

TEST REPORT

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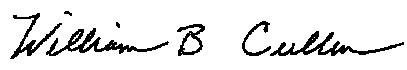
Product Designation: Hose Module - 2.4GHz

Standards: FCC 15.249 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz RSS-210, Issue 7, 2007

Tested by:
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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.

2 Test Summary

Section	Test full name	Test date	Result
3	Description of Equipment Under Test		
4	System setup including cable interconnection details, support equipment and simplified block diagram		
5	Duty Cycle Determination (FCC 15A - 15.35(c))	6/29/10	Pass
6	Radiated emissions (E-field) for low power intentional radiators	6/28/10	Pass
7	Occupied Bandwidth (15.215(c) and RSS-GEN Sec 4.6.1)	6/29/10	Pass
8	15.249(b): Requirements for fixed, point-to-point operation		N/A*
9	Conducted emissions on AC power lines		N/A*
10	Revision History		

Notes: The EUT is not a fixed, point to point operating system.

The EUT is a sealed battery operated device, therefore contains no AC power lines.

3 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
2.4 GHz Hose Module	EJ Ward	NOZ-RF	Proto 1

Receive Date:	06/25/10
Received Condition:	Good
Type:	Modified

Description of Equipment Under Test (provided by client)

The EUT is a battery operated sealed module intended to be mounted on the nozzle of a gasoline hose. When the hose nozzle is removed from the pump, the movement initiates a 2.4 GHz transmission to communicate to the RT system that gasoline is being dispensed.

Transmitter Overview:

FCC Identifier	TBD
IC Identifier	TBD
Frequency Range	2.41GHz
Modulation	FSK
Antenna type (15.203)	Vertical 4dBi

Equipment Under Test Power Configuration

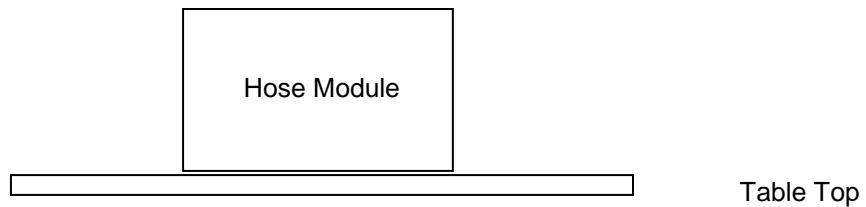
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
Internal battery	Battery	DC	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	To facilitate measuring of radiated emissions, a sample was modified to repeat its transmission continuously for approximately 30 minutes.
2	For duty cycle determination, an unmodified sample was used. After being shaken, it transmits one burst followed by a second burst several seconds later.

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	Description	Length	Shielding	Ferrites
	None	---	---	---

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	---	---	---

The EUT had no cables and required no support equipment to function.

5 Duty Cycle Determination (FCC 15A - 15.35(c))**5.1 Method:**

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

Determine the period of the pulse train, T, in mSec and record the results. T is defined as the time from the beginning of one pulse train to the beginning of the next pulse train.

Count the number of different types of pulses, N and record the results.

For each of the different types of pulses, count the number of occurrences within one pulse train.

Use the Duty Cycle Correction Factor, DCCF, from the results table and use it to adjust the field strength measurements recorded for radiated emissions.

5.2 Test Equipment Used:

Prescan emissions plot: 1 to 7 GHz Hor

Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
EMI Test Receiver	Agilent Technologies	E7405A	US40240235	03/17/10	03/17/11
Manometer	Omega	OM-CP-PRHTemp2000	N10673	04/12/10	04/12/11
DMM	Fluke	116	99520008	11/20/09	11/20/10
RF Cable	Custom made	243	none	07/23/09	07/23/10

5.3 Plots:**5.4 Data:**

Duration of Pulse Train, T (mSec): 100
Averaging Interval, A_i (mSec): 100
Number of different Pulses, N: 1

	Number (#P _x)	Pulse Width, mSec (PW _x)	Product (#P _x)*(PW _x)
Pulse Width 1	1	4.225	4.225
Pulse Width 2			
Pulse Width 3			
Pulse Width 4			
Pulse Width 5			
Pulse Width 6			
Pulse Width 7			
Pulse Width 8			
Pulse Width 9			
Pulse Width 10			

