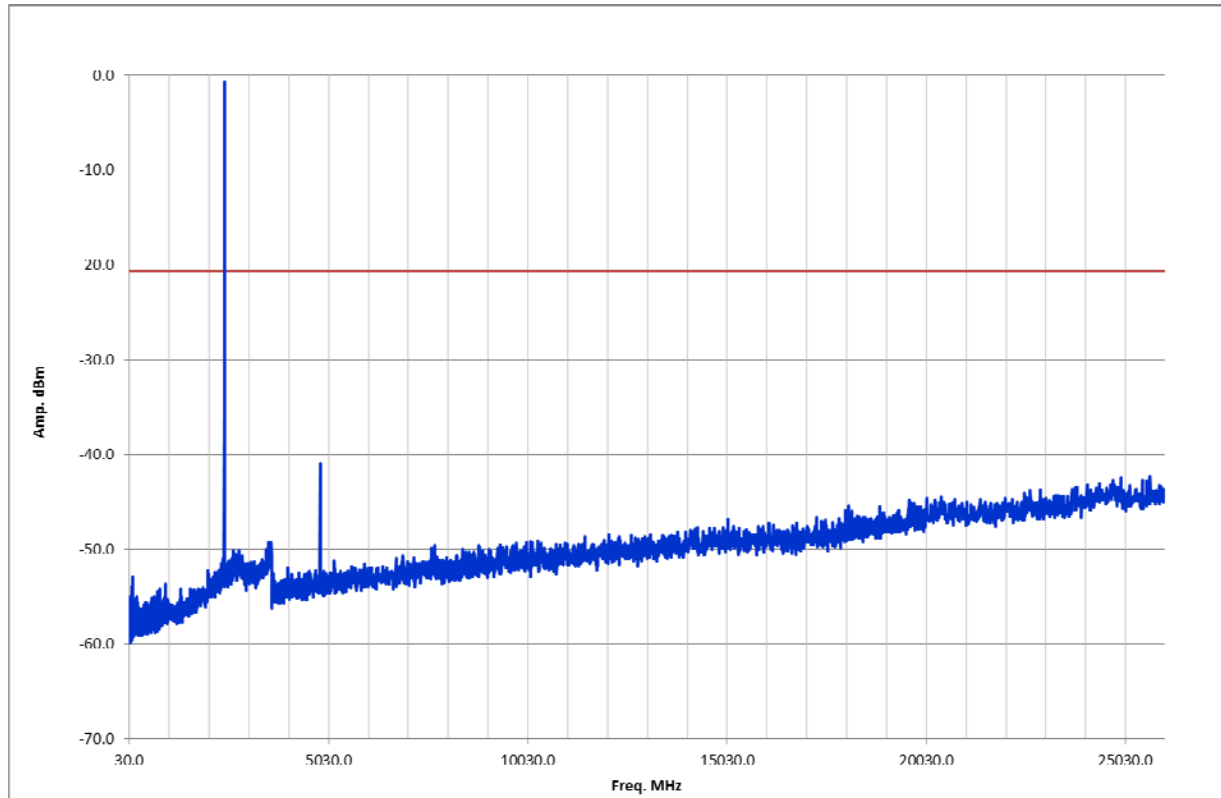
Test Report #:	G102271213	Test Area:	CC1	Temperature:	23.2	°C
Test Method:	FCC 15.247	Test Date:	9/30/205	Relative Humidity:	31.5	%
EUT Model #:	31570014	EUT Power:	12 VDC	Air Pressure:	82.9	kPa
EUT Serial #:	0815K000002					
Manufacturer:	Ampt			Level Key		
EUT Description:	DC to DC string converter			Pk – Peak		
Notes:				Qp – Quasi Peak		
				Av - Average		

FREQ	LEVEL	DET	Limit	DELTA	RBW
MHz	dBm	Qp Av Pk	dBm	dB	(MHz)
Low Channel Spurious					
4820.51	-40.95	Pk	-20.68	20.27	0.1
Mid Channel Spurious					
4884.6154	- 41.93	Pk	-21.23	20.7	0.1
High Channel Spurious					
4948.7179	- 43.15	Pk	-21.55	21.6	0.1
Hopping Spurious					
4878.2051	- 41.97	Pk	-21.55	20.42	0.1
1913.4615	- 33.14	Pk	-21.55	11.45	0.1

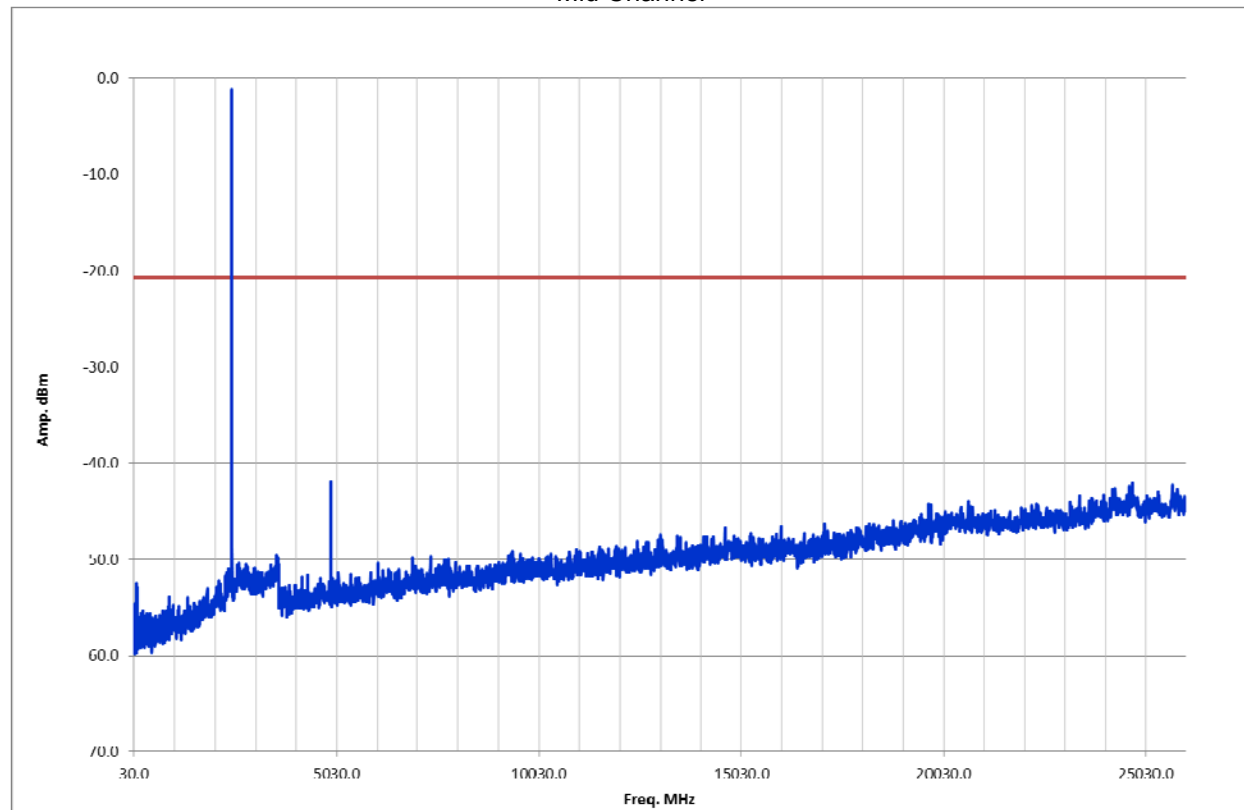
Setup Photographs:

Plots:

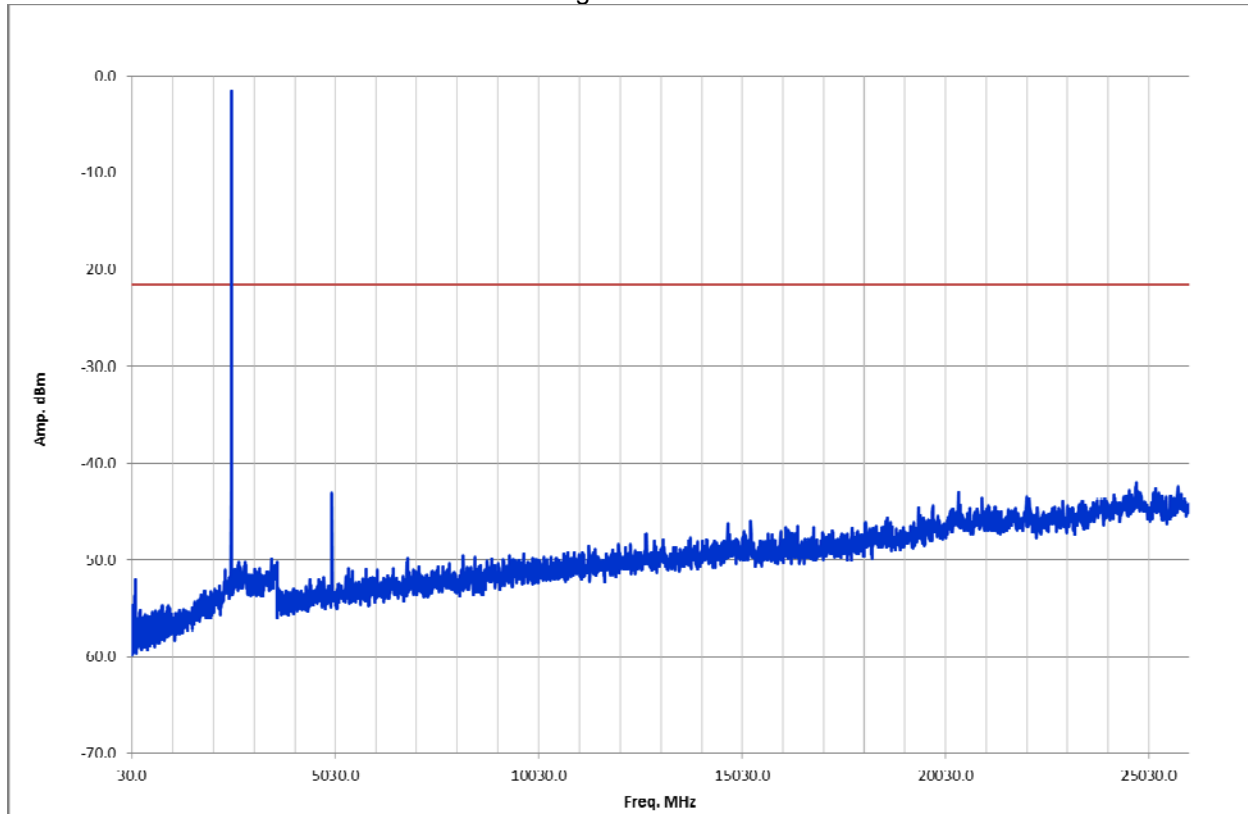
Low Channel



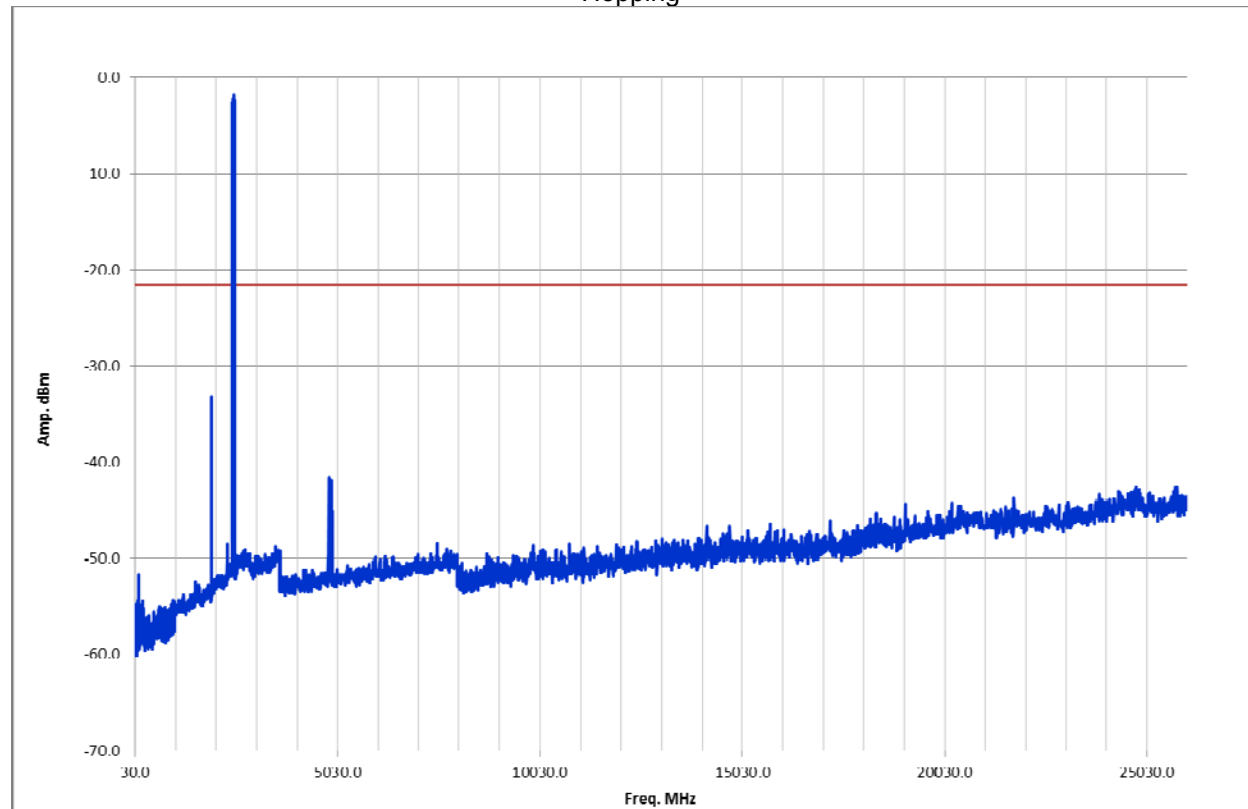
Mid Channel



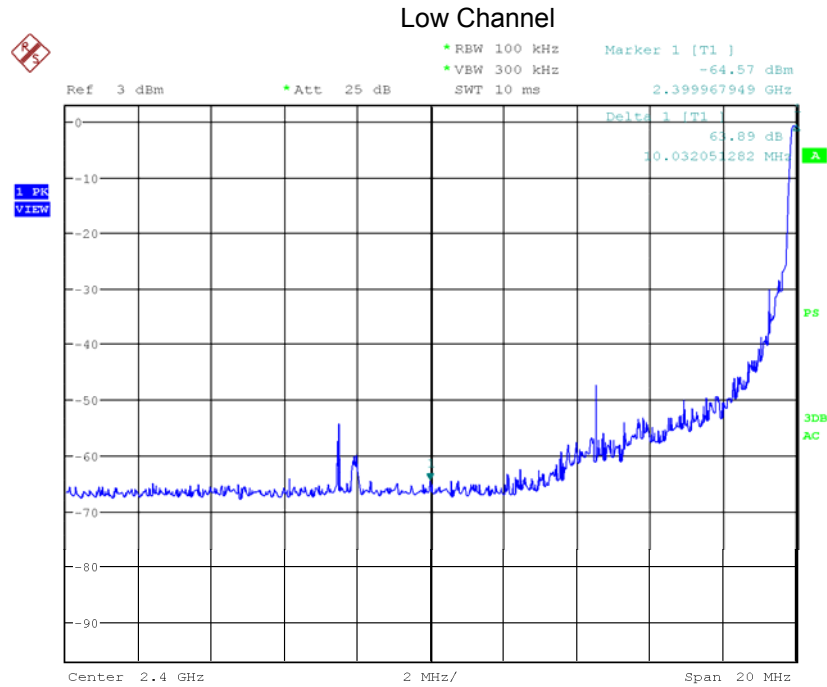
High Channel



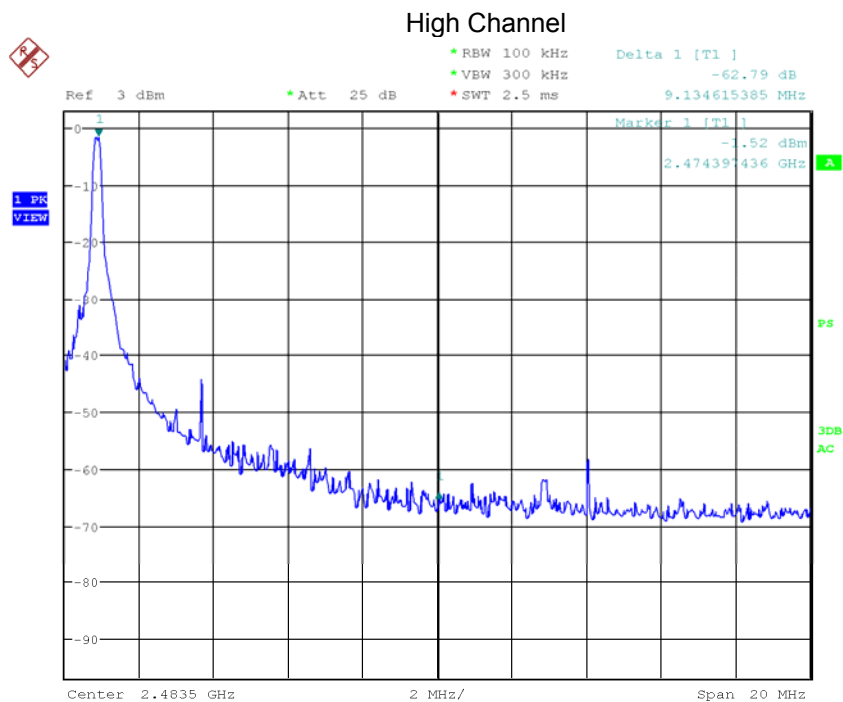
Hopping



Band Edge

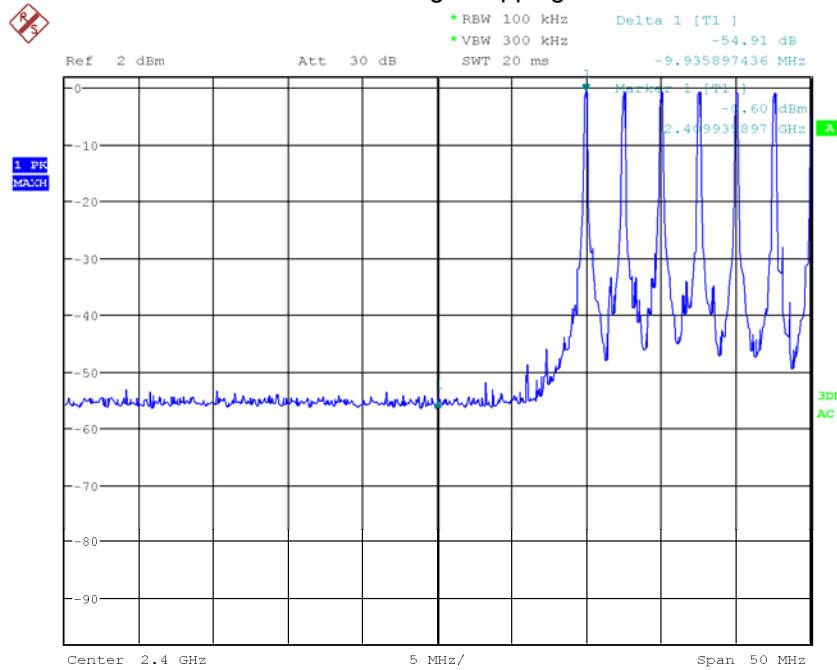


Date: 30.SEP.2015 10:13:20



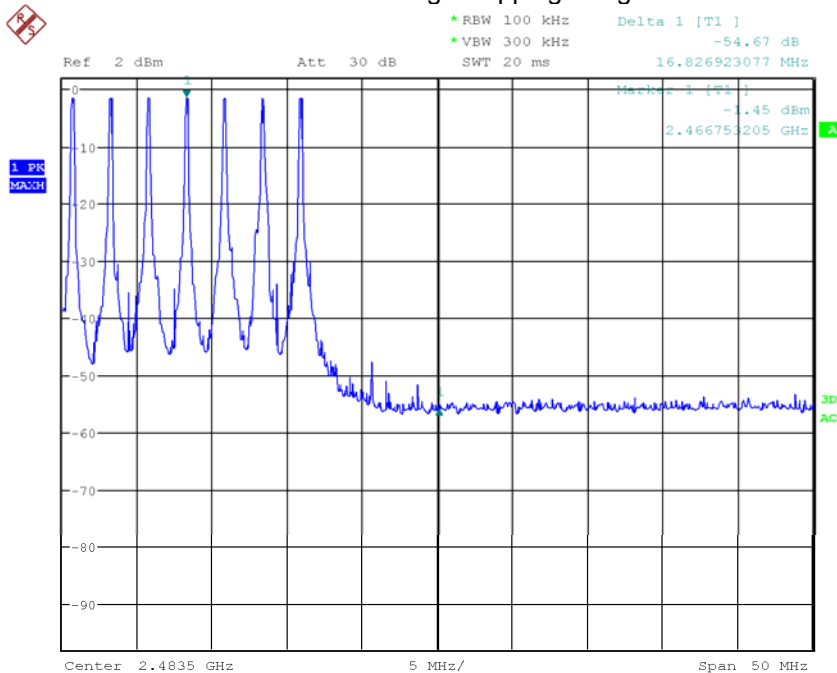
Date: 30.SEP.2015 10:35:48

Band Edge Hopping – Low



Date: 30.SEP.2015 15:09:24

Band Edge Hopping – High



Date: 30.SEP.2015 15:11:25

Notes: None

11 Spurious and Band Edge/Restricted Band Emissions - Radiated**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.

Test Requirement/Specification:

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 360° 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.

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

- 15.247(d)/15.209
- RSS-247 5.5/RSS-GEN 8.1

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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	10/22/2014	10/22/2015
18906	Amplifier 1-4 GHz	Mini-Circuits Lab	ZHL-42	N052792-2	05/01/2015	05/01/2016

Results:

The sample tested was found to comply.

Test Summary:

Test Report #:	G102271213	Test Area:	CC1	Temperature:	23.2	°C
Test Method:	FCC 15.247	Test Date:	9/30/2015	Relative Humidity:	31.5	%
EUT Model #:	31570014	EUT Power:	12 VDC	Air Pressure:	82.9	kPa
EUT Serial #:	0815K000002					
Manufacturer:	Ampt	Level Key				
EUT Description:	DC to DC string converter			Pk – Peak		
Notes:				Qp – Quasi Peak		
				Av - Average		

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	FINAL	POL	HT	AZ	DELTA1	DELTA2	RBW
MHz	dBuV	$\frac{Qp}{Av}$ $\frac{Pk}{Rms}$	+ [dB]	+ [dB/m]	- [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.209 >1GHz Pk	(MHz)
Axis 1 Low channel Bandedge												
2390.00	48.20	Pk	3.56	28.18	38.04	41.91	V	1.00	0.0	NA	- 32.09	1.0
2390.00	36.17	Av	3.56	28.18	38.04	29.88	V	1.00	0.0	- 24.10	NA	1.0
2390.00	49.55	Pk	3.56	28.18	38.04	43.26	H	1.00	0.0	NA	- 30.74	1.0
2390.00	36.13	Av	3.56	28.18	38.04	29.84	H	2.00	0.0	- 24.14	NA	1.0
Axis 1 High channel Bandedge												
2483.50	48.85	Pk	3.63	28.38	38.04	42.83	V	1.90	0.0	NA	- 31.17	1.0

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FREQ	LEVEL	DET	CABLE	ANT	PREAMP	FINAL	POL	HT	AZ	DELTA1	DELTA2	RBW
MHz	dBuV	$\frac{Qp}{Av}$ $\frac{Pk}{Rms}$	+ [dB]	+ [dB/m]	- [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.209 >1GHz Pk	(MHz)
2483.50	36.31	Av	3.63	28.38	38.04	30.29	V	1.90	0.0	- 23.69	NA	1.0
2483.50	48.38	Pk	3.63	28.38	38.04	42.36	H	3.10	285.0	NA	- 31.64	1.0
2483.50	36.35	Av	3.63	28.38	38.04	30.33	H	3.10	285.0	- 23.65	NA	1.0
Axis 2 Low channel Bandedge												
2390.00	49.63	Pk	3.56	28.18	38.04	43.34	V	1.50	0.0	NA	- 30.66	1.0
2390.00	36.94	Av	3.56	28.18	38.04	30.65	V	1.50	0.0	- 23.33	NA	1.0
2390.00	49.09	Pk	3.56	28.18	38.04	42.80	H	1.50	0.0	NA	- 31.20	1.0
2390.00	36.16	Av	3.56	28.18	38.04	29.87	H	1.50	0.0	- 24.11	NA	1.0
Axis 2 High channel Bandedge												
2483.50	51.39	Pk	3.63	28.38	38.04	45.37	V	1.50	0.0	NA	- 28.63	1.0
2483.50	39.42	Av	3.63	28.38	38.04	33.40	V	1.50	0.0	- 20.58	NA	1.0
2483.50	49.20	Pk	3.63	28.38	38.04	43.18	H	1.50	0.0	NA	- 30.82	1.0
2483.50	36.21	Av	3.63	28.38	38.04	30.19	H	1.50	0.0	- 23.79	NA	1.0
Axis 3 Low channel Bandedge												
2390.00	48.48	Pk	3.56	28.18	38.04	42.19	H	1.50	0.0	NA	- 31.81	1.0
2390.00	36.20	Av	3.56	28.18	38.04	29.91	H	1.50	0.0	- 24.07	NA	1.0
2390.00	49.75	Pk	3.56	28.18	38.04	43.46	V	1.50	0.0	NA	- 30.54	1.0
2390.00	36.54	Av	3.56	28.18	38.04	30.25	V	1.50	0.0	- 23.73	NA	1.0
Axis 3 High channel Bandedge												
2483.50	50.39	Pk	3.63	28.38	38.04	44.37	V	1.50	0.0	NA	- 29.63	1.0
2483.50	38.19	Av	3.63	28.38	38.04	32.17	V	1.50	0.0	- 21.81	NA	1.0
2483.50	49.79	Pk	3.63	28.38	38.04	43.77	H	1.50	0.0	NA	- 30.23	1.0
2483.50	36.74	Av	3.63	28.38	38.04	30.72	H	1.50	0.0	- 23.26	NA	1.0
Axis 1 Low channel												
4819.96	54.81	Pk	5.19	32.87	38.25	54.61	V	3.20	10.0	NA	- 19.39	1.0
4819.96	50.54	Av	5.19	32.87	38.25	50.34	V	3.20	10.0	- 3.64	NA	1.0
4819.96	52.02	Av	5.19	32.87	38.25	51.82	H	3.20	0.0	- 2.16	NA	1.0
4819.96	55.12	Pk	5.19	32.87	38.25	54.92	H	3.20	0.0	NA	- 19.08	1.0
12050.00	38.54	Av	8.49	39.23	47.12	39.13	V	1.00	0.0	- 14.85	NA	1.0
12050.00	38.53	Av	8.49	39.23	47.12	39.12	H	1.00	0.0	- 14.86	NA	1.0
12050.00	51.29	Pk	8.49	39.23	47.12	51.88	V	1.00	0.0	NA	- 22.12	1.0
12050.00	51.19	Pk	8.49	39.23	47.12	51.78	H	1.00	0.0	NA	- 22.22	1.0
Axis 1 Mid channel												
4883.66	54.80	Pk	5.22	32.96	39.01	53.98	H	2.10	0.0	NA	- 20.02	1.0
4883.66	51.53	Av	5.22	32.96	39.01	50.71	H	2.10	0.0	- 3.27	NA	1.0
4883.66	49.18	Av	5.22	32.96	39.01	48.36	V	3.20	80.0	- 5.62	NA	1.0
4883.66	53.05	Pk	5.22	32.96	39.01	52.23	V	3.20	80.0	NA	- 21.77	1.0
7325.46	44.36	Av	6.50	36.71	47.40	40.17	V	2.40	80.0	- 13.81	NA	1.0

