



Engineering and Testing for EMC and Safety Compliance

**CERTIFICATION APPLICATION REPORT
FCC Part 15.247 & INDUSTRY CANADA RSS-210**

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc.	Phone: 703-689-0368 360 Herndon Parkway Suite 1400 Herndon, VA 20170 E-Mail: ATCBINFO@rheintech.com	Power Monitors, Inc. Contact: Glen Shomo, P.E. 1661 Virginia Ave. Harrisonburg, VA 22802 E-Mail: gshomo@powermonitors.com	Phone: 540-434-4120 Fax: 540-432-9430
FCC ID/ IC ID:	RO920505008 / 4806A-20505008	Test Report Date:	January 27, 2006
Platform:	N/A	RTL Work Order Number:	2006006
Model Name/ Model Numbers:	Bluetooth Module/ 20505008/20505009	RTL Quote Number:	QRTL06-324
American National Standard Institute:	ANSI C63.4: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
FCC Classification:	DSS – Part 15 Spread Spectrum Transmitter (Bluetooth portion)		
FCC Rule Part(s):	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System		
Industry Canada:	RSS-210: Low Power License-Exempt Communications Devices		
Digital Interface Information	Digital Interface was found to be compliant		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
2402-2480	0.017	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, FCC 97-114, ANSI C63.4, and Industry Canada RSS-210.

Signature: Desmond A. Fraser

Date: January 27, 2006

Typed/Printed Name: Desmond A. Fraser

Position: President

*This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc.
The test results relate only to the item(s) tested.*

Table of Contents

1	General Information	5
1.1	Scope	5
1.2	Description of EUT	5
1.3	Test Facility	5
1.4	Related Submittal(s)/Grant(s)	5
1.5	Modifications	5
2	Test Information	6
2.1	Description of Test Modes	6
2.2	Exercising the EUT	6
2.3	Test Result Summary	6
2.4	Test System Details	7
2.5	Configuration of Tested System	7
3	Peak Output Power - §15.247(b)(1); RSS-210 §6.6.2(o)	8
3.1	Power Output Test Procedure	8
3.2	Power Output Test Data	8
4	Compliance with the Band Edge – FCC §15.247(d); RSS-210 §6.6.2(o)	9
4.1	Band Edge Test Procedure	9
4.2	Restricted Band Edge Test Results	10
4.2.1	Calculation of Lower Band Edge	10
4.2.2	Calculation of Upper Band Edge	11
5	Antenna Conducted Spurious Emissions - §15.247(d); RSS-210 §6.6.2(o)	12
5.1	Antenna Conducted Spurious Emissions Test Procedures	12
5.2	Antenna Conducted Spurious Emissions Test Results	12
6	20 dB Bandwidth – FCC §15.247(a)(1)(ii); IC RSS-210 §5.9.1	13
6.1	20 dB Bandwidth Test Procedure	13
6.2	20 dB Modulated Bandwidth Test Data	13
6.3	20 dB Bandwidth Plots	14
7	Carrier Frequency Separation - §15.247(a)(1)	17
7.1	Carrier Frequency Separation Test Procedure	17
7.2	Carrier Frequency Separation Test Data	17
8	Hopping Characteristics – FCC §15.247(a)(1)(iii); IC RSS-210 §6.2.2(o)	18
8.1	Hopping Characteristics Test Procedure	18
8.2	Number of Hopping Frequencies	18
8.3	Average Time of Occupancy	19
9	Conducted Emissions Measurement Limits – FCC §15.207; RSS-210 §9	21
9.1	Limits of Conducted Emissions Measurement	21
9.2	Conducted Emissions Measurement Test Procedure	21
9.3	Conducted Emissions Line Test Equipment	21
9.4	Conducted Line Emission Test Data	22
10	Radiated Emissions - §15.209; RSS-210 §6.2.1	24
10.1	Limits of Radiated Emissions Measurement	24
10.2	Radiated Emissions Measurement Test Procedure	24
10.3	Radiated Emissions Test Results	26
10.3.1	Radiated Emissions Digital/Receiver	26
10.3.2	Radiated Emissions Harmonics/Spurious	27
11	Conclusion	28

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

Figure Index

Figure 2-1: Configuration of System Under Test.....	7
---	---

Table Index

Table 2-1: Channels Tested for FHSS – 1 Mbps	6
Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247)	6
Table 2-3: Equipment Under Test.....	7
Table 3-1: Power Output Test Equipment.....	8
Table 3-2: Power Output Test Data	8
Table 4-1: Band Edge Test Equipment.....	9
Table 5-1: Antenna Conducted Spurious Emissions Test Equipment.....	12
Table 6-1: 20 dB Bandwidth Test Equipment.....	13
Table 6-2: 20 dB Modulated Bandwidth Test Data.....	13
Table 7-1: Carrier Frequency Separation Test Equipment.....	17
Table 8-1: Hopping Characteristics Test Equipment.....	18
Table 9-1: Conducted Emissions Line Test Equipment	21
Table 9-2: Conducted Emissions (Neutral Side); Transmitting (2440 MHz)	22
Table 9-3: Conducted Emissions (Phase Side); Transmitting (2440 MHz)	22
Table 9-4: Conducted Emissions (Neutral Side); Receive Mode	22
Table 9-5: Conducted Emissions (Phase Side); Receive Mode	23
Table 10-1: Radiated Emissions Test Equipment	25
Table 10-2: Digital/Receiver Radiated Emissions Test Results	26
Table 10-3: Radiated Emissions Harmonics/Spurious Channel 0 (TX Frequency: 2402 MHz).....	27
Table 10-4: Radiated Emissions Harmonics/Spurious Channel 38 (TX Frequency: 2440 MHz).....	27
Table 10-5: Radiated Emissions Harmonics/Spurious Channel 78 (TX Frequency: 2480 MHz).....	27

Plot Index

Plot 4-1: Lower Band Edge: Average Measurement Channel 0 (TX Frequency: 2402 MHz)	10
Plot 4-2: Upper Band Edge: Average Measurement Channel 78 (TX Frequency: 2480 MHz)	11
Plot 6-1: 20 dB Bandwidth Channel 0	14
Plot 6-2: 20 dB Bandwidth Channel 38	15
Plot 6-3: 20 dB Bandwidth Channel 78	16
Plot 7-1: Carrier Frequency Separation	17
Plot 8-1: Number of Hopping Frequencies.....	18
Plot 8-2: Time of Occupancy (Dwell Time)	19
Plot 8-3: Time of Occupancy (Dwell Time 5 Second Sweep)	20

Appendix Index

Appendix A:	RF Exposure Compliance.....	29
Appendix B:	FCC Agency Authorization Letter	30
Appendix C:	FCC Confidentiality Request Letter	31
Appendix D:	Acknowledgement of IC Listing Requirements Letter	32
Appendix E:	IC Authority to Act as Agent.....	33
Appendix F:	FCC DA00-1407 Limited Modular Approval Compliance.....	34
Appendix G:	Industry Canada Limited Modular Approval Compliance	35
Appendix H:	Label and Label Location	36
Appendix I:	Technical Operational Description	37
Appendix J:	Schematics	38
Appendix K:	Block Diagram	39
Appendix L:	Manual.....	40
Appendix M:	Test Photographs	41
Appendix N:	External Photographs	45
Appendix O:	Internal Photographs	48

Photograph Index

Photograph 1:	Radiated Testing – Front View	41
Photograph 2:	Radiated Testing – Back View	42
Photograph 3:	Conducted AC Testing – Front View	43
Photograph 4:	Conducted AC Testing – Back View	44
Photograph 5:	BT Module Straight Version with Shield – Front View	45
Photograph 6:	BT Module Straight Version – Rear View.....	45
Photograph 7:	BT Module Right Angle Version with Shield - Front View.....	46
Photograph 8:	BT Module Right Angle Version – Rear View.....	47
Photograph 9:	BT Module Straight Version without Shield – Front View	48
Photograph 10:	BT Module Right Angle Version without Shield – Front View	49

1 General Information

1.1 Scope

This is a request for a **LIMITED MODULAR APPROVAL**.