Duty Cycle: 0.04225
Duty Cycle Correction Factor, dB: -27.5

$$T_{on} = (PW_1 * #P_1) + (PW_2 * #P_2) + \dots + (PW_n * #P_n)$$

$$DutyCycle = T_{on} \div A_i$$

$$DCCF = 20 * \log_{10}(DutyCycle)$$

6 Radiated emissions (E-field) for low power intentional radiators

6.1 Method

Measurements below 1 GHz shall be performed with a quasi-peak detector instrument that meets the requirements of Section One of CISPR 16.

Bandwidths:

30 MHz to 1000 MHz: 120 kHz RBW and 1 MHz VBW

Above 1000 MHz: 1 MHz RBW and 3 MHz VBW

Detectors:

Equal to or less than 1000 MHz: CISPR quasi-peak detector (alternative: peak detector)

Above 1000 MHz: Average detector (applies to average limit)

Above 1000 MHz: Peak detector (applies to peak limit)

Limits:

Equal to or less than 1000 MHz, the limits are specified as quasi-peak. If a peak detector is used, the limit does not change. Above 1000 MHz, the limits are specified as average. The peak limit is 20 dB above the average limit. Both peak and average measurements are required to be reported.

Limits from 15.249 / RSS-210 Annex A2.9 specified at 3 meters

Fundamental Frequency	Field Strength of fundamental (millivolts / meter)	Field Strength of harmonics (microvolts/meter)
902 to 928 MHz	50	500
2400 to 2483.5 MHz	50	500
5725 to 5875 MHz	50	500
24.0 to 24.25 MHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Frequency range of radiated measurements

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

- (1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
- (3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.
- (4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

Measurement antenna requirements:

Below 30 MHz - Loop antenna

30 to 1000 MHz - Biconical, Log Periodic, or equivalent

Above 1000 MHz - Horn or equivalent

Measurements of the radiated field are made with the antenna located at a distance of 3 or 10 meters from the EUT. The limit applied to the measurement shall be appropriate for the test distance. The test

distance shall be indicated in the results section.

The EUT shall be arranged and connected with cables terminated in accordance with the product specification.

Exploratory tests should be carried out while varying the cable positions to determine the maximum or near-maximum emission levels. During manipulation, cables shall not be placed under or on top of the system test components unless such placement is required by the inherent equipment design.

The antenna shall be adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency. The antenna-to-EUT azimuth shall be varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) shall be varied during the measurements to find the maximum field-strength readings.

If the EUT is handheld, it shall be oriented in each of its orthogonal axes.

If the EUT is intended for tabletop use, it shall be placed on a table whose top is 0.8m above the ground plane. The table shall be constructed of nonconductive materials. Its dimensions are at least 1m by 1.5m, but may be extended for larger EUT.

If EUT is floor standing, the EUT was placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material.

Equipment setup for radiated disturbance tests shall follow the guidelines of ANSI C63.4:2003.

