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 Fax: 703-689-2056 Suite 1400 Web: www.rheintech.com Herndon, VA 20170 E-Mail: ATCBINFO@rheintech.com	Vocollect, Inc. Phone: 412-349-2580 Contact: Joe Lesik Fax: 412-829-1063 703 Rodi Road Pittsburgh, PA 15235 E-Mail: jlesik@vocollect.com

FCC ID/ IC ID:	MQOTT700-20000/ 2570A-TT700200	**Test Report Date:**	June 30, 2006
Platform:	N/A	**RTL Work Order Number:**	2006065
Model Name/ Model Number:	T5/TT-700-100_R WF	**RTL Quote Number:**	QRTL06-183

American National Standard Institute:	ANSI C63.4-2003 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:	DTS – Part 15 Digital Transmission System (WLAN portion) 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 10-01-05
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
2412-2462	0.093	N/A	10M3G7D
2402-2480	0.001	N/A	1M14FXD

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: _____ Date: June 30, 2006

Typed/Printed Name: Desmond A. Fraser Position: President

Table of Contents

Figure Index

Table Index

Plot Index

Appendix Index

Photograph Index

1 General Information

1.1 Scope

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	Body Worn Terminal	
Model	TT-700	
Power Supply	Battery operated	
Modulation Type	DSSS – WLAN	FHSS - Bluetooth
Transfer Rate	11, 5.5, 2, and 1 Mbps	
Frequency Range	2412 – 2462 MHz	2402 – 2480 MHz
Antenna Connector Type	Internal	Internal
Antenna Types	Internal	Internal

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 Vocollect, Inc. Model # TT-700-100_R WF, FCC ID: MQOTT700-20000, IC: 2570A-TT700200.

1.5 Modifications

No modifications were required for compliance.

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 DSSS – 11 Mbps

Channel	Frequency
1	2412
6	2437
11	2462

Table 2-2: 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 2-3: Test Result Summary – FCC Part 15, Subpart C (Section 15.247) – DSSS WLAN

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(a)(2)	6 dB Bandwidth	Pass
FCC 15.247(b)	Maximum Peak Power Output	Pass
FCC 15.247(d)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(e)	Power Spectral Density	Pass
FCC 15.247(d)	Band Edge Measurement	Pass

Table 2-4: Test Result Summary – FCC Part 15, Subpart C (Section 15.247) – FHSS Bluetooth

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

2.4 Test System Details

The test sample was received on May 26, 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 2-5: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
T5 Talkman WLAN/Bluetooth terminal	Vocollect, Inc.	TT-700-100_R WF	REV C 30	MQOTT700-20000	N/A	17248
T5 Talkman WLAN/Bluetooth terminal	Vocollect, Inc.	TT-700-100_R WF	REV C 30	MQOTT700-20000	N/A	17249
Battery	Vocollect, Inc.	730022	04180014	N/A	N/A	17218