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FREQ	LEVEL	DET	CABLE	ANT	PREAMP	FINAL	POL	HT	AZ	DELTA1	DELTA2	RBW
MHz	dBuV	$\frac{Qp}{Av}$ $\frac{Pk}{Rms}$	+ [dB]	+ [dB/m]	- [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.209 >1GHz Pk	(MHz)
7325.46	54.85	Pk	6.50	36.71	47.40	50.66	V	2.40	80.0	NA	- 23.34	1.0
7325.46	45.54	Av	6.50	36.71	47.40	41.35	H	2.30	40.0	- 12.63	NA	1.0
7325.46	54.71	Pk	6.50	36.71	47.40	50.52	H	2.30	40.0	NA	- 23.48	1.0
12210.00	37.75	Av	8.57	39.01	47.08	38.25	H	1.50	0.0	- 15.73	NA	1.0
12210.00	37.74	Av	8.57	39.01	47.08	38.24	V	2.40	80.0	- 15.74	NA	1.0
12210.00	50.31	Pk	8.57	39.01	47.08	50.81	H	1.50	0.0	NA	- 23.19	1.0
12210.00	51.35	Pk	8.57	39.01	47.08	51.85	V	2.40	80.0	NA	- 22.15	1.0
Axis 1 High channel												
4948.76	55.53	Pk	5.26	33.09	39.78	54.10	V	2.30	286.0	NA	- 19.90	1.0
4948.76	52.14	Av	5.26	33.09	39.78	50.71	V	2.30	286.0	- 3.27	NA	1.0
4948.76	50.25	Av	5.26	33.09	39.78	48.82	H	3.10	285.0	- 5.16	NA	1.0
4948.76	54.62	Pk	5.26	33.09	39.78	53.19	H	3.10	285.0	NA	- 20.81	1.0
7423.12	42.08	Av	6.55	36.82	47.25	38.20	V	1.00	0.0	- 15.78	NA	1.0
7423.12	45.09	Av	6.55	36.82	47.25	41.21	H	1.30	0.0	- 12.77	NA	1.0
7423.12	52.96	Pk	6.55	36.82	47.25	49.08	V	1.00	0.0	NA	- 24.92	1.0
7423.12	54.54	Pk	6.55	36.82	47.25	50.66	H	1.30	0.0	NA	- 23.34	1.0
12372.00	38.20	Av	8.66	38.89	46.85	38.90	V	1.00	0.0	- 15.08	NA	1.0
12372.00	38.20	Av	8.66	38.89	46.85	38.90	H	1.00	0.0	- 15.08	NA	1.0
12372.00	52.96	Pk	8.66	38.89	46.85	53.66	V	1.00	0.0	NA	- 20.34	1.0
12372.00	50.81	Pk	8.66	38.89	46.85	51.51	H	1.00	0.0	NA	- 22.49	1.0
Axis 2 Low channel												
4819.99	54.75	Pk	5.19	32.87	38.26	54.55	H	1.20	48.0	NA	- 19.45	1.0
4819.97	51.22	Av	5.19	32.87	38.25	51.02	V	1.40	21.0	- 2.96	NA	1.0
4819.97	54.42	Pk	5.19	32.87	38.25	54.22	V	1.40	21.0	NA	- 19.78	1.0
4819.99	50.86	Av	5.19	32.87	38.26	50.66	H	1.20	48.0	- 3.32	NA	1.0
12050.00	38.53	Av	8.49	39.23	47.12	39.12	H	1.50	0.0	- 14.86	NA	1.0
12050.00	38.43	Av	8.49	39.23	47.12	39.02	V	1.50	0.0	- 14.96	NA	1.0
12050.00	50.32	Pk	8.49	39.23	47.12	50.91	H	1.50	0.0	NA	- 23.09	1.0
12050.00	50.65	Pk	8.49	39.23	47.12	51.24	V	1.50	0.0	NA	- 22.76	1.0
Axis 2 Mid channel												
4883.64	54.36	Pk	5.22	32.96	39.01	53.54	V	1.50	0.0	NA	- 20.46	1.0
4883.64	50.82	Av	5.22	32.96	39.01	50.00	V	1.50	0.0	- 3.98	NA	1.0
4883.64	50.49	Av	5.22	32.96	39.01	49.67	H	1.40	50.0	- 4.31	NA	1.0
7325.47	43.78	Av	6.50	36.71	47.40	39.59	H	2.30	0.0	- 14.39	NA	1.0
7325.47	54.46	Pk	6.50	36.71	47.40	50.27	H	2.30	0.0	NA	- 23.73	1.0
7325.47	54.49	Pk	6.50	36.71	47.40	50.30	H	1.40	50.0	NA	- 23.70	1.0
7325.47	45.90	Av	6.50	36.71	47.40	41.71	V	1.40	112.0	- 12.27	NA	1.0
7325.47	54.41	Pk	6.50	36.71	47.40	50.22	V	1.40	112.0	NA	- 23.78	1.0
12210.00	37.67	Av	8.57	39.01	47.08	38.17	V	1.50	0.0	- 15.81	NA	1.0
12210.00	37.77	Av	8.57	39.01	47.08	38.27	H	1.50	0.0	- 15.71	NA	1.0
12210.00	50.05	Pk	8.57	39.01	47.08	50.55	V	1.50	0.0	NA	- 23.45	1.0
12210.00	51.13	Pk	8.57	39.01	47.08	51.63	H	1.50	0.0	NA	- 22.37	1.0

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FREQ	LEVEL	DET	CABLE	ANT	PREAMP	FINAL	POL	HT	AZ	DELTA1	DELTA2	RBW
MHz	dBuV	$\frac{Qp}{Av}$ $\frac{Pk}{Rms}$	+ [dB]	+ [dB/m]	- [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.209 >1GHz Pk	(MHz)
Axis 2 High channel												
4948.84	55.27	Pk	5.26	33.09	39.78	53.84	H	3.40	283.0	NA	- 20.16	1.0
4948.84	52.06	Av	5.26	33.09	39.78	50.63	H	3.40	283.0	- 3.35	NA	1.0
4948.84	52.90	Av	5.26	33.09	39.78	51.47	V	1.50	10.0	- 2.51	NA	1.0
4948.84	56.28	Pk	5.26	33.09	39.78	54.85	V	1.50	10.0	NA	- 19.15	1.0
7423.28	43.90	Av	6.55	36.82	47.25	40.02	H	2.00	283.0	- 13.96	NA	1.0
7423.28	45.22	Av	6.55	36.82	47.25	41.34	V	3.70	23.0	- 12.64	NA	1.0
7423.28	54.10	Pk	6.55	36.82	47.25	50.22	H	2.00	283.0	NA	- 23.78	1.0
7423.28	55.27	Pk	6.55	36.82	47.25	51.39	V	3.70	23.0	NA	- 22.61	1.0
12372.00	38.26	Av	8.66	38.89	46.85	38.96	H	1.50	0.0	- 15.02	NA	1.0
12372.00	38.37	Av	8.66	38.89	46.85	39.07	V	1.50	0.0	- 14.91	NA	1.0
12372.00	50.58	Pk	8.66	38.89	46.85	51.28	H	1.50	0.0	NA	- 22.72	1.0
12372.00	51.91	Pk	8.66	38.89	46.85	52.61	V	1.50	0.0	NA	- 21.39	1.0
Axis 3 Low channel												
4819.99	55.06	Pk	5.19	32.87	38.26	54.86	V	2.00	338.0	NA	- 19.14	1.0
4819.99	51.82	Av	5.19	32.87	38.26	51.62	V	2.00	338.0	- 2.36	NA	1.0
4819.99	53.77	Av	5.19	32.87	38.26	53.57	H	2.10	90.0	- 0.41	NA	1.0
4819.99	56.57	Pk	5.19	32.87	38.26	56.37	H	2.10	90.0	NA	- 17.63	1.0
12050.00	38.74	Av	8.49	39.23	47.12	39.33	V	1.50	0.0	- 14.65	NA	1.0
12050.00	38.70	Av	8.49	39.23	47.12	39.29	H	1.50	0.0	- 14.69	NA	1.0
12050.00	51.76	Pk	8.49	39.23	47.12	52.35	V	1.50	0.0	NA	- 21.65	1.0
12050.00	52.04	Pk	8.49	39.23	47.12	52.63	H	1.50	0.0	NA	- 21.37	1.0
Axis 3 Mid channel												
4883.64	55.93	Pk	5.22	32.96	39.01	55.11	H	2.10	120.0	NA	- 18.89	1.0
4883.64	52.97	Av	5.22	32.96	39.01	52.15	H	2.10	120.0	- 1.83	NA	1.0
4883.64	50.29	Av	5.22	32.96	39.01	49.47	V	2.30	269.0	- 4.51	NA	1.0
4883.64	54.11	Pk	5.22	32.96	39.01	53.29	V	2.30	269.0	NA	- 20.71	1.0
7325.47	48.65	Av	6.50	36.71	47.40	44.46	H	2.40	120.0	- 9.52	NA	1.0
7325.47	45.12	Av	6.50	36.71	47.40	40.93	V	1.90	0.0	- 13.05	NA	1.0
7325.47	56.22	Pk	6.50	36.71	47.40	52.03	H	2.40	120.0	NA	- 21.97	1.0
7325.47	55.08	Pk	6.50	36.71	47.40	50.89	V	1.90	0.0	NA	- 23.11	1.0
12210.00	37.80	Av	8.57	39.01	47.08	38.30	H	1.50	0.0	- 15.68	NA	1.0
12210.00	37.86	Av	8.57	39.01	47.08	38.36	V	1.50	0.0	- 15.62	NA	1.0
12210.00	51.43	Pk	8.57	39.01	47.08	51.93	H	1.50	0.0	NA	- 22.07	1.0
12210.00	50.49	Pk	8.57	39.01	47.08	50.99	V	1.50	0.0	NA	- 23.01	1.0
Axis 3 High channel												
4948.84	54.16	Pk	5.26	33.09	39.78	52.73	V	3.10	352.0	NA	- 21.27	1.0
4948.84	49.67	Av	5.26	33.09	39.78	48.24	V	3.10	352.0	- 5.74	NA	1.0
4948.84	54.45	Av	5.26	33.09	39.78	53.02	H	1.60	140.0	- 0.96	NA	1.0
4948.84	57.37	Pk	5.26	33.09	39.78	55.94	H	1.60	140.0	NA	- 18.06	1.0
7423.28	47.78	Av	6.55	36.82	47.25	43.90	V	1.20	85.0	- 10.08	NA	1.0

