TEST REPORT – EMC Emissions

Report Number: 100257233DEN-001
Project Number: G100257233

Report Issue Date: 4/22/2011

Product Designation: **Model: EN5040**

Standards: **FCC title 47 CFR part 15 subpart C**
RSS-210:2010 Issue 8
AS/NZS 4268:2008

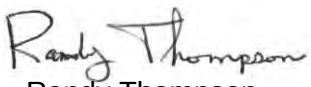
Tested by:

Intertek Testing Services NA, Inc.
1795 Dogwood Street, Suite 200
Louisville, CO 80027

Client:

Inovonics
315 CTC Blvd.
Louisville, CO 80027

Report prepared by



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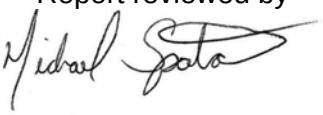

Michael Spataro
Engineering Team Leader

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Section **Page**

Product Tested:

EN5040
(EchoStream Repeater)

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.

2 Test Summary

Section	Test full name	Test date	Result
5	Radiated Emissions – Output power of the Fundamental & Harmonics of the Fundamental - FCC 247(b)(2) (d)/15.205 [Covers RSS-210, A8.4/ A8.5]	11/01/2010 03/26/2011	Pass
6	Radiated Emissions – Unintentional & Spurious - 15.247(d) FCC 15.209/109/205 [Covers RSS-210, A8.5 – RSS-GEN, Section 4.8 & 4.9]	03/19/2011	Pass
7	20 dB Bandwidth – FCC 15.247 (a)(1)(i) [Covers RSS-210, A8.1(c)]	11/08/2010	Pass
8	Number of Hopping Channels – FCC 15.247(a)(1)(i) [Covers RSS-210, A8.1(c)]	11/08/2010	Pass
9	Hopping Channel Carrier Separation – FCC 15.247(a)(1) [Covers RSS-210, A8.1(b)]	11/08/2010	Pass
10	Channel Time of Occupancy (On/Off Time) – FCC 15.247(a)(1)(i) [Covers RSS-210, A8.1(c)]	11/08/2010	Pass
11	Band Edge Measurements – FCC 15.247(d) / 15.209 [Covers RSS-210, A8.5]	11/08/2010 03/19/2011	Pass
12	Occupied Bandwidth (OBW) – RSS-GEN, Section 4.6.1	11/08/2010	Pass
13	Duty Cycle & Duty Cycle Correction Factor – FCC 15.35 [Covers RSS-GEN, Section 4.5]	11/08/2010	N/A
14	AC Conducted Emissions – FCC 15.207/107 [Covers RSS-GEN, Section 7.2.2]	09/08/2010 03/26/2011	Pass

Notes:

1) The product tested has (2) integral antennas – therefore, all measurements are radiated field strength. Moreover, both antennas were evaluated.

2) Only the high channel of the transmitter at 927.58 MHz falls within the frequency band specified in AS/NZS 4268:2008.

General Remarks:

The following remarks are to be considered as “where applicable” and are taken into account while completing any FCC/IC/ETSI Radio tests at Intertek-Louisville.

Testing was performed in 3 different orthogonal axes to determine the worst-case emissions from the device. The worst-case axis and emissions are shown in this report.

FCC CFR47 Part 15.31: Measurement Standards: In any case where the device is powered off a battery, a fresh battery was used during testing. In cases where the device is powered of an AC Supply, voltage was varied per Part 15.31 to find worst-case emissions.

FCC CFR Part 15.35: Measurement Detector Functions and Bandwidths: FCC Part 15.35 was utilized when performing measurements within this report.

Whenever possible, the approved test procedures specified in FCC DA 00-705 for Frequency Hopping Spread Spectrum devices was used for testing.

The product tested was configured with an integral antenna – therefore all measurements are radiated field strength measurements. If antenna conducted port tests cannot be performed, radiated field strength measurements may be taken to demonstrate compliance with the various conducted port power requirements of FCC 15.247. When applicable, the following equation was utilized to covert measurements from conducted port power to radiated field strength for a given test distance.

Limit Calculation:

$P = (E \times d)^2 / (30 \times G)$

Whereby:

P = Power in watts
E= measured maximum field strength in Volts/meter
d = test distance in meters from which the field strength was measured
G = numeric gain of the transmitting antenna over an isotropic radiator

If the antenna gain is not known (or declared by the client) at the time of testing, a maximum antenna gain of 6dBi was utilized per FCC 15.247(b)(4).

3 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Repeater	Inovonics	EN5040	05755
Repeater	Inovonics	EN5040	90035794

Receive Date:	09/08/2010 to 03/26/2011
Received Condition:	Good
Type:	Production Sample

Description of Equipment Under Test (provided by client)

The product will be marketed in the US, Canada and Australia.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
AC Adapter Output: 14 VAC	250 mA	60	1
3.7 VDC Battery Backup	2.15 mAh	-----	-----

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Fundamental & Harmonics of the Fundamental: Product configured for transmit operation at full power, un-modulated continuous wave (CW) mode. (not normal operation – testing purposes only)
2	Unintentional/Spurious emissions: Product configured in a normal “standby” or “idle” mode – intermittent transmit “chirping”. (normal operation with modulation and hopping function enabled)
3	20dB Bandwidth & OBW: hopping function disabled, modulated signal, maximum data rate
4	Number of Hopping Channels: normal operation with hopping function enabled
5	Hopping Channel Carrier Separation: normal operation with hopping function enabled
6	Time of Occupancy (On/Off Time): normal operation with hopping function enabled
7	Band Edge: normal operation with modulation enabled
8	Duty Cycle: normal operation with modulation and hopping function enabled

Clock Frequencies of the EUT:

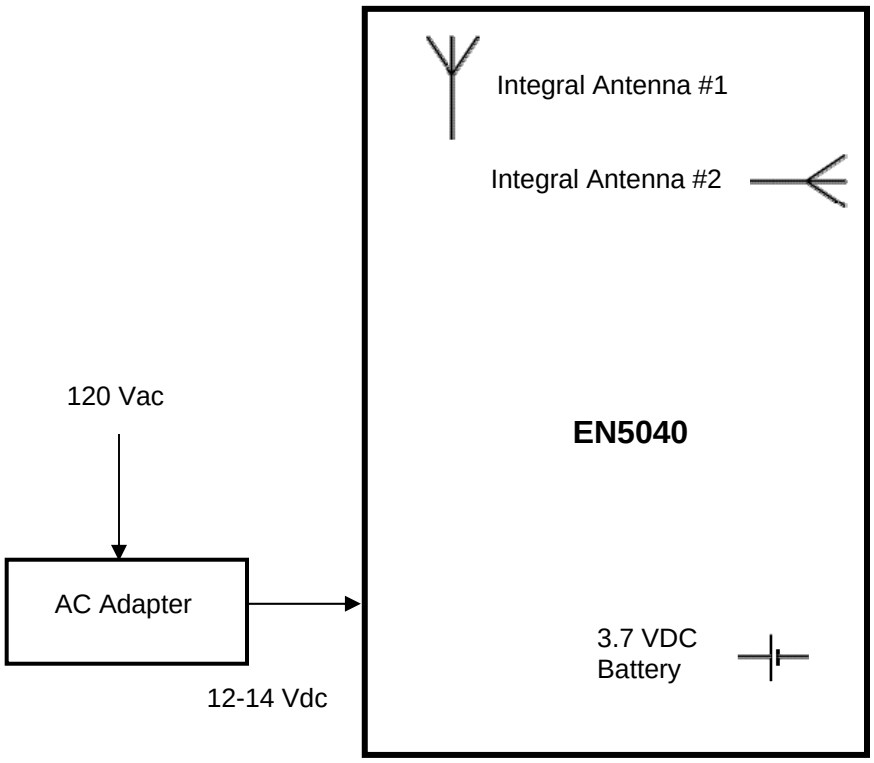
No.	Descriptions of Product Clocks
1	Transmit Frequency: 902.4 MHz, 914.8 MHz and 927.6 MHz (Low, Mid and High Channels)
2	Lowest Frequency Utilized in Device: 32 kHz

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

4.1 Method:

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

4.2 EUT Block Diagram:



4.3 Data:

ID	Cable Description	Length	Shielding	Ferrites
1	AC-to-DC Power Adapter	3 feet	none	none

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
AC Adapter Class 2 Transformer	Ault Inc.	T48141428V010G	-----

General notes:
1. Product did not require any support equipment other than the ac adapter.

5 Radiated Emissions – Output Power of the Fundamental & Harmonics of the Fundamental

5.1 Method

Unless otherwise stated, no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Louisville OATS site, located at 40 Meadow Rd. Pinewood Springs, CO 80540 and CC1 Emissions Chamber located at 1795 Dogwood Street, Louisville, CO 80027.

5.2 Test Equipment Used:

Testing of Antenna 1 @ Pinewood Springs OATS on 11-1-2010

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18882	Spectrum Analyzer (dc-22 GHz)	Hewlett-Packard	8566B	2410A00154	12/06/2010	12/06/2011
18660	Spectrum Analyzer Display Section (set 1)	Hewlett-Packard	85662A	2318A04983	12/06/2010	12/06/2011
18880	Q.P Adapter	Hewlett-Packard	85650A	2811A01300	12/06/2010	12/06/2011
18906	Pre-Amplifier (1-4 GHz)	Mini-Circuits Lab	ZHL-42	N052792-2	06/11/2010	06/11/2011
18900	RF Pre-Amplifier (4-8 GHz)	Avantek	AFT97-8434-10F	1007	06/07/2010	06/07/2011
18901	RF Pre-Amplifier (8-18 GHz)	Avantek	AWT-18037	1002	06/07/2010	06/07/2011
18798	Bicon Antenna 30 - 300 MHz	EMCO	3109	9801-3142	02/03/2010	02/03/2011
18808	Log Periodic Antenna 200MHz-1GHz	EMCO	3146	9203-3376	12/05/2009	12/05/2010
18886	Ridged Guide Antenna 1-18GHz	TENSOR	4105	2020	10/08/2010	10/08/2011

Testing of Antenna 2 @ Louisville CC1 on 3-26-2011

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18882	Spectrum Analyzer (dc-22 GHz)	Hewlett-Packard	8566B	2410A00154	12/06/2010	12/06/2011
18660	Spectrum Analyzer Display Section (set 1)	Hewlett-Packard	85662A	2318A04983	12/06/2010	12/06/2011
18880	Q.P Adapter	Hewlett-Packard	85650A	2811A01300	12/06/2010	12/06/2011
18906	Pre-Amplifier (1-4 GHz)	Mini-Circuits Lab	ZHL-42	N052792-2	06/11/2010	06/11/2011
18900	RF Pre-Amplifier (4-8 GHz)	Avantek	AFT97-8434-10F	1007	06/07/2010	06/07/2011
18901	RF Pre-Amplifier (8-18 GHz)	Avantek	AWT-18037	1002	06/07/2010	06/07/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011
18886	Ridged Guide Antenna 1-18GHz	TENSOR	4105	2020	10/08/2010	10/08/2011

5.3 Results:

The sample tested was found to Comply.

5.4 Setup Photographs

Test setup – Front View (Pinewood OATS)

Test setup – Rear View (Pinewood OATS)

Photo:

Test setup – Front View (CC1 Louisville)

Test setup – Rear View (CC1 Louisville)

Photo:

Worst-Case Axis 3 (EUT Vertical & Rotated 90 degrees)

Axis 1 (EUT Flat on Table)

Axis 2 (EUT Vertical)

Photo:

Antenna Setups – CC1

5.5 Test Data – Antenna #1:

Field Strength Measurements
Fundamental and Spurious of the Transmitter

Test Report #:	**100257233**	Test Area:	Pinewood Site 1 (3m)	Temperature:	25.1	°C
Test Method:	FCC 15.247	Test Date:	01-Nov-2010	Relative Humidity:	26.1	%
EUT Model #:	EN5040	EUT Power:	3.6 VDC Battery	Air Pressure:	79.9	kPa
EUT Serial #:	05755					
Manufacturer:	Inovonincs					
EUT Description:	Repeater					

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

Notes: **Tx measurements of antenna #1 (**Tx power = 48 (PA))

Testing < 1GHz, detector/bandwidth settings: Peak detector, RBW 100kHz, VBW 300kHz

Testing > 1GHz, detector/bandwidth settings: Peak detector, RBW 1MHz, VBW 1MHz

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit FCC 15.247	DELTA
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
The following Duty Cycle was verified by Intertek:								
21.8%								
Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions. The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 emissions and delta limits were calculated as follows: Final Corrected Peak Measurement – Duty Cycle Correction Factor* = Final Calculated Emission The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.209 and 15.247 and the emission/limit delta was calculated. DTCF is calculated as follows $20*\log_{10}$(duty cycle in 100mS).								
Part 15.247 and 15.205 Respectively								
Fundamental Measurements								
Low Channel Axis 1 - EUT is Flat on the table.								
902.38	94.9 Pk	3.6 / 22.5 / 0.0	121	H / 1.5 / 200.0	0.0	121.0	125.2	-4.2
902.38	92.1 Pk	3.6 / 22.5 / 0.0	118.2	V / 1.4 / 350.0	0.0	118.2	125.2	-7.0
Axis 2 - EUT is Vertical on the table.								
902.38	96.4 Pk	3.6 / 22.5 / 0.0	122.5	V / 1.1 / 16.0	0.0	122.5	125.2	-2.7
902.38	96.3 Pk	3.6 / 22.5 / 0.0	122.5	H / 1.5 / 200.0	0.0	122.5	125.2	-2.7
Axis 3 - EUT is Vertical on the table & Rotated 90 Deg.								
902.38	92.1 Pk	3.6 / 22.5 / 0.0	118.2	H / 1.8 / 336.0	0.0	118.2	125.2	-7.0
902.38	97.0 Pk	3.6 / 22.5 / 0.0	123.1	V / 1.2 / 204.0	0.0	123.1	125.2	-2.1
Mid Channel Axis 1								
914.78	95.6 Pk	3.6 / 22.5 / 0.0	121.7	H / 1.4 / 204.0	0.0	121.7	125.2	-3.5
914.78	95.0 Pk	3.6 / 22.5 / 0.0	121.2	V / 1.4 / 20.0	0.0	121.2	125.2	-4.0
Axis 2								
914.78	95.6 Pk	3.6 / 22.5 / 0.0	121.7	H / 1.4 / 204.0	0.0	121.7	125.2	-3.5

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit FCC 15.247	DELTA
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
914.78	95.6 Pk	3.6 / 22.5 / 0.0	121.7	H / 1.4 / 204.0	0.0	121.7	125.2	-3.5
Axis 3								
914.78	**97.8 Pk**	**3.6 / 22.5 / 0.0**	**123.9**	**V / 1.1 / 175.0**	**0.0**	**123.9**	**125.2**	**-1.3**
914.78	92.1 Pk	3.6 / 22.5 / 0.0	118.2	H / 1.7 / 320.0	0.0	118.2	125.2	-7.0
High Channel Axis 1								
927.59	91.3 Pk	3.6 / 22.6 / 0.0	117.5	V / 1.6 / 20.0	0.0	117.5	125.2	-7.7
927.59	92.7 Pk	3.6 / 22.6 / 0.0	118.9	H / 1.6 / 350.0	0.0	118.9	125.2	-6.3
Axis 2								
927.59	96.3 Pk	3.6 / 22.6 / 0.0	122.5	H / 1.1 / 22.0	0.0	122.5	125.2	-2.7
927.59	96.1 Pk	3.6 / 22.6 / 0.0	122.3	V / 1.1 / 15.0	0.0	122.3	125.2	-2.9
Axis 3								
927.59	97.0 Pk	3.6 / 22.6 / 0.0	123.2	V / 1.1 / 170.0	0.0	123.2	125.2	-2.0
927.59	93.0 Pk	3.6 / 22.6 / 0.0	119.2	H / 1.7 / 328.0	0.0	119.2	125.2	-6.0

Example calculation for Intentional Radiated Emissions:

Measured Level	**+**	**Transducer, Cable Loss Pre-Amplifier**	**=**	**Corrected Reading**	**-**	**Duty Cycle Correction**	**=**	**FINAL Measurement**	**-**	**Specification Limit**	**=**	**Delta from Specification Limit**
(dBμV)		(dB)		(dBμV/m)		(dBμV/m)		(dBμV/m)		(dBμV/m)		
24.0		**14.9**		**38.9**		**10.0**		**28.9**		**40.0**		**-11.1**

Electric Field to Power Conversion - Fundamental

From DA 00-705 – Alternative Test Procedures.

If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the peak output power limit specified in Section 15.247(b) and the spurious RF conducted emission limit specified in Section 15.247(c) are acceptable. As stated previously, a pre-amp, and, in the latter case, a high pass filter, are required for the following measurements.

1) Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where: E is the measured maximum fundamental field strength in V/m, utilizing a RBW ≥ the 20 dB bandwidth of the emission, VBW > RBW, peak detector function. Follow the procedures in C63.4-1992 with respect to maximizing the emission.

G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.

d is the distance in meters from which the field strength was measured.

P is the power in watts for which you are solving:

$$P = \frac{(E*d)^2}{30G}$$

In this case:

E = 123.9 dB/uV (from above Mid Channel axis 3) = 1.5668 V/m
D = 3 meters
G = 4 unknown

P = 0.1841 W

Limit from 15.247(b)(2) = .25W

Delta = 0.1841 - .25 = -0.0659W

Harmonics of the Fundamental

Axis 3 was determined to be the worst case axis								
All Harmonics will be measured in Axis 3 – Harmonics in Restricted Bands are Highlighted in Yellow								
Harmonics - Low Channel								
1804.78	71.5 Pk	2.8 / 27.1 / 36.1	65.30	V / 1.2 / 286.0	13.3	52.0	103.1	-51.1
1804.78	65.9 Pk	2.8 / 27.1 / 36.1	59.70	H / 1.7 / 84.0	13.3	46.4	103.1	-56.7
2707.16	47.1 Pk	3.5 / 29.1 / 37.0	42.80	V / 1.2 / 216.0	13.3	29.5	54.0	-24.5
2707.18	49.8 Pk	3.5 / 29.1 / 37.0	45.40	H / 1.5 / 254.0	13.3	32.1	54.0	-21.9
3609.58	45.0 Pk	4.5 / 31.7 / 37.5	43.60	V / 1.2 / 216.0	13.3	30.3	54.0	-23.7
3609.58	41.5 Pk	4.5 / 31.7 / 37.5	40.10	H / 1.4 / 270.0	13.3	26.8	54.0	-27.2
4511.98	51.9 Pk	5.3 / 32.4 / 39.0	50.50	H / 1.4 / 242.0	13.3	37.2	54.0	-16.8
4511.99	46.0 Pk	5.3 / 32.4 / 39.0	44.60	V / 1.5 / 188.0	13.3	31.3	54.0	-22.7
5414.38	58.9 Pk	6.0 / 34.4 / 39.1	60.20	H / 1.3 / 176.0	13.3	46.9	54.0	-7.1
5414.38	58.3 Pk	6.0 / 34.4 / 39.1	59.60	V / 1.5 / 188.0	13.3	46.3	54.0	-7.7
6316.81	53.6 Pk	6.6 / 34.6 / 39.5	55.30	H / 1.2 / 242.0	13.3	42.0	103.1	-61.1
6316.81	51.9 Pk	6.6 / 34.6 / 39.5	53.50	V / 1.4 / 194.0	13.3	40.2	103.1	-62.9
7219.21	44.1 Pk	7.3 / 36.1 / 39.7	47.80	H / 1.2 / 190.0	13.3	34.5	103.1	-68.6
7219.21	50.6 Pk	7.3 / 36.1 / 39.7	54.30	V / 1.4 / 194.0	13.3	41.0	103.1	-62.1
8121.62	58.0 Pk	7.7 / 36.7 / 45.7	56.70	V / 1.4 / 198.0	13.3	43.4	54.0	-10.6
8121.62	51.9 Pk	7.7 / 36.7 / 45.7	50.70	H / 1.6 / 202.0	13.3	37.4	54.0	-16.6
9024.00	50.5 Pk	8.4 / 37.1 / 47.3	48.70	V / 1.4 / 154.0	13.3	35.4	54.0	-18.6
9024.00	49.6 Pk	8.4 / 37.1 / 47.3	47.80	H / 1.4 / 224.0	13.3	34.5	54.0	-19.5
Harmonics - Mid Channel								
1829.58	68.7 Pk	2.8 / 27.0 / 36.1	62.4	H / 1.6 / 68.0	13.3	49.1	103.9	-54.8
1829.58	71.8 Pk	2.8 / 27.0 / 36.1	65.5	V / 1.1 / 92.0	13.3	52.2	103.9	-51.7
2744.38	47.4 Pk	3.5 / 29.2 / 37.0	43	H / 1.7 / 68.0	13.3	29.7	54.0	-24.3
2744.39	43.4 Pk	3.5 / 29.2 / 37.0	39.1	V / 1.9 / 170.0	13.3	25.8	54.0	-28.2
3659.18	42.1 Pk	4.5 / 31.8 / 37.5	40.9	H / 1.6 / 68.0	13.3	27.6	54.0	-26.4
3659.18	43.1 Pk	4.5 / 31.8 / 37.5	41.8	V / 1.6 / 192.0	13.3	28.5	54.0	-25.5
4573.98	47.1 Pk	5.3 / 32.4 / 39.1	45.8	V / 1.7 / 142.0	13.3	32.5	54.0	-21.5
4573.98	52.5 Pk	5.3 / 32.4 / 39.1	51.2	H / 1.4 / 242.0	13.3	37.9	54.0	-16.1
5488.78	61.1 Pk	6.1 / 34.4 / 39.1	62.5	V / 1.6 / 190.0	13.3	49.2	103.9	-54.7
5488.78	62.9 Pk	6.1 / 34.4 / 39.1	64.3	H / 1.6 / 208.0	13.3	51.0	103.9	-52.9
6403.6	59.8 Pk	6.7 / 34.6 / 39.5	61.5	H / 1.1 / 220.0	13.3	48.2	103.9	-55.7
6403.61	62.0 Pk	6.7 / 34.6 / 39.5	63.7	V / 1.3 / 164.0	13.3	50.4	103.9	-53.5
7318.4	52.8 Pk	7.4 / 36.4 / 39.5	57	V / 1.6 / 216.0	13.3	43.7	54.0	-10.3
7318.41	47.1 Pk	7.4 / 36.4 / 39.5	51.4	H / 1.5 / 264.0	13.3	38.1	54.0	-15.9
8233.21	53.9 Pk	7.9 / 36.6 / 45.8	52.5	H / 1.4 / 176.0	13.3	39.2	54.0	-14.8
8233.21	60.8 Pk	7.9 / 36.6 / 45.8	59.5	V / 1.6 / 176.0	13.3	46.2	54.0	-7.8
9148.02	45.0 Pk	8.5 / 37.1 / 47.4	43.1	H / 1.4 / 176.0	13.3	29.8	54.0	-24.2
9148.02	44.6 Pk	8.5 / 37.1 / 47.4	42.8	V / 1.4 / 176.0	13.3	29.5	54.0	-24.5
Harmonics - High Channel								
1855.18	74.4 Pk	2.9 / 27.0 / 36.2	68.1	V / 1.2 / 92.0	13.3	54.8	103.2	-48.4
1855.18	66.8 Pk	2.9 / 27.0 / 36.2	60.5	H / 1.5 / 354.0	13.3	47.2	103.2	-56.0
2782.78	42.9 Pk	3.5 / 29.3 / 37.0	38.6	V / 1.2 / 260.0	13.3	25.3	54.0	-28.7
2782.79	44.6 Pk	3.5 / 29.3 / 37.0	40.4	H / 1.6 / 260.0	13.3	27.1	54.0	-26.9