TEST SITE

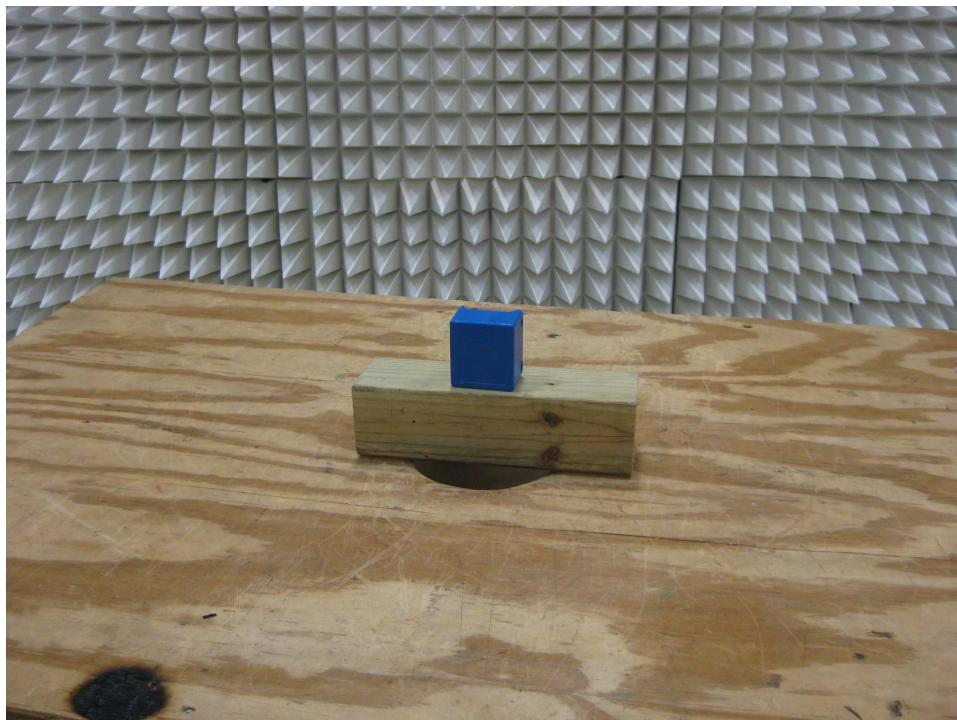
The test site for radiated emissions consists of a 3 meter semi-anechoic chamber and is located at 1809 10th Street, Suite 400, Plano, TX 75074.

6.2 Test Equipment Used:

Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
EMI Receiver	Rhode & Schwarz	ESI	100044	03/19/10	03/19/11
Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	07/15/09	07/15/10
Sm Horn Antenna	AH systems	SAS-571	787	04/6/10	04/6/10
Sm Horn	AH systems	SAS-574	288	06/08/10	06/08/10
RF Cable	Custom made	#1	128	07/23/09	07/23/10
RF Cable	Custom made	#4	131	07/23/09	07/23/10
Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	03/25/10	03/25/11
DMM	Fluke	116	99520008	11/20/09	11/20/10

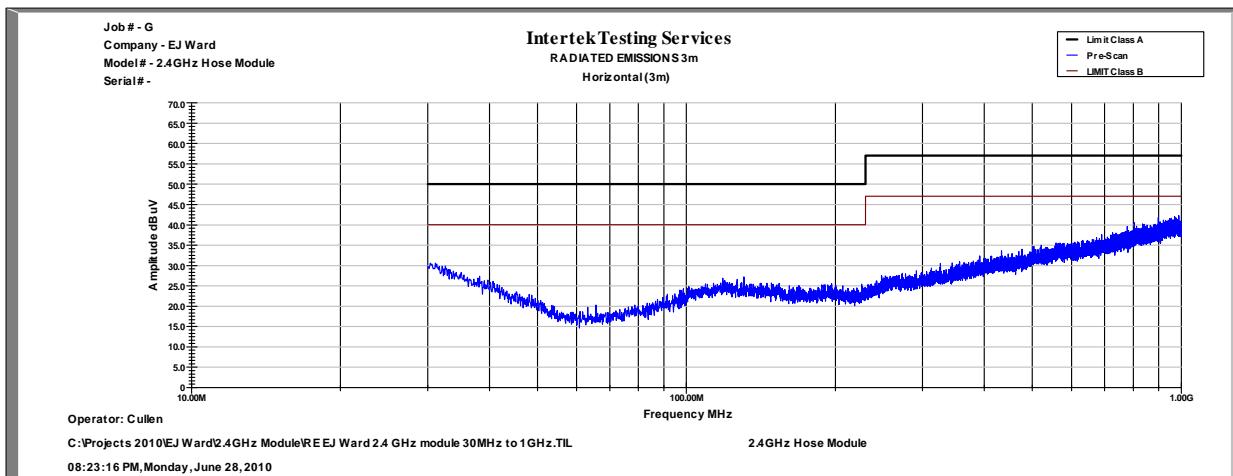
6.3 Results:

The sample tested was found to Comply.