Applicable Standards:

- FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

1.2 Description of EUT

Equipment Under Test	Bluetooth Terminal
Models	20505008/20505009
Power Supply	+12V DC from AC Wall Transformer
Modulation Type	FHSS - Bluetooth
Frequency Range	2402 – 2480 MHz
Antenna Connector Type	Antenna is permanently attached
Antenna Types	Internal

The EUT comes in two variations: a straight version (20505008) and a right angle version (20505009). Other than the end of the PCB where the antenna is mounted, both versions are physically identical. Based on a spot check of electrical parameters, both versions are deemed to be electrically identical and the results in this report apply to both versions.

U11 will optionally be populated with a 3.0 VDC regulator instead of a 3.3 VDC regulator. Based on a spot check of electrical parameters, conducted power is slightly lower with the 3.0 VDC regulator, and the 3.3 VDC regulator version represents the worst case data.

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for Power Monitors, Inc. Models: 20505008/20505009, FCC ID: RO920505008, IC: 4806A-20505008.

1.5 Modifications

No modifications were required for compliance.

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Channels Tested for FHSS – 1 Mbps

Channel	Frequency
0	2402
38	2440
78	2480

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247)

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(b)	Maximum Peak Power Output	Pass
FCC 15.247(d)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Band Edge Measurement	Pass
FCC 15.247(a)(1)	Carrier Frequency Separation	Pass
FCC 15.247(a)(1)(ii)	20 dB Bandwidth	Pass
FCC 15.247(a)(1)(iii)	Hopping Characteristics	Pass
FCC 15.247(a)(1)(iii)	Average Time of Occupancy	Pass

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

2.4 Test System Details

The test samples were received on January 20, 2006. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Bluetooth Module	Power Monitors, Inc.	20505008/20505009	#1	RO920505008	N/A	16985
Bluetooth Module	Power Monitors, Inc.	20505008/20505009	#1	RO920505008	N/A	16986
Power Supply	Phihong	PSA05R-120	I43100062A4	N/A	Unshielded	16987

2.5 Configuration of Tested System

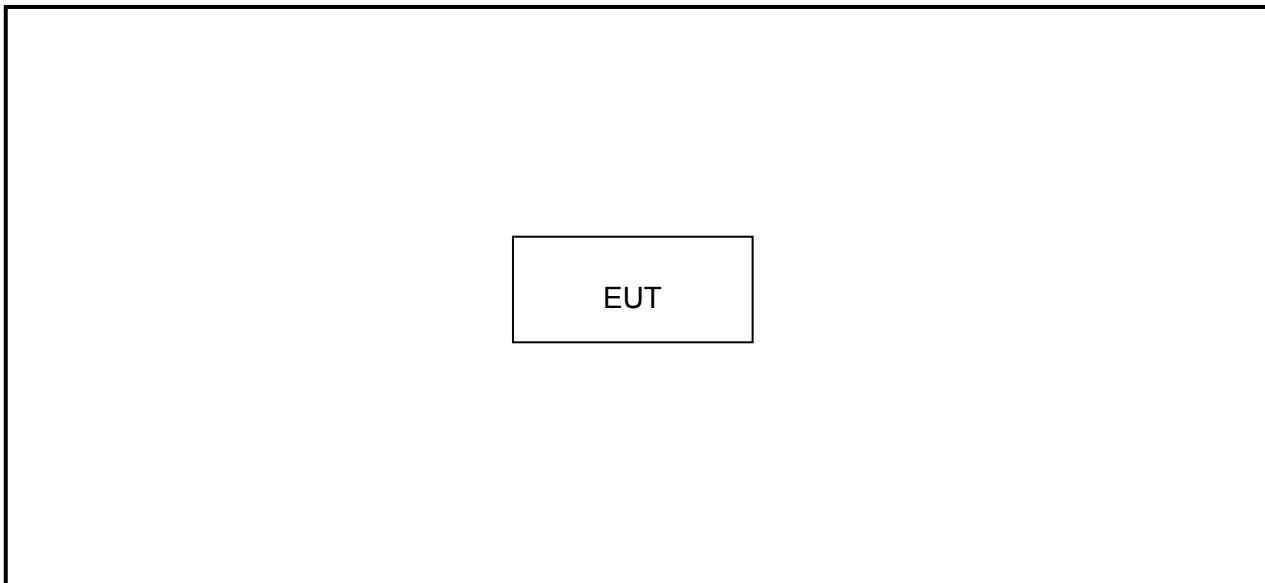


Figure 2-1: Configuration of System Under Test

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

3 Peak Output Power - §15.247(b)(1); RSS-210 §6.6.2(o)

3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using an Agilent 4416A EPM-P Series Power Meter with an E9323A Peak and Average Power Sensor.

Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

3.2 Power Output Test Data

Table 3-2: Power Output Test Data

Channel	Frequency (MHz)	Peak Power conducted output (dBm) U11 - 3.3 V	Peak Power conducted output (dBm) U11 - 3.0 V
0	2402	12.3	11.7
38	2440	11.6	11.0
78	2480	11.3	10.4

Test Personnel:

Richard B. McMurray, P.E. EMC Test Engineer	<i>Richard B. McMurray</i> Signature	January 24 and 27, 2006 Dates Of Tests
--	---	---

Rhein Tech Laboratories, Inc.
 360 Herndon Parkway
 Suite 1400
 Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
 Model #: 20505008/20505009
 Standards: FCC 15.247 & RSS-210
 FCC ID/IC: RO920505008/4806A-20505008
 Report #: 2006006

4 Compliance with the Band Edge – FCC §15.247(d); RSS-210 §6.6.2(o)

4.1 Band Edge Test Procedure

The transmitter output was connected to its appropriate antenna. Peak (1 MHz RBW/VBW) and average (1 MHz RBW/10 Hz VBW) radiated measurements were taken with a suitable span to encompass the peak of the fundamental. A delta measurement was performed from the highest peak in the restricted band to the peak of the fundamental, and subtracted from the field strength; the result was compared to the limit in the restricted band (54 dBuV/m).