3710.37	45.1 Pk	4.5 / 32.0 / 37.5	44.2	V / 1.2 / 220.0	13.3	30.9	54.0	-23.1
3710.37	40.1 Pk	4.5 / 32.0 / 37.5	39.1	H / 1.6 / 192.0	13.3	25.8	54.0	-28.2
4637.98	55.2 Pk	5.4 / 32.6 / 39.1	54.1	H / 1.3 / 230.0	13.3	40.8	54.0	-13.2
4637.98	48.0 Pk	5.4 / 32.6 / 39.1	46.8	V / 1.3 / 225.0	13.3	33.5	54.0	-20.5
5565.58	63.2 Pk	6.1 / 34.3 / 39.1	64.6	V / 1.8 / 242.0	13.3	51.3	103.2	-51.9
5565.59	**67.7 Pk**	**6.1 / 34.3 / 39.1**	**69.1**	**H / 1.3 / 218.0**	**13.3**	**55.8**	**103.2**	**-47.4**
6493.2	61.1 Pk	6.8 / 34.6 / 39.5	63	V / 1.2 / 186.0	13.3	49.7	103.2	-53.5
6493.21	60.8 Pk	6.8 / 34.6 / 39.5	62.7	H / 1.3 / 135.0	13.3	49.4	103.2	-53.8
7420.8	48.6 Pk	7.4 / 36.4 / 39.4	53	H / 1.6 / 264.0	13.3	39.7	54.0	-14.3
7420.8	**55.9 Pk**	**7.4 / 36.4 / 39.4**	**60.3**	**V / 1.2 / 178.0**	**13.3**	**47.0**	**54.0**	**-7.0**
8348.41	60.0 Pk	8.0 / 36.8 / 46.1	58.7	V / 1.7 / 192.0	13.3	45.4	54.0	-8.6
8348.41	54.8 Pk	8.0 / 36.8 / 46.1	53.5	H / 1.3 / 188.0	13.3	40.2	54.0	-13.8
9275.99	45.9 Pk	8.5 / 37.4 / 47.5	44.2	V / 1.3 / 192.0	13.3	30.9	103.2	-72.3
9275.99	42.9 Pk	8.5 / 37.4 / 47.5	41.2	H / 1.3 / 192.0	13.3	27.9	103.2	-75.3

Notes:

1. Worst-Case Harmonic Duty-Cycle Corrected Measurement – High Channel @ 7420.8 MHz, 47.0 dBuV/m (7.0 dB below Limit). This signal was within the FCC Restricted Band, where the limit is 54dBuV/m.

2. Worst-Case Harmonic outside the FCC Restricted Band – High Channel @ 5565.59 MHz, 55.8 dBuV/m (- 47.4 dBc). The specification is -20 dBc

Deviations, Additions, or Exclusions: None

5.6 Test Data – Antenna #2:

Field Strength Measurements
Fundamental and Spurious of the Transmitter

Test Report #:	**100356542 PCOR Run 01**	Test Area:	CC1 Radiated	Temperature:	22.4	°C
Test Method:	FCC 15.247	Test Date:	24-Mar-2011	Relative Humidity:	20.8	%
EUT Model #:	EN5040	EUT Power:	3.6 VDC Battery	Air Pressure:	81.3	kPa
EUT Serial #:	90035794					
Manufacturer:	Inovonics					
EUT Description:	Repeater					

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

Notes: **Tx measurements of Antenna #2 (**Tx power = 48 (PA))

Testing < 1GHz, detector/bandwidth settings: Peak detector, RBW 100kHz, VBW 300kHz

Testing > 1GHz, detector/bandwidth settings: Peak detector, RBW 1MHz, VBW 1MHz

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit FCC 15.247	DELTA
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
The following Duty Cycle was verified by Intertek:								
21.8%								
Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions. The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 emissions and delta limits were calculated as follows: Final Corrected Peak Measurement – Duty Cycle Correction Factor* = Final Calculated Emission The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.209 and 15.247 and the emission/limit delta was calculated. DTCF is calculated as follows $20*\log_{10}$(duty cycle in 100mS).								
Part 15.247 and 15.205 Respectively								
Fundamental Measurements								
Low Channel Axis 1 - EUT is Flat on the table.								
902.29	88.4 Pk	2.1 / 22.5 / 0.0	113	V / 1.8 / 26.0	0.0	113.0	125.2	-12.2
902.29	92.7 Pk	2.1 / 22.5 / 0.0	117.3	H / 1.1 / 42.0	0.0	117.3	125.2	-7.9
Axis 2 - EUT is Vertical on the table.								
902.29	91.8 Pk	2.1 / 22.5 / 0.0	116.4	H / 1.5 / 192.0	0.0	116.4	125.2	-8.8
902.29	92.4 Pk	2.1 / 22.5 / 0.0	117	V / 1.5 / 192.0	0.0	117.0	125.2	-8.2
Axis 3 - EUT is Vertical on the table & Rotated 90 Deg.								
902.29	94.5 Pk	2.1 / 22.5 / 0.0	119	V / 1.1 / 32.0	0.0	119.0	125.2	-6.2
902.29	94.0 Pk	2.1 / 22.5 / 0.0	118.6	H / 2.1 / 5.0	0.0	118.6	125.2	-6.6
Mid Channel Axis 1								
914.78	87.2 Pk	2.1 / 22.5 / 0.0	111.8	V / 1.8 / 24.0	0.0	111.8	125.2	-13.4
914.78	91.8 Pk	2.1 / 22.5 / 0.0	116.4	H / 1.5 / 54.0	0.0	116.4	125.2	-8.8
Axis 2								
914.78	90.0 Pk	2.1 / 22.5 / 0.0	114.6	H / 1.4 / 194.0	0.0	114.6	125.2	-10.6

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit FCC 15.247	DELTA
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
914.78	92.3 Pk	2.1 / 22.5 / 0.0	117	V / 1.2 / 194.0	0.0	117.0	125.2	-8.2
Axis 3								
914.78	93.2 Pk	2.1 / 22.5 / 0.0	117.8	V / 1.2 / 194.0	0.0	117.8	125.2	-7.4
914.78	**94.5 Pk**	**2.1 / 22.5 / 0.0**	**119.1**	**H / 1.3 / 5.0**	**0.0**	**119.1**	**125.2**	**-6.1**
High Channel Axis 1								
927.58	92.2 Pk	2.1 / 22.5 / 0.0	116.8	H / 2.3 / 46.0	0.0	116.8	125.2	-8.4
927.58	85.5 Pk	2.1 / 22.5 / 0.0	110.1	V / 1.7 / 20.0	0.0	110.1	125.2	-15.1
Axis 2								
927.58	93.2 Pk	2.1 / 22.5 / 0.0	117.7	V / 1.2 / 36.0	0.0	117.7	125.2	-7.5
927.58	88.0 Pk	2.1 / 22.5 / 0.0	112.5	H / 1.1 / 32.0	0.0	112.5	125.2	-12.7
Axis 3								
927.58	94.2 Pk	2.1 / 22.5 / 0.0	118.8	H / 1.2 / 8.0	0.0	118.8	125.2	-6.4
927.58	92.5 Pk	2.1 / 22.5 / 0.0	117.1	V / 1.2 / 78.0	0.0	117.1	125.2	-8.1

Example calculation for Intentional Radiated Emissions:

Measured Level	**+**	**Transducer, Cable Loss Pre-Amplifier**	**=**	**Corrected Reading**	**-**	**Duty Cycle Correction**	**=**	**FINAL Measurement**	**-**	**Specification Limit**	**=**	**Delta from Specification Limit**
(dBμV)		(dB)		(dBμV/m)		(dBμV/m)		(dBμV/m)		(dBμV/m)		
24.0		**14.9**		**38.9**		**10.0**		**28.9**		**40.0**		**-11.1**

Electric Field to Power Conversion - Fundamental

From DA 00-705 – Alternative Test Procedures.

If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the peak output power limit specified in Section 15.247(b) and the spurious RF conducted emission limit specified in Section 15.247(c) are acceptable. As stated previously, a pre-amp, and, in the latter case, a high pass filter, are required for the following measurements.

1) Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where: E is the measured maximum fundamental field strength in V/m, utilizing a RBW ≥ the 20 dB bandwidth of the emission, VBW > RBW, peak detector function. Follow the procedures in C63.4-1992 with respect to maximizing the emission.

G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.

d is the distance in meters from which the field strength was measured.

P is the power in watts for which you are solving:

$$P = \frac{(E*d)^2}{30G}$$

In this case:

E = 119.1 dB/uV (from above Mid Channel axis 3) = 0.9016 V/m
D = 3 meters
G = 4 unknown

P = 0.0610 W

Limit from 15.247(b)(2) = .25W

Delta = 0.0610 - .25 = -0.1890W

Harmonics of the Fundamental

Axis 3 was determined to be the worst case axis								
All Harmonics will be measured in Axis 3 – Harmonics in Restricted Bands are Highlighted in Yellow								
Harmonics - Low Channel								
1804.77	69.4 Pk	3.0 / 27.1 / 36.1	63.4	H / 2.3 / 12.0	13.3	50.1	99.0	-48.9
1804.76	55.2 Pk	3.0 / 27.1 / 36.1	49.2	V / 1.1 / 5.0	13.3	35.9	99.0	-63.1
2707.17	48.9 Pk	3.8 / 29.1 / 37.0	44.8	H / 1.6 / 34.0	13.3	31.5	54.0	-22.5
2707.17	46.5 Pk	3.8 / 29.1 / 37.0	42.4	V / 1.3 / 36.0	13.3	29.1	54.0	-24.9
3609.57	40.8 Pk	4.4 / 31.7 / 37.5	39.3	H / 1.4 / 42.0	13.3	26.0	54.0	-28.0
3609.57	40.2 Pk	4.4 / 31.7 / 37.5	38.8	V / 1.4 / 36.0	13.3	25.5	54.0	-28.5
4511.95	43.9 Pk	5.0 / 32.4 / 38.1	43.1	V / 1.5 / 75.0	13.3	29.8	54.0	-24.2
4511.96	53.1 Pk	5.0 / 32.4 / 38.1	52.4	H / 1.9 / 62.0	13.3	39.1	54.0	-14.9
5414.35	48.4 Pk	5.5 / 34.4 / 36.3	52	H / 1.7 / 5.0	13.3	38.7	54.0	-15.3
5414.36	49.8 Pk	5.5 / 34.4 / 36.3	53.3	V / 1.8 / 20.0	13.3	40.0	54.0	-14.0
6316.81	40.2 Pk	5.9 / 34.6 / 35.9	44.8	V / 1.5 / 46.0	13.3	31.5	99.0	-67.5
6316.82	43.7 Pk	5.9 / 34.6 / 35.9	48.3	H / 2.1 / 12.0	13.3	35.0	99.0	-64.0
7219.21	43.1 Pk	6.4 / 36.1 / 34.9	50.8	V / 1.6 / 10.0	13.3	37.5	99.0	-61.5
7219.21	41.1 Pk	6.4 / 36.1 / 34.9	48.8	H / 1.7 / 24.0	13.3	35.5	99.0	-63.5
8121.6	51.5 Pk	6.9 / 36.7 / 45.7	49.5	V / 1.6 / 5.0	13.3	36.2	54.0	-17.8
8121.62	53.4 Pk	6.9 / 36.7 / 45.7	51.3	H / 1.5 / 34.0	13.3	38.0	54.0	-16.0
9023.99	47.2 Pk	7.3 / 37.1 / 47.3	44.3	V / 1.5 / 14.0	13.3	31.0	54.0	-23.0
9024.01	47.1 Pk	7.3 / 37.1 / 47.3	44.3	H / 1.4 / 44.0	13.3	31.0	54.0	-23.0
Harmonics - Mid Channel								
1829.57	57.6 Pk	3.0 / 27.0 / 36.1	51.6	V / 1.3 / 5.0	13.3	38.3	99.1	-60.8
1829.57	66.7 Pk	3.0 / 27.0 / 36.1	60.6	H / 2.3 / 15.0	13.3	47.3	99.1	-51.8
2744.37	47.5 Pk	3.8 / 29.2 / 37.0	43.5	V / 1.1 / 37.0	13.3	30.2	54.0	-23.8
2744.37	49.2 Pk	3.8 / 29.2 / 37.0	45.2	H / 1.5 / 37.0	13.3	31.9	54.0	-22.1
3659.17	43.4 Pk	4.4 / 31.8 / 37.5	42.1	V / 1.4 / 42.0	13.3	28.8	54.0	-25.2
3659.17	43.9 Pk	4.4 / 31.8 / 37.5	42.6	H / 1.5 / 42.0	13.3	29.3	54.0	-24.7
4573.96	60.2 Pk	5.0 / 32.4 / 37.9	59.8	H / 1.9 / 54.0	13.3	46.5	54.0	-7.5
4573.96	53.4 Pk	5.0 / 32.4 / 37.9	53	V / 1.8 / 12.0	13.3	39.7	54.0	-14.3
5488.76	57.0 Pk	5.5 / 34.4 / 36.3	60.7	H / 1.8 / 58.0	13.3	47.4	99.1	-51.7
5488.76	55.5 Pk	5.5 / 34.4 / 36.3	59.2	V / 1.8 / 5.0	13.3	45.9	99.1	-53.2
6403.63	49.2 Pk	6.0 / 34.6 / 35.6	54.1	H / 2.1 / 26.0	13.3	40.8	99.1	-58.3
6403.63	52.1 Pk	6.0 / 34.6 / 35.6	57	V / 2.4 / 6.0	13.3	43.7	99.1	-55.4
7318.43	41.0 Pk	6.5 / 36.4 / 34.6	49.2	H / 1.9 / 7.0	13.3	35.9	54.0	-18.1
7318.43	44.7 Pk	6.5 / 36.4 / 34.6	52.9	V / 1.9 / 7.0	13.3	39.6	54.0	-14.4
8233.21	44.3 Pk	6.9 / 36.6 / 45.8	42	H / 1.5 / 33.0	13.3	28.7	54.0	-25.3
8233.24	44.4 Pk	6.9 / 36.6 / 45.8	42.1	V / 1.7 / 5.0	13.3	28.8	54.0	-25.2
9148.03	46.8 Pk	7.4 / 37.1 / 47.4	43.9	H / 1.4 / 28.0	13.3	30.6	54.0	-23.4
9148.03	46.7 Pk	7.4 / 37.1 / 47.4	43.8	V / 1.3 / 5.0	13.3	30.5	54.0	-23.5
Harmonics - High Channel								
1855.17	71.9 Pk	3.1 / 27.0 / 36.2	65.8	H / 2.4 / 20.0	13.3	52.5	98.8	-46.3
1855.18	59.8 Pk	3.1 / 27.0 / 36.2	53.7	V / 1.3 / 5.0	13.3	40.4	98.8	-58.4
2782.77	45.8 Pk	3.8 / 29.3 / 37.0	41.9	H / 1.5 / 36.0	13.3	28.6	54.0	-25.4
2782.78	41.8 Pk	3.8 / 29.3 / 37.0	37.9	V / 1.4 / 12.0	13.3	24.6	54.0	-29.4

3710.37	41.5 Pk	4.5 / 32.0 / 37.5	40.6	H / 1.4 / 48.0	13.3	27.3	54.0	-26.7
3710.37	40.1 Pk	4.5 / 32.0 / 37.5	39.2	V / 1.4 / 38.0	13.3	25.9	54.0	-28.1
4637.98	55.2 Pk	5.1 / 32.6 / 37.7	55.2	V / 1.9 / 8.0	13.3	41.9	54.0	-12.1
4637.98	**60.4 Pk**	**5.1 / 32.6 / 37.7**	**60.4**	**H / 1.9 / 54.0**	**13.3**	**47.1**	**54.0**	**-6.9**
5565.58	52.1 Pk	5.6 / 34.3 / 36.3	55.7	V / 1.7 / 10.0	13.3	42.4	98.8	-56.4
5565.58	50.4 Pk	5.6 / 34.3 / 36.3	54	H / 2.7 / 52.0	13.3	40.7	98.8	-58.1
6493.24	**61.0 Pk**	**6.0 / 34.6 / 35.3**	**66.4**	**V / 1.8 / 7.0**	**13.3**	**53.1**	**98.8**	**-45.7**
6493.24	59.0 Pk	6.0 / 34.6 / 35.3	64.3	H / 2.1 / 28.0	13.3	51.0	98.8	-47.8
7420.84	49.9 Pk	6.5 / 36.4 / 34.4	58.3	V / 1.9 / 10.0	13.3	45.0	54.0	-9.0
7420.84	48.1 Pk	6.5 / 36.4 / 34.4	56.5	H / 1.9 / 10.0	13.3	43.2	54.0	-10.8
8348.44	49.0 Pk	7.0 / 36.8 / 46.1	46.7	V / 1.7 / 5.0	13.3	33.4	54.0	-20.6
8348.44	46.9 Pk	7.0 / 36.8 / 46.1	44.6	H / 1.4 / 48.0	13.3	31.3	54.0	-22.7
9276.04	46.8 Pk	7.5 / 37.4 / 47.5	44.1	V / 1.6 / 12.0	13.3	30.8	98.8	-68.0
9276.04	48.5 Pk	7.5 / 37.4 / 47.5	45.8	H / 1.5 / 21.0	13.3	32.5	98.8	-66.3

Example calculation:

Measured Level	**+**	**Transducer, Cable Loss Pre-Amplifier**	**=**	**Corrected Reading**	**-**	**Duty Cycle Correction**	**FINAL Measurement**	**-**	**Specification Limit**	**=**	**Delta Specification Limit**
(dBµV)		(dB)		(dBµV/m)		(dBµV/m)	(dBµV/m)		(dBµV/m)		
24.0		**14.9**		**38.9**		**10.0**	**28.9**		**40.0**		**-11.1**

Notes:

1. Worst-Case Harmonic Duty-Cycle Corrected Measurement – High Channel @ 4637.98 MHz, 47.1 dBuV/m (6.9 dB below Limit). This signal was within the FCC Restricted Band, where the limit is 54dBuV/m.

2. Worst-Case Harmonic outside the FCC Restricted Band – High Channel @ 6493.24 MHz, 53.1 dBuV/m (- 45.7 dBc). The specification is -20 dBc.

Deviations, Additions, or Exclusions: None

6 Radiated Emissions – Unintentional and Tx Spurious

6.1 Method

Unless otherwise stated, no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Louisville, located at 1795 Dogwood Street, Louisville, CO 80027.

6.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18882	Spectrum Analyzer	HP	8566B	2410A00154	12/06/2010	12/06/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011
18887	Horn Antenna 1-18GHz	EMCO	3115	9205-3886	12/09/2010	12/09/2011
18897	Magnetic loop antenna	EMCO	6502	9205-2738	11/18/2010	11/18/2011
18880	Q.P Adapter	HP	85650A	2811A01300	12/06/2010	12/06/2011
18912	9 kHz- 1.3GHz Pre Amp	HP	8447F	3113A05545	06/04/2010	06/04/2011
18900	RF Pre-Amplifier (4-8 GHz)	Avantek	AFT97-8434-10F	1007	06/07/2010	06/07/2011
18901	RF Pre-Amplifier (8-18 GHz)	Avantek	AWT-18037	1002	06/07/2010	06/07/2011
18906	RF Pre-Amplifier (1-4 GHz)	Mini-Circuits	ZHL-42	N052792-2	06/11/2010	06/11/2011

6.3 Results:

The sample tested was found to Comply.