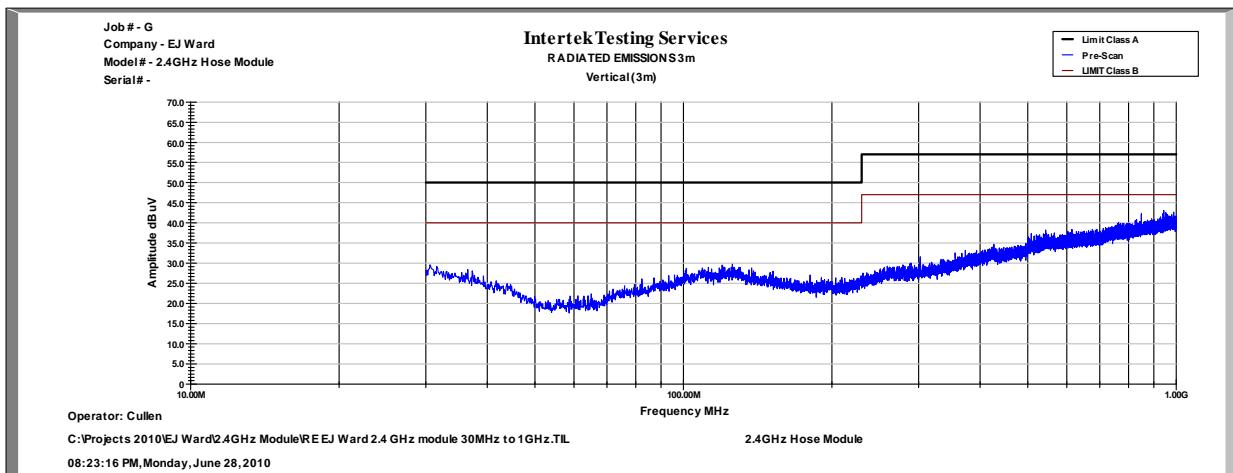
6.4 Setup Photographs:

Test setup

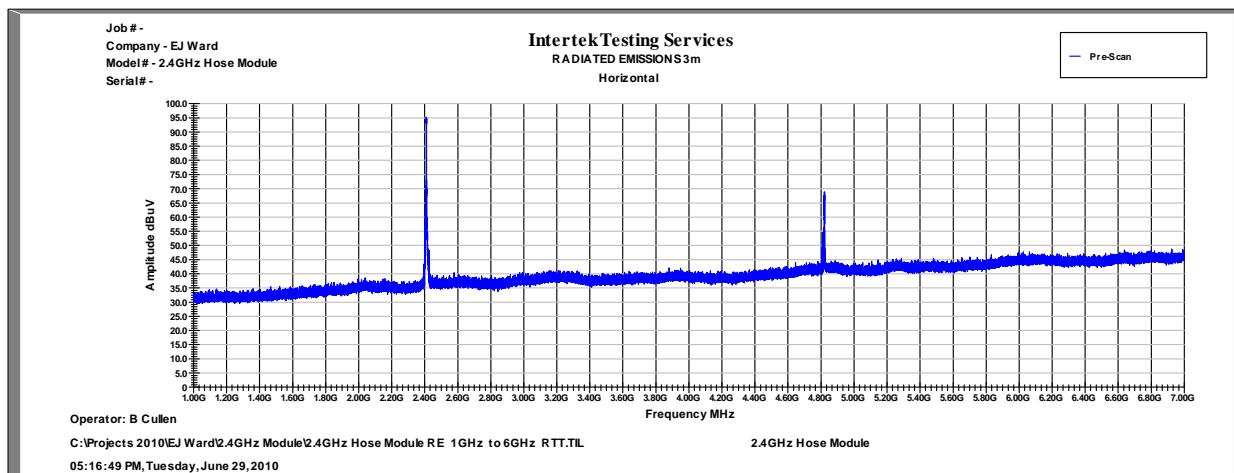
6.5 Plots:



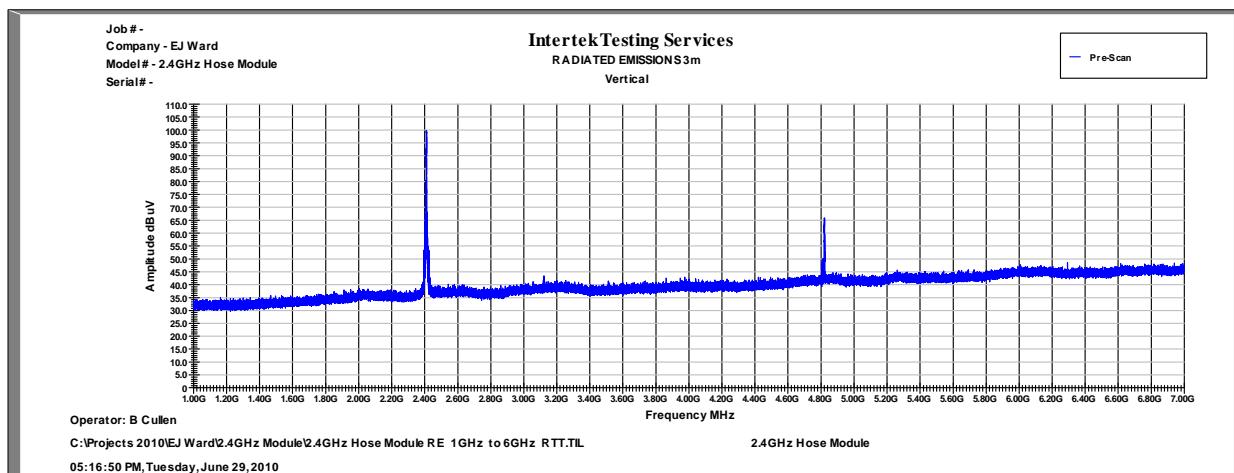
Prescan emissions plot: 30 to 1000 MHz Hor



Prescan emissions plot: 30 to 1000 MHz Vert



Prescan emissions plot: 1 to 7 GHz Horizontal



Prescan emissions plot: 1 to 7 GHz Vertical

6.6 Test Data:

Frequency Range (MHz): 1GHz to 25GHz

Input power: Fully charged battery

Test Distance (m): 3

Limit: 114dBuV

Modifications for compliance (y/n): n

A	B	C	D	E	F	F2	G	H	I	J	
Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Duty Cycle dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW	
H	2409.700	93.3	28.0	11.5	32.0	0.0	100.8	114.0	-13.2	Pk/1M/3M	
H	2409.700	93.3	28.0	11.5	32.0	27.5	73.3	94.0	-20.7	Pk/1M/3M	
H	4821.600	57.4	31.9	13.0	32.0	0.0	70.3	94.0	-23.7	Pk/1M/3M	
H	4821.600	57.4	31.9	13.0	32.0	27.5	42.8	74.0	-31.2	Pk/1M/3M	
V	2409.700	96.9	28.0	11.5	32.0	0.0	104.4	114.0	-9.6	Pk/1M/3M	
V	2409.700	96.9	28.0	11.5	32.0	27.5	76.9	94.0	-17.1	Pk/1M/3M	
V	4819.500	56.9	31.8	13.0	32.0	0.0	69.7	94.0	-24.3	Pk/1M/3M	
V	4819.500	56.9	31.8	13.0	32.0	27.5	42.2	74.0	-31.8	Pk/1M/3M	
Calculations	$G=C+D+E-F-F2$			$I=G-H$							

Note: There were no other emissions detected.

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth (15.215(c) and RSS-GEN Sec 4.6.1)**7.1 Method**

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission (i.e. 20 dB bandwidth).