Table 4-1: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	9/1/06
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07

4.2 Restricted Band Edge Test Results

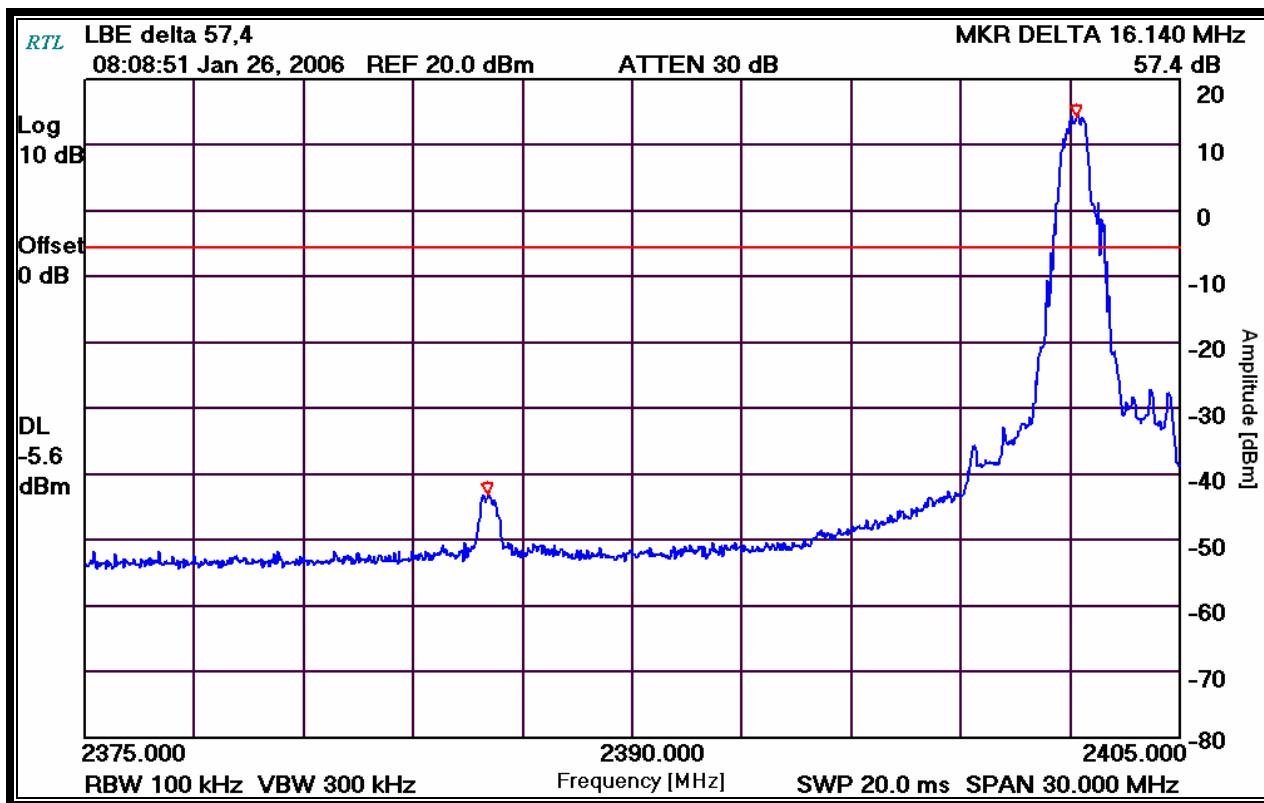
4.2.1 Calculation of Lower Band Edge

76.1 dBuV/m is the field strength measurement, from which the delta measurement of 57.4 dB is subtracted (reference plots), resulting in a level of 18.7 dB. This level has a margin of 35.3 dB below the limit of 54 dBuV/m.

Calculation: $76.1 \text{ dBuV/m} - 57.4 \text{ dB} - 54 \text{ dBuV/m} = -35.3 \text{ dB}$

Field Strength of Lower Band Edge (1 MHz RBW/10 Hz VBW) = 76.1 dBuV/m
 Delta measurement = 57.4 dB

Plot 4-1: Lower Band Edge: Average Measurement Channel 0 (TX Frequency: 2402 MHz)



4.2.2 Calculation of Upper Band Edge

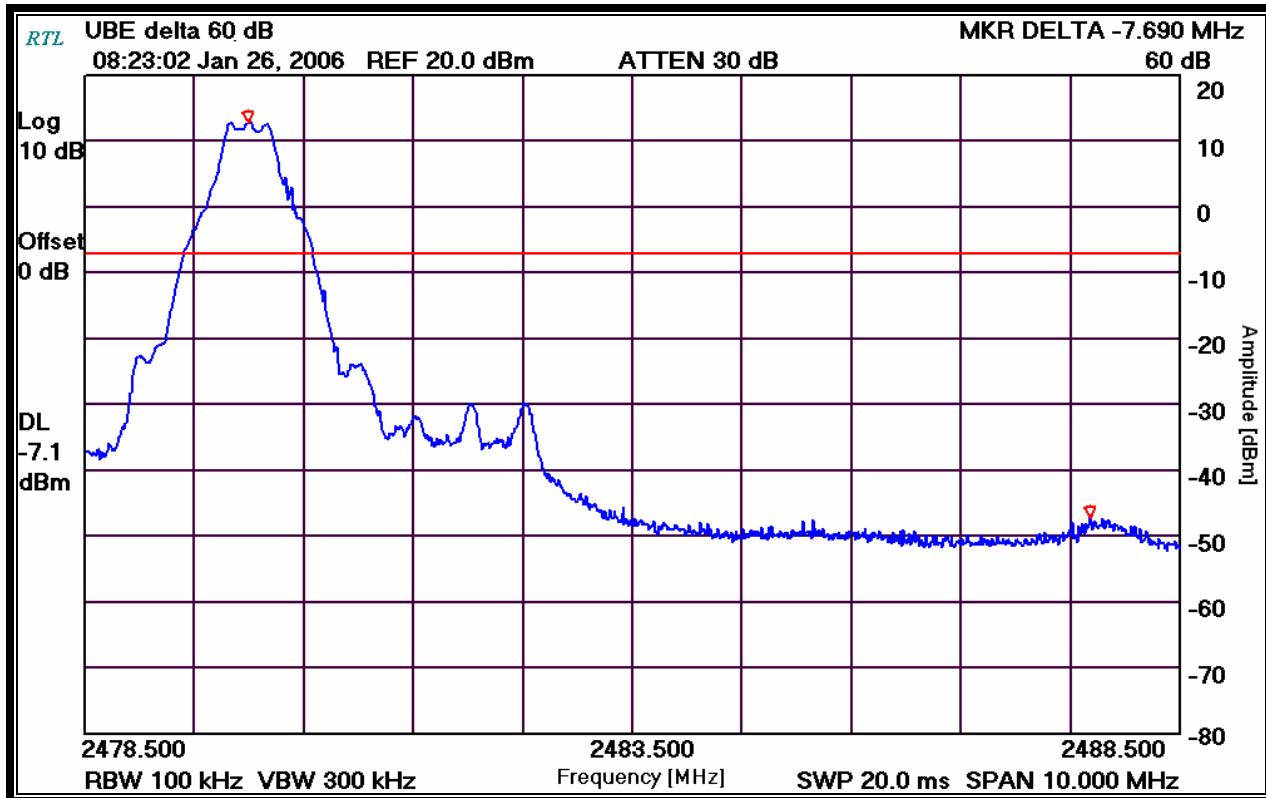
76.9 dBuV/m is the field strength measurement, from which the delta measurement of 60.0 dB is subtracted (reference plots), resulting in a level of 16.9 dB. This level has a margin of 37.1 dB below the limit of 54 dBuV/m.