6.4 Setup Photographs:

Test setup – Front View

Test setup – Rear View

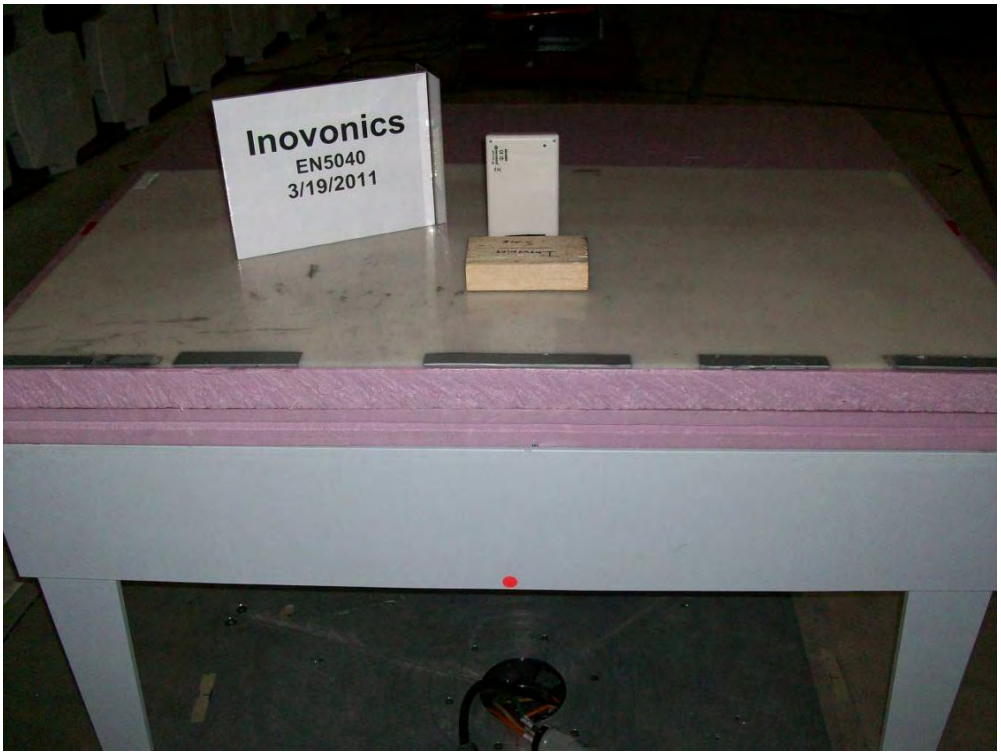
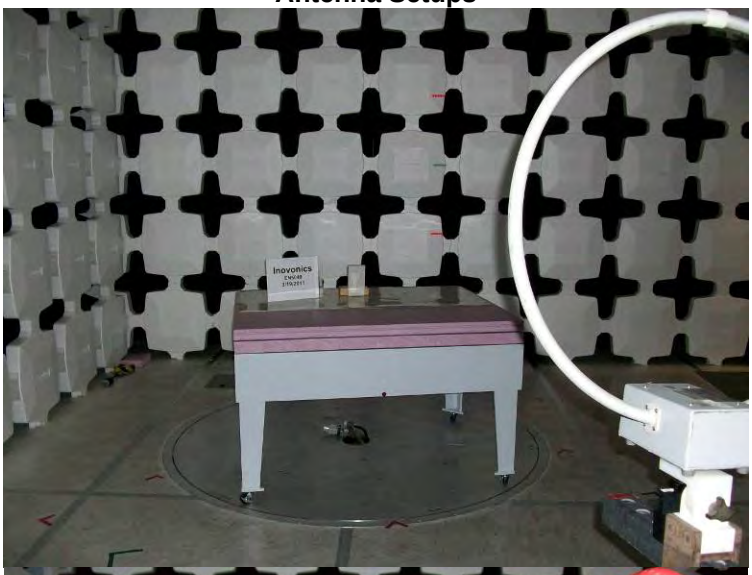
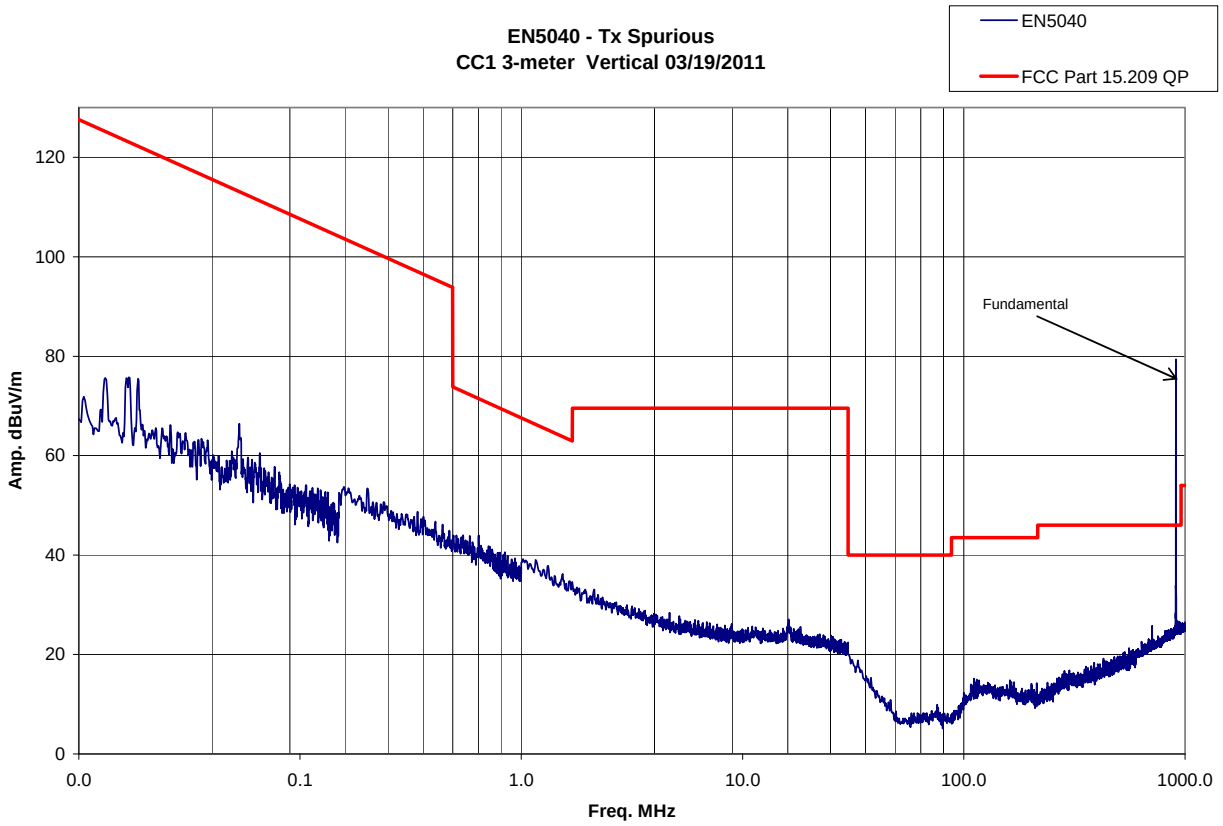


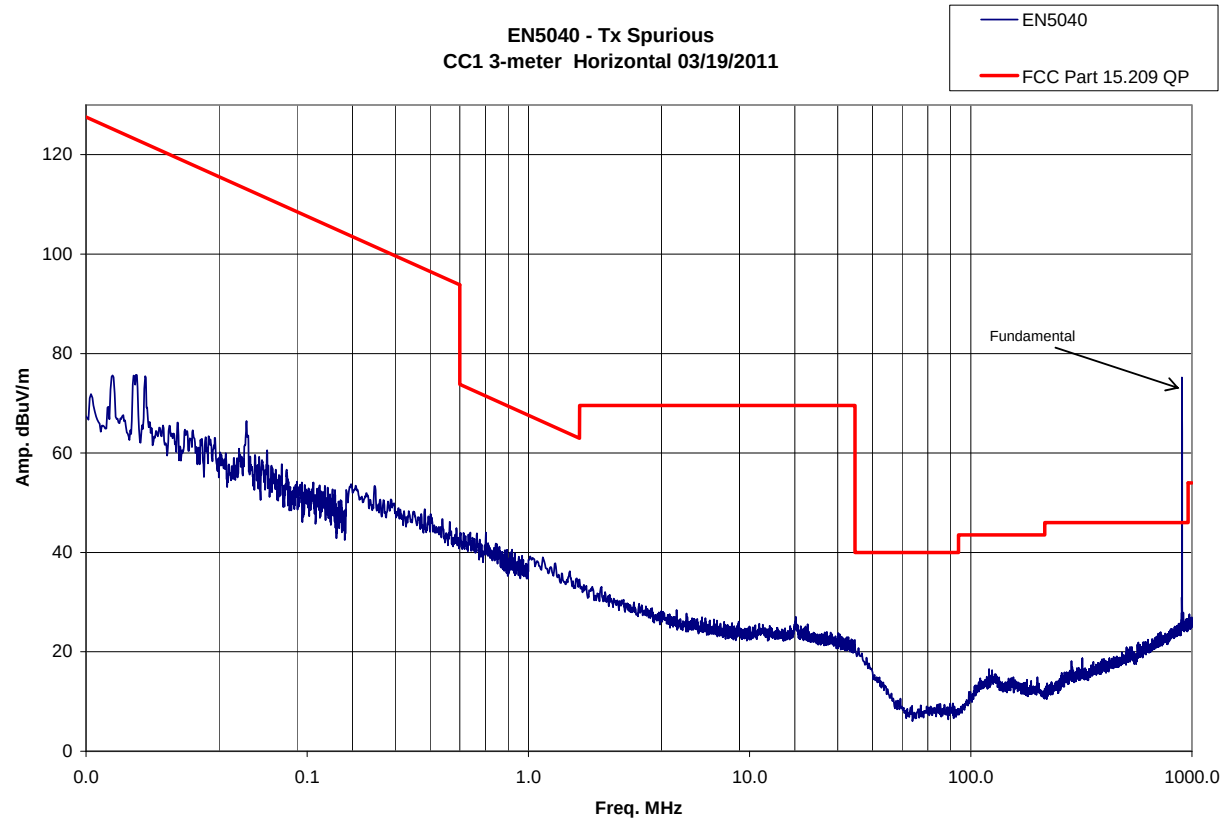
Photo:

Antenna Setups

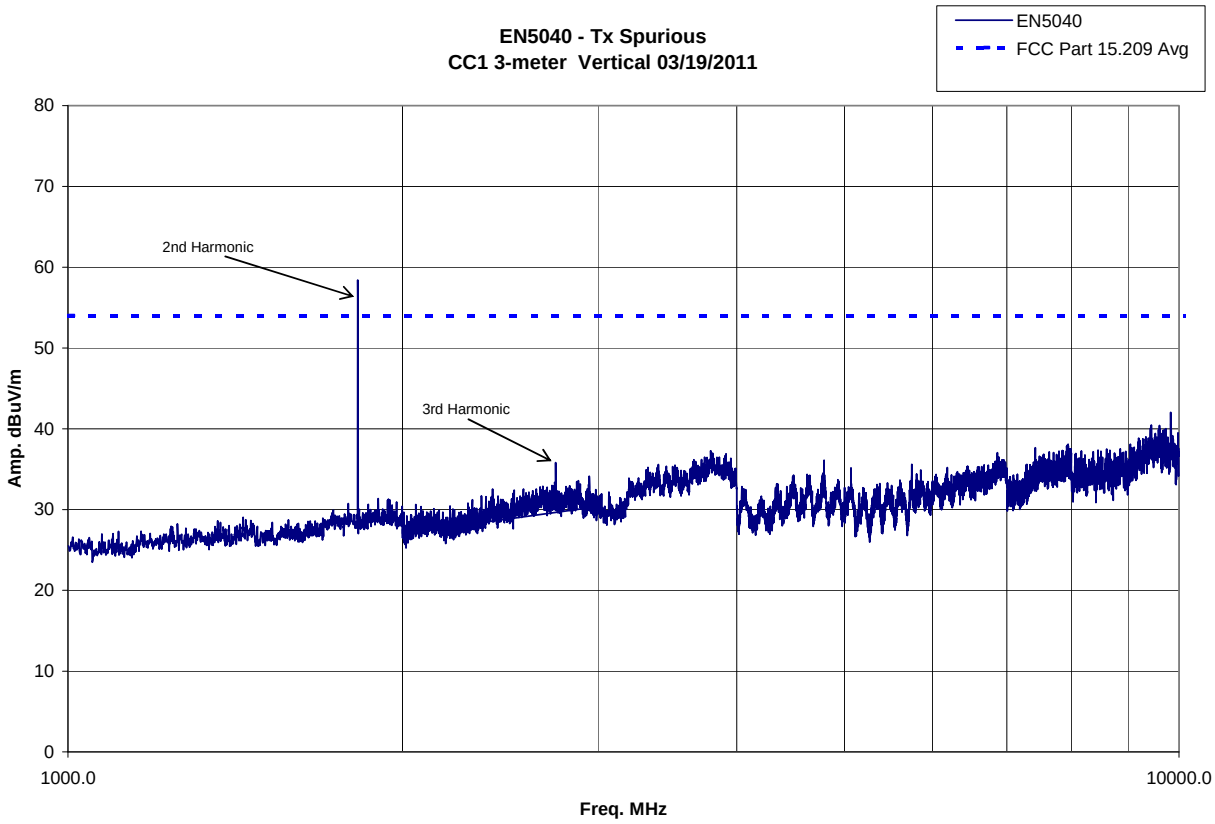


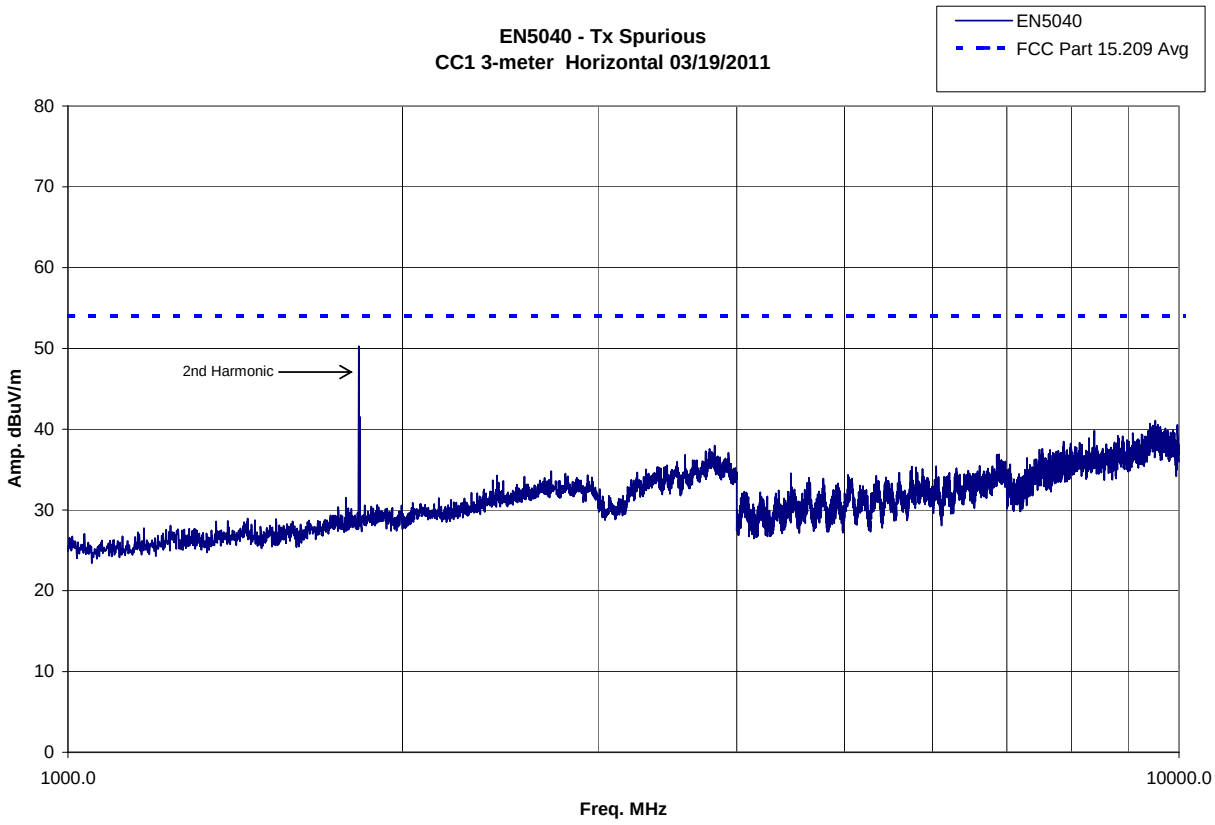
6.5 Plots - Tx Spurious:



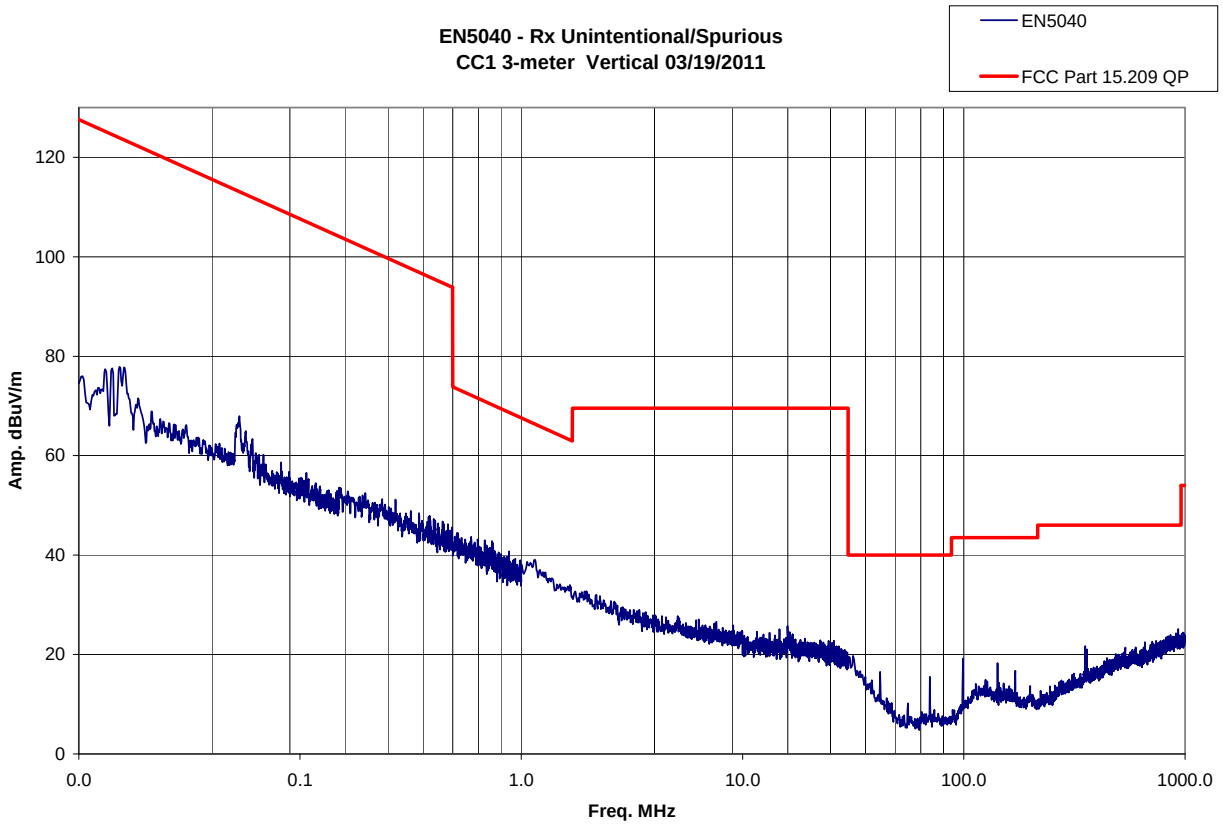


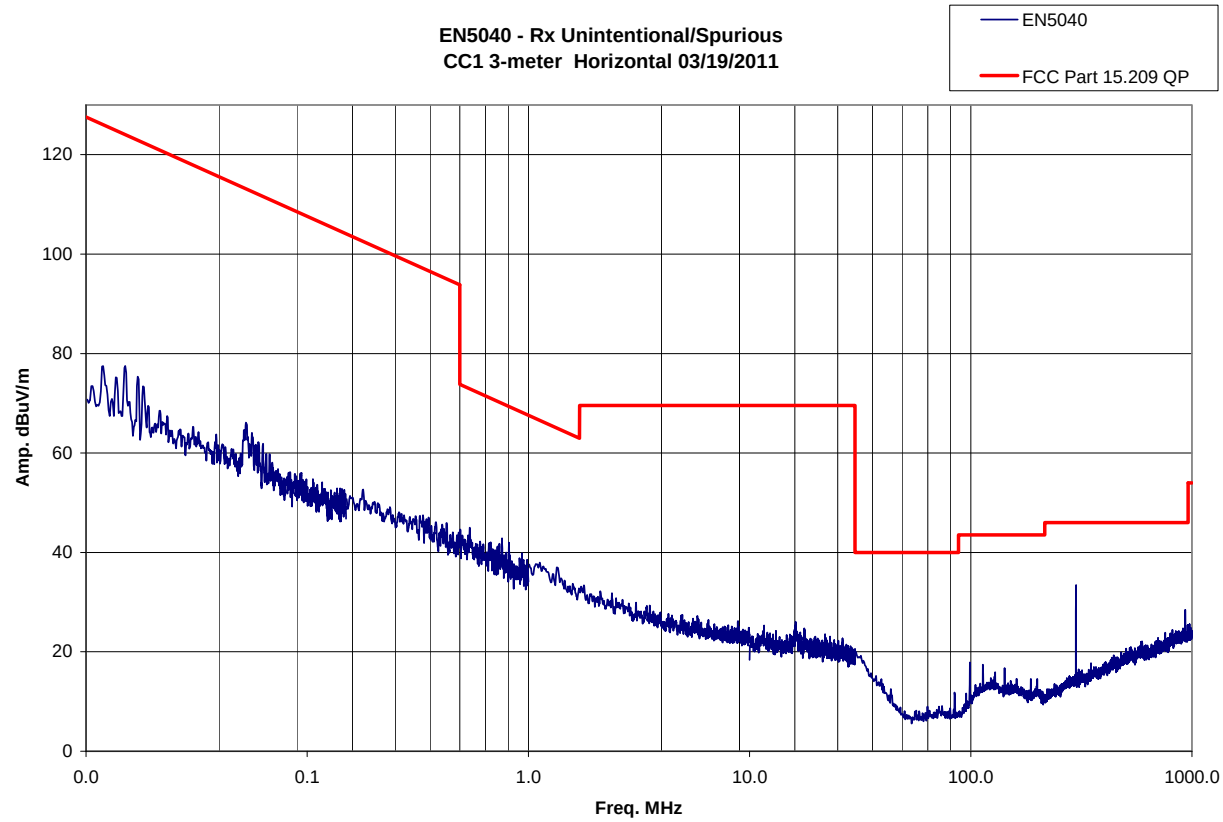
Plots:


EN5040 - Tx Spurious
CC1 3-meter Vertical 03/19/2011
EN5040
FCC Part 15.209 Avg
2nd Harmonic
3rd Harmonic
Amp. dBuV/m
Freq. MHz
1000.0
10000.0
0
10
20
30
40
50
60
70
80

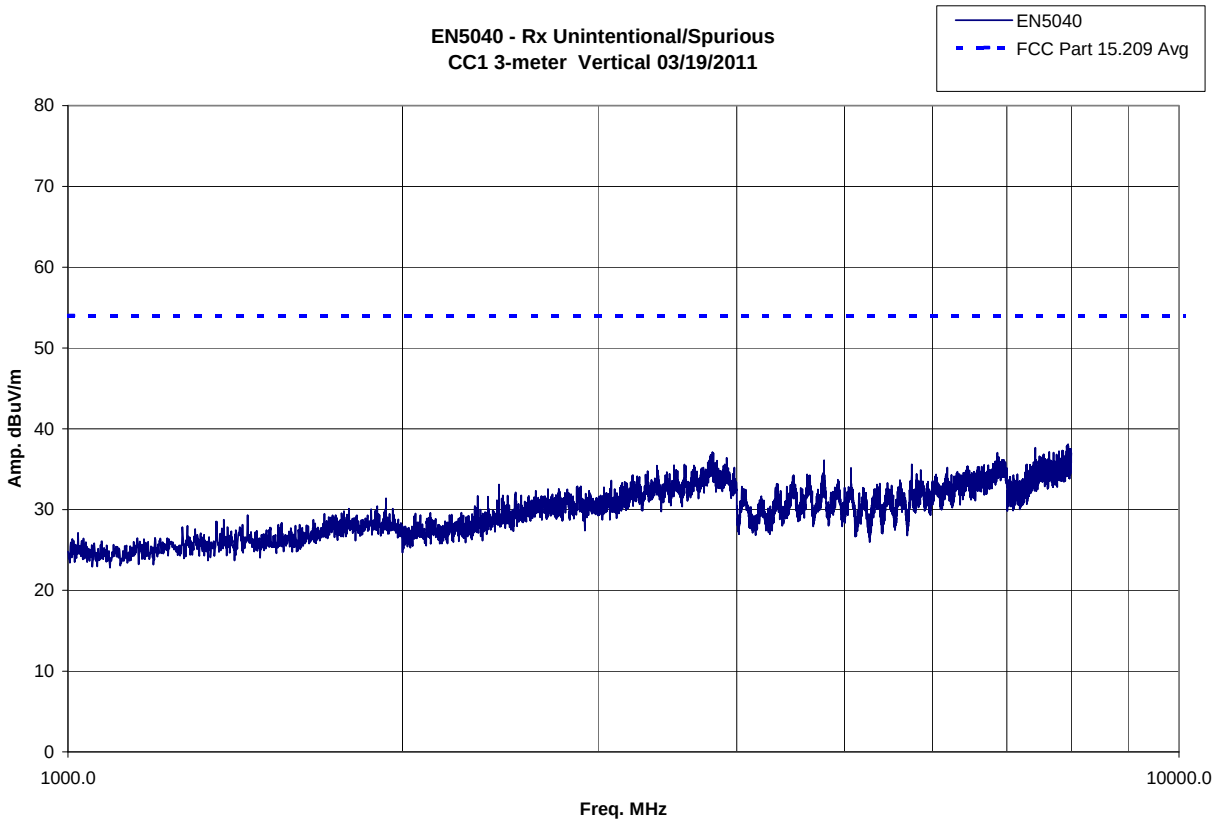

EN5040 - Tx Spurious
CC1 3-meter Horizontal 03/19/2011
EN5040
FCC Part 15.209 Avg
2nd Harmonic
Amp. dBuV/m
Freq. MHz
1000.0
10000.0
0
10
20
30
40
50
60
70
80

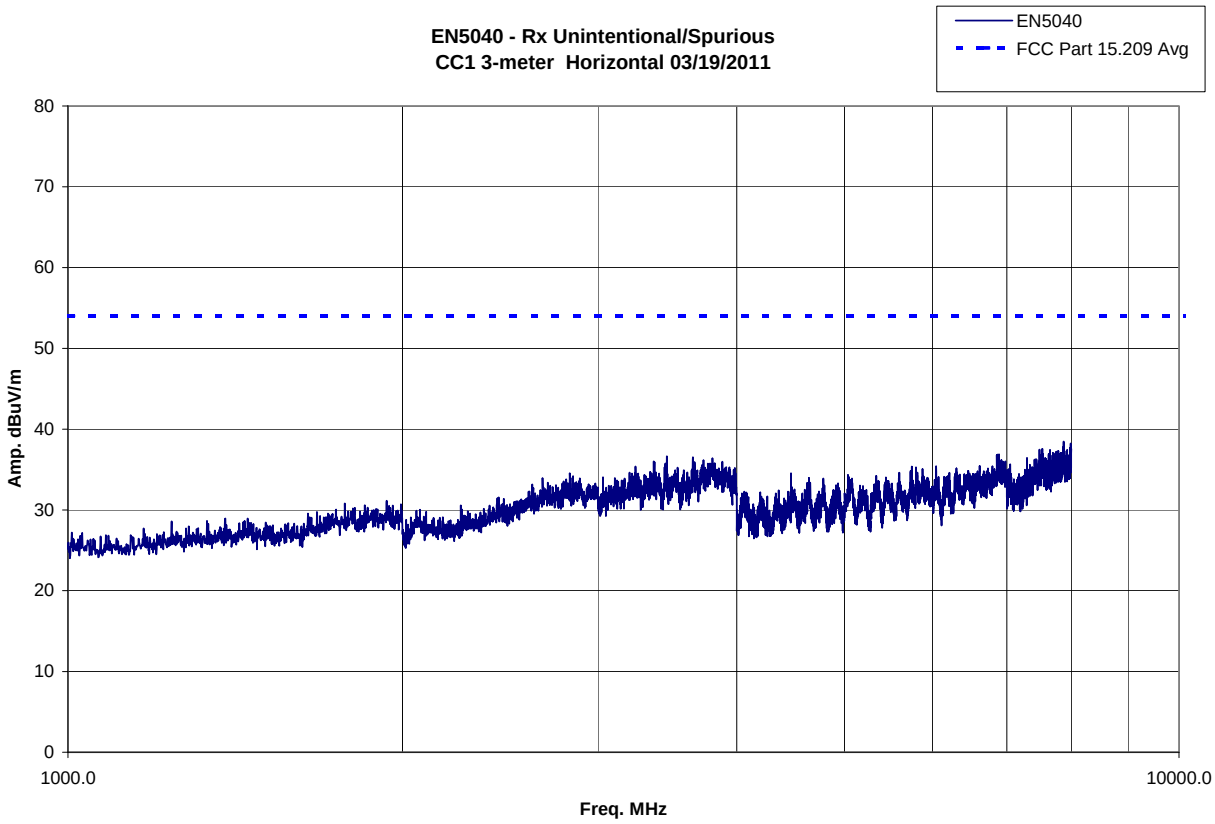
6.6 Plots – Rx Unintentional/Spurious



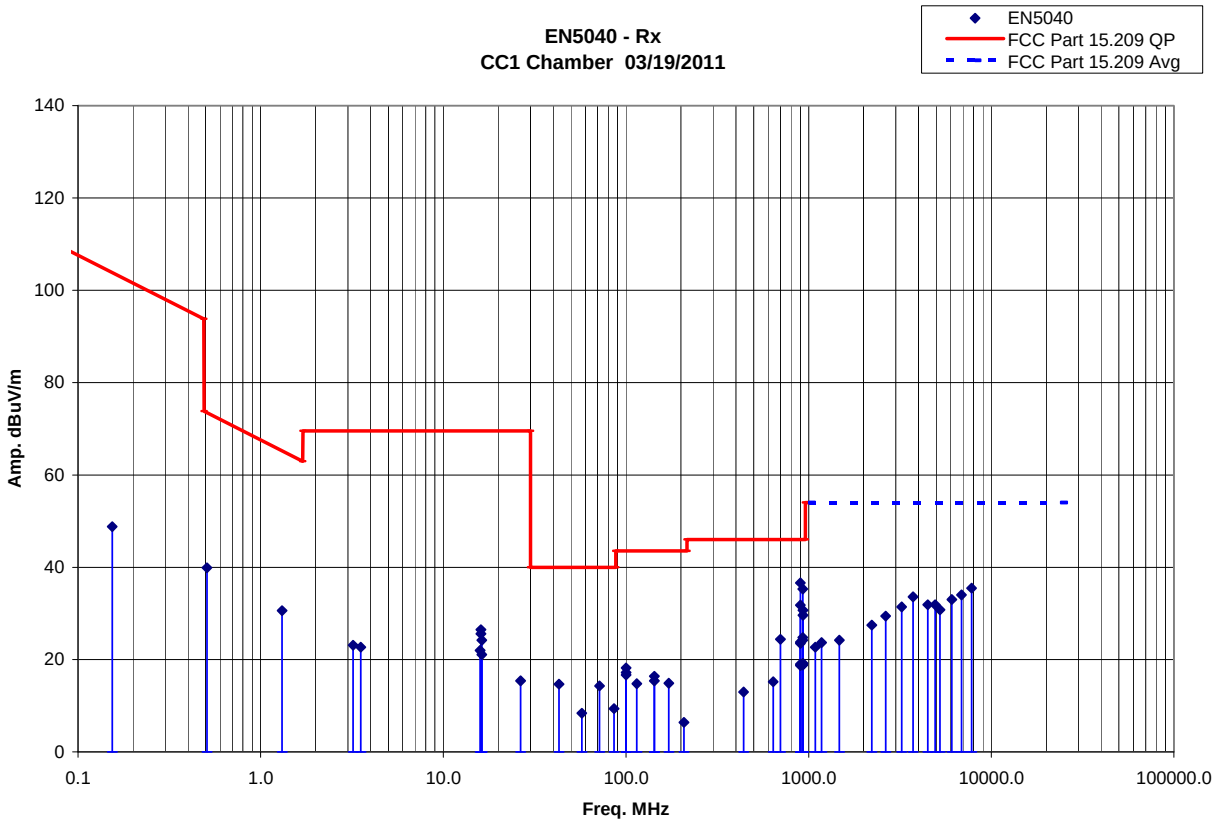


Plots:


EN5040 - Rx Unintentional/Spurious
CC1 3-meter Vertical 03/19/2011
EN5040
FCC Part 15.209 Avg
Amp. dBuV/m
80
70
60
50
40
30
20
10
0
1000.0
10000.0
Freq. MHz


EN5040 - Rx Unintentional/Spurious
CC1 3-meter Horizontal 03/19/2011
EN5040
FCC Part 15.209 Avg
Amp. dBuV/m
80
70
60
50
40
30
20
10
0
1000.0
10000.0
Freq. MHz

Plots: Final Measurements



6.7 Test Data – Unintentional/Spurious:

Radiated Electromagnetic Emissions

Test Report #:	**Unintentional & Spurious Run 01**	Test Area:	CC1 Radiated	Temperature:	23.1	°C
Test Method:	FCC Part 15.209	Test Date:	19-Mar-2011	Relative Humidity:	31.4	%
EUT Model #:	EN5040	EUT Power:	12-14 VDC	Air Pressure:	81.2	kPa
EUT Serial #:	90035794					
Manufacturer:	Inovonics					
EUT Description:	Repeater					

Notes: Testing < 150kHz: CISPR QP detector, 200Hz QP BW

Testing 150kHz to 30MHz: CISPR QP detector, 9kHz QP BW

Testing 30MHz to 1000MHz: CISPR QP detector, 120kHz QP BW

Testing > 1GHz: Average detector, RBW 1MHz, VBW 10 Hz

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
Horizontal Antenna - 30MHz to 1000MHz						
85.91	28.9 Qp	0.8 / 7.6 / 27.8	9.4	H / 1.6 / 46.0	-30.6	N/A
100.23	33.6 Qp	0.8 / 10.6 / 27.8	17.2	H / 1.5 / 112.0	-26.3	N/A
114.54	28.5 Qp	0.8 / 13.3 / 27.7	14.8	H / 1.4 / 35.0	-28.7	N/A
143.17	29.6 Qp	0.8 / 12.5 / 27.5	15.4	H / 1.4 / 54.0	-28.1	N/A
207.60	21.7 Qp	1.0 / 10.9 / 27.2	6.4	H / 1.4 / 22.0	-37.1	N/A
440.16	22.5 Qp	1.4 / 16.9 / 27.9	13.0	H / 1.6 / 22.0	-33.0	N/A
100.23	33.1 Qp	0.8 / 10.6 / 27.8	16.7	H / 1.6 / 36.0	-26.8	N/A
640.00	22.4 Qp	1.8 / 19.2 / 28.1	15.2	H / 1.6 / 36.0	-30.8	N/A
901.86	39.5 Qp	2.1 / 22.5 / 27.5	36.6	H / 1.3 / 36.0	-9.4	N/A
Band Edge Measurements - Tx						
901.99	26.7 Qp	2.1 / 22.5 / 27.5	23.8	H / 1.3 / 36.0	-22.2	N/A
928.11	38.1 Qp	2.1 / 22.5 / 27.4	35.3	H / 1.3 / 27.0	-10.7	N/A
929.41	27.6 Qp	2.1 / 22.5 / 27.4	24.8	H / 1.3 / 27.0	-21.2	N/A
930.32	33.5 Qp	2.1 / 22.5 / 27.4	30.7	H / 1.3 / 27.0	-15.3	N/A
Band Edge Measurements - Rx						
901.86	21.6 Qp	2.1 / 22.5 / 27.5	18.7	H / 1.3 / 36.0	-27.3	N/A
901.99	21.9 Qp	2.1 / 22.5 / 27.5	19.0	H / 1.3 / 36.0	-27.0	N/A
928.11	21.7 Qp	2.1 / 22.5 / 27.4	18.9	H / 1.3 / 27.0	-27.1	N/A
929.41	21.6 Qp	2.1 / 22.5 / 27.4	18.8	H / 1.3 / 27.0	-27.2	N/A
930.32	22.0 Qp	2.1 / 22.5 / 27.4	19.2	H / 1.3 / 27.0	-26.8	N/A
Vertical Antenna - 30MHz to 1000MHz						
42.97	30.4 Qp	0.8 / 11.5 / 28.0	14.7	V / 1.1 / 86.0	-25.3	N/A
57.28	28.3 Qp	0.8 / 7.3 / 28.0	8.4	V / 1.1 / 132.0	-31.6	N/A
71.59	33.5 Qp	0.8 / 8.0 / 27.9	14.3	V / 1.1 / 56.0	-25.7	N/A
100.23	34.6 Qp	0.8 / 10.6 / 27.8	18.2	V / 1.1 / 128.0	-25.3	N/A

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
143.18	30.6 Qp	0.8 / 12.5 / 27.5	16.4	V / 1.1 / 128.0	-27.1	N/A
171.82	29.6 Qp	0.9 / 11.9 / 27.4	14.9	V / 1.1 / 122.0	-28.6	N/A
699.90	30.6 Qp	1.9 / 19.9 / 28.1	24.4	V / 1.5 / 38.0	-21.6	N/A
901.86	34.8 Qp	2.1 / 22.5 / 27.5	31.8	V / 1.5 / 38.0	-14.2	N/A
901.99	26.4 Qp	2.1 / 22.5 / 27.5	23.5	V / 1.4 / 24.0	-22.5	N/A
928.11	27.0 Qp	2.1 / 22.5 / 27.4	24.2	V / 1.4 / 26.0	-21.8	N/A
929.41	21.9 Qp	2.1 / 22.5 / 27.4	19.1	V / 1.4 / 26.0	-26.9	N/A
930.32	32.4 Qp	2.1 / 22.5 / 27.4	29.6	V / 1.4 / 12.0	-16.4	N/A
Loop Antenna - Antenna Parallel to EUT						
0.0320	47.9 Qp	0.0 / 12.6 / 0.0	60.5	V / 1.4 / 12.0	-57.0	N/A
0.0536	52.5 Qp	0.0 / 10.8 / 0.0	63.4	V / 1.4 / 48.0	-49.6	N/A
0.0644	45.2 Qp	0.0 / 10.8 / 0.0	56.0	V / 1.4 / 48.0	-55.4	N/A
0.0763	42.5 Qp	0.0 / 10.6 / 0.0	53.2	V / 1.4 / 22.0	-56.7	N/A
0.154	38.4 Qp	0.0 / 10.4 / 0.0	48.8	V / 1.4 / 33.0	-55.0	N/A
0.508	29.5 Qp	0.1 / 10.3 / 0.0	39.9	V / 1.4 / 64.0	-33.6	N/A
1.31	20.1 Qp	0.1 / 10.4 / 0.0	30.6	V / 1.4 / 64.0	-34.6	N/A
3.21	12.4 Qp	0.1 / 10.6 / 0.0	23.1	V / 1.4 / 64.0	-46.4	N/A
15.90	11.1 Qp	0.3 / 10.6 / 0.0	22.0	V / 1.4 / 28.0	-47.5	N/A
16.23	10.2 Qp	0.3 / 10.6 / 0.0	21.1	V / 1.4 / 98.0	-48.4	N/A
26.47	5.8 Qp	0.4 / 9.2 / 0.0	15.4	V / 1.4 / 68.0	-54.1	N/A
Loop Antenna Perpendicular to EUT						
0.0320	47.4 Qp	0.0 / 12.6 / 0.0	60.0	H / 1.4 / 112.0	-57.5	N/A
0.0536	52.5 Qp	0.0 / 10.8 / 0.0	63.3	H / 1.4 / 112.0	-49.7	N/A
0.0644	45.2 Qp	0.0 / 10.8 / 0.0	56.0	H / 1.4 / 98.0	-55.4	N/A
3.53	12.0 Qp	0.1 / 10.6 / 0.0	22.7	H / 1.4 / 72.0	-46.8	N/A
16.06	15.6 Qp	0.3 / 10.6 / 0.0	26.5	H / 1.4 / 72.0	-43.0	N/A
16.06	14.7 Qp	0.3 / 10.6 / 0.0	25.6	H / 1.4 / 72.0	-43.9	N/A
16.23	13.3 Qp	0.3 / 10.6 / 0.0	24.2	H / 1.4 / 32.0	-45.3	N/A
Horizontal Antenna 1-4GHz						
1086.88	33.5 Av	2.3 / 24.2 / 37.3	22.7	H / 1.2 / 12.0	N/A	-31.3
1472.74	33.0 Av	2.7 / 25.1 / 36.7	24.2	H / 1.3 / 33.0	N/A	-29.8
2637.47	34.2 Av	3.7 / 29.1 / 37.6	29.4	H / 1.3 / 33.0	N/A	-24.6
3733.07	34.6 Av	4.5 / 32.2 / 37.7	33.6	H / 1.4 / 56.0	N/A	-20.4
Vertical Antenna - 1GHz to 4GHz						
1179.46	34.0 Av	2.4 / 24.6 / 37.3	23.7	V / 1.6 / 32.0	N/A	-30.3
2216.15	33.8 Av	3.4 / 27.8 / 37.4	27.5	V / 1.6 / 32.0	N/A	-26.5
3232.85	33.2 Av	4.2 / 31.3 / 37.3	31.4	V / 1.5 / 42.0	N/A	-22.6
Horizontal Antenna - 4GHz to 8GHz						
4484.98	33.6 Av	5.0 / 32.4 / 39.0	31.9	V / 1.3 / 21.0	N/A	-22.1
5237.08	30.4 Av	5.4 / 34.1 / 39.1	30.8	V / 1.3 / 10.0	N/A	-23.2
6867.29	32.3 Av	6.2 / 35.4 / 39.9	34.0	V / 1.2 / 42.0	N/A	-20.0

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
7802.10	31.8 Av	6.7 / 36.4 / 39.4	35.5	V / 1.2 / 32.0	N/A	-18.5
Vertical Antenna - 4GHz to 8GHz						
4929.22	32.5 Av	5.2 / 33.4 / 39.1	31.9	V / 1.2 / 8.0	N/A	-22.1
6083.63	31.9 Av	5.8 / 34.6 / 39.2	33.0	V / 1.2 / 12.0	N/A	-21.0