2.5 Configuration of Tested System

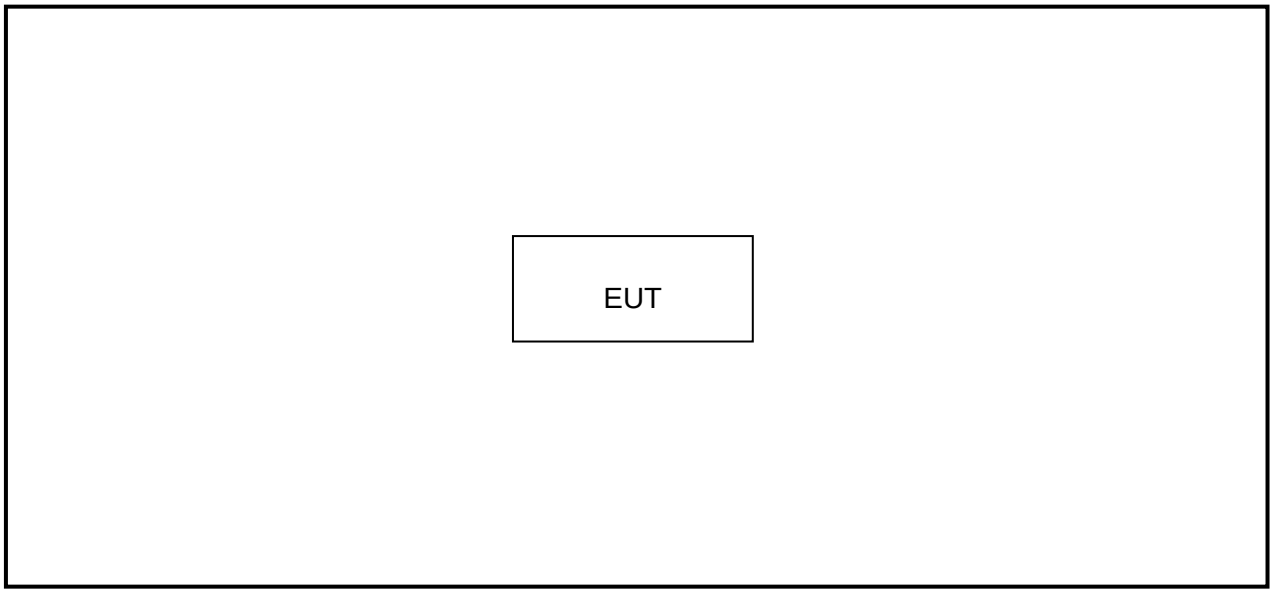


Figure 2-1: Configuration of System Under Test

3 Peak Output Power – FCC §15.247(b)(1); RSS-210 §A8.4(4)

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
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	9/10/06
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	9/10/06

3.2 Power Output Test Data

Table 3-2: Power Output Test Data – DSSS WLAN

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	19.9
6	2437	19.8
11	2462	19.8

Table 3-3: Power Output Test Data – FHSS Bluetooth

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
0	2402	0.6
38	2440	-0.2
78	2480	-0.7

Test Personnel:

Richard B. McMurray	Richard B. McMurray	May 26, 2006
EMC Test Engineer	Signature	Date Of Test

4 Compliance with the Band Edge – FCC §15.247(d); RSS-210 §2.2

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
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	8/03/06

4.2 Restricted Band Edge Test Results

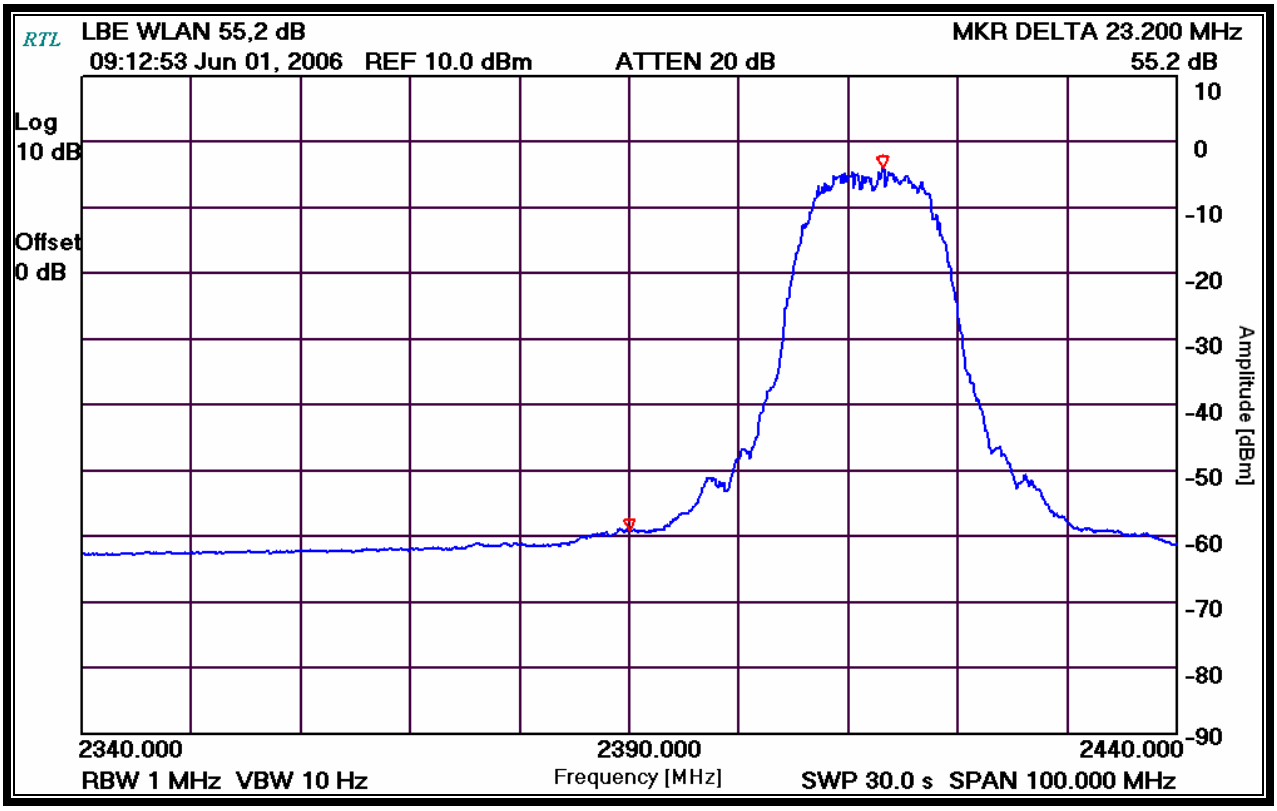
4.2.1 Calculation of Lower Band Edge – DSSS WLAN