Calculation: $76.9 \text{ dBuV/m} - 60.0 \text{ dB} - 54 \text{ dBuV/m} = -37.1 \text{ dB}$

Field Strength of Lower Band Edge (1 MHz RBW/10 Hz VBW) = 76.9 dBuV/m

Delta measurement = 60.0 dB

Plot 4-2: Upper Band Edge: Average Measurement Channel 78 (TX Frequency: 2480 MHz)



Test Personnel:

Daniel W. Baltzell
 Test Engineer

Signature

January 26, 2006
 Dates Of Test

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

5 Antenna Conducted Spurious Emissions - §15.247(d); RSS-210 §6.6.2(o)

5.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna spurious emissions per FCC 15.247(c) were measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz. The modulated carrier was identified at the following frequencies: 2402 MHz, 2440 MHz and 2480 MHz.

5.2 Antenna Conducted Spurious Emissions Test Results

No harmonics or spurs were found within 20 dB (note that we are reporting power as peak) of the limit from the carrier to the 10th harmonic of the carrier frequency. Per FCC 15.31(o), no data is being reported.

Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

Test Personnel:

Richard B. McMurray, P.E. EMC Test Engineer	<i>Richard B. McMurray</i> Signature	January 20, 2006 Date Of Test
--	---	----------------------------------

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

6 20 dB Bandwidth – FCC §15.247(a)(1)(ii); IC RSS-210 §5.9.1

6.1 20 dB Bandwidth Test Procedure

The minimum 20 dB bandwidths per RSS-210 were measured using a 50 ohm spectrum analyzer. The carrier was adjusted on the analyzer so that it was displayed entirely on the Spectrum Analyzer. The sweep time was set to 1 second and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 30 kHz, and the video bandwidth set at 300 kHz. The minimum 20 dB bandwidths were measured using the spectrum analyzer delta marker set 20 dB down from the peak of the carrier. The table below contains the bandwidth measurement results.