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
********** Measurement Summary **********						
901.86	39.5 Qp	2.1 / 22.5 / 27.5	36.6	H / 1.3 / 36.0	-9.4	N/A
928.11	38.1 Qp	2.1 / 22.5 / 27.4	35.3	H / 1.3 / 27.0	-10.7	N/A
930.32	33.5 Qp	2.1 / 22.5 / 27.4	30.7	H / 1.3 / 27.0	-15.3	N/A
7802.10	31.8 Av	6.7 / 36.4 / 39.4	35.5	V / 1.2 / 32.0	N/A	-18.5
6867.29	32.3 Av	6.2 / 35.4 / 39.9	34.0	V / 1.2 / 42.0	N/A	-20.0
3733.07	34.6 Av	4.5 / 32.2 / 37.7	33.6	H / 1.4 / 56.0	N/A	-20.4
6083.63	31.9 Av	5.8 / 34.6 / 39.2	33.0	V / 1.2 / 12.0	N/A	-21.0
929.41	27.6 Qp	2.1 / 22.5 / 27.4	24.8	H / 1.3 / 27.0	-21.2	N/A
699.90	30.6 Qp	1.9 / 19.9 / 28.1	24.4	V / 1.5 / 38.0	-21.6	N/A
4484.98	33.6 Av	5.0 / 32.4 / 39.0	31.9	V / 1.3 / 21.0	N/A	-22.1
4929.22	32.5 Av	5.2 / 33.4 / 39.1	31.9	V / 1.2 / 8.0	N/A	-22.1
901.99	26.7 Qp	2.1 / 22.5 / 27.5	23.8	H / 1.3 / 36.0	-22.2	N/A
3232.85	33.2 Av	4.2 / 31.3 / 37.3	31.4	V / 1.5 / 42.0	N/A	-22.6
5237.08	30.4 Av	5.4 / 34.1 / 39.1	30.8	V / 1.3 / 10.0	N/A	-23.2
2637.47	34.2 Av	3.7 / 29.1 / 37.6	29.4	H / 1.3 / 33.0	N/A	-24.6
42.97	30.4 Qp	0.8 / 11.5 / 28.0	14.7	V / 1.1 / 86.0	-25.3	N/A
100.23	34.6 Qp	0.8 / 10.6 / 27.8	18.2	V / 1.1 / 128.0	-25.3	N/A
71.59	33.5 Qp	0.8 / 8.0 / 27.9	14.3	V / 1.1 / 56.0	-25.7	N/A
2216.15	33.8 Av	3.4 / 27.8 / 37.4	27.5	V / 1.6 / 32.0	N/A	-26.5
143.18	30.6 Qp	0.8 / 12.5 / 27.5	16.4	V / 1.1 / 128.0	-27.1	N/A
171.82	29.6 Qp	0.9 / 11.9 / 27.4	14.9	V / 1.1 / 122.0	-28.6	N/A
114.54	28.5 Qp	0.8 / 13.3 / 27.7	14.8	H / 1.4 / 35.0	-28.7	N/A
1472.74	33.0 Av	2.7 / 25.1 / 36.7	24.2	H / 1.3 / 33.0	N/A	-29.8
1179.46	34.0 Av	2.4 / 24.6 / 37.3	23.7	V / 1.6 / 32.0	N/A	-30.3
85.91	28.9 Qp	0.8 / 7.6 / 27.8	9.4	H / 1.6 / 46.0	-30.6	N/A
640.00	22.4 Qp	1.8 / 19.2 / 28.1	15.2	H / 1.6 / 36.0	-30.8	N/A
1086.88	33.5 Av	2.3 / 24.2 / 37.3	22.7	H / 1.2 / 12.0	N/A	-31.3
57.28	28.3 Qp	0.8 / 7.3 / 28.0	8.4	V / 1.1 / 132.0	-31.6	N/A
440.16	22.5 Qp	1.4 / 16.9 / 27.9	13.0	H / 1.6 / 22.0	-33.0	N/A
0.508	29.5 Qp	0.1 / 10.3 / 0.0	39.9	V / 1.4 / 64.0	-33.6	N/A
1.31	20.1 Qp	0.1 / 10.4 / 0.0	30.6	V / 1.4 / 64.0	-34.6	N/A
207.60	21.7 Qp	1.0 / 10.9 / 27.2	6.4	H / 1.4 / 22.0	-37.1	N/A
16.06	15.6 Qp	0.3 / 10.6 / 0.0	26.5	H / 1.4 / 72.0	-43.0	N/A
16.23	13.3 Qp	0.3 / 10.6 / 0.0	24.2	H / 1.4 / 32.0	-45.3	N/A
3.21	12.4 Qp	0.1 / 10.6 / 0.0	23.1	V / 1.4 / 64.0	-46.4	N/A
3.53	12.0 Qp	0.1 / 10.6 / 0.0	22.7	H / 1.4 / 72.0	-46.8	N/A
15.90	11.1 Qp	0.3 / 10.6 / 0.0	22.0	V / 1.4 / 28.0	-47.5	N/A
0.0536	52.5 Qp	0.0 / 10.8 / 0.0	63.4	V / 1.4 / 48.0	-49.6	N/A
26.47	5.8 Qp	0.4 / 9.2 / 0.0	15.4	V / 1.4 / 68.0	-54.1	N/A
0.154	38.4 Qp	0.0 / 10.4 / 0.0	48.8	V / 1.4 / 33.0	-55.0	N/A
0.0644	45.2 Qp	0.0 / 10.8 / 0.0	56.0	V / 1.4 / 48.0	-55.4	N/A
0.0763	42.5 Qp	0.0 / 10.6 / 0.0	53.2	V / 1.4 / 22.0	-56.7	N/A
0.0320	47.9 Qp	0.0 / 12.6 / 0.0	60.5	V / 1.4 / 12.0	-57.0	N/A

Example Unintentional Radiated Emissions calculation:

Measured Level	+	Transducer, Cable Loss & Amplifier corrections	=	Corrected Reading	Specification Limit	-	Corrected Reading	=	Delta Specification
(dBμV)		(dB)		(dBμV/m)	(dBμV/m)		(dBμV/m)		
14.0		**14.9**		**28.9**	**40.0**		**28.9**		**-11.1**

Notes:

(1) All measurements are field strength measurements taken at 3-meter product-to-antenna.

(2) Quasi-peak detector measurements up to 1GHz – Average detector measurements above 1 GHz.

Deviations, Additions, or Exclusions: None

7 20dB Bandwidth

7.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Denver, located at 40 1795 Dogwood St. Suite 200 Louisville, CO 80027.

7.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011

7.3 Results:

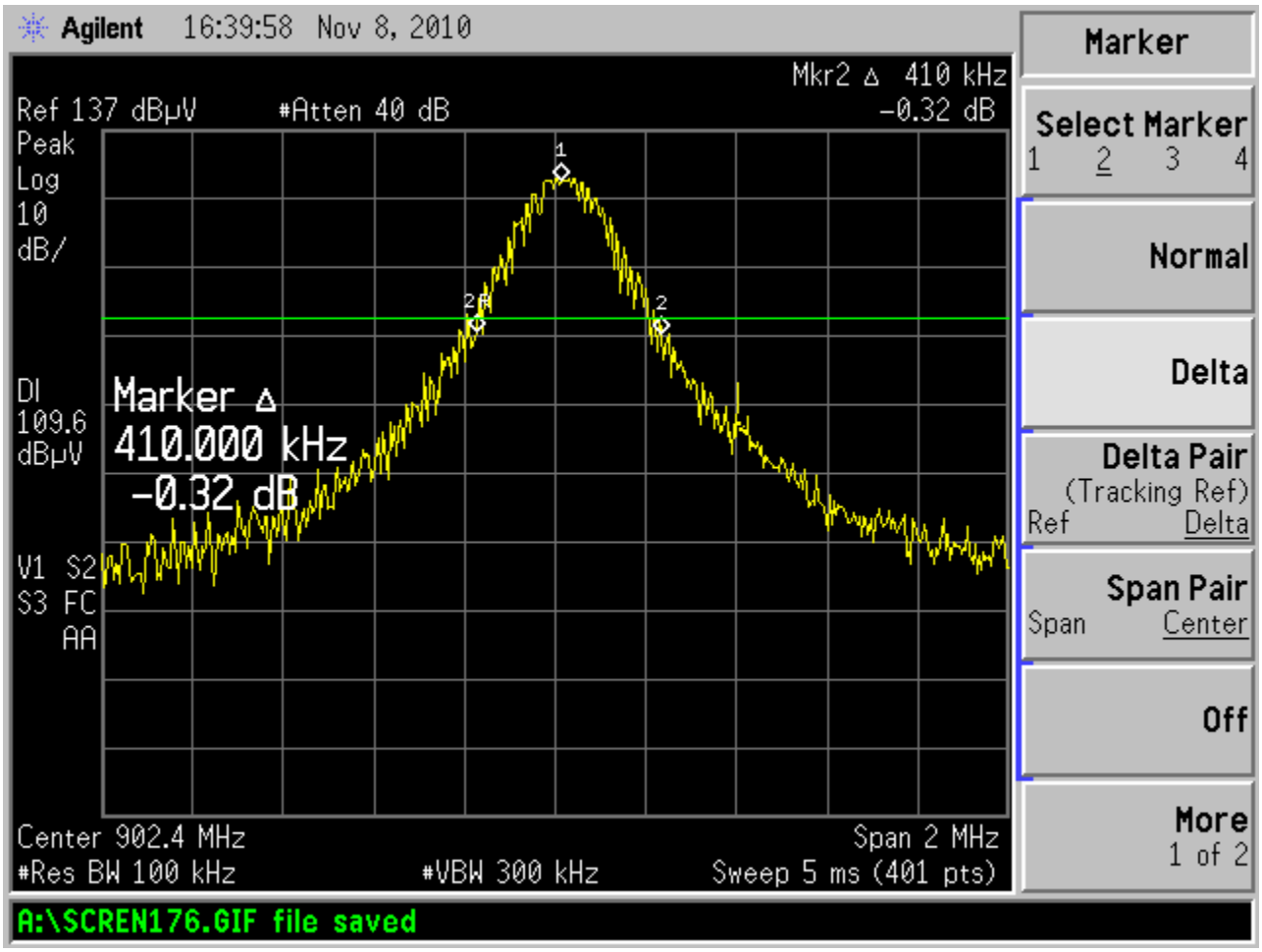
The sample tested was found to Comply.

7.4 Test Data:

20 dB Bandwidth – EN5040

FCC 15.247(a)(1)(i) / RSS-210 A8.1(c)

Low Channel – 902.4 MHz



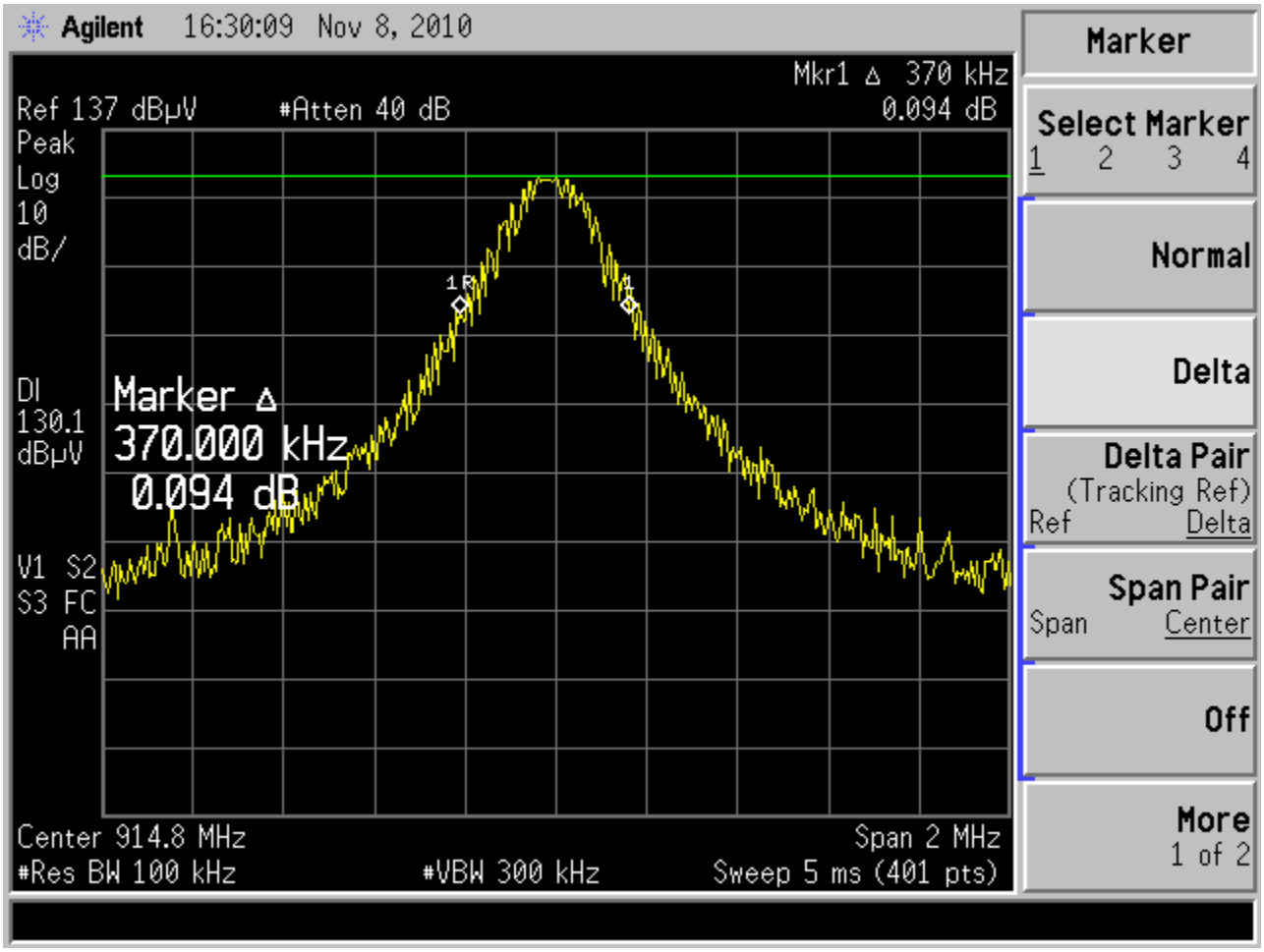
Specification: 20dB Bandwidth < 500 kHz

If 250 kHz or greater (≥ 25 channels)

20 dB Bandwidth

FCC 15.247(a)(1)(i) / RSS-210 A8.1(c)

Mid Channel – 914.8 MHz



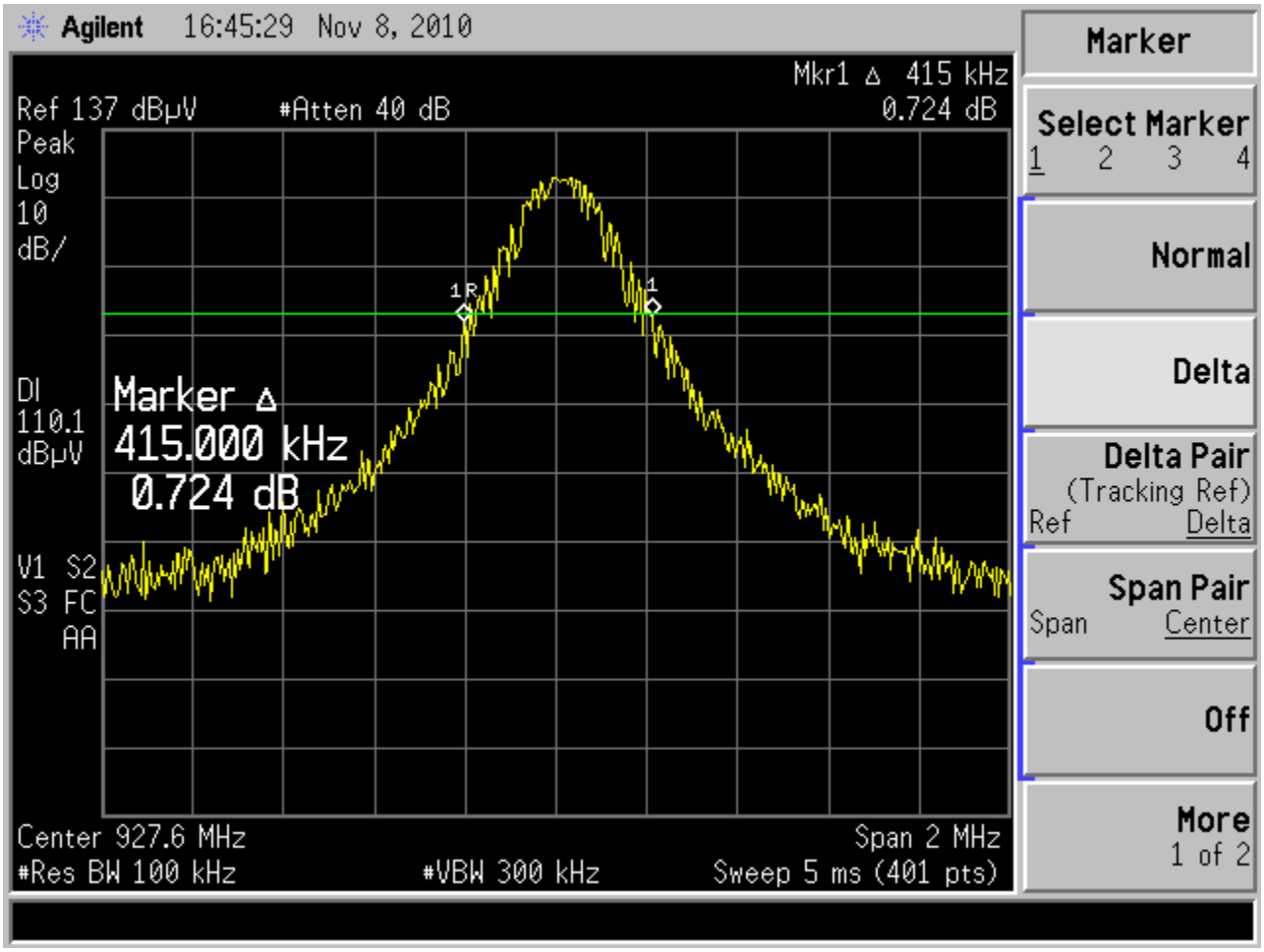
Specification: 20dB Bandwidth < 500 kHz

If 250 kHz or greater (≥ 25 channels)

20 dB Bandwidth

FCC 15.247(a)(1)(i) / RSS-210 A8.1(c)

High Channel – 927.6 MHz



Specification: 20dB Bandwidth < 500 kHz

If 250 kHz or greater (≥ 25 channels)

Notes:

(1) All measurements are Radiated Field Strength

(2) Worst-case – High Channel – 20dB Bandwidth 415 kHz

Deviations, Additions, or Exclusions: None

8 Number of Hopping Channels

8.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Denver, located at 40 1795 Dogwood St. Suite 200 Louisville, CO 80027.

8.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011

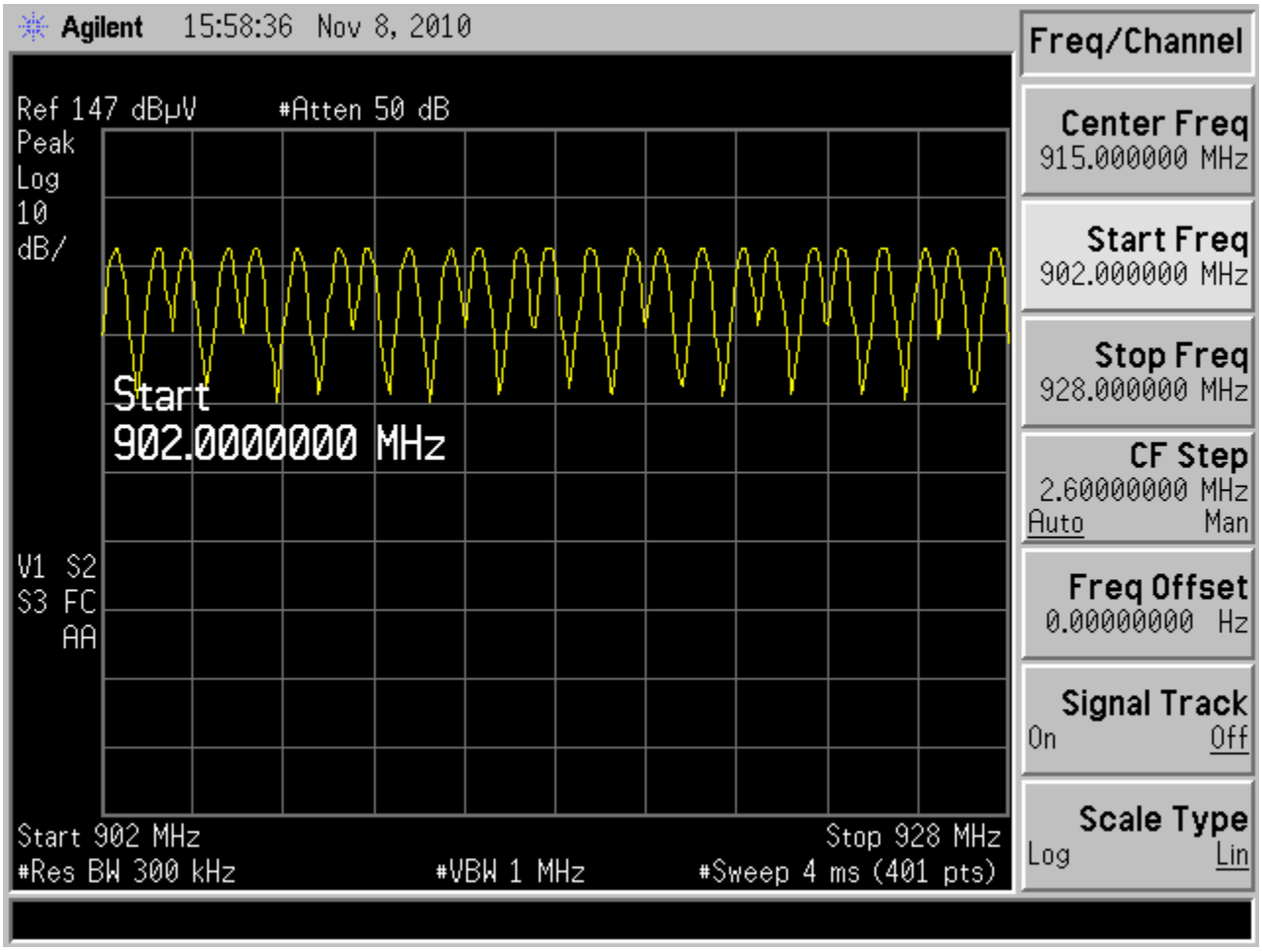
8.3 Results:

The sample tested was found to Comply.

8.4 Test Data:

Number of Hopping Channels – EN5040

FCC 15.247(a)(1)(i) / RSS-210 A8.1(c)



Specification: If the 20dB BW ≥ 250 kHz, at least 25 Hopping Channels

9 Hopping Channel Carrier Separation

9.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Denver, located at 40 1795 Dogwood St. Suite 200 Louisville, CO 80027.