Intertek

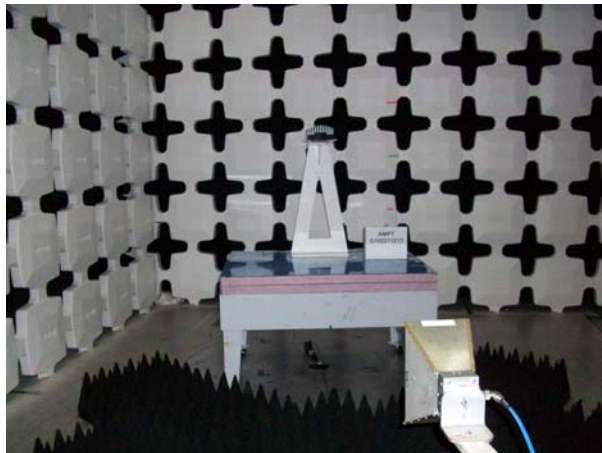
Report Number: **102271213DEN-001B**

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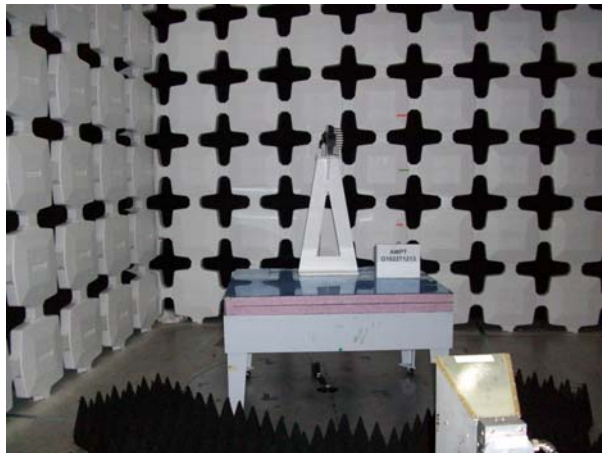
FREQ	LEVEL	DET	CABLE	ANT	PREAMP	FINAL	POL	HT	AZ	DELTA1	DELTA2	RBW
<u>MHz</u>	<u>dBuV</u>	<u>Qp</u> <u>Av</u> <u>Pk</u> <u>Rms</u>	+ [dB]	+ [dB/m]	- [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.209 >1GHz Av	FCC 15.209 >1GHz Pk	(MHz)
7423.28	48.92	Av	6.55	36.82	47.25	45.04	H	2.60	30.0	- 8.94	NA	1.0
7423.28	55.81	Pk	6.55	36.82	47.25	51.93	V	1.20	85.0	NA	- 22.07	1.0
7423.28	56.46	Pk	6.55	36.82	47.25	52.58	H	2.60	30.0	NA	- 21.42	1.0
12372.00	38.46	Av	8.66	38.89	46.85	39.16	V	1.50	0.0	- 14.82	NA	1.0
12372.00	38.46	Av	8.66	38.89	46.85	39.16	H	1.50	0.0	- 14.82	NA	1.0
12372.00	51.82	Pk	8.66	38.89	46.85	52.52	V	1.50	0.0	NA	- 21.48	1.0
12372.00	51.05	Pk	8.66	38.89	46.85	51.75	H	1.50	0.0	NA	- 22.25	1.0

Setup Photographs:

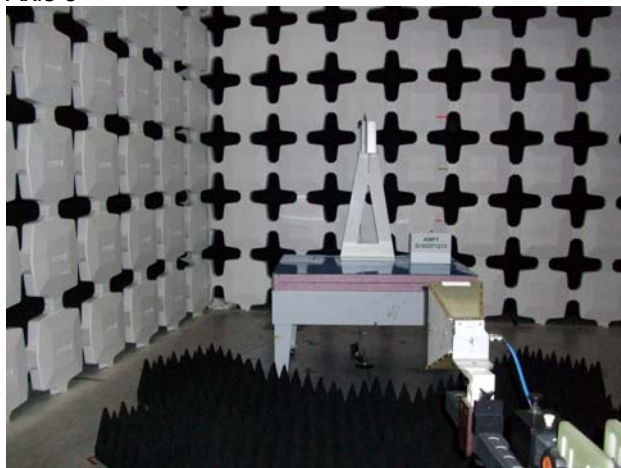
Axis 1



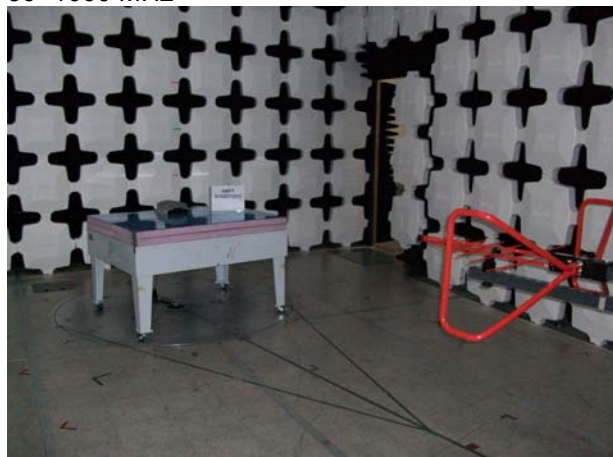
Axis 2



Axis 3



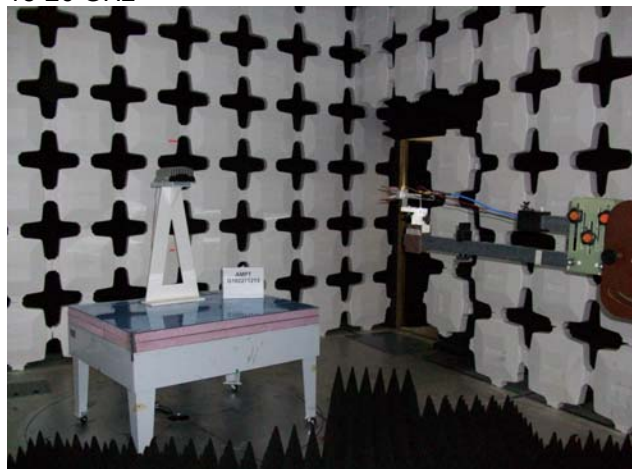
30 -1000 MHz



1-18 GHz

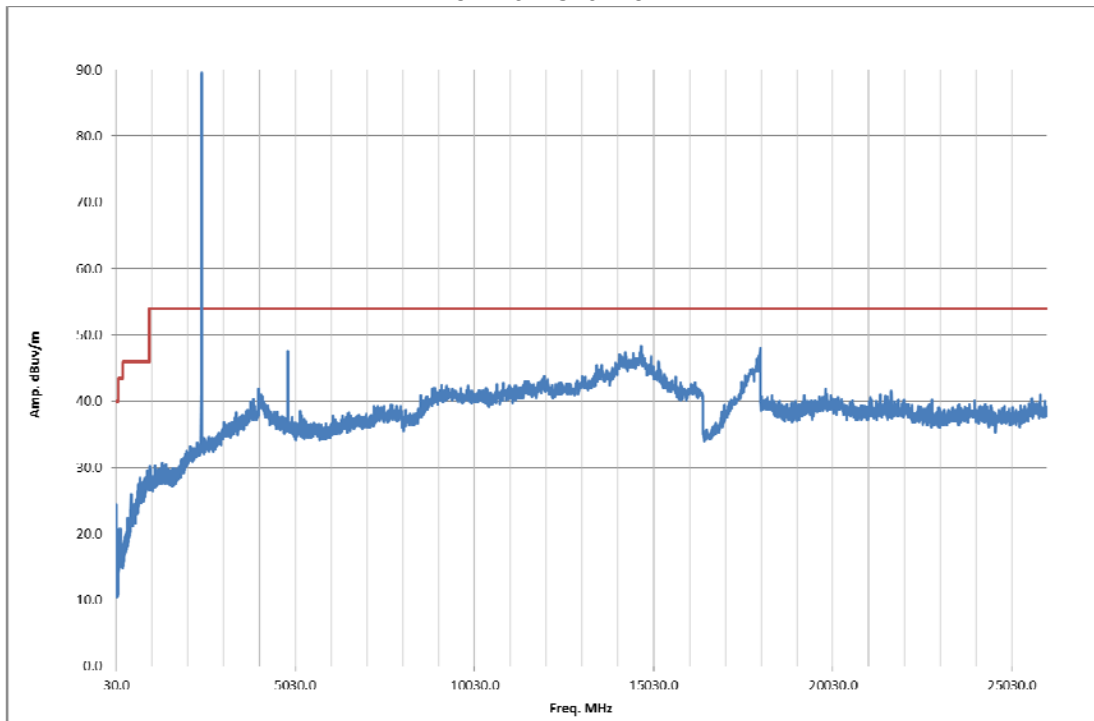


18-26 GHz

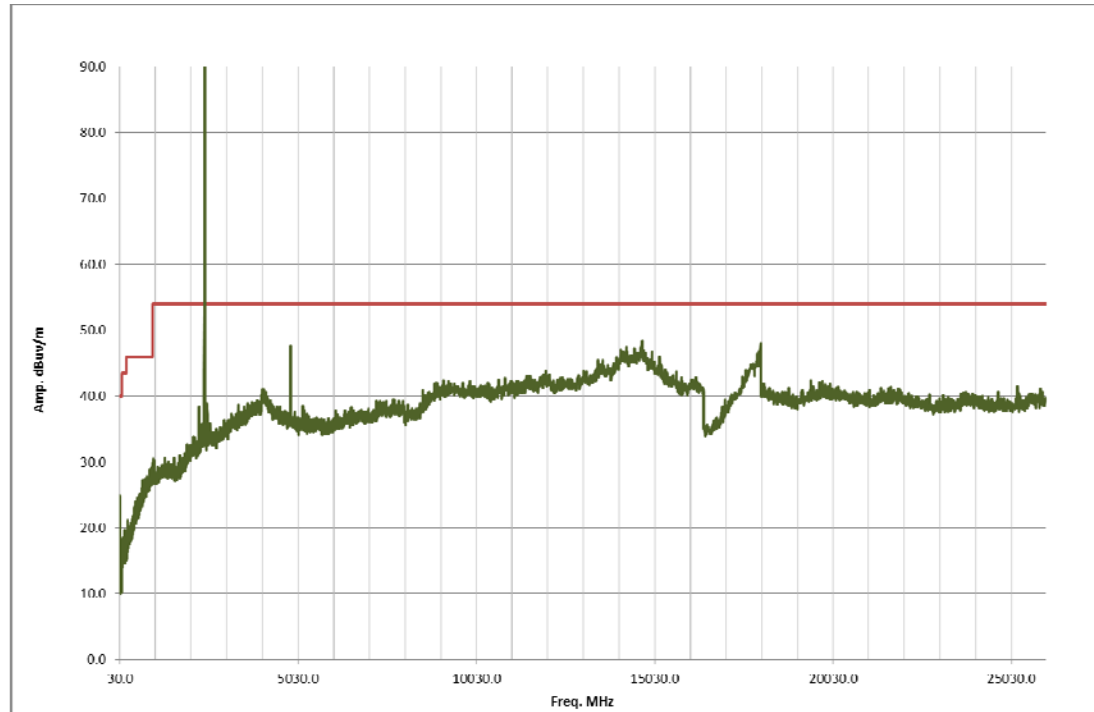


Plots:

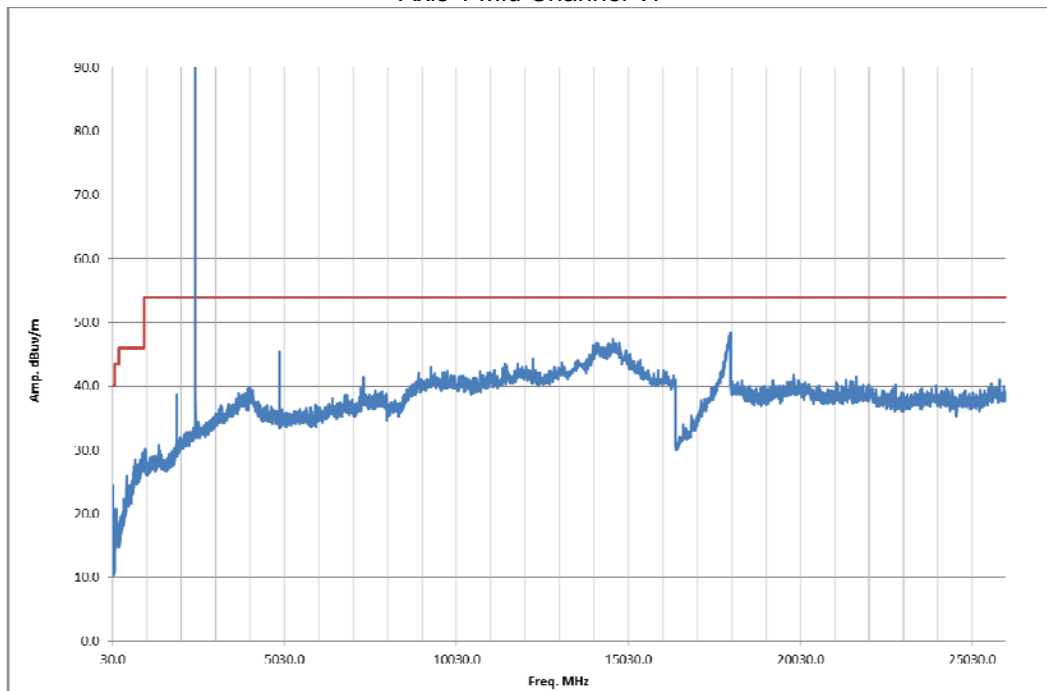
Axis 1 Low Channel VP



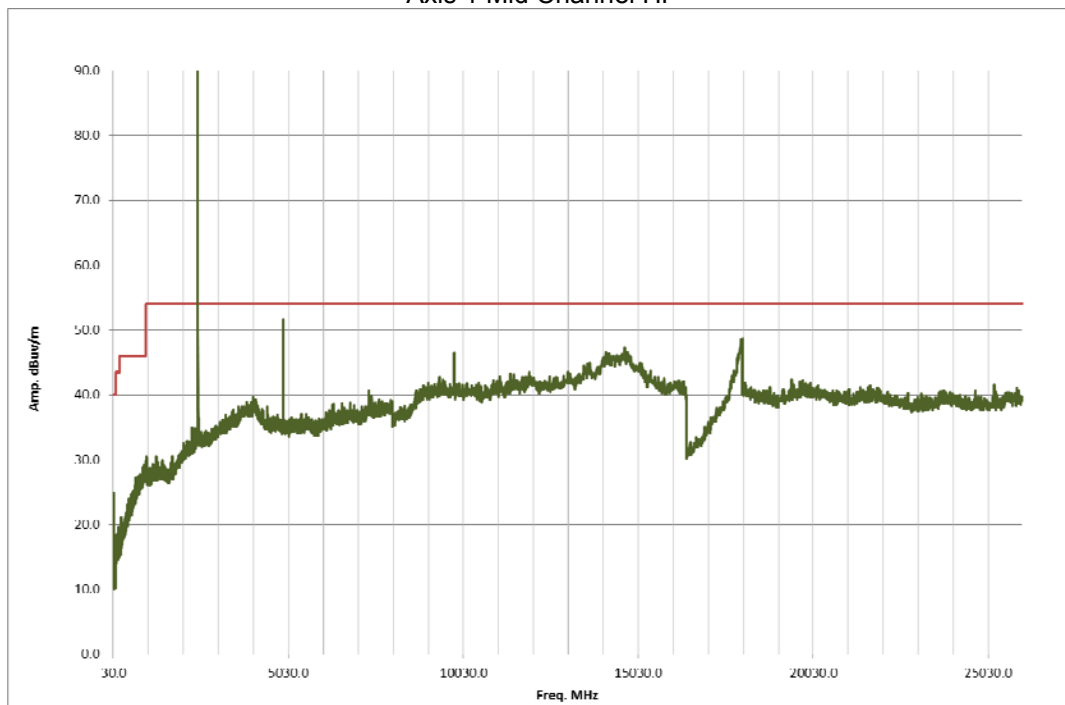
Axis 1 Low Channel HP



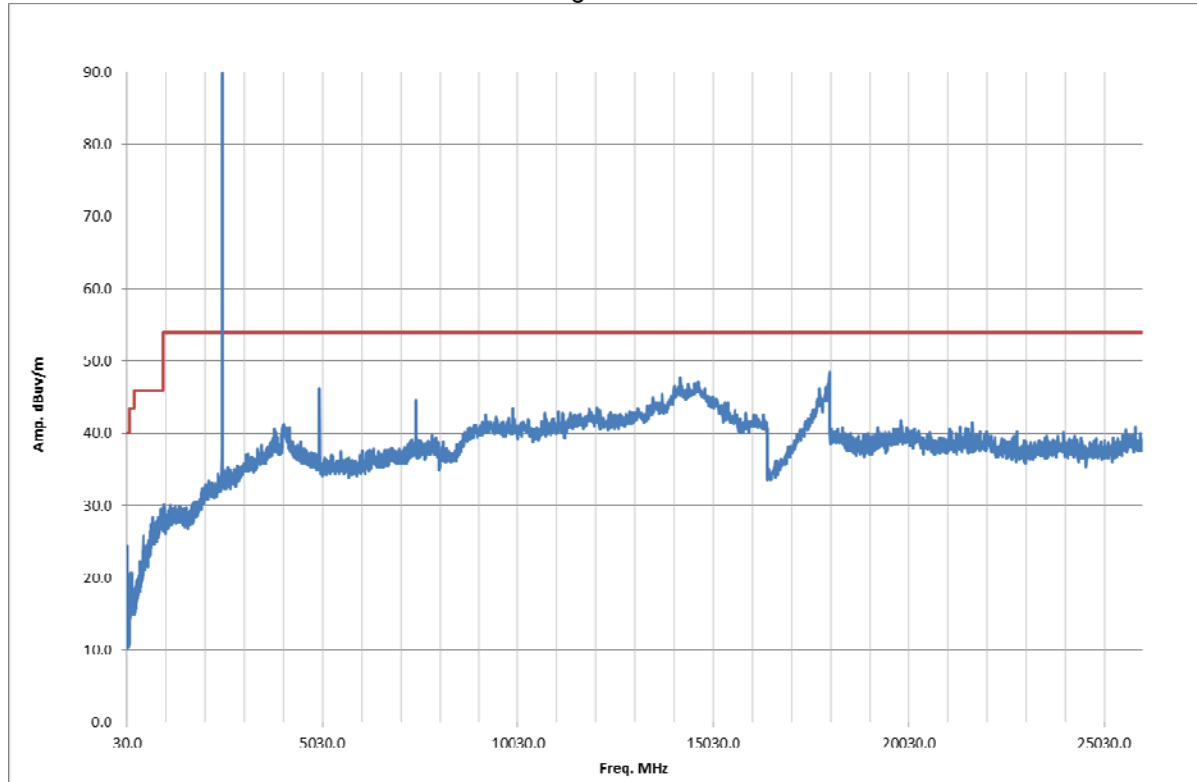
Axis 1 Mid Channel VP



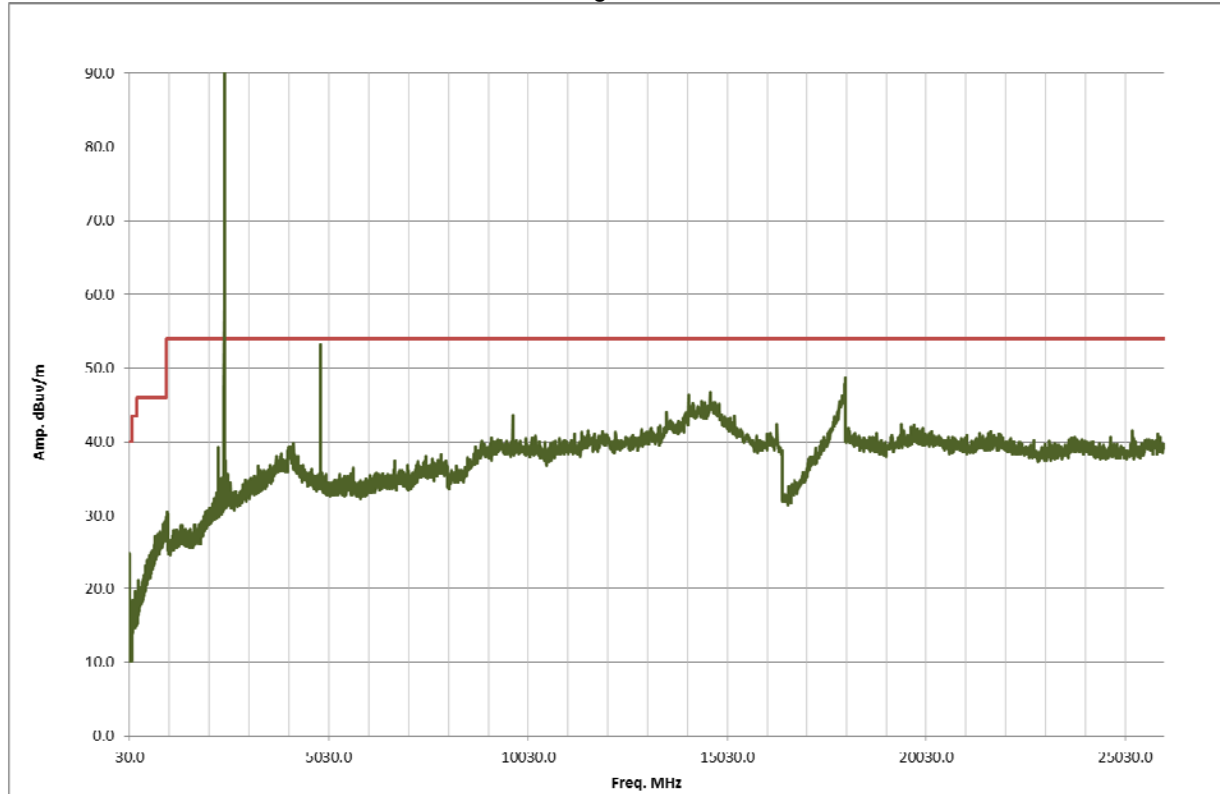
Axis 1 Mid Channel HP



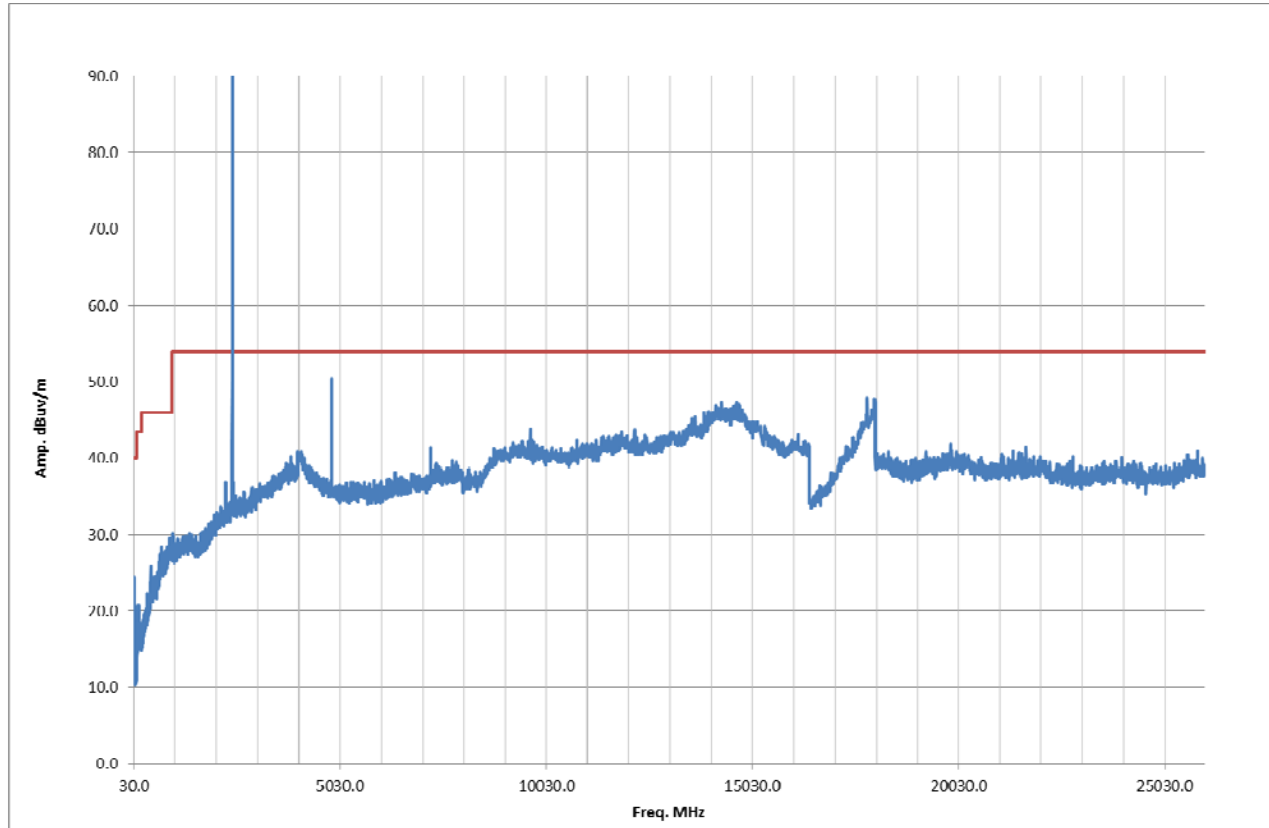
Axis 1 High Channel VP



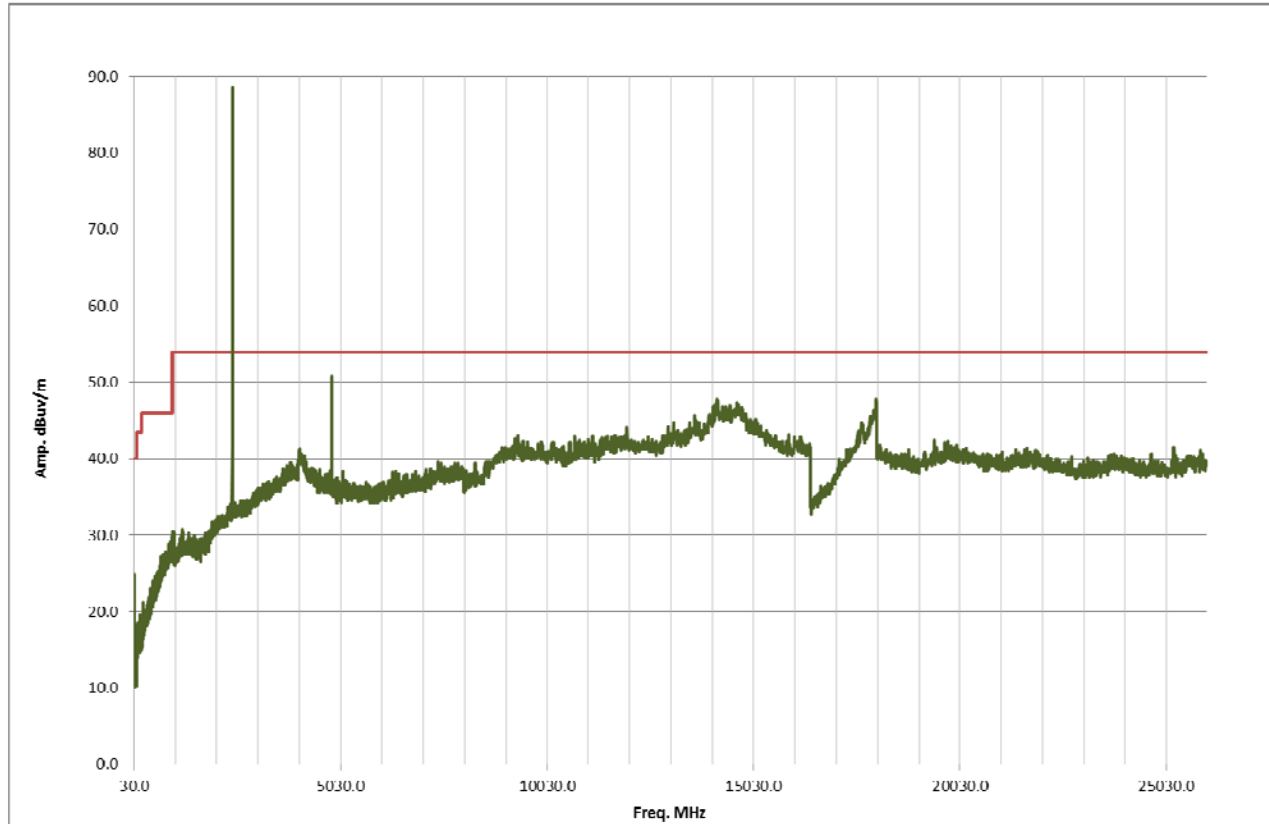
Axis 1 High Channel HP



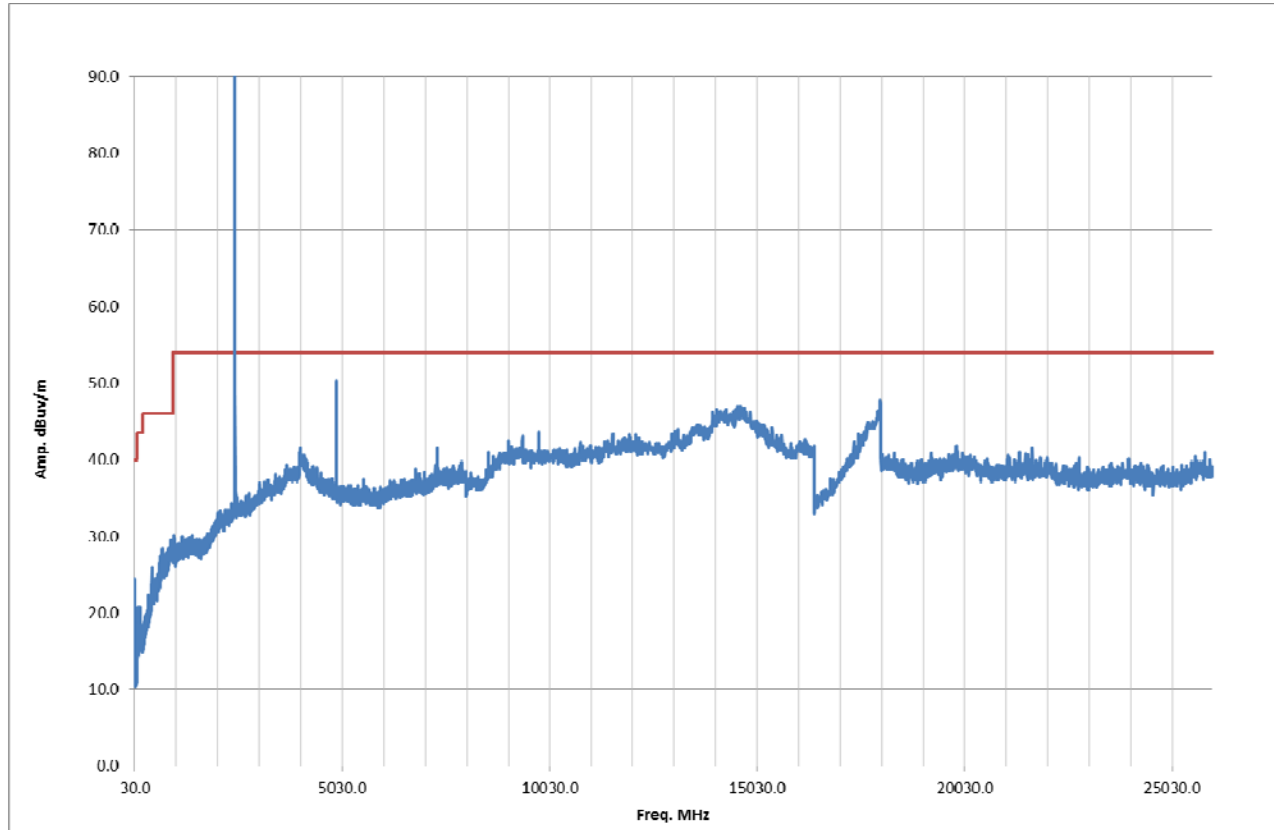
Axis 2 Low Channel VP



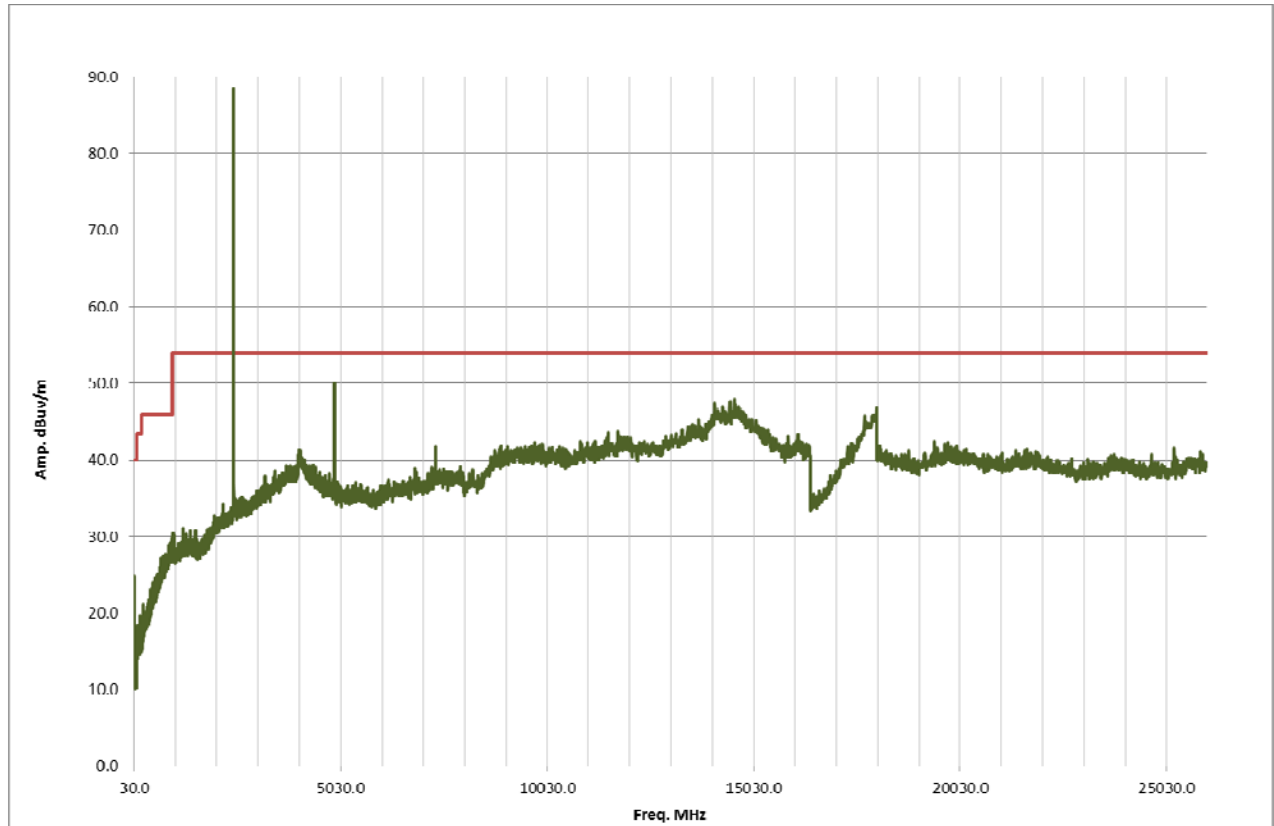
Axis 2 Low Channel HP



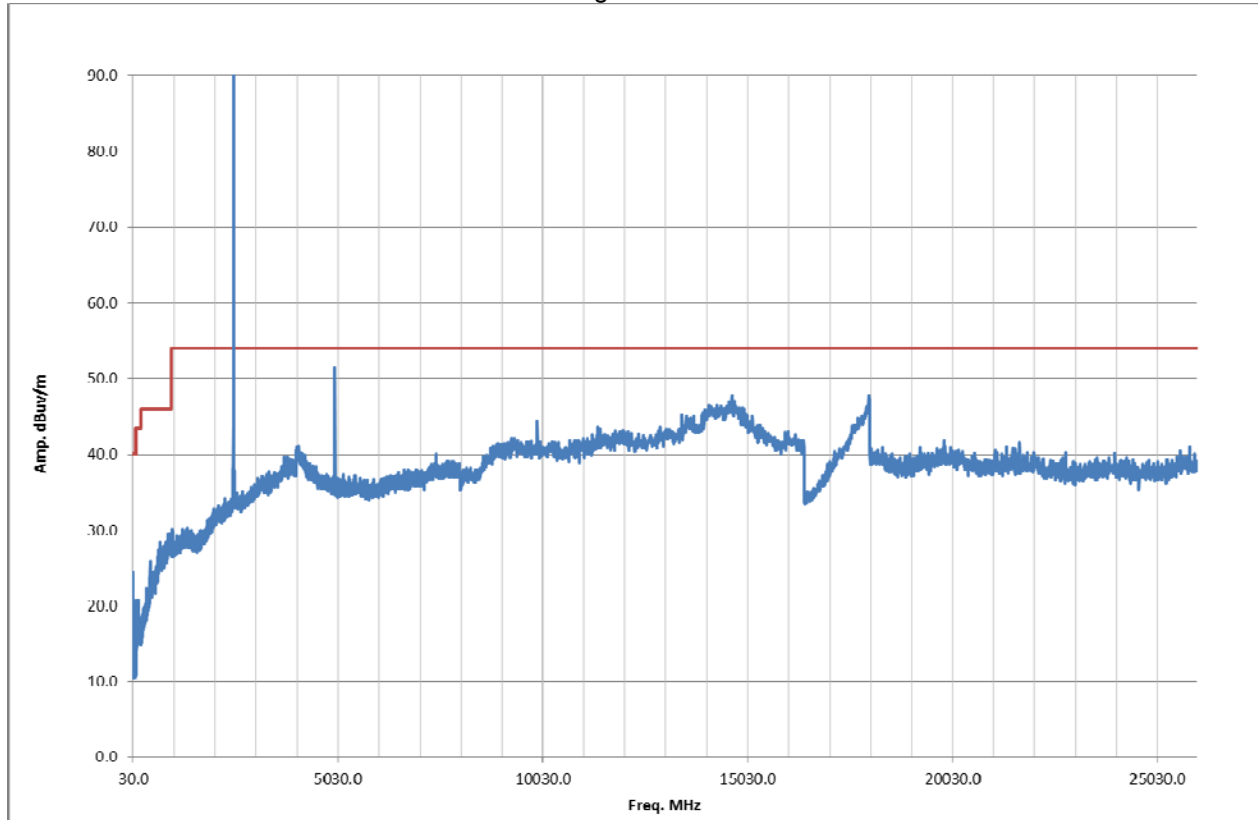
Axis 2 Mid Channel VP



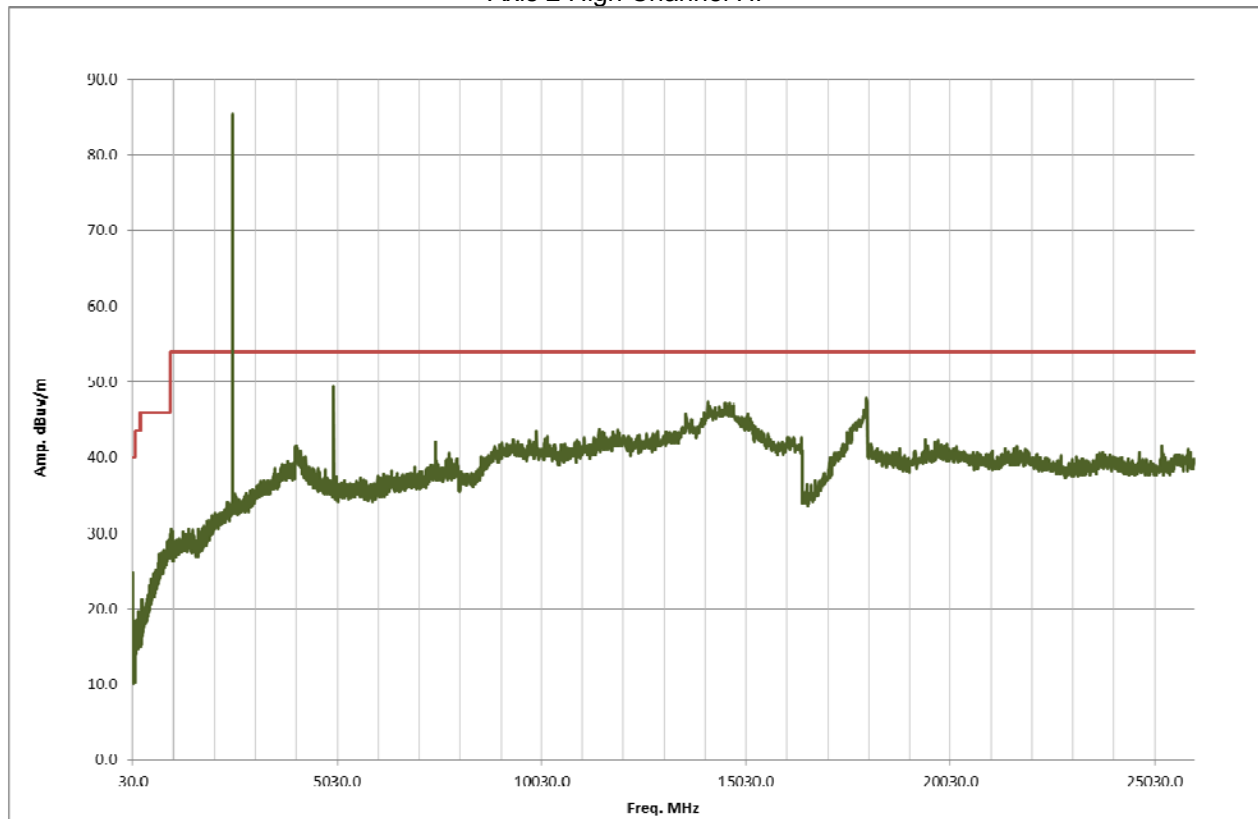
Axis 2 Mid Channel HP



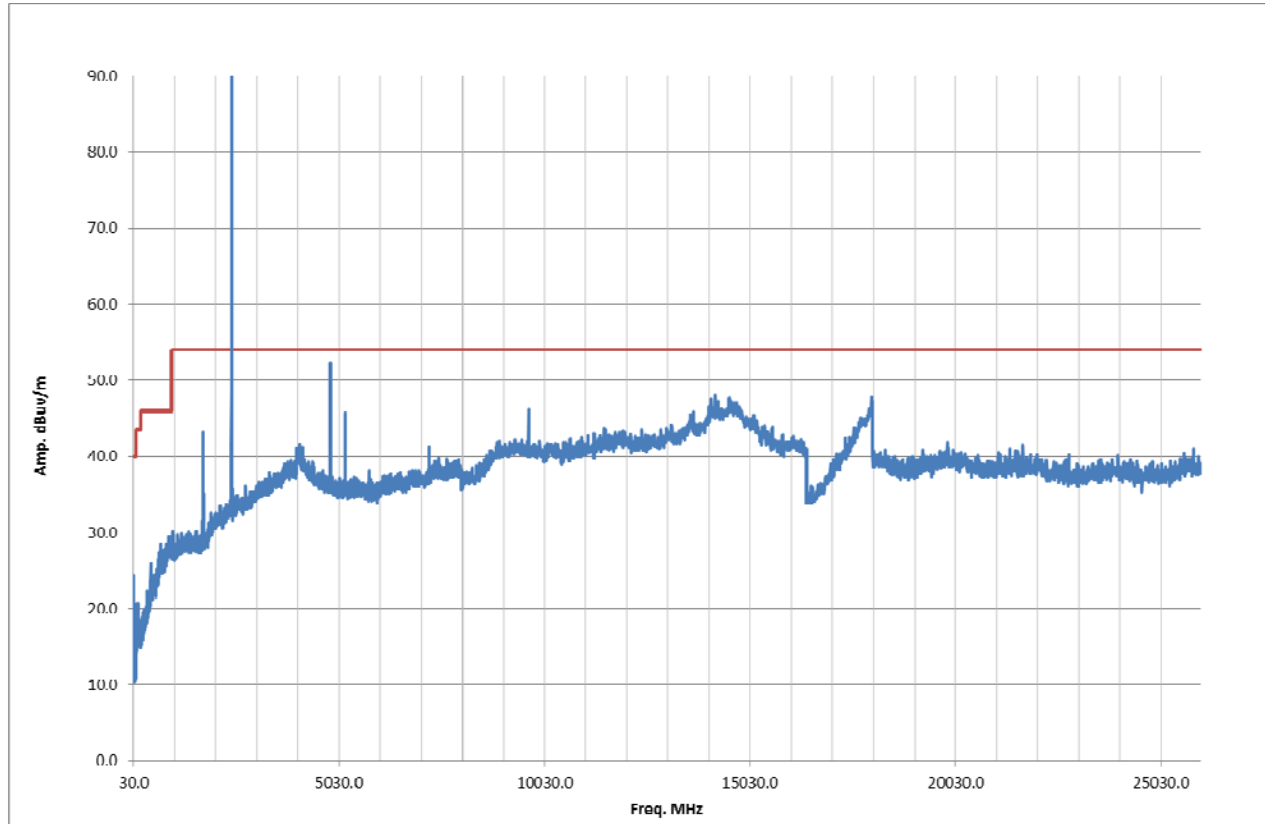
Axis 2 High Channel VP



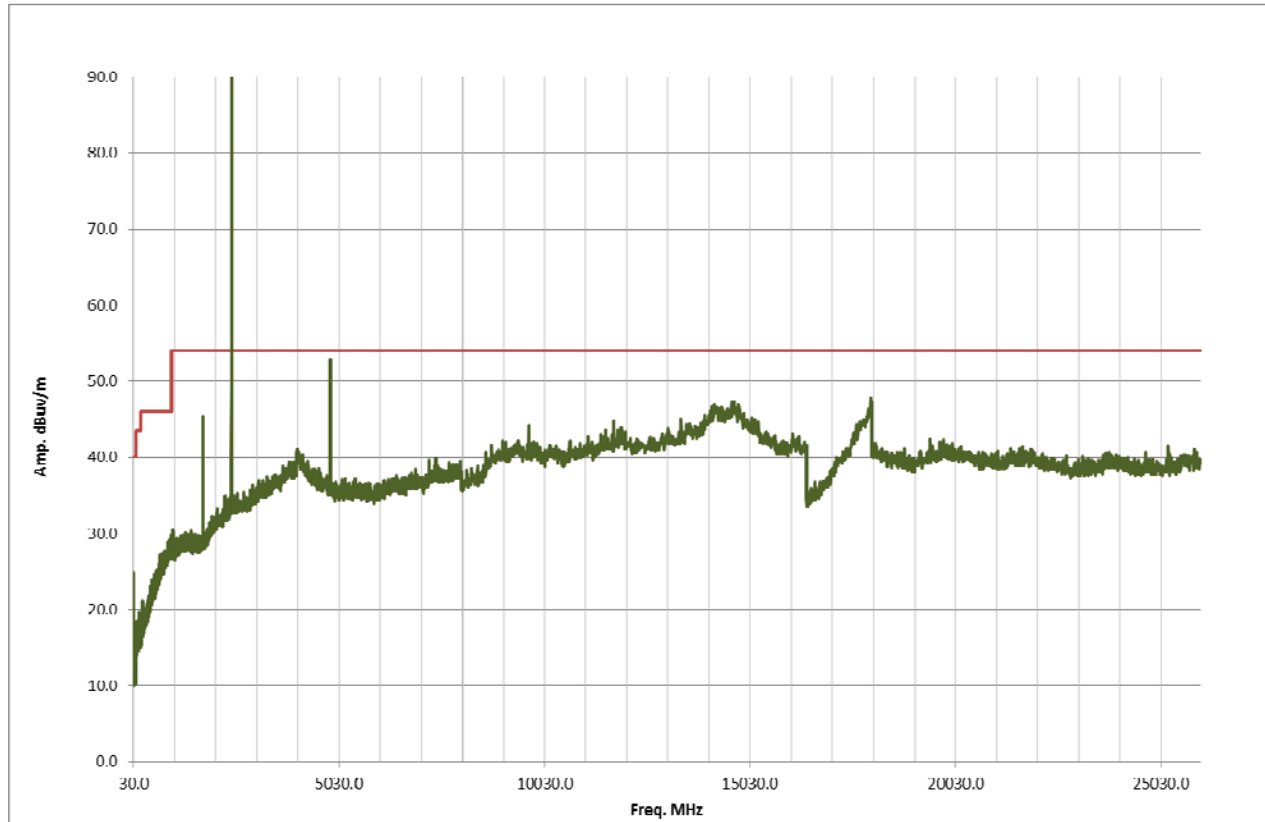
Axis 2 High Channel HP



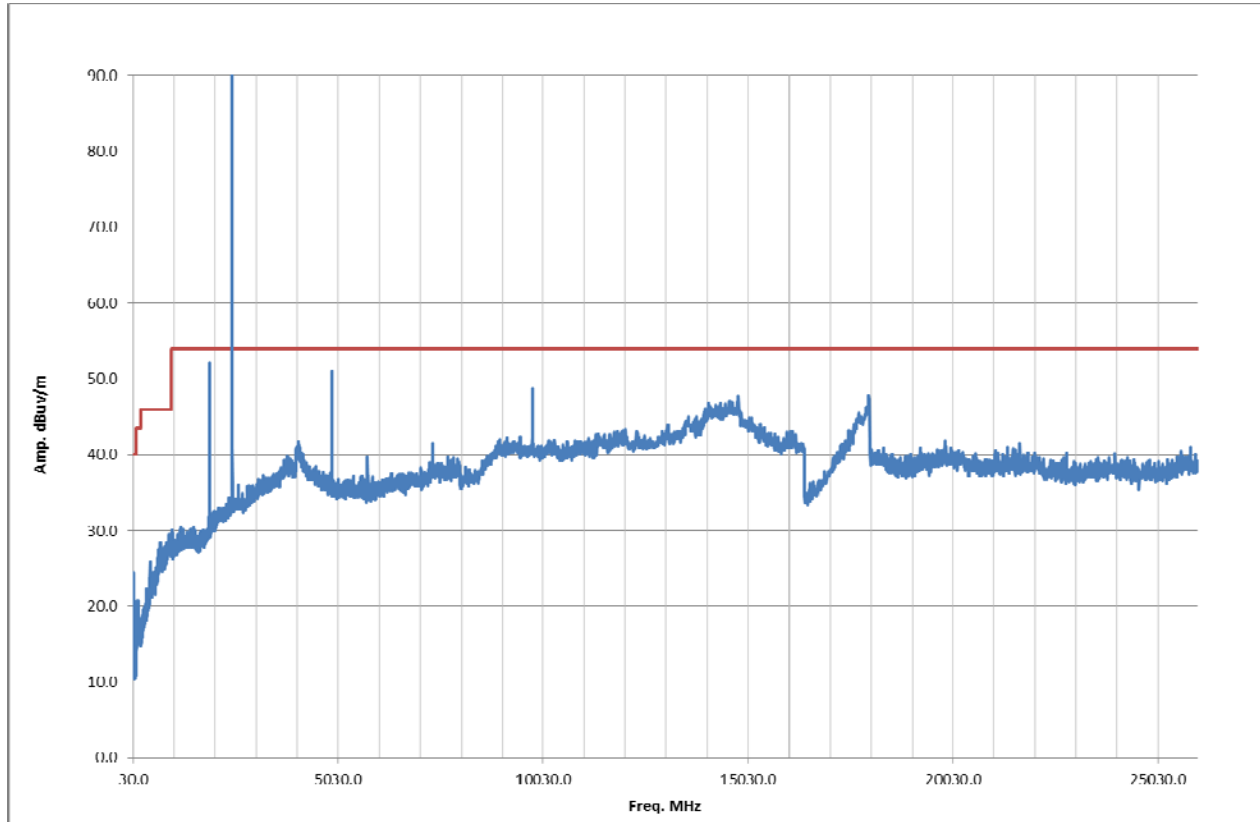
Axis 3 Low Channel VP



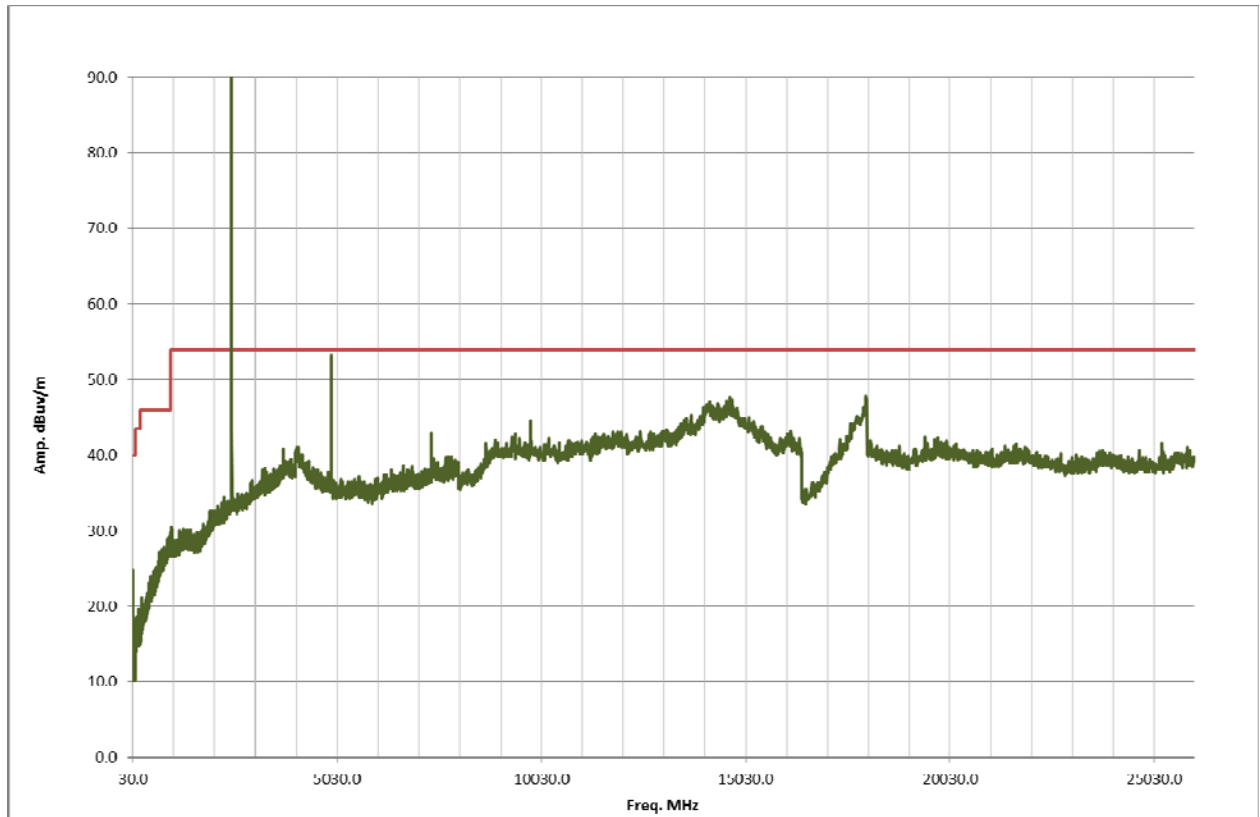
Axis 3 Low Channel HP



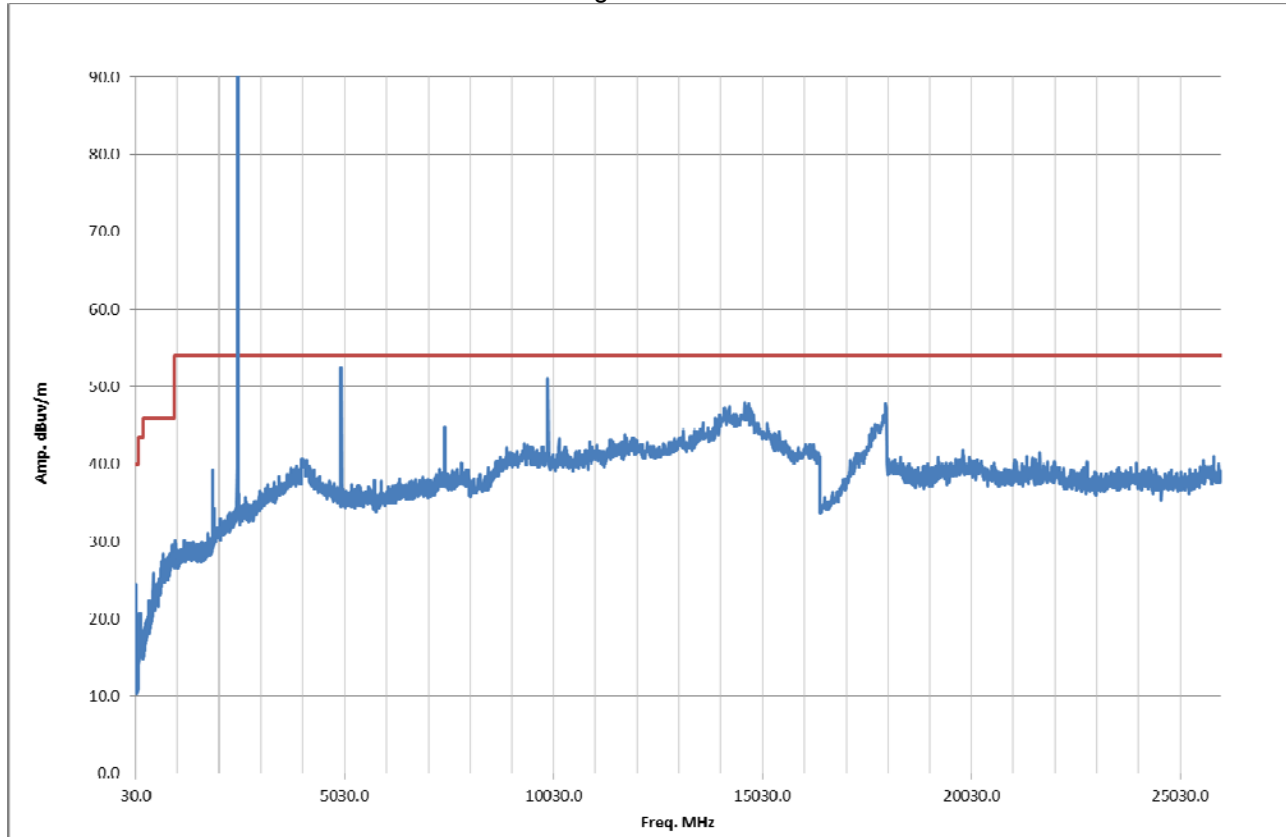
Axis 3 Mid Channel VP



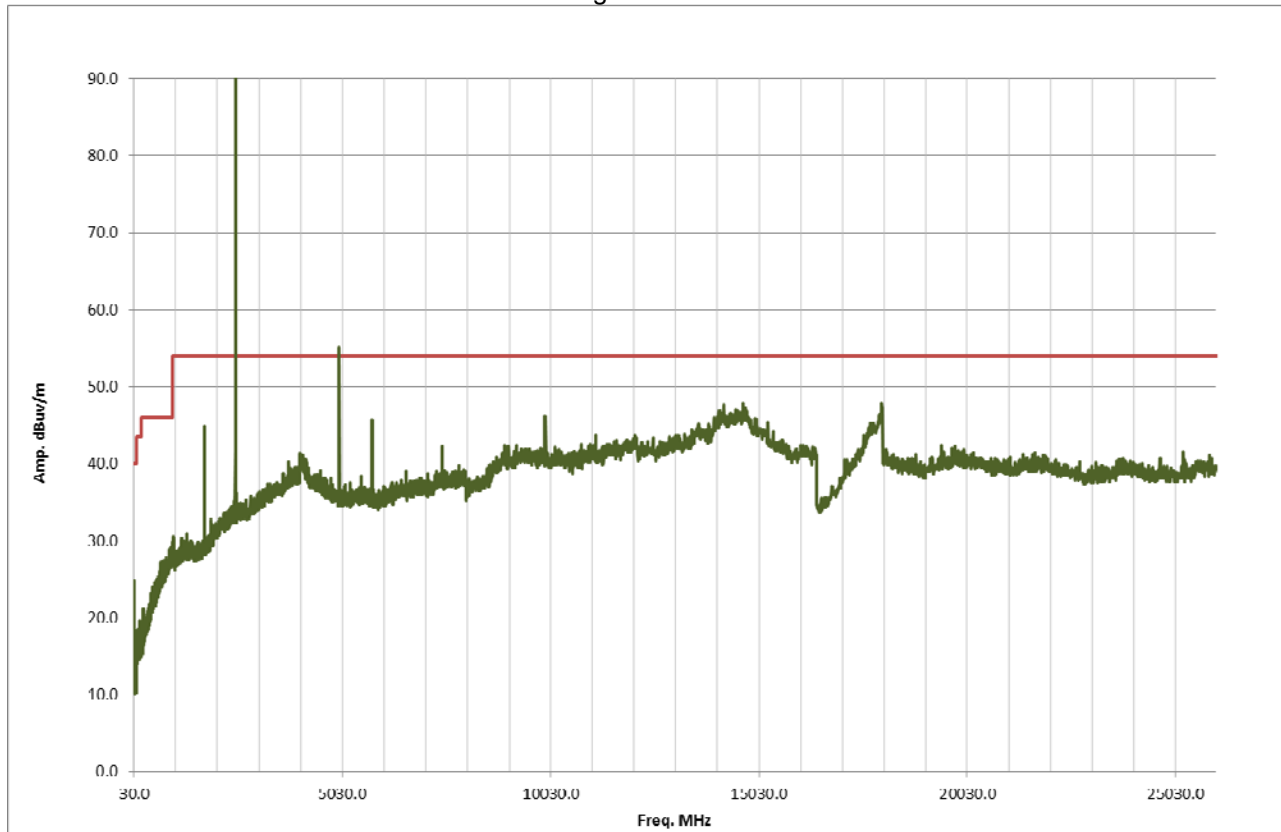
Axis 3 Mid Channel HP