Table 6-1: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

6.2 20 dB Modulated Bandwidth Test Data

Table 6-2: 20 dB Modulated Bandwidth Test Data

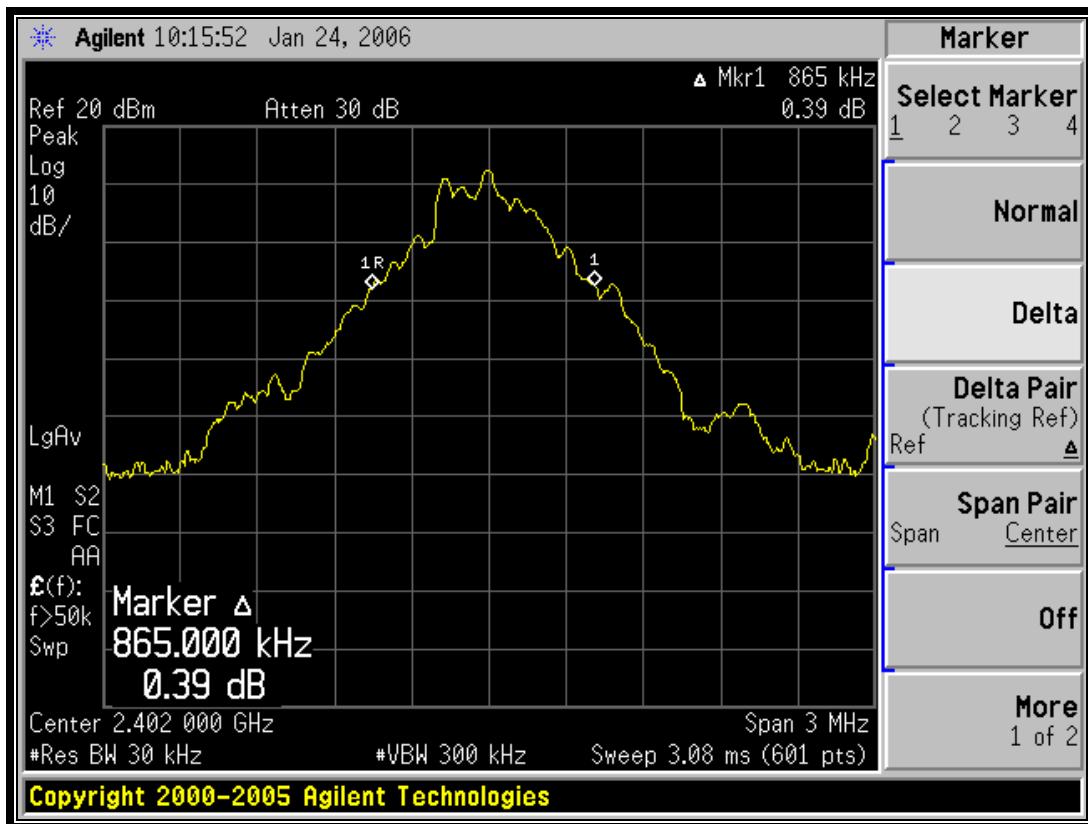
Minimum 20 dB Bandwidths

Channel	20 dB Bandwidth (kHz)
0	865 kHz
38	850 kHz
78	870 kHz

6.3 20 dB Bandwidth Plots

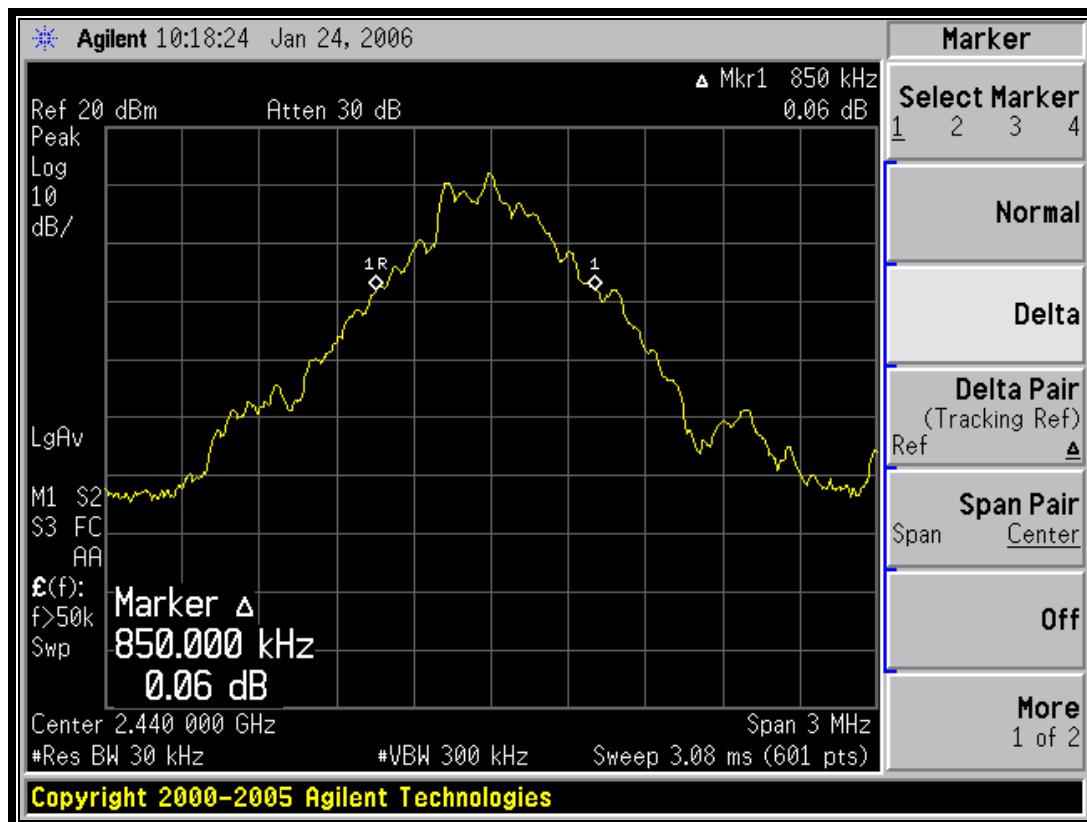
Channel: 0
Channel Frequency (MHz): 2402
Resolution Bandwidth (kHz): 30
Video Bandwidth (kHz): 300
Span (MHz): 3

Plot 6-1: 20 dB Bandwidth Channel 0



Channel: 38
Channel Frequency (MHz): 2440
Resolution Bandwidth (kHz): 30
Video Bandwidth (kHz): 300
Span (MHz): 3

Plot 6-2: 20 dB Bandwidth Channel 38



Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

Channel: 78
Channel Frequency (MHz): 2480
Resolution Bandwidth (kHz): 30
Video Bandwidth (kHz): 300
Span (MHz): 3

Plot 6-3: 20 dB Bandwidth Channel 78



Test Personnel:

Richard B. McMurray, P.E.
EMC Test Engineer

Richard B. McMurray
Signature

January 24, 2006
Date Of Test

7 Carrier Frequency Separation - §15.247(a)(1)

7.1 Carrier Frequency Separation Test Procedure

Frequency Hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

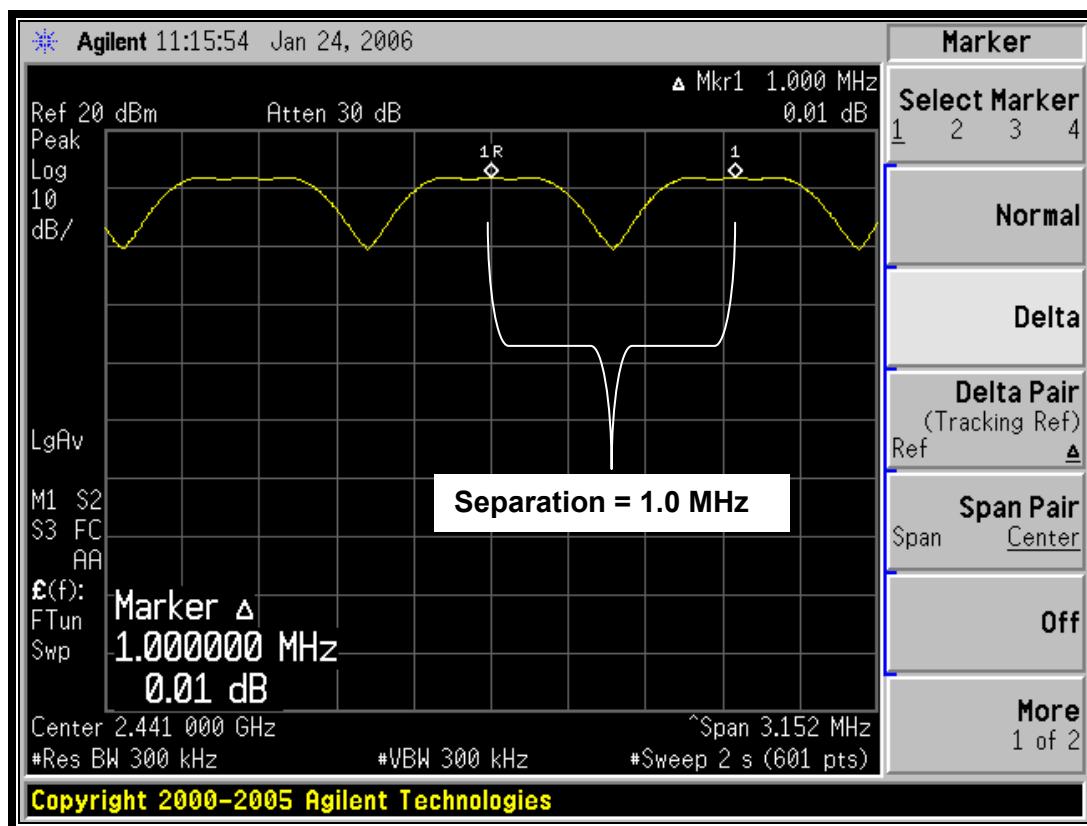
Measured frequency separation = 1.0 MHz

Table 7-1: Carrier Frequency Separation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

7.2 Carrier Frequency Separation Test Data

Plot 7-1: Carrier Frequency Separation



Test Personnel:

Richard B. McMurray, P.E.
 EMC Test Engineer

Richard B. McMurray

January 24, 2006

Signature

Date Of Test

8 Hopping Characteristics – FCC §15.247(a)(1)(iii); IC RSS-210 §6.2.2(o)

8.1 Hopping Characteristics Test Procedure

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

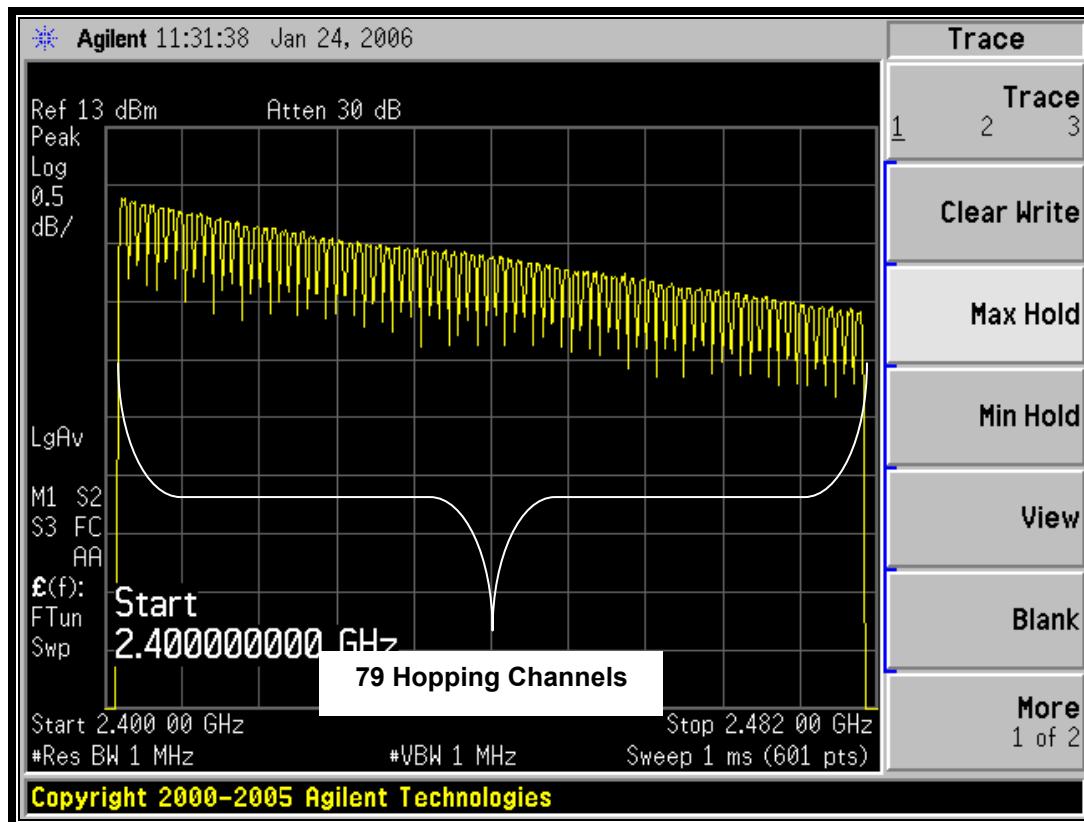
Table 8-1: Hopping Characteristics Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

8.2 Number of Hopping Frequencies

Measured number of hopping frequencies = 79

Plot 8-1: Number of Hopping Frequencies



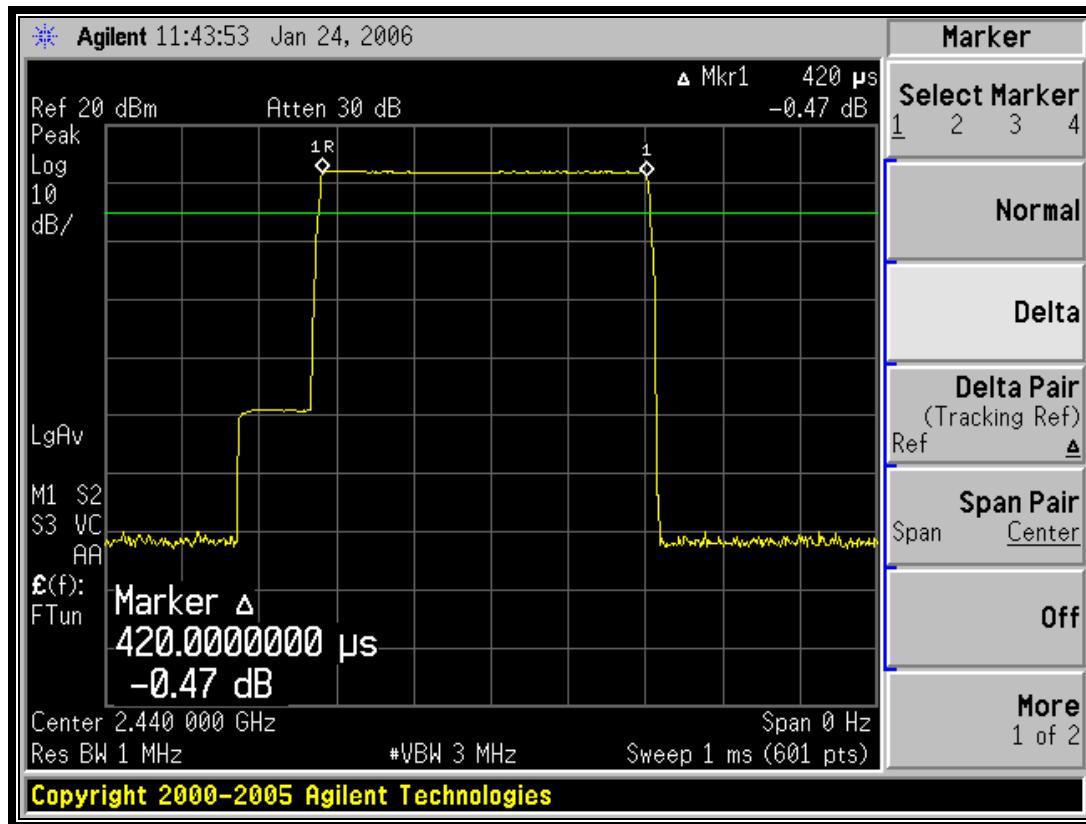
8.3 Average Time of Occupancy

The spectrum analyzer sweep was set to 1 ms, with a zero span and max hold until a pulse from the device under test was captured. A marker delta was used to measure the dwell time for this pulse. The sweep was then set to single sweep for 5 s (it was not possible to get a suitable display with a sweep time of 31.6 s).

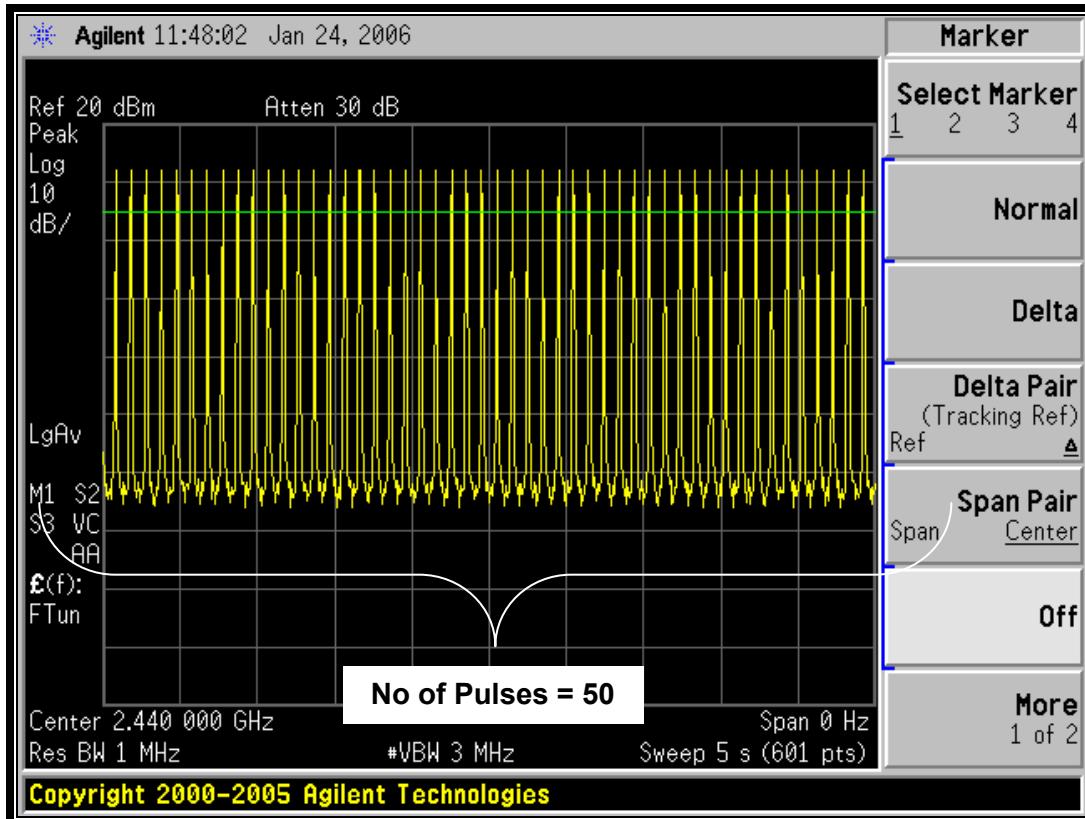
The number of pulses in 5 s was 50. Therefore, the number of pulses in a period of 0.4 seconds X 79 hopping channels (31.6 s) would be 316 pulses.