9.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011

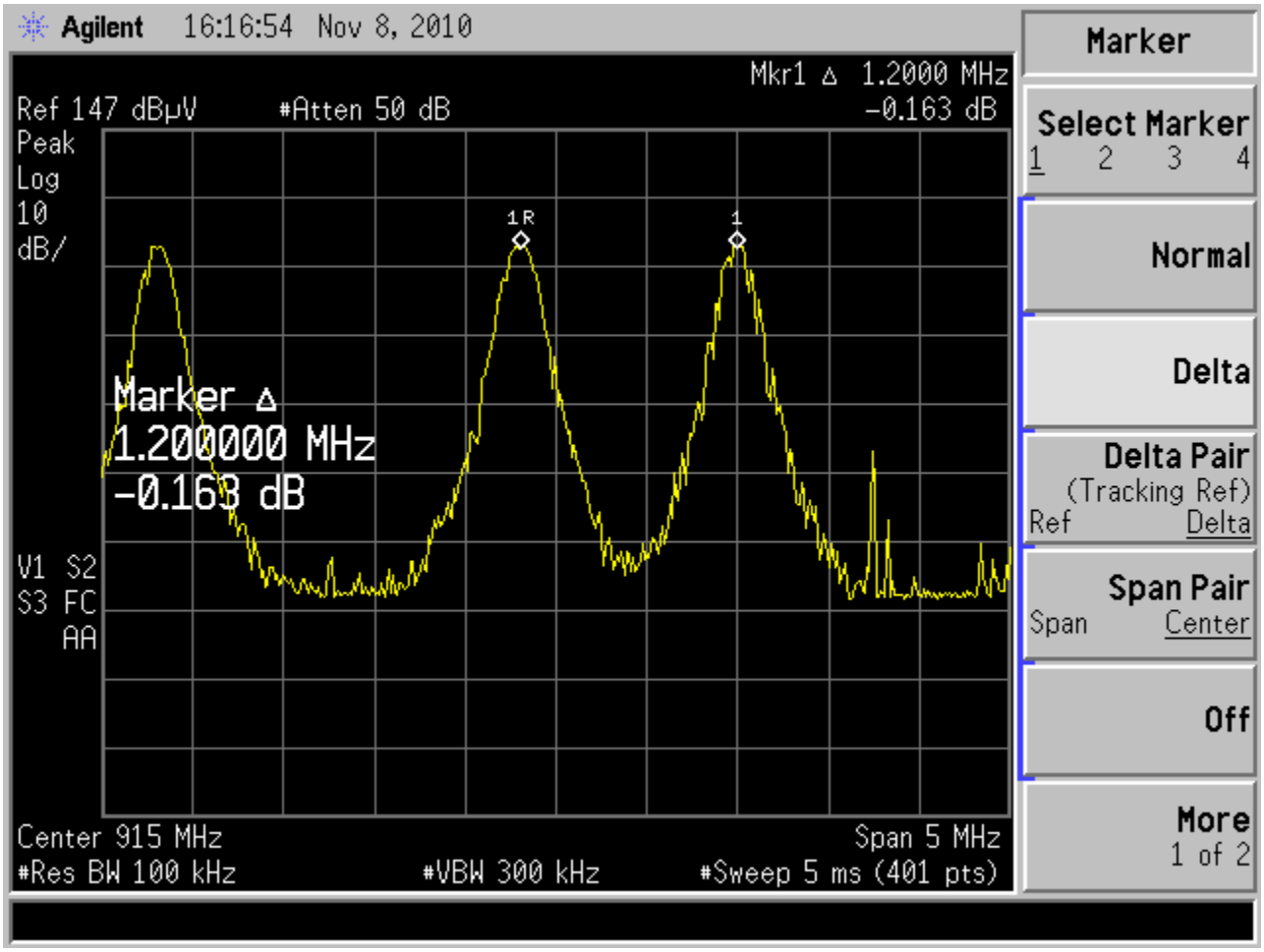
9.3 Results:

The sample tested was found to Comply.

9.4 Test Data:

Hopping Channel Carrier Separation – EN5040

FCC 15.247(a)(1) / RSS-210 A8.1(b)



Specification: ≥ 25 kHz
or
≥ 20dB BW of Hopping Channel, whichever is greater

10 Time of Occupancy (On/Off Time)

10.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Denver, located at 40 1795 Dogwood St. Suite 200 Louisville, CO 80027.

10.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011

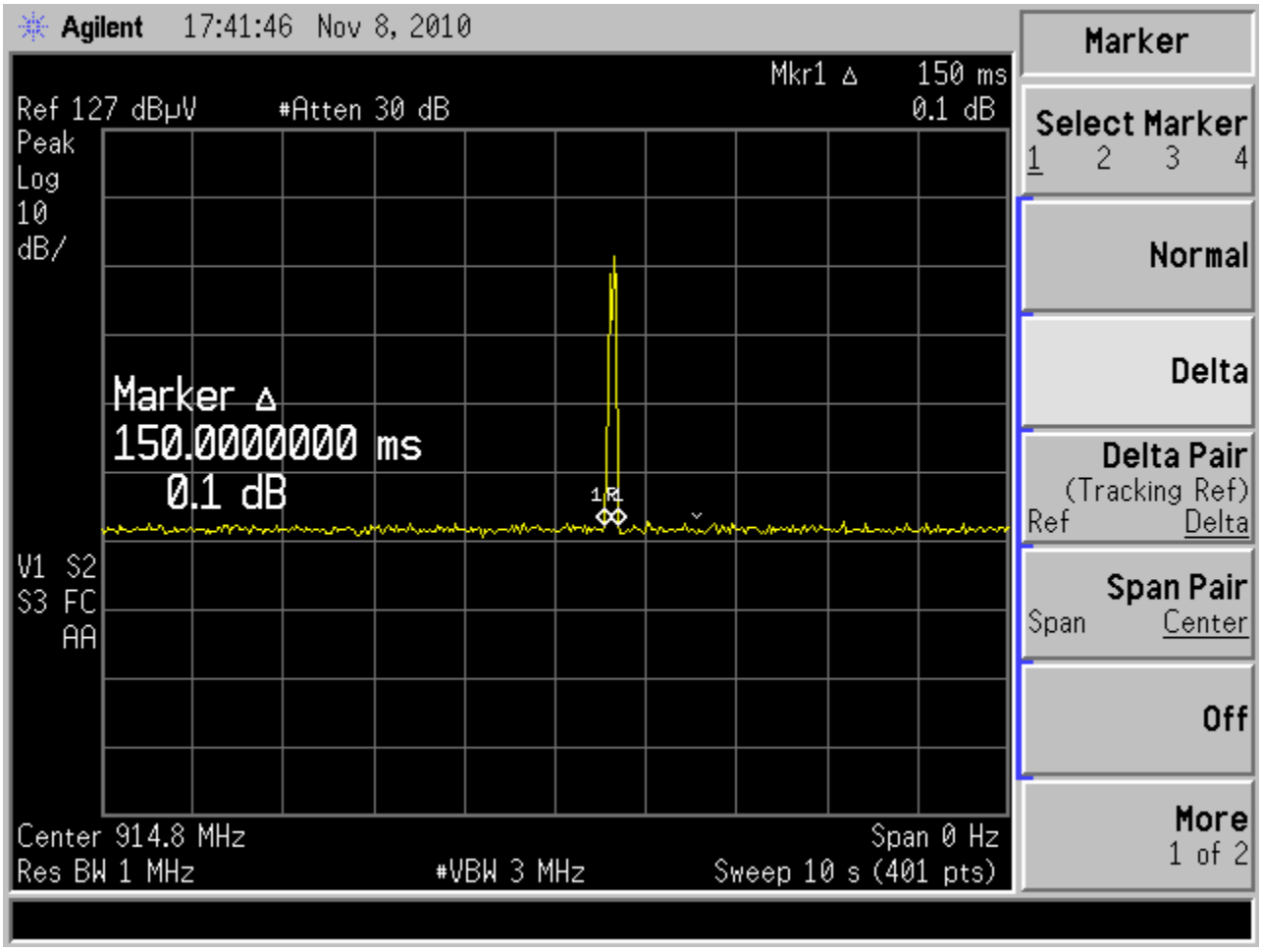
10.3 Results:

The sample tested was found to Comply.

10.4 Test Data:

Channel On Time – EN5040

FCC 15.247(a)(1)(i) / RSS-210 A8.1(c)



Specification: Maximum On-Time ≤ 0.4 sec within 10 sec period

11 Band Edge Measurements

11.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Denver, located at 40 1795 Dogwood St. Suite 200 Louisville, CO 80027.

11.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
18882	Spectrum Analyzer	HP	8566B	2410A00154	12/06/2010	12/06/2011
18880	Q.P Adapter	HP	85650A	2811A01300	12/06/2010	12/06/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011
18912	9 kHz- 1.3GHz Pre Amp	HP	8447F	3113A05545	06/04/2010	06/04/2011

11.3 Results:

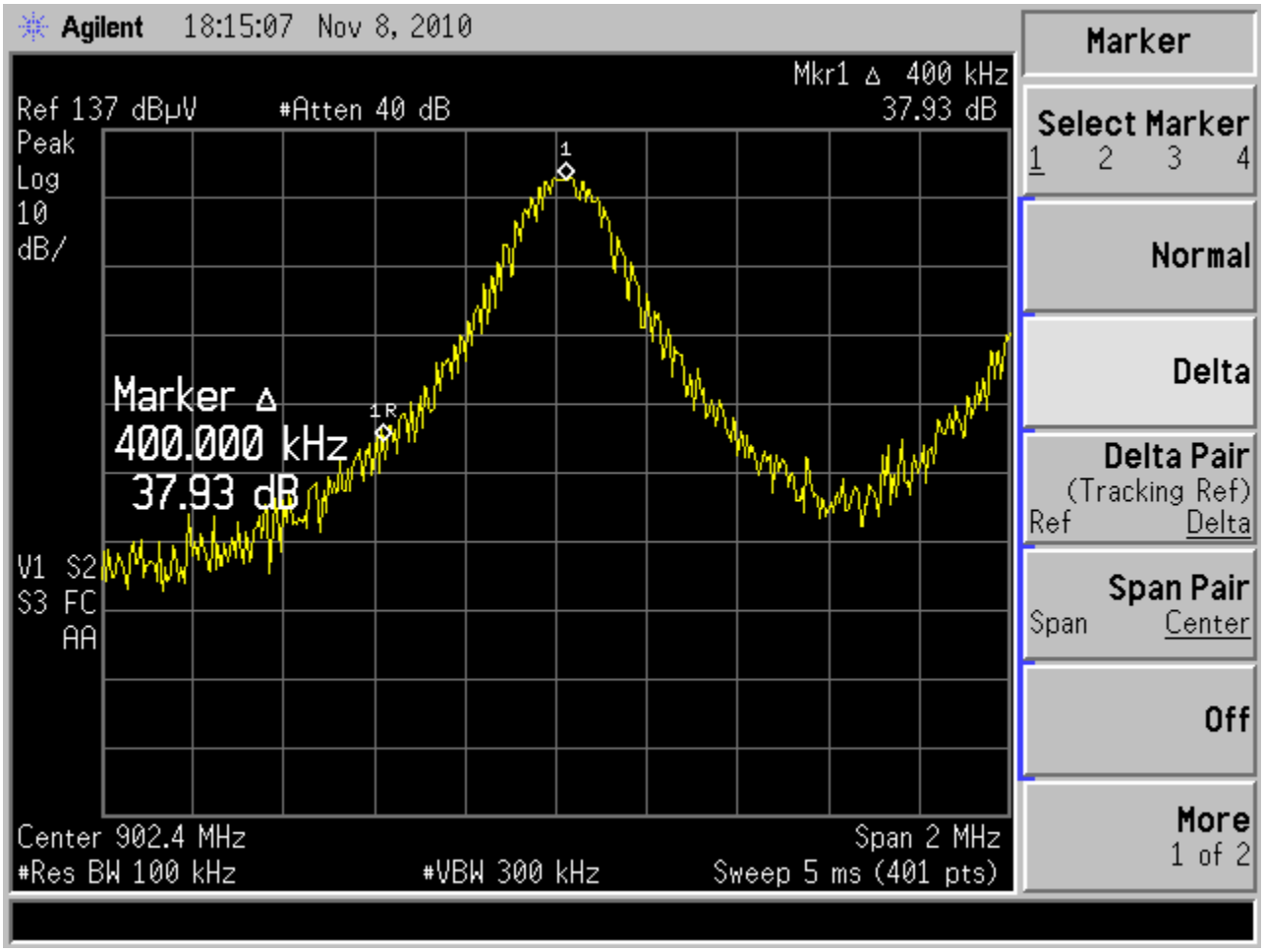
The sample tested was found to Comply.

11.4 Test Data: Band Edge FCC 15.247(d)

Band Edge – EN5040

FCC 15.247(d) / RSS-210 A8.5

Low Channel Band Edge (902.4 MHz)

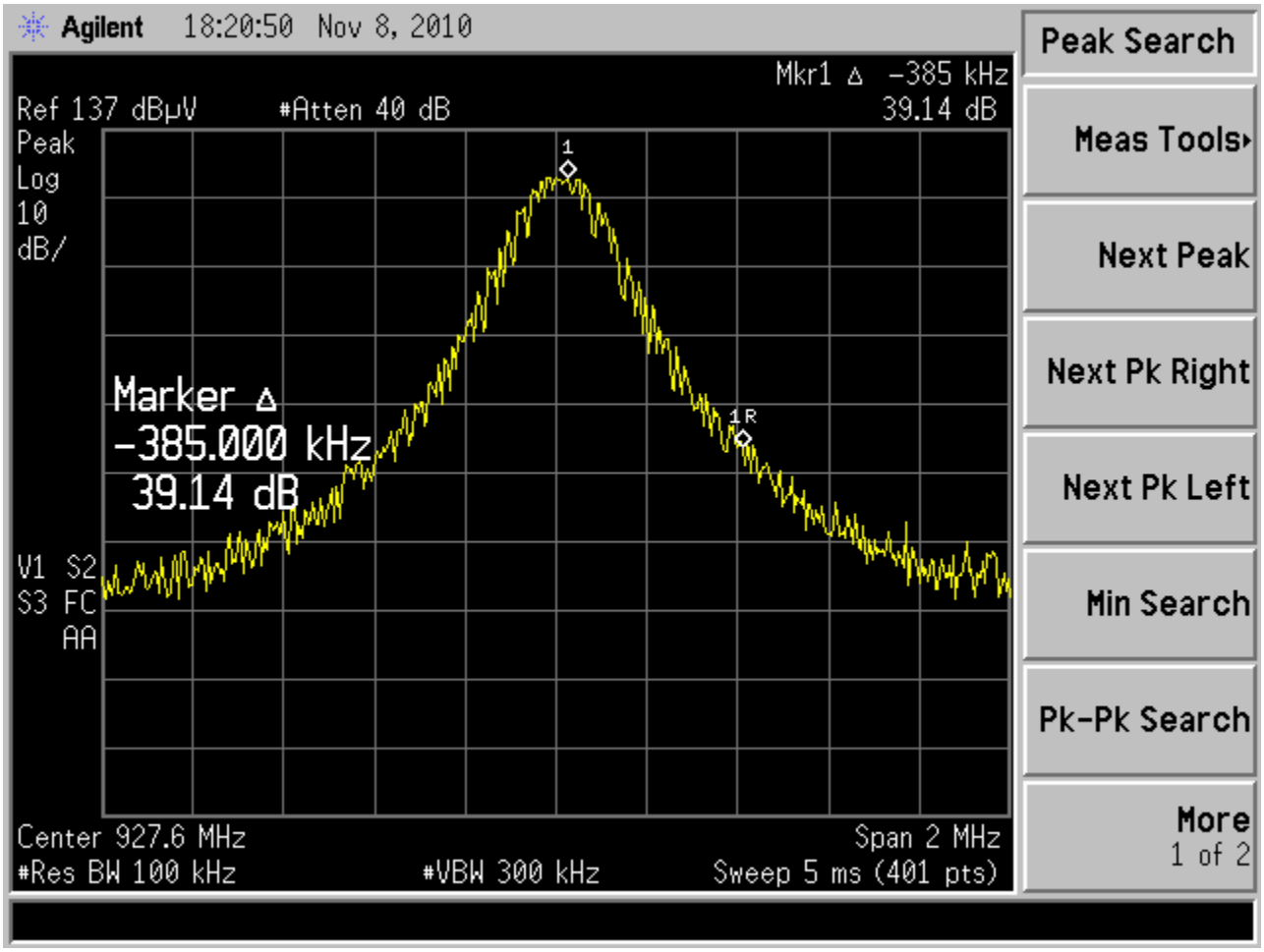


Specification: Spurious - 20dBc

Band Edge – EN5040

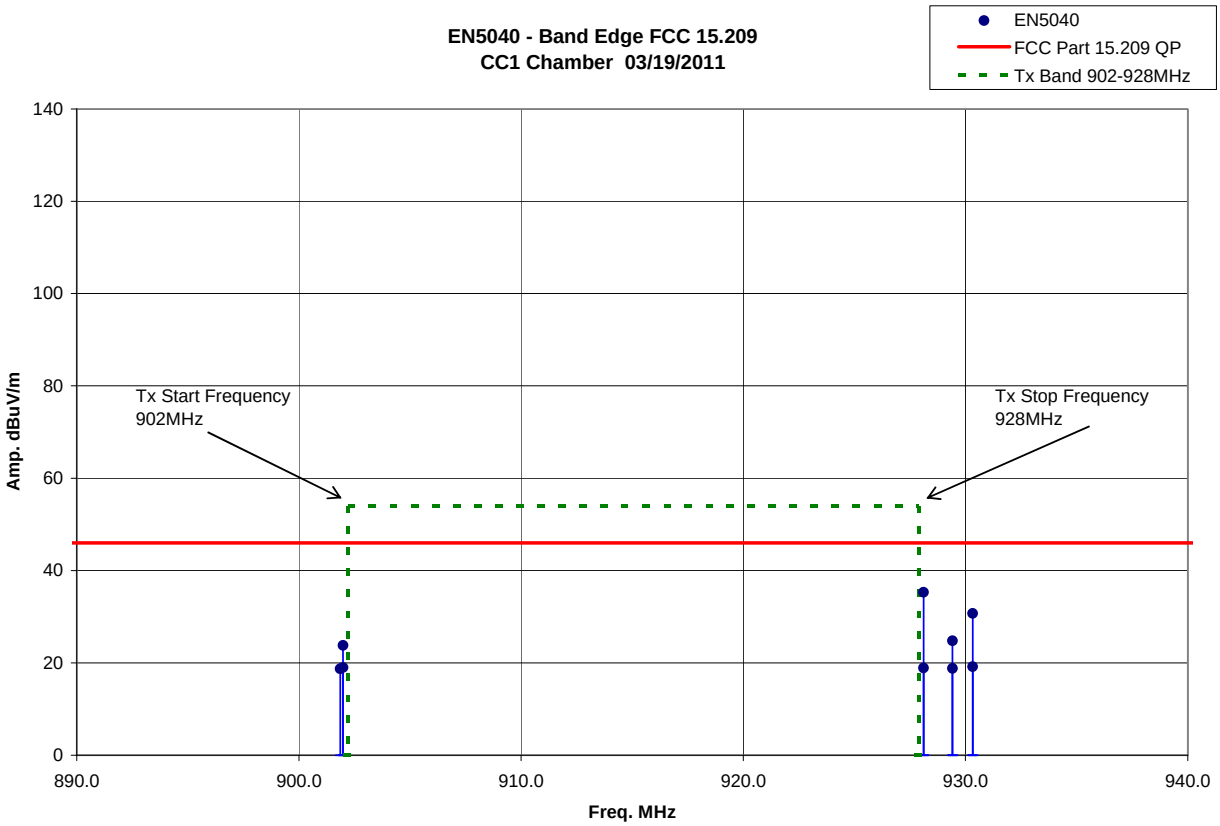
FCC 15.247(d) / RSS-210 A8.5

High Channel Band Edge (927.6 MHz)



Specification: Spurious - 20dBc

11.5 Plot: Band Edge - FCC 15.209



11.6 Test Data: Band Edge - FCC 15.209

Radiated Electromagnetic Emissions

Test Report #:	**Unintentional & Spurious Run 01**	Test Area:	CC1 Radiated	Temperature:	23.1	°C
Test Method:	FCC Part 15.209	Test Date:	19-Mar-2011	Relative Humidity:	31.4	%
EUT Model #:	EN5040	EUT Power:	Battery	Air Pressure:	81.2	kPa
EUT Serial #:	90035794					
Manufacturer:	Inovonics					
EUT Description:	Repeater					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
Band Edge Tx Mode						
Low Channel						
901.99	26.7 Qp	2.1 / 22.5 / 27.5	23.8	H / 1.3 / 36.0	-22.2	N/A
High Channel						
928.11	38.1 Qp	2.1 / 22.5 / 27.4	35.3	H / 1.3 / 27.0	-10.7	N/A
929.41	27.6 Qp	2.1 / 22.5 / 27.4	24.8	H / 1.3 / 27.0	-21.2	N/A
930.32	33.5 Qp	2.1 / 22.5 / 27.4	30.7	H / 1.3 / 27.0	-15.3	N/A
Band Edge Rx Mode						
Low Channel						
901.86	21.6 Qp	2.1 / 22.5 / 27.5	18.7	H / 1.3 / 36.0	-27.3	N/A
901.99	21.9 Qp	2.1 / 22.5 / 27.5	19.0	H / 1.3 / 36.0	-27.0	N/A
High Channel						
928.11	21.7 Qp	2.1 / 22.5 / 27.4	18.9	H / 1.3 / 27.0	-27.1	N/A
929.41	21.6 Qp	2.1 / 22.5 / 27.4	18.8	H / 1.3 / 27.0	-27.2	N/A
930.32	22.0 Qp	2.1 / 22.5 / 27.4	19.2	H / 1.3 / 27.0	-26.8	N/A