Axis 3 High Channel VP



Axis 3 High Channel HP



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12 Antenna Requirement

Method

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from FCC CFR47 15.203.

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

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.

- FCC 15.203

Results:

The product utilizes an integral antenna – not user accessible; therefore, the sample tested was found to comply.

Intertek	
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13 AC Mains Conducted Emissions – NA

Method:

The test methods used comply with ANSI C63.4. Unless otherwise stated no deviations were made from FCC 15.207 and RSS-GEN.

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

Test Requirement/Specification:

- FCC 15.207
- RSS-GEN 8.8

Test Equipment Used:

Results:

N/A

Test Summary:

Setup Photographs: AC Mains Conducted Emissions – Transmitter

Plots:

Intertek	
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14 RF Exposure Requirements

Method

Unless otherwise stated no deviations were made from FCC Part 1.1310 or 2.1091& IC RSS-102.

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

Test Requirement/Specification

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

Results:

The sample tested was found to comply.

Intertek	
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Test Data: RF Exposure – MPE

RF Exposure Requirements - MPE

Project #:	G102271213	Test Area:	Intertek Louisville
Test Method:	FCC CFR47 Part 1.1310	Test Date:	10/1/2015
EUT Model #:	31570014		
EUT Serial #:	0815K000002		
Manufacturer:	Ampt		
EUT Description:	DC to DC string converter		
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/cm²

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

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

Where:

S = power density (in appropriate units, e.g. mW/cm²)

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 = 2.51dBm = 1.78mW

Maximum typical gain declared by the manufacture = +1 dBi = 1.1 (numeric gain)

Power Density

Power (mW)	Gain (dbi)	Gain numeric	Distance (cm)	Power Density (mW/cm ²)
1.78	+1	1.1	20	0.00025

Therefore: Power Density Margin (Δ Limit) = 0.00025 – 1.0 = - 0.9997 mW/cm²

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

$$R(\text{cm}) = \text{SQRT}[(P \cdot G)/(4 \cdot \pi \cdot S)] = 0.3 \text{ cm}$$

Therefore: Distance Margin (Δ Limit) = 0.3 cm – 20 cm = -19.7 cm

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Reference Conversion Equations:

1. Gain numeric = $10^{(\text{dBi}/10)}$
2. Gain (dBi) = $10 \log(\text{Gain numeric})$
3. dBm = dBuV/m – 107 (50 ohm system)
4. dBm to Watts (W) = $10^{((\text{dBm} - 30)/10)}$

15 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 \pm	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 to 18 GHz	1.6 dB	
AC mains Conducted emissions, 9kHz to 30 MHz	3.14 dB	

16 Revision History

Revision Level	Date	Report Number	Notes
0	10/27/2015	G102271213DEN-001B	Original
1	12/1/2015	G102271213DEN-001B	Revisions requested by TCB reviewer. Page 8 – Removed note from block diagram. Revisions By: Michael Spataro <i>MS</i> Reviewed By: Son La <i>SL</i>