The average time of occupancy in the above period (31.6 s) is equal to 316 pulses X 420 us = 133 ms, which meets the limit as defined by 15.247(a)(1)(iii) of 0.4 seconds.

Plot 8-2: Time of Occupancy (Dwell Time)



Plot 8-3: Time of Occupancy (Dwell Time 5 Second Sweep)



Number of pulses in 5 seconds: 50. Therefore, the number of pulses in the period of 0.4 s X 79 channels would be 316 pulses.

Test Personnel:

Richard B. McMurray, P.E.
EMC Test Engineer

Richard B. McMurray
Signature

January 24, 2006
Date Of Test

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

9 Conducted Emissions Measurement Limits – FCC §15.207; RSS-210 §9

9.1 Limits of Conducted Emissions Measurement

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

9.2 Conducted Emissions Measurement Test Procedure

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 micro Henry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50 ohm output of the EUT LISN was connected to the spectrum analyzer input. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

9.3 Conducted Emissions Line Test Equipment

Table 9-1: Conducted Emissions Line Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/06
901083	AFJ International	LS16	16A LISN	16010020080	3/24/06

Rhein Tech Laboratories, Inc.
 360 Herndon Parkway
 Suite 1400
 Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
 Model #: 20505008/20505009
 Standards: FCC 15.247 & RSS-210
 FCC ID/IC: RO920505008/4806A-20505008
 Report #: 2006006

9.4 Conducted Line Emission Test Data

Table 9-2: Conducted Emissions (Neutral Side); Transmitting (2440 MHz)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)	FCC B AV Limit (dBuV)	FCC B AV Margin (dBuV)	Pass/Fail
0.177	Pk	49.0	0.2	49.2	64.6	-15.4	54.6	-5.4	Pass
0.255	Pk	45.3	0.1	45.4	61.6	-16.2	51.6	-6.2	Pass
0.488	Pk	41.1	0.2	41.3	56.2	-14.9	46.2	-4.9	Pass
0.765	Pk	40.8	0.4	41.2	56.0	-14.8	46.0	-4.8	Pass
2.480	Pk	37.7	0.8	38.5	56.0	-17.5	46.0	-7.5	Pass
27.280	Pk	34.6	2.4	37.0	60.0	-23.0	50.0	-13.0	Pass

Table 9-3: Conducted Emissions (Phase Side); Transmitting (2440 MHz)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)	FCC B AV Limit (dBuV)	FCC B AV Margin (dBuV)	Pass/Fail
0.198	Av	33.8	0.2	34.0	63.7	-29.7	53.7	-19.7	Pass
0.198	Qp	42.1	0.2	42.3	63.7	-21.4	53.7	-11.4	Pass
0.255	Pk	49.2	0.1	49.3	61.6	-12.3	51.6	-2.3	Pass
0.389	Pk	43.7	0.3	44.0	58.1	-14.1	48.1	-4.1	Pass
0.522	Pk	41.1	0.2	41.3	56.0	-14.7	46.0	-4.7	Pass
2.480	Pk	36.4	0.8	37.2	56.0	-18.8	46.0	-8.8	Pass
28.490	Pk	24.9	2.3	27.2	60.0	-32.8	50.0	-22.8	Pass

Table 9-4: Conducted Emissions (Neutral Side); Receive Mode

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)	FCC B AV Limit (dBuV)	FCC B AV Margin (dBuV)	Pass/Fail
0.159	Av	28.1	0.2	28.3	65.5	-37.2	55.5	-27.2	Pass
0.159	Qp	45.8	0.2	46.0	65.5	-19.5	55.5	-9.5	Pass
0.241	Pk	45.1	0.1	45.2	62.1	-16.9	52.1	-6.9	Pass
0.396	Pk	45.2	0.3	45.5	57.9	-12.4	47.9	-2.4	Pass
0.522	Pk	36.3	0.2	36.5	56.0	-19.5	46.0	-9.5	Pass
24.230	Pk	39.2	2.5	41.7	60.0	-18.3	50.0	-8.3	Pass
29.500	Pk	39.6	2.3	41.9	60.0	-18.1	50.0	-8.1	Pass

Rhein Tech Laboratories, Inc.
 360 Herndon Parkway
 Suite 1400
 Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
 Model #: 20505008/20505009
 Standards: FCC 15.247 & RSS-210
 FCC ID/IC: RO920505008/4806A-20505008
 Report #: 2006006

Table 9-5: Conducted Emissions (Phase Side); Receive Mode

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)	FCC B AV Limit (dBuV)	FCC B AV Margin (dBuV)	Pass/Fail
0.157	Av	34.1	0.2	34.3	65.6	-31.3	55.6	-21.3	Pass
0.159	Qp	47.2	0.2	47.4	65.5	-18.1	55.5	-8.1	Pass
0.265	Pk	40.1	0.2	40.3	61.3	-21.0	51.3	-11.0	Pass
0.326	Pk	42.7	0.3	43.0	59.6	-16.6	49.6	-6.6	Pass
0.584	Pk	39.0	0.3	39.3	56.0	-16.7	46.0	-6.7	Pass
24.200	Pk	39.1	2.5	41.6	60.0	-18.4	50.0	-8.4	Pass
29.050	Pk	40.0	2.2	42.2	60.0	-17.8	50.0	-7.8	Pass

Test Personnel:

Daniel W. Baltzell
 EMC Test Engineer



Signature

January 25, 2006
 Date Of Test

10 Radiated Emissions - §15.209; RSS-210 §6.2.1

10.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

10.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (24.8 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Rhein Tech Laboratories, Inc.
 360 Herndon Parkway
 Suite 1400
 Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
 Model #: 20505008/20505009
 Standards: FCC 15.247 & RSS-210
 FCC ID/IC: RO920505008/4806A-20505008
 Report #: 2006006