12 Occupied Bandwidth (OBW)

12.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

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

12.2 Test Equipment Used:

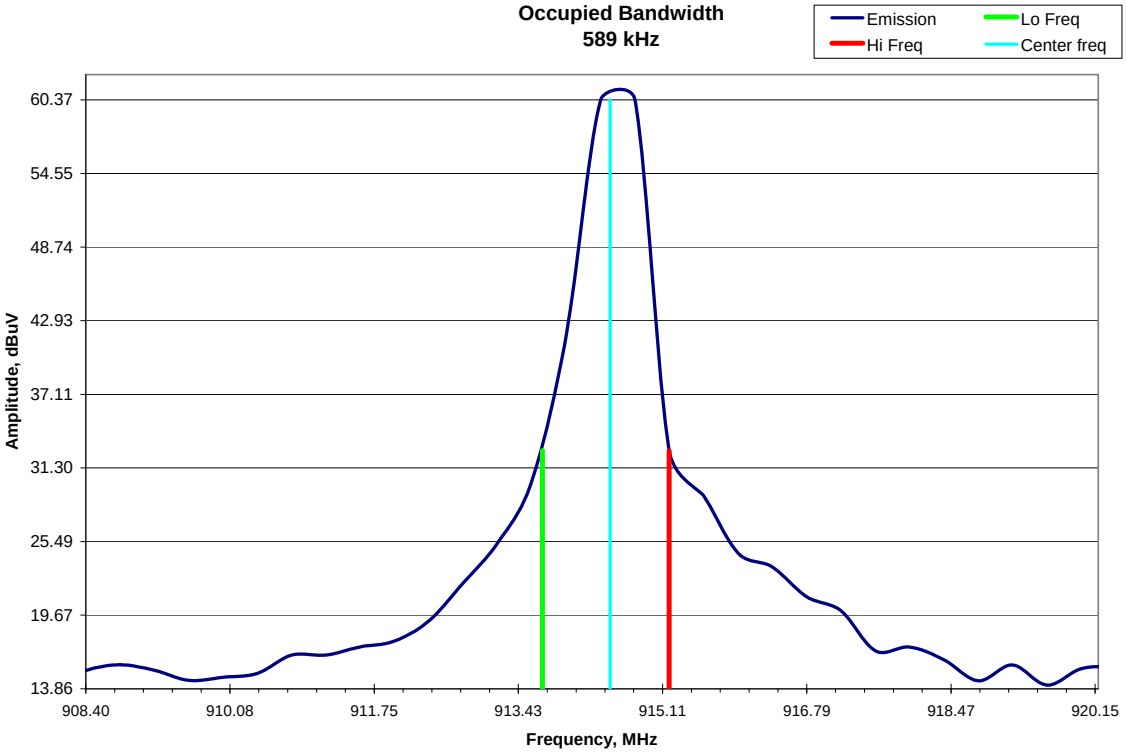
Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011

12.3 Results:

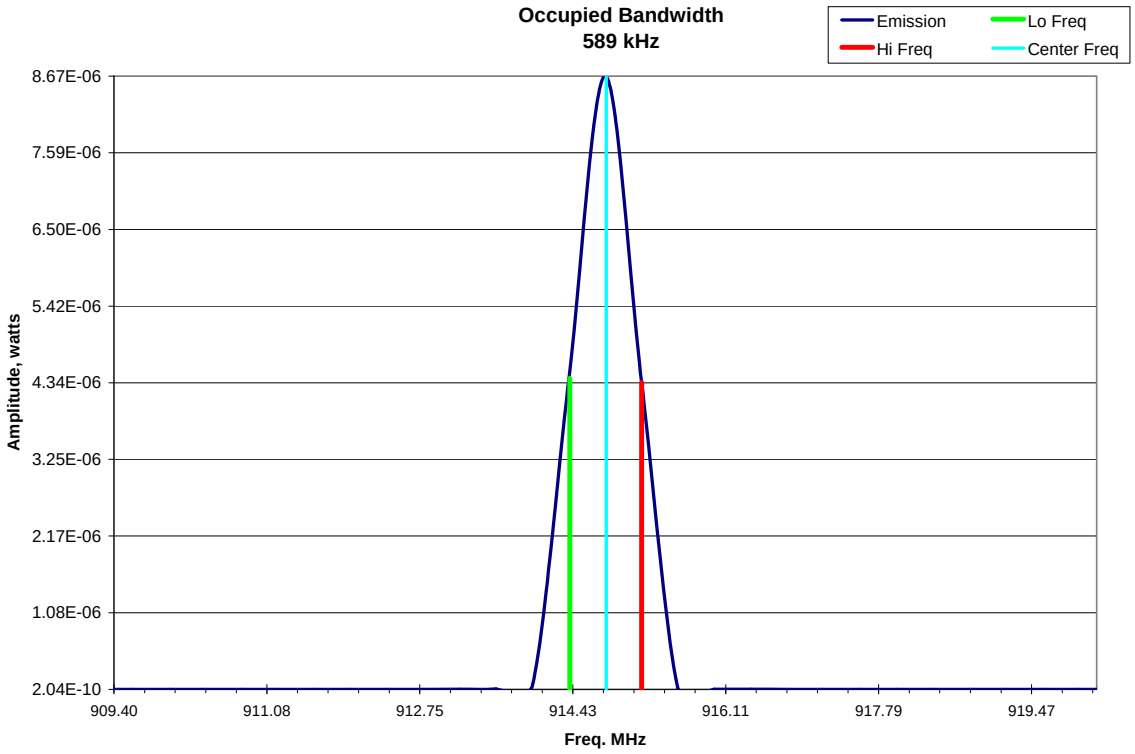
The sample tested was found to Comply.

Occupied Bandwidth - (RSS-GEN, Section 4.6.1)
Mid Channel – 914.8 MHz (RBW 100kHz, VBW 300kHz)

Field Strength Graph



Power Graph



13 Duty Cycle & Duty Cycle Correction Factor

13.1 Method

Unless otherwise stated no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

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

13.2 Test Equipment Used:

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18913	Spectrum Analyzer with Pre-Amp	Hewlett-Packard	E7405A	My44211889	05/11/2010	05/11/2011
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	10/11/2010	10/11/2011

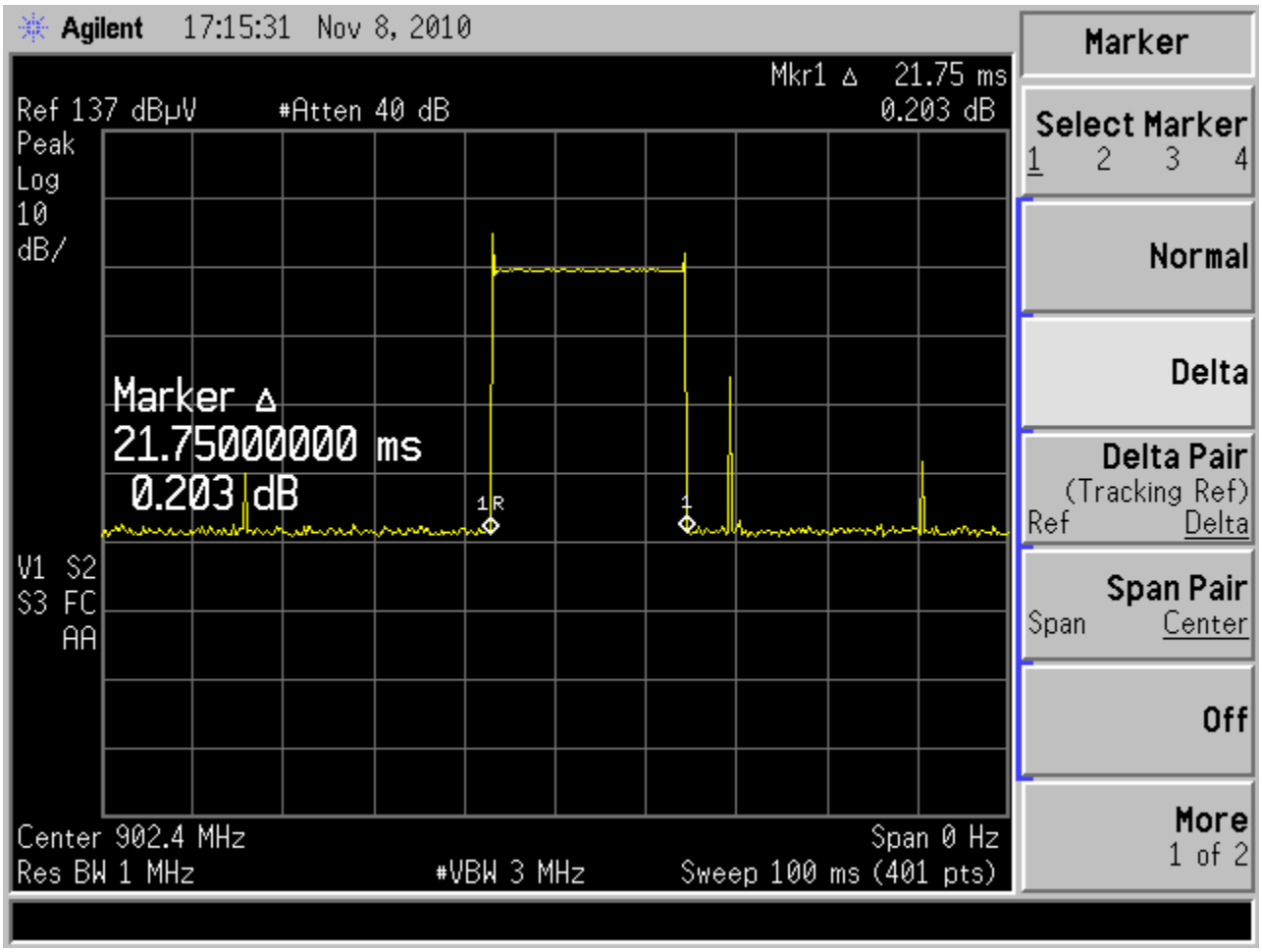
13.3 Results:

The sample tested was found to Comply.

13.4 Test Data:

Duty Cycle – EN5040

FCC 15.35 / RSS-GEN Section 4.5



Duty Cycle: 21.75 ms

14 AC Conducted Emissions

14.1 Method

Unless otherwise stated, no deviations were made from ANSI C63.10 and FCC public notice DA 00-705.

This testing was performed at Intertek Louisville OATS site, located at 40 Meadow Rd. Pinewood Springs, CO 80540 and CC1 Emissions Chamber located at 1795 Dogwood Street, Louisville, CO 80027.

14.2 Test Equipment Used:

Testing @ OATS on 9-8-10

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18885	Transient Limiter	Hewlett-Packard	11947A	3107A00700	04/27/2010	04/27/2011
18890	LISN 50 ohm/50uH 3 line (1kHz - 30 MHz)	RHODE & SCHWARZ	ESH2-Z5	830364/002	05/21/2010	05/21/2011
18909	EMI Test Receiver	RHODE & SCHWARZ	ESHS 30	842806/001	06/15/2010	06/15/2011

Testing @ CC1 Chamber on 3-26-11

Asset ID:	Description:	Manufacturer:	Model:	Serial:	Cal Date	Cal Due
18885	Transient Limiter	Hewlett-Packard	11947A	3107A00700	04/27/2010	04/27/2011
18909	EMI Test Receiver	RHODE & SCHWARZ	ESHS 30	842806/001	06/15/2010	06/15/2011
18914	Single Phase LISN	EMCO	3816/NM	9408-1003	06/08/2010	06/08/2011

14.3 Results:

The sample tested was found to Comply.

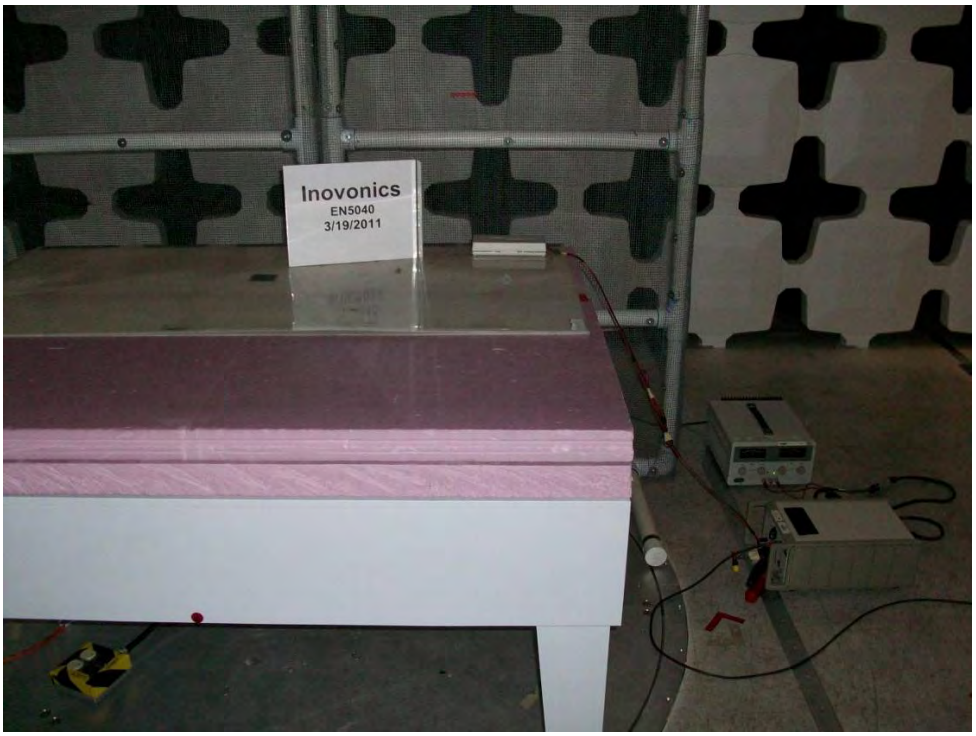
14.4 Setup Photographs:

Test setup ac conducted emissions - Front View (Pinewood)

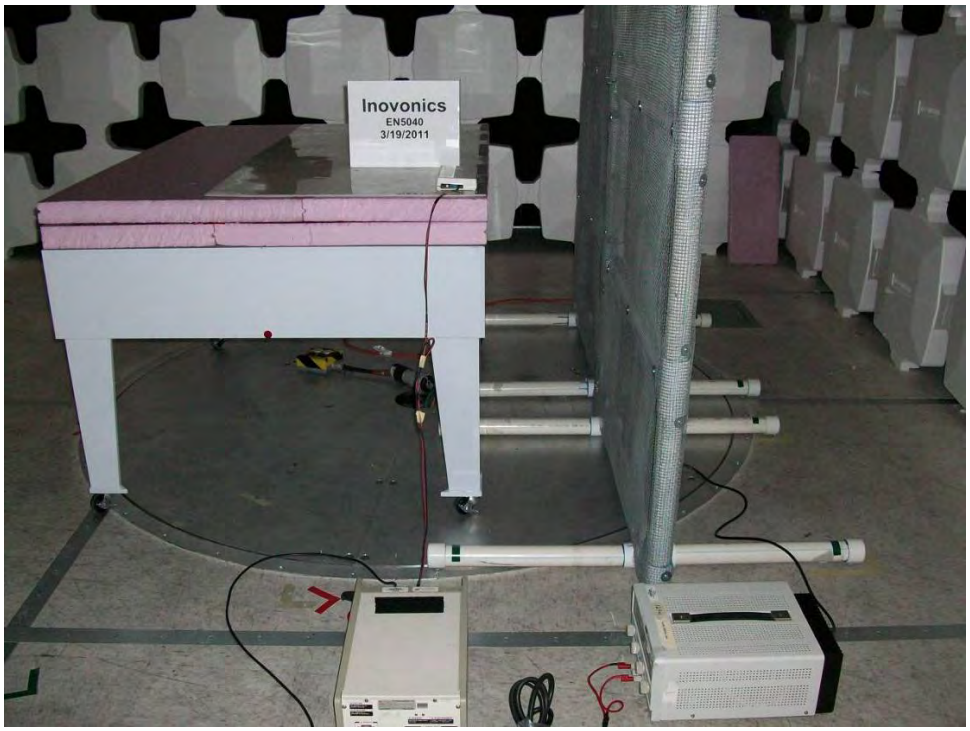
Test setup - Side View (Pinewood)

Photo:

Test setup dc conducted emissions - Front View (CC1)

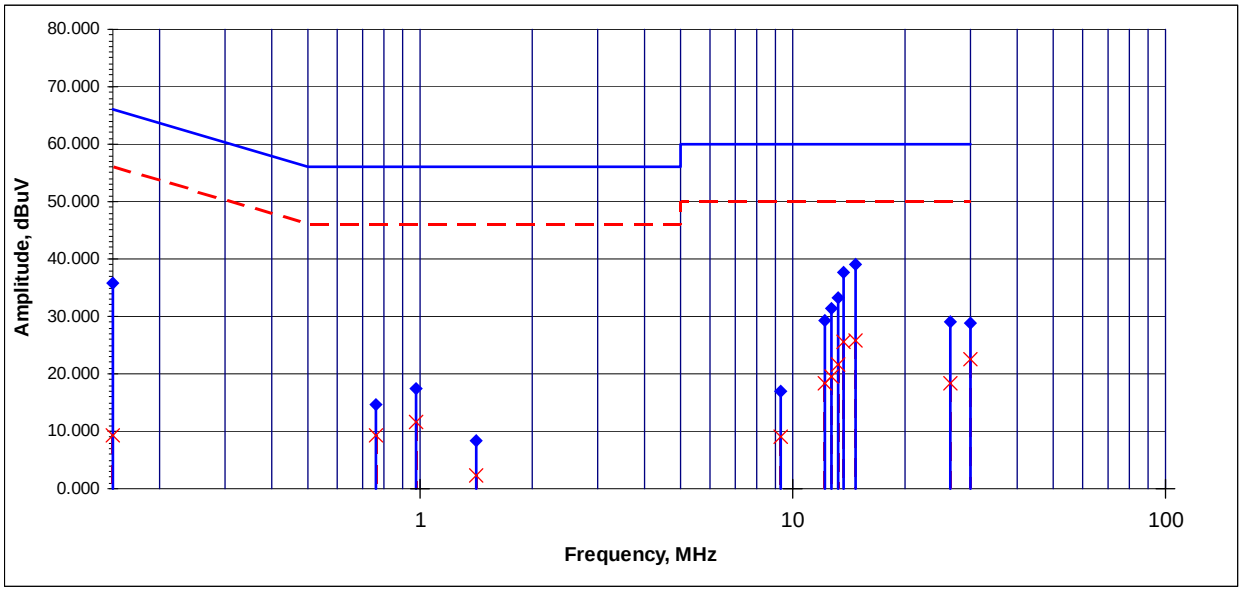


Test setup - Side View (CC1)