99.9 dBuV/m is the field strength measurement, from which the delta measurement of 55.2 dB is subtracted (reference plots), resulting in a level of 44.7 dB. This level has a margin of 9.3 dB below the limit of 54 dBuV/m.

Calculation: 99.9 dBuV/m – 55.2 dB – 54 dBuV/m = -9.3 dB

Peak Field Strength of Lower Band Edge (1 MHz RBW/1 MHz VBW) = 112.3 dBuV/m
Average Field Strength of Lower Band Edge (1 MHz RBW/10 Hz VBW) = 99.9 dBuV/m
Delta measurement = 55.2 dB

Plot 4-1: Lower Band Edge: Average Measurement Channel 1 (TX Frequency: 2412 MHz)



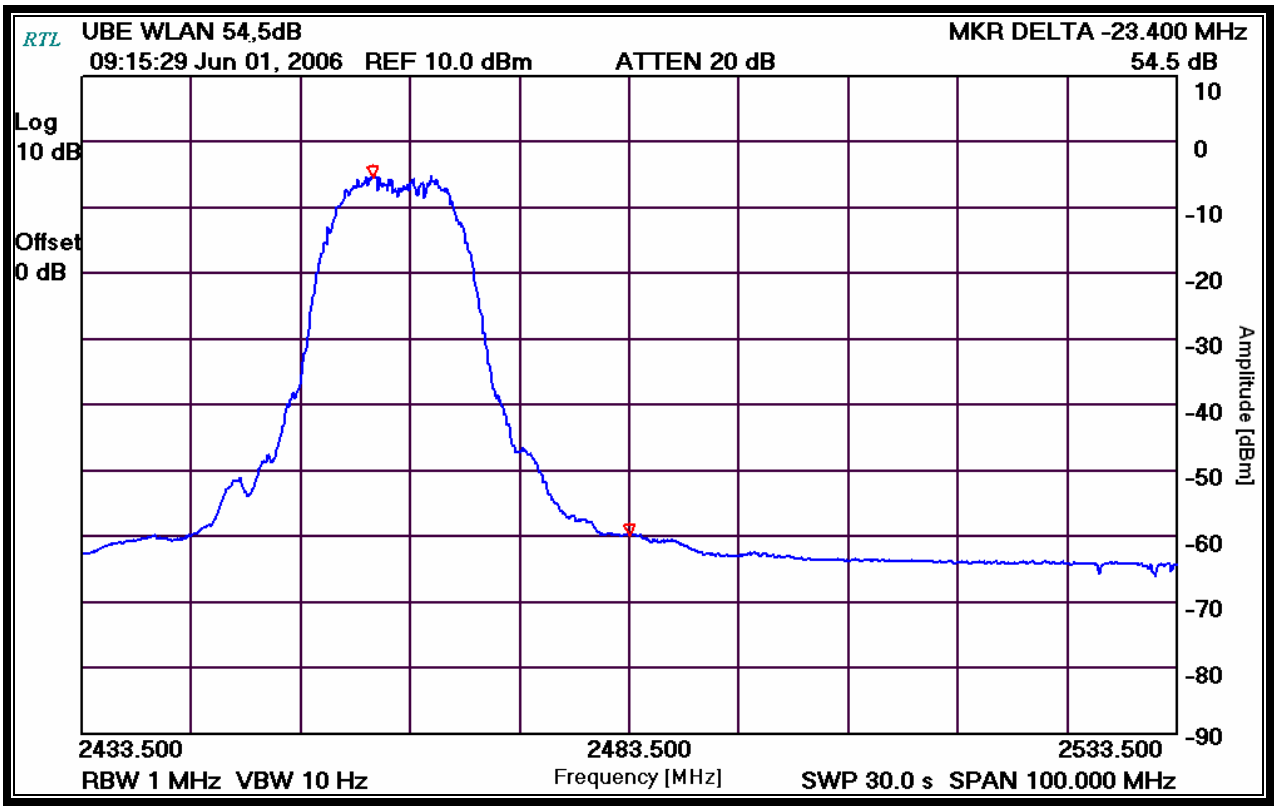
4.2.2 Calculation of Upper Band Edge – DSSS WLAN