Table 10-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	5/20/06
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900811	Rhein Tech Labs	PR-1040	Amplifier	1003	3/8/06
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	9/1/06
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 - 8.2GHz)	9508-1020	5/20/07
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	5/20/07
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	5/20/07
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051	5/20/07
900392	Hewlett Packard	1197OK	Harmonic Mixer (18 – 26.5 GHz)	3525A00159	11/27/07
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/06
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	8/3/06
900889	Hewlett Packard	85685A	RF Preselector (20 Hz - 2 GHz)	3146A01309	4/5/06
901020	Hewlett Packard	8564E	Spectrum Analyzer (30 Hz – 40 GHz)	3943A01719	9/14/06

10.3 Radiated Emissions Test Results

10.3.1 Radiated Emissions Digital/Receiver

Table 10-2: Digital/Receiver Radiated Emissions Test Results

Temperature: 40°F Humidity: 46%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
156.534	Qp	V	90	1.0	57.6	-17.0	40.6	43.5	-2.9	Pass
158.747	Qp	V	0	1.0	45.7	-17.1	28.6	43.5	-14.9	Pass
160.962	Qp	V	0	1.0	52.8	-17.2	35.6	43.5	-7.9	Pass
165.370	Qp	V	0	1.0	50.5	-17.6	32.9	43.5	-10.6	Pass
169.778	Qp	V	0	1.0	49.7	-17.7	32.0	43.5	-11.5	Pass
174.186	Qp	V	0	1.0	48.1	-17.9	30.2	43.5	-13.3	Pass
178.588	Qp	V	0	1.0	45.5	-18.2	27.3	43.5	-16.2	Pass
182.996	Qp	V	0	1.0	47.7	-18.3	29.4	43.5	-14.1	Pass
187.404	Qp	V	0	1.0	43.4	-18.3	25.1	43.5	-18.4	Pass
196.220	Qp	V	0	1.0	44.8	-17.9	26.9	43.5	-16.6	Pass
200.628	Qp	V	0	1.0	43.0	-17.7	25.3	43.5	-18.2	Pass
209.450	Qp	V	0	1.0	46.4	-17.4	29.0	43.5	-14.5	Pass
213.858	Qp	V	0	1.0	46.5	-17.3	29.2	43.5	-14.3	Pass
218.266	Qp	V	0	1.0	46.2	-17.2	29.0	46.0	-17.0	Pass
233.710	Qp	H	0	1.8	51.1	-16.2	34.9	46.0	-11.1	Pass
246.918	Qp	V	0	1.0	41.7	-15.1	26.6	46.0	-19.4	Pass
264.562	Qp	H	0	1.0	55.9	-13.6	42.3	46.0	-3.7	Pass
268.984	Qp	H	0	1.0	57.5	-13.8	43.7	46.0	-2.3	Pass
282.212	Qp	V	0	1.0	49.9	-14.2	35.7	46.0	-10.3	Pass
427.731	Qp	V	0	1.0	47.7	-9.2	38.5	46.0	-7.5	Pass
429.935	Qp	V	0	1.0	47.1	-9.0	38.1	46.0	-7.9	Pass
432.139	Qp	V	0	1.0	48.1	-9.1	39.0	46.0	-7.0	Pass
434.343	Qp	V	0	1.0	46.9	-9.2	37.7	46.0	-8.3	Pass
436.547	Qp	V	0	1.0	47.9	-9.3	38.6	46.0	-7.4	Pass
438.751	Qp	V	0	1.0	46.4	-9.4	37.0	46.0	-9.0	Pass
440.955	Qp	V	0	1.0	47.5	-9.4	38.1	46.0	-7.9	Pass
443.159	Qp	V	0	1.0	47.5	-9.5	38.0	46.0	-8.0	Pass
445.363	Qp	V	0	1.0	46.8	-9.5	37.3	46.0	-8.7	Pass
447.567	Qp	V	0	1.0	45.2	-9.4	35.8	46.0	-10.2	Pass
449.784	Qp	H	0	1.8	52.4	-9.0	43.4	46.0	-2.6	Pass
451.988	Qp	H	0	1.8	46.8	-8.9	37.9	46.0	-8.1	Pass
454.192	Qp	H	0	1.8	49.6	-8.8	40.8	46.0	-5.2	Pass
458.600	Qp	H	0	1.8	49.3	-8.6	40.7	46.0	-5.3	Pass
476.232	Qp	H	0	1.8	46.1	-8.2	37.9	46.0	-8.1	Pass

Rhein Tech Laboratories, Inc.
 360 Herndon Parkway
 Suite 1400
 Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
 Model #: 20505008/20505009
 Standards: FCC 15.247 & RSS-210
 FCC ID/IC: RO920505008/4806A-20505008
 Report #: 2006006

10.3.2 Radiated Emissions Harmonics/Spurious

Table 10-3: Radiated Emissions Harmonics/Spurious Channel 0 (TX Frequency: 2402 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804.0	45.5	31.8	10.1	41.9	54.0	-12.1
7206.0	46.8	33.0	10.4	43.4	57.1	-13.7
9608.0	47.2	34.0	13.3	47.3	57.1	-9.8
12010.0	44.8	31.7	15.8	47.5	54.0	-6.5
14412.0	48.5	36.0	19.0	55.0	57.1	-2.1
16814.0	47.0	35.2	19.2	54.4	57.1	-2.7

Table 10-4: Radiated Emissions Harmonics/Spurious Channel 38 (TX Frequency: 2440 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4880.0	45.5	32.3	9.9	42.2	54.0	-11.8
7320.0	46.7	32.7	10.1	42.8	54.0	-11.2
9760.0	47.2	34.0	12.4	46.4	57.2	-10.8
12200.0	44.7	31.3	14.5	45.8	54.0	-8.2
14640.0	48.3	36.0	20.1	56.1	57.2	-1.1
17080.0	48.5	35.3	19.8	55.1	57.2	-2.1

Table 10-5: Radiated Emissions Harmonics/Spurious Channel 78 (TX Frequency: 2480 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960.0	45.2	32.5	10.6	43.1	54.0	-10.9
7440.0	48.5	35.3	10.8	46.1	54.0	-7.9
9920.0	47.2	34.2	13.3	47.5	56.9	-9.4
12400.0	45.2	32.2	17.8	50.0	54.0	-4.0
14880.0	48.2	34.5	20.6	55.1	56.9	-1.8
17360.0	48.0	35.7	17.8	53.5	56.9	-3.4

Test Personnel:

Daniel W. Baltzell
 EMC Test Engineer

Signature

January 26, 2006

Date Of Test

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Power Monitors, Inc.
Model #: 20505008/20505009
Standards: FCC 15.247 & RSS-210
FCC ID/IC: RO920505008/4806A-20505008
Report #: 2006006

11 Conclusion

The data in this measurement report shows that the EUT as tested, Power Monitors, Inc. Models: 20505008/20505009, FCC ID: RO920505008, IC: 4806A-20505008, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and Industry Canada RSS-210.