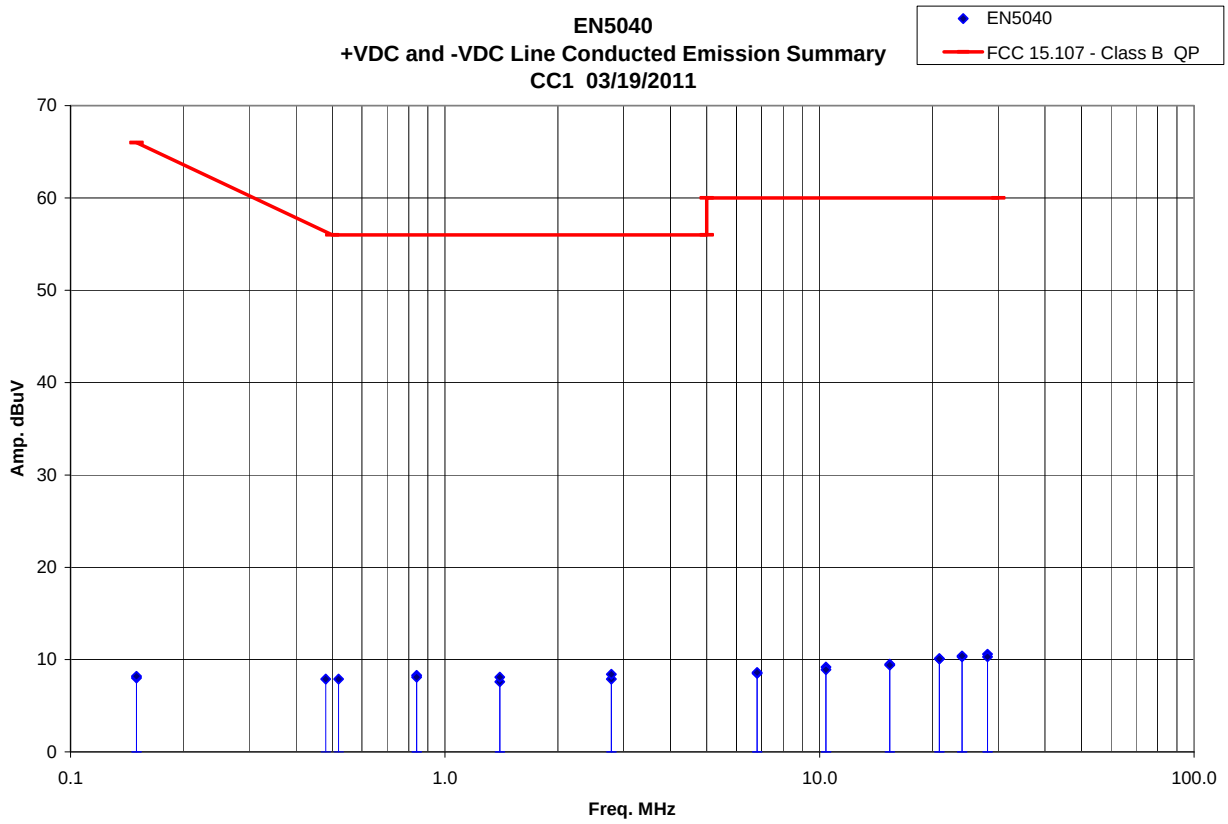


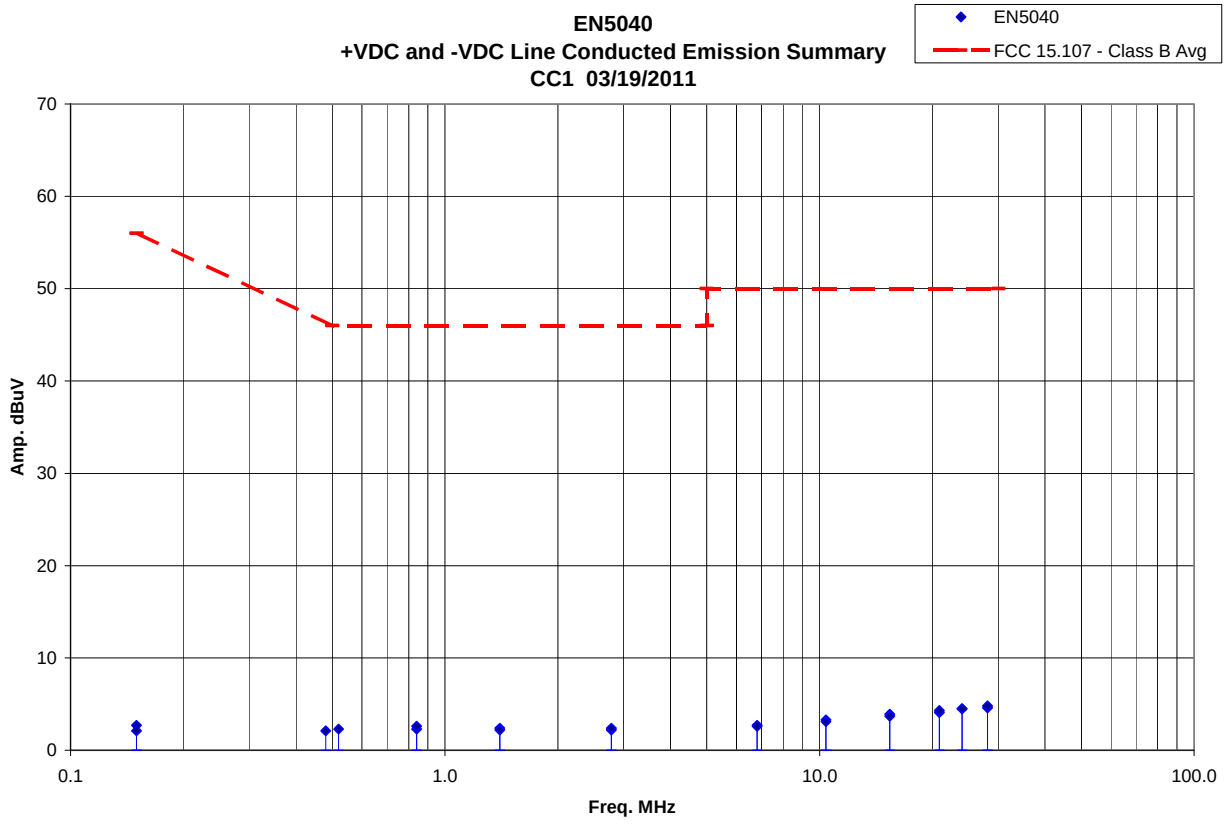
14.5 Plots – AC Conducted Emissions:

Average measurements - X
Quasi-peak measuremts - <>
CISPR22 class B Limit
Neutral line



Plots – DC Conducted Emissions:





14.6 Test Data – AC Conducted Emissions:

Conducted Electromagnetic Emissions

Test Report #:	**500256545 Run 02**	Test Area:	Pinewood Site 1 Cond	Temperature:	26.5	°C
Test Method:	EN55022	Test Date:	08-Sep-2010	Relative Humidity:	25	%
EUT Model #:	EN5040	EUT Power:	110V/60	Air Pressure:	79	kPa
EUT Serial #:	EMC003					
Manufacturer:	Inovonics			Level Key		
EUT Description:	Repeater			Pk – Peak	Nb – Narrow Band	
Notes:	**Product tested with ac adapter power supply – product option where an ac adapter is shipped with the product**			Qp – QuasiPeak	Bb – Broad Band	
	Testing 150kHz to 30MHz: CISPR QP detector, 9kHz QP BW			Av - Average		
	Testing 150kHz to 30MHz: Average detector, RBW 10kHz					

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		EN55022 B Avg	EN55022 B QP
********** Measurement Summary **********						
0.150	-0.7 Av	0.1 / 0.1 / -9.9	9.4	Neutral	-46.6	N/A
0.150	25.8 Qp	0.1 / 0.1 / -9.9	35.9	Neutral	N/A	-30.1
0.760	-1.0 Av	0.2 / 0.1 / -10.0	9.3	Neutral	-36.7	N/A
0.760	4.4 Qp	0.2 / 0.1 / -10.0	14.7	Neutral	N/A	-41.3
0.978	1.2 Av	0.2 / 0.2 / -10.0	11.6	Neutral	-34.4	N/A
0.978	7.1 Qp	0.2 / 0.2 / -10.0	17.5	Neutral	N/A	-38.5
1.42	-8.0 Av	0.2 / 0.2 / -10.0	2.4	Neutral	-43.6	N/A
1.42	-2.1 Qp	0.2 / 0.2 / -10.0	8.3	Neutral	N/A	-47.7
9.30	-1.9 Av	0.7 / 0.2 / -10.0	9.0	Neutral	-41.0	N/A
9.30	6.1 Qp	0.7 / 0.2 / -10.0	16.9	Neutral	N/A	-43.1
12.24	7.4 Av	0.7 / 0.2 / -10.0	18.3	Neutral	-31.7	N/A
12.24	18.4 Qp	0.7 / 0.2 / -10.0	29.3	Neutral	N/A	-30.7
12.73	8.7 Av	0.7 / 0.2 / -10.0	19.6	Neutral	-30.4	N/A
12.73	20.4 Qp	0.7 / 0.2 / -10.0	31.3	Neutral	N/A	-28.7
13.22	10.7 Av	0.7 / 0.2 / -10.0	21.6	Neutral	-28.4	N/A
13.22	22.3 Qp	0.7 / 0.2 / -10.0	33.2	Neutral	N/A	-26.8
13.71	14.6 Av	0.7 / 0.3 / -10.0	25.6	Neutral	-24.4	N/A
13.71	26.7 Qp	0.7 / 0.3 / -10.0	37.7	Neutral	N/A	-22.3
14.69	14.8 Av	0.7 / 0.3 / -10.0	25.8	Neutral	-24.2	N/A
14.69	28.1 Qp	0.7 / 0.3 / -10.0	39.1	Neutral	N/A	-20.9
26.45	5.8 Av	1.1 / 1.4 / -10.0	18.3	Neutral	-31.7	N/A
26.45	16.6 Qp	1.1 / 1.4 / -10.0	29.1	Neutral	N/A	-30.9
29.88	9.5 Av	1.2 / 1.8 / -10.0	22.5	Neutral	-27.5	N/A
29.88	15.9 Qp	1.2 / 1.8 / -10.0	28.9	Neutral	N/A	-31.1
0.150	-0.6 Av	0.1 / 0.1 / -9.9	9.5	Line 1	-46.5	N/A
0.150	25.9 Qp	0.1 / 0.1 / -9.9	36.0	Line 1	N/A	-30.0
0.760	-1.1 Av	0.2 / 0.1 / -10.0	9.2	Line 1	-36.8	N/A

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		EN55022 B Avg	EN55022 B QP
********** Measurement Summary **********						
0.760	4.3 Qp	0.2 / 0.1 / -10.0	14.5	Line 1	N/A	-41.5
0.978	0.3 Av	0.2 / 0.2 / -10.0	10.7	Line 1	-35.3	N/A
0.978	6.6 Qp	0.2 / 0.2 / -10.0	17.0	Line 1	N/A	-39.0
1.42	-8.0 Av	0.2 / 0.2 / -10.0	2.4	Line 1	-43.6	N/A
1.42	-2.0 Qp	0.2 / 0.2 / -10.0	8.4	Line 1	N/A	-47.6
9.30	-4.6 Av	0.7 / 0.2 / -10.0	6.3	Line 1	-43.7	N/A
9.30	1.9 Qp	0.7 / 0.2 / -10.0	12.8	Line 1	N/A	-47.2
12.24	6.6 Av	0.7 / 0.2 / -10.0	17.5	Line 1	-32.5	N/A
12.24	20.7 Qp	0.7 / 0.2 / -10.0	31.6	Line 1	N/A	-28.4
12.73	10.0 Av	0.7 / 0.2 / -10.0	20.9	Line 1	-29.1	N/A
12.73	22.6 Qp	0.7 / 0.2 / -10.0	33.5	Line 1	N/A	-26.5
13.22	10.9 Av	0.7 / 0.2 / -10.0	21.8	Line 1	-28.2	N/A
13.22	24.2 Qp	0.7 / 0.2 / -10.0	35.1	Line 1	N/A	-24.9
13.71	15.9 Av	0.7 / 0.3 / -10.0	26.9	Line 1	-23.1	N/A
13.71	28.3 Qp	0.7 / 0.3 / -10.0	39.3	Line 1	N/A	-20.7
14.69	16.4 Av	0.7 / 0.3 / -10.0	27.4	Line 1	-22.6	N/A
14.69	30.0 Qp	0.7 / 0.3 / -10.0	41.0	Line 1	N/A	-19.0
14.69	14.6 Av	0.7 / 0.3 / -10.0	25.6	Line 1	-24.4	N/A
14.69	30.1 Qp	0.7 / 0.3 / -10.0	41.1	Line 1	N/A	-18.9
26.45	10.7 Av	1.1 / 1.4 / -10.0	23.2	Line 1	-26.8	N/A
26.45	20.9 Qp	1.1 / 1.4 / -10.0	33.4	Line 1	N/A	-26.6
29.87	10.3 Av	1.2 / 1.8 / -10.0	23.3	Line 1	-26.7	N/A
29.87	18.8 Qp	1.2 / 1.8 / -10.0	31.8	Line 1	N/A	-28.2
0.150	-6.9 Av	0.1 / 0.1 / -9.9	3.2	Neutral	-52.8	N/A
0.150	8.5 Qp	0.1 / 0.1 / -9.9	18.6	Neutral	N/A	-47.4
0.760	-1.2 Av	0.2 / 0.1 / -10.0	9.1	Neutral	-36.9	N/A
0.760	3.1 Qp	0.2 / 0.1 / -10.0	13.4	Neutral	N/A	-42.6
0.947	-1.6 Av	0.2 / 0.2 / -10.0	8.7	Neutral	-37.3	N/A
0.947	2.7 Qp	0.2 / 0.2 / -10.0	13.1	Neutral	N/A	-42.9
1.42	1.4 Av	0.2 / 0.2 / -10.0	11.8	Neutral	-34.2	N/A
1.42	5.3 Qp	0.2 / 0.2 / -10.0	15.8	Neutral	N/A	-40.2
9.35	-1.1 Av	0.7 / 0.2 / -10.0	9.8	Neutral	-40.2	N/A
9.35	3.1 Qp	0.7 / 0.2 / -10.0	14.0	Neutral	N/A	-46.0
12.31	-3.0 Av	0.7 / 0.2 / -10.0	7.9	Neutral	-42.1	N/A
12.31	7.2 Qp	0.7 / 0.2 / -10.0	18.1	Neutral	N/A	-41.9
12.78	0.1 Av	0.7 / 0.2 / -10.0	11.0	Neutral	-39.0	N/A
12.78	12.1 Qp	0.7 / 0.2 / -10.0	23.0	Neutral	N/A	-37.0
13.25	1.5 Av	0.7 / 0.2 / -10.0	12.4	Neutral	-37.6	N/A
13.25	14.3 Qp	0.7 / 0.2 / -10.0	25.2	Neutral	N/A	-34.8
13.73	3.0 Av	0.7 / 0.3 / -10.0	14.1	Neutral	-35.9	N/A
13.73	15.7 Qp	0.7 / 0.3 / -10.0	26.7	Neutral	N/A	-33.3
14.67	2.0 Av	0.7 / 0.3 / -10.0	13.0	Neutral	-37.0	N/A
14.67	15.4 Qp	0.7 / 0.3 / -10.0	26.4	Neutral	N/A	-33.6
20.83	7.6 Av	1.0 / 0.9 / -10.0	19.5	Neutral	-30.5	N/A

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		EN55022 B Avg	EN55022 B QP
********** Measurement Summary **********						
20.83	17.4 Qp	1.0 / 0.9 / -10.0	29.3	Neutral	N/A	-30.7
26.51	3.6 Av	1.1 / 1.4 / -10.0	16.1	Neutral	-33.9	N/A
26.51	9.0 Qp	1.1 / 1.4 / -10.0	21.6	Neutral	N/A	-38.4
29.83	2.6 Av	1.2 / 1.8 / -10.0	15.7	Neutral	-34.3	N/A
29.83	11.1 Qp	1.2 / 1.8 / -10.0	24.1	Neutral	N/A	-35.9

14.7 Test Data – DC Conducted Emissions

Conducted Electromagnetic Emissions

Test Report #:	**Conducted 3-19-11 Run 01**	Test Area:	CC1 Conducted	Temperature:	23.4	°C
Test Method:	FCC Part 15.107 Class B	Test Date:	19-Mar-2011	Relative Humidity:	31.8	%
EUT Model #:	EN5040	EUT Power:	12 VDC	Air Pressure:	81.3	kPa
EUT Serial #:	90035794					
Manufacturer:	Inovonics					
EUT Description:	Repeater					

Notes: **Product tested with dc power supply – product option where no dedicated ac adapter is shipped with the product**

Testing 150kHz to 30MHz: CISPR QP detector, 9kHz QP BW

Testing 150kHz to 30MHz: Average detector, RBW 10kHz

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		AV15.107B	QP15.107B
- 12VDC Line Measurements						
0.150	-7.4 Av	0.1 / 0.1 / -9.9	2.7	- 12 VDC Line	-53.3	N/A
0.150	-2.1 Qp	0.1 / 0.1 / -9.9	8.0	- 12 VDC Line	N/A	-58.0
0.480	-8.1 Av	0.1 / 0.1 / -10.0	2.1	- 12 VDC Line	-44.2	N/A
0.480	-2.3 Qp	0.1 / 0.1 / -10.0	7.9	- 12 VDC Line	N/A	-48.4
0.840	-8.0 Av	0.2 / 0.1 / -10.0	2.3	- 12 VDC Line	-43.7	N/A
0.840	-2.0 Qp	0.2 / 0.1 / -10.0	8.3	- 12 VDC Line	N/A	-47.7
1.40	-7.9 Av	0.2 / 0.1 / -10.0	2.4	- 12 VDC Line	-43.6	N/A
1.40	-2.7 Qp	0.2 / 0.1 / -10.0	7.6	- 12 VDC Line	N/A	-48.4
2.78	-8.1 Av	0.2 / 0.1 / -10.0	2.2	- 12 VDC Line	-43.8	N/A
2.78	-2.4 Qp	0.2 / 0.1 / -10.0	7.9	- 12 VDC Line	N/A	-48.1
6.81	-7.8 Av	0.4 / 0.1 / -10.0	2.7	- 12 VDC Line	-47.3	N/A
6.81	-2.0 Qp	0.4 / 0.1 / -10.0	8.5	- 12 VDC Line	N/A	-51.5
10.40	-7.5 Av	0.6 / 0.2 / -10.0	3.3	- 12 VDC Line	-46.7	N/A
10.40	-1.6 Qp	0.6 / 0.2 / -10.0	9.2	- 12 VDC Line	N/A	-50.8
15.40	-7.3 Av	1.0 / 0.2 / -10.0	3.9	- 12 VDC Line	-46.1	N/A
15.40	-1.7 Qp	1.0 / 0.2 / -10.0	9.5	- 12 VDC Line	N/A	-50.5
20.88	-7.4 Av	1.1 / 0.4 / -10.0	4.1	- 12 VDC Line	-45.9	N/A
20.88	-1.4 Qp	1.1 / 0.4 / -10.0	10.1	- 12 VDC Line	N/A	-49.9
24.02	-7.3 Av	1.2 / 0.6 / -10.0	4.5	- 12 VDC Line	-45.5	N/A
24.02	-1.5 Qp	1.2 / 0.6 / -10.0	10.3	- 12 VDC Line	N/A	-49.7
28.10	-7.2 Av	1.3 / 0.5 / -10.0	4.6	- 12 VDC Line	-45.4	N/A
28.10	-1.2 Qp	1.3 / 0.5 / -10.0	10.6	- 12 VDC Line	N/A	-49.4
+ 12VDC Line Measurements						
0.150	-8.0 Av	0.1 / 0.1 / -9.9	2.1	+ 12VDC Line	-53.9	N/A
0.150	-1.9 Qp	0.1 / 0.1 / -9.9	8.2	+ 12VDC Line	N/A	-57.8
0.520	-7.9 Av	0.1 / 0.1 / -10.0	2.3	+ 12VDC Line	-43.7	N/A

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		AV15.107B	QP15.107B
0.520	-2.3 Qp	0.1 / 0.1 / -10.0	7.9	+ 12VDC Line	N/A	-48.1
0.840	-7.7 Av	0.2 / 0.1 / -10.0	2.6	+ 12VDC Line	-43.4	N/A
0.840	-2.2 Qp	0.2 / 0.1 / -10.0	8.1	+ 12VDC Line	N/A	-47.9
1.40	-8.1 Av	0.2 / 0.1 / -10.0	2.2	+ 12VDC Line	-43.8	N/A
1.40	-2.2 Qp	0.2 / 0.1 / -10.0	8.1	+ 12VDC Line	N/A	-47.9
2.78	-7.9 Av	0.2 / 0.1 / -10.0	2.4	+ 12VDC Line	-43.6	N/A
2.78	-1.9 Qp	0.2 / 0.1 / -10.0	8.4	+ 12VDC Line	N/A	-47.6
6.81	-7.9 Av	0.4 / 0.1 / -10.0	2.6	+ 12VDC Line	-47.4	N/A
6.81	-1.9 Qp	0.4 / 0.1 / -10.0	8.6	+ 12VDC Line	N/A	-51.4
10.40	-7.7 Av	0.6 / 0.2 / -10.0	3.1	+ 12VDC Line	-46.9	N/A
10.40	-1.9 Qp	0.6 / 0.2 / -10.0	8.9	+ 12VDC Line	N/A	-51.1
15.40	-7.5 Av	1.0 / 0.2 / -10.0	3.7	+ 12VDC Line	-46.3	N/A
15.40	-1.8 Qp	1.0 / 0.2 / -10.0	9.4	+ 12VDC Line	N/A	-50.6
20.88	-7.2 Av	1.1 / 0.4 / -10.0	4.3	+ 12VDC Line	-45.7	N/A
20.88	-1.4 Qp	1.1 / 0.4 / -10.0	10.1	+ 12VDC Line	N/A	-49.9
24.02	-7.3 Av	1.2 / 0.6 / -10.0	4.5	+ 12VDC Line	-45.5	N/A
24.02	-1.4 Qp	1.2 / 0.6 / -10.0	10.4	+ 12VDC Line	N/A	-49.6
28.10	-7.0 Av	1.3 / 0.5 / -10.0	4.8	+ 12VDC Line	-45.2	N/A
28.10	-1.5 Qp	1.3 / 0.5 / -10.0	10.3	+ 12VDC Line	N/A	-49.7

FREQ	LEVEL	CABLE / LISN / ATTEN	FINAL	TEST POINT	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB)	(dBuV)		AV15.107B	QP15.107B
********** Measurement Summary **********						
0.840	-7.7 Av	0.2 / 0.1 / -10.0	2.6	+ 12VDC Line	-43.4	N/A
1.40	-7.9 Av	0.2 / 0.1 / -10.0	2.4	- 12 VDC Line	-43.6	N/A
2.78	-7.9 Av	0.2 / 0.1 / -10.0	2.4	+ 12VDC Line	-43.6	N/A
0.520	-7.9 Av	0.1 / 0.1 / -10.0	2.3	+ 12VDC Line	-43.7	N/A
0.480	-8.1 Av	0.1 / 0.1 / -10.0	2.1	- 12 VDC Line	-44.2	N/A
28.10	-7.0 Av	1.3 / 0.5 / -10.0	4.8	+ 12VDC Line	-45.2	N/A
24.02	-7.3 Av	1.2 / 0.6 / -10.0	4.5	+ 12VDC Line	-45.5	N/A
20.88	-7.2 Av	1.1 / 0.4 / -10.0	4.3	+ 12VDC Line	-45.7	N/A
15.40	-7.3 Av	1.0 / 0.2 / -10.0	3.9	- 12 VDC Line	-46.1	N/A
10.40	-7.5 Av	0.6 / 0.2 / -10.0	3.3	- 12 VDC Line	-46.7	N/A
6.81	-7.8 Av	0.4 / 0.1 / -10.0	2.7	- 12 VDC Line	-47.3	N/A
0.150	-7.4 Av	0.1 / 0.1 / -9.9	2.7	- 12 VDC Line	-53.3	N/A

Notes:

(1) The product is shipped with (2) product options – with and without an ac power adapter. Therefore, to satisfy the case with an ac adapter, the ac adapter was tested directly. To satisfy the case of no ac adapter being shipped with the product, dc conducted emissions were measured, using a “generic” dc power supply to power the product.

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 ±	Notes
Radiated emissions, 10kHz to 1000 MHz	4.8 dB	
Radiated emissions, 1 to 18 GHz	4.9 dB	
AC mains Conducted emissions, 150kHz to 30 MHz	3.14 dB	

16 Revision History

Revision Level	Date	Report Number	Notes
0	4/22/2011	100257233DEN-001	Original Issue