98.1 dBuV/m is the field strength measurement, from which the delta measurement of 54.5 dB is subtracted (reference plots), resulting in a level of 43.6 dB. This level has a margin of 10.4 dB below the limit of 54 dBuV/m.

Calculation: 98.1 dBuV/m – 54.5 dB – 54 dBuV/m = -10.4 dB

Peak Field Strength of Upper Band Edge (1 MHz RBW/1 MHz VBW) = 111.1 dBuV/m
Average Field Strength of Upper Band Edge (1 MHz RBW/10 Hz VBW) = 98.1 dBuV/m
Delta measurement = 54.5 dB

Plot 4-2: Upper Band Edge: Average Measurement Channel 11 (TX Frequency: 2462 MHz)



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	June 1, 2006
Test Engineer	Signature	Dates Of Test

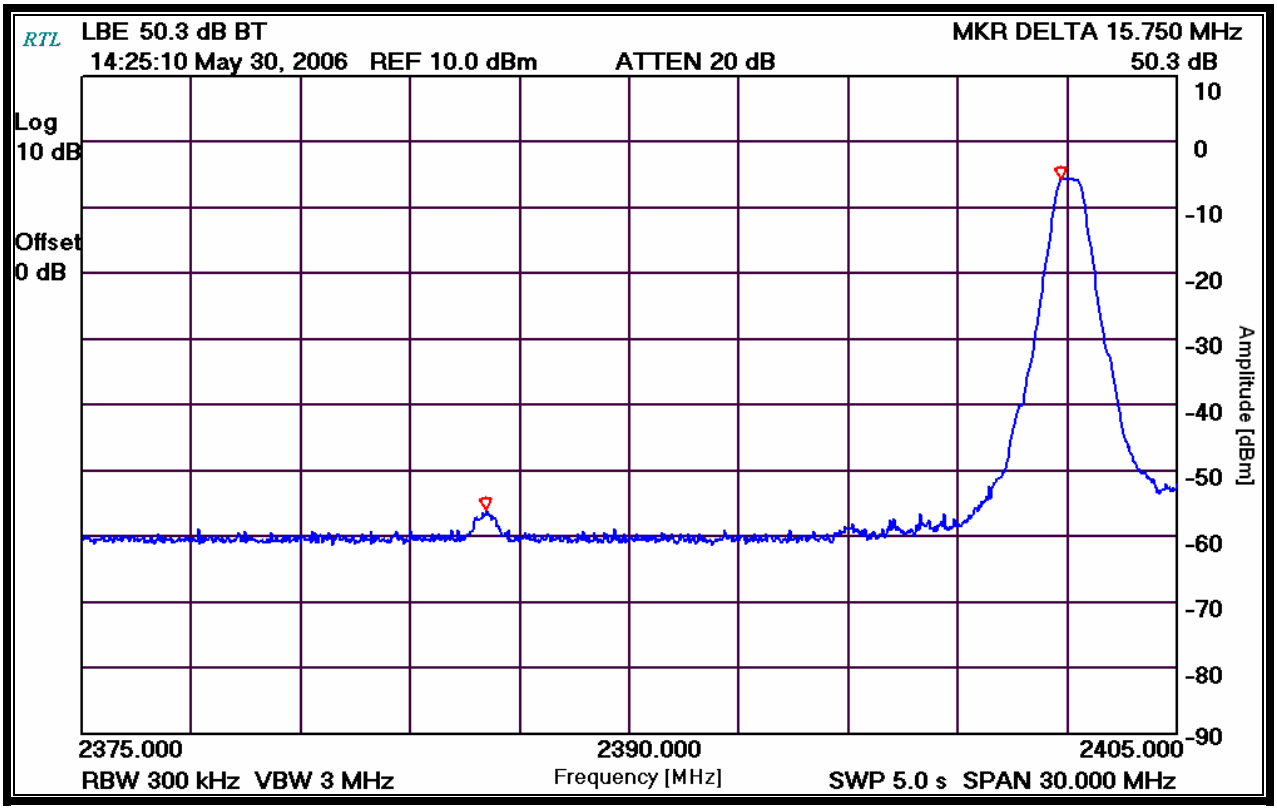
4.2.3 Calculation of Lower Band Edge – Bluetooth

95.9 dBuV/m is the peak field strength measurement, from which the delta measurement of 50.3 dB is subtracted (reference plots), resulting in a level of 45.6 dB. This level has a margin of 8.4 dB below the limit of 54 dBuV/m.

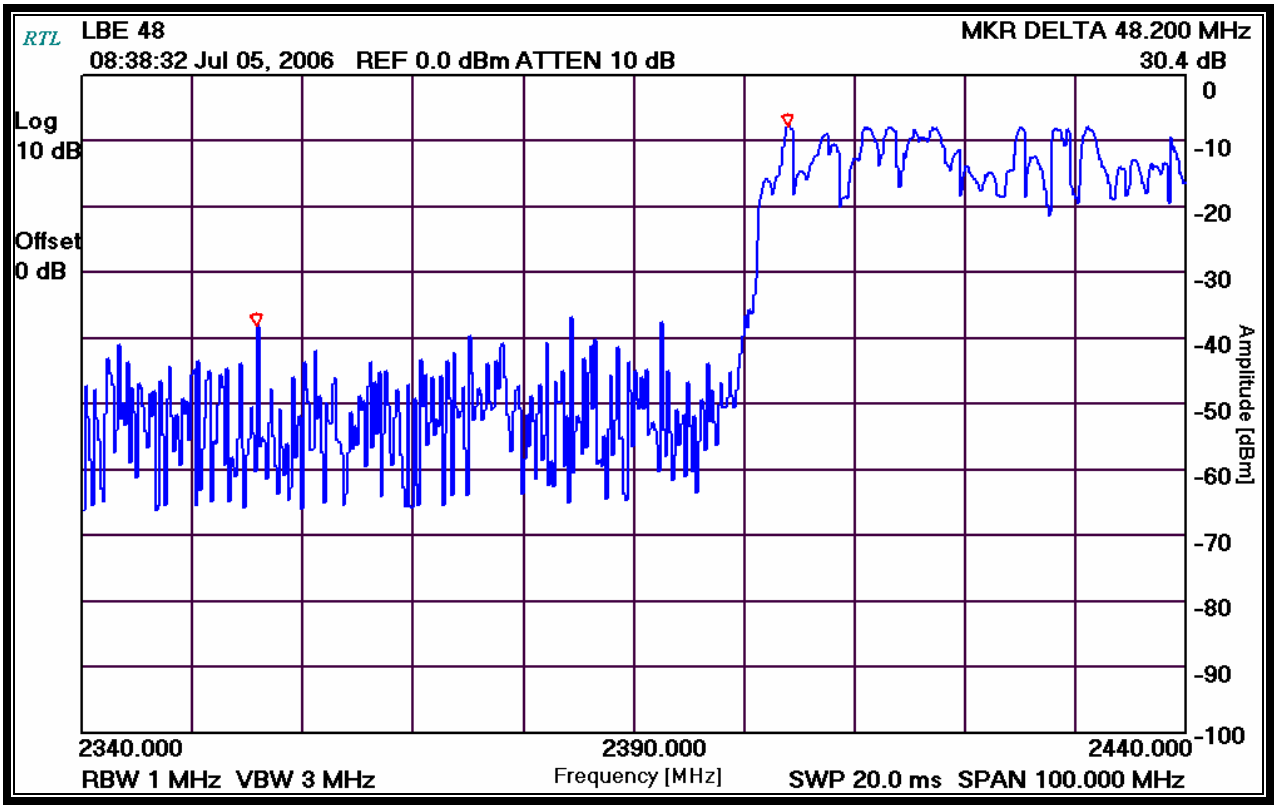
Calculation: 95.9 dBuV/m – 50.3 dB – 54 dBuV/m = -8.4 dB

Peak Field Strength of Upper Band Edge (1 MHz RBW/1 MHz VBW) = 95.9 dBuV/m
Average Field Strength of Upper Band Edge (1 MHz RBW/10 Hz VBW) = 70.1 dBuV/m
Delta measurement = 50.3 dB

Plot 4-3: Lower Band Edge: Channel 0 (TX Frequency: 2402 MHz)



Plot 4-4: Lower Band Edge: Hopping Channel 0 (TX Frequency: 2402 MHz)



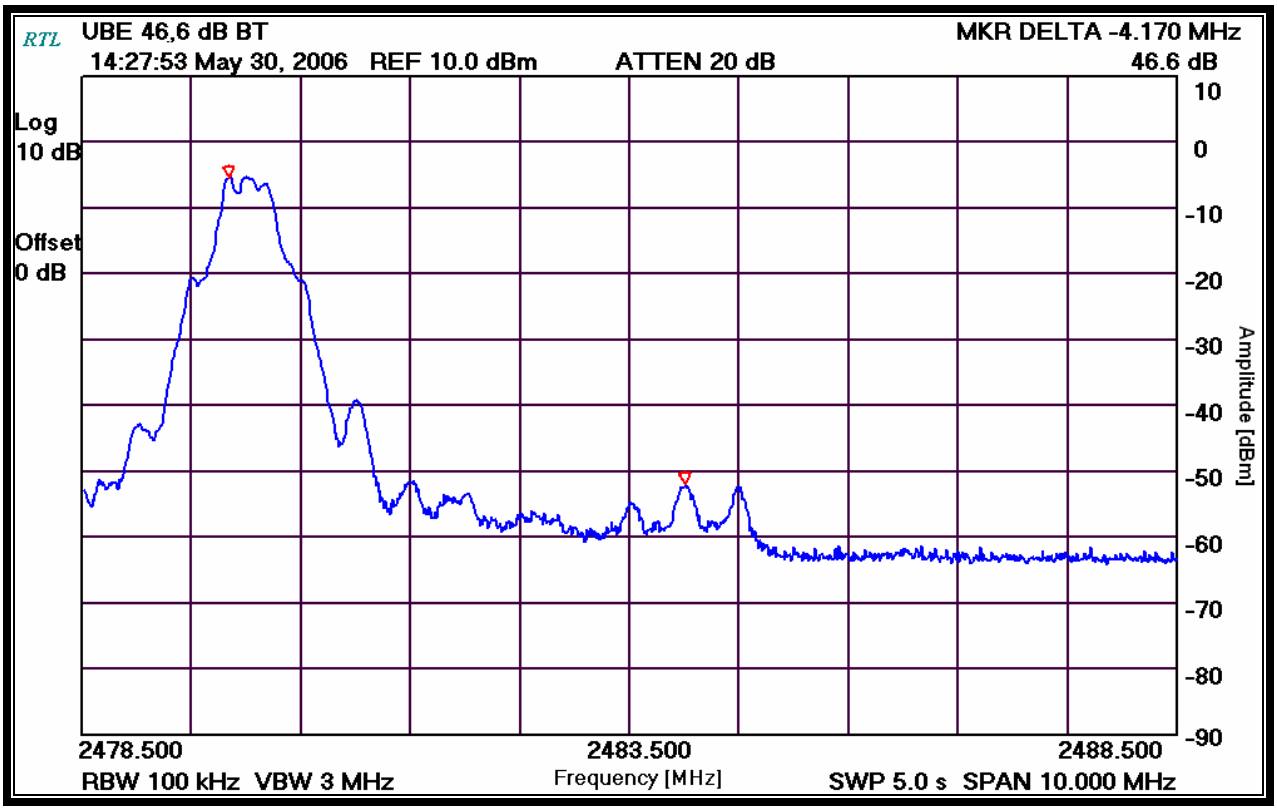
4.2.4 Calculation of Upper Band Edge – Bluetooth

96.4 dBuV/m is the peak field strength measurement, from which the delta measurement of 46.6 dB is subtracted (reference plots), resulting in a level of 49.8 dB. This level has a margin of 4.2 dB below the limit of 54 dBuV/m.

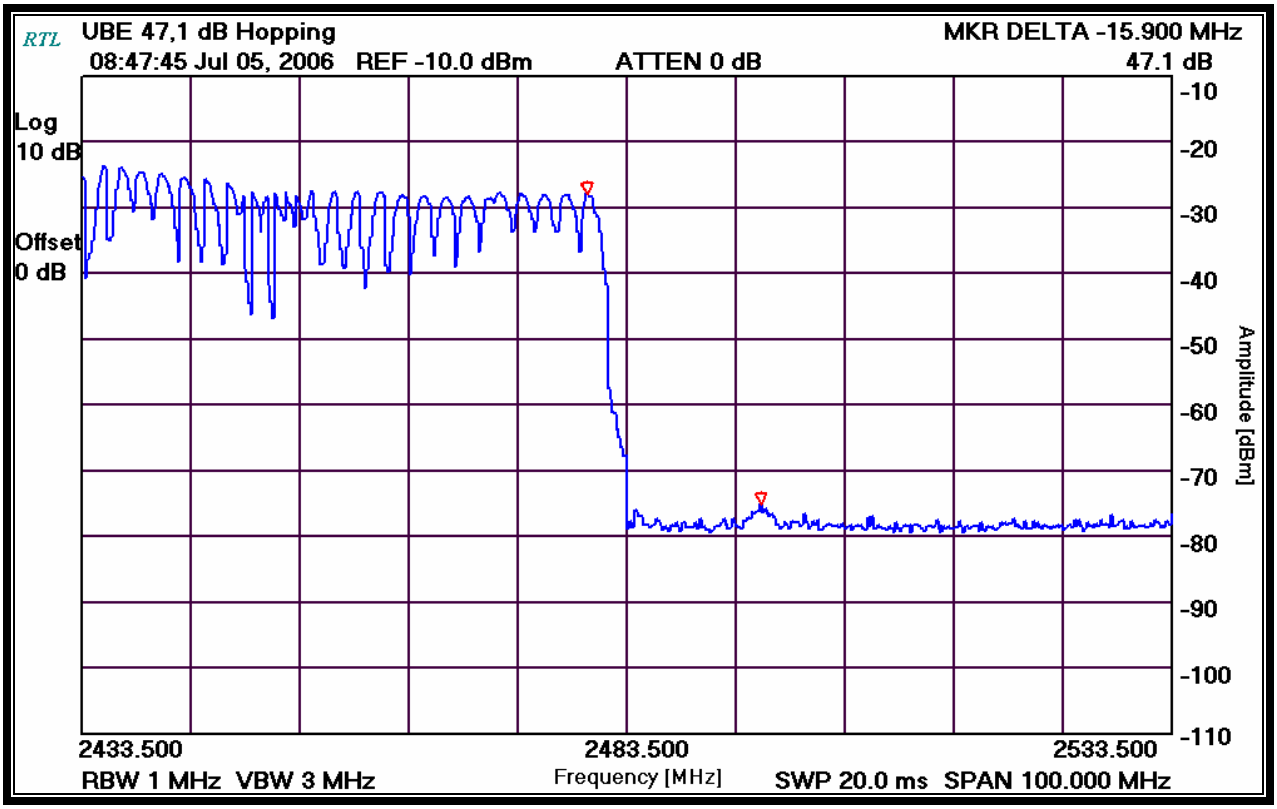
Calculation: 96.4 dBuV/m – 46.6dB – 54 dBuV/m = -4.2 dB

Peak Field Strength of Upper Band Edge (1 MHz RBW/1 MHz VBW) = 96.4 dBuV/m
Average Field Strength of Upper Band Edge (1 MHz RBW/10 Hz VBW) = 70.4 dBuV/m
Delta measurement = 46.6 dB

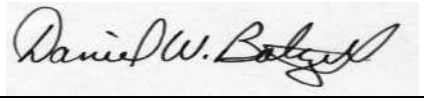
Plot 4-5: Upper Band Edge: Channel 78 (TX Frequency: 2480 MHz)



Plot 4-6: Upper Band Edge: Hopping Channel 78 (TX Frequency: 2480 MHz)



Test Personnel:

Daniel W. Baltzell		May 30 and July 5, 2006
Test Engineer	Signature	Date Of Test

5 Antenna Conducted Spurious Emissions – FCC §15.247(d); RSS-Gen

5.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna spurious emissions per FCC 15.247(c) was 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: 2412 MHz, 2437 MHz and 2462 MHz, and 2402 MHz, 2440 MHz and 2480 MHz.

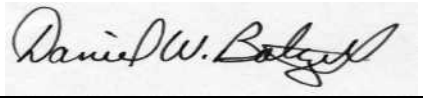
5.2 Antenna Conducted Spurious Emissions Test Results – DSSS WLAN

No harmonics or spurs were found within 20 dB (note that we are reporting power as peak) of the carrier level 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 Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	8/03/06

Test Personnel:

Daniel W. Baltzell		May 30, 2006
Test Engineer	Signature	Date Of Test

6 6 dB Bandwidth – FCC §15.247(a)(2); RSS-210 §A8.2

6.1 6 db Bandwidth Test Procedure – Minimum 6 db Bandwidth

The minimum 6 dB bandwidths per FCC 15.247(a)(2) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 Hz. The device was modulated. The minimum 6 dB bandwidths are presented below.

Table 6-1: 6 dB Bandwidth Test Equipment

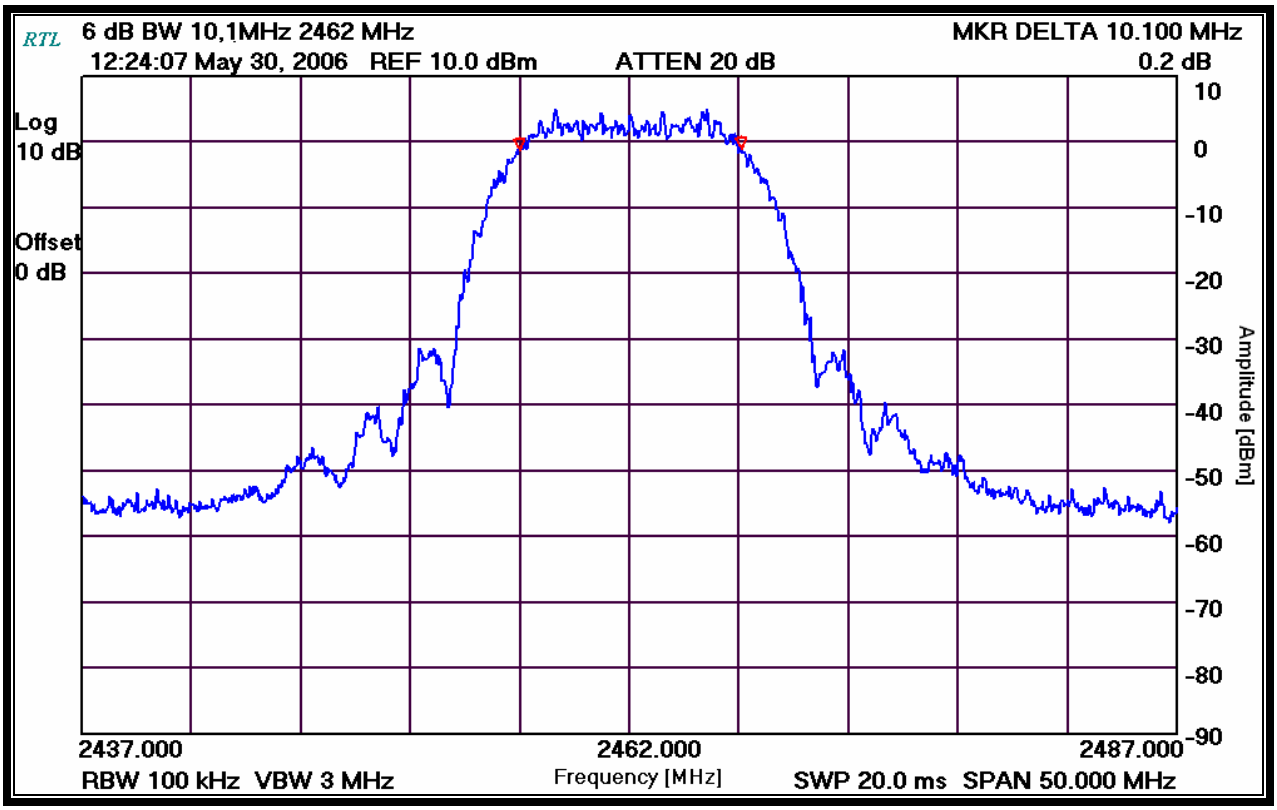
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900930/900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	8/26/2006

6.2 6 db Bandwidth Test Results – DSSS WLAN