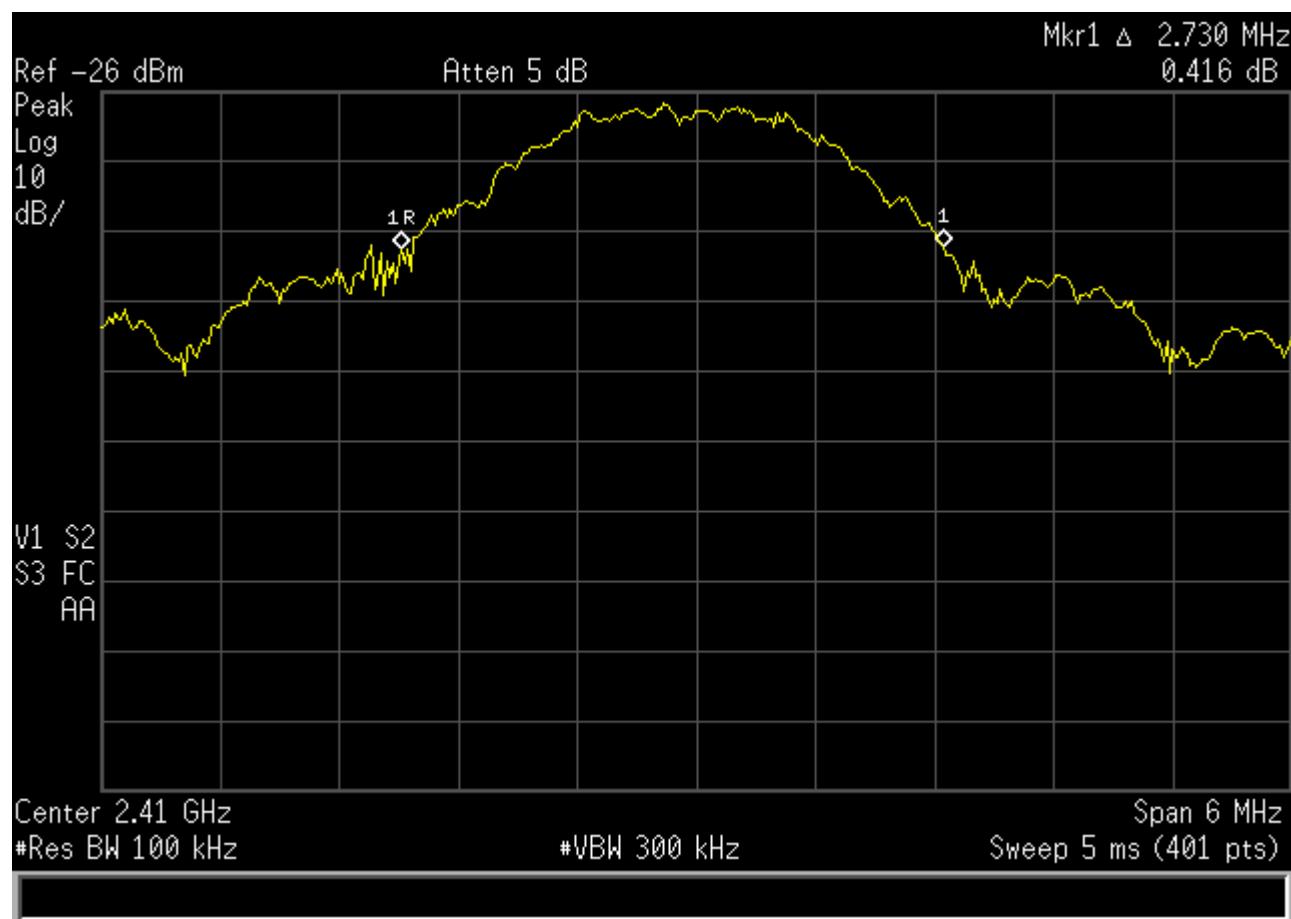
Connect the antenna port of the EUT to a spectrum analyzer using a calibrated coaxial cable and attenuator. Set the EUT to transmit at its highest power setting. The 99% bandwidth function of the analyzer was used to automatically generate the occupied bandwidth plots.

7.2 Test Equipment Used:

Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
EMI Test Receiver	Agilent Technologies	E7405A	US40240235	03/17/10	03/17/11
Manometer	Omega	OM-CP-PRHTemp2000	N10673	04/12/10	04/12/11
DMM	Fluke	116	99520008	11/20/09	11/20/10
RF Cable	Custom made	243	none	07/23/09	07/23/10

7.3 Results:

The sample tested was found to Comply.

7.4 Plot:

8 15.249(b): Requirements for fixed, point-to-point operation

This test is Not Applicable to this device. It is not intended for fixed, point to point operation.

9 Conducted emissions on AC power lines

This test is Not Applicable to this device. This device does not connect to the AC mains. It is powered by an internal battery.

10 Revision History

Revision Level	Date	Report Number	Notes
0	06/29/2010	100086439DAL-001	Original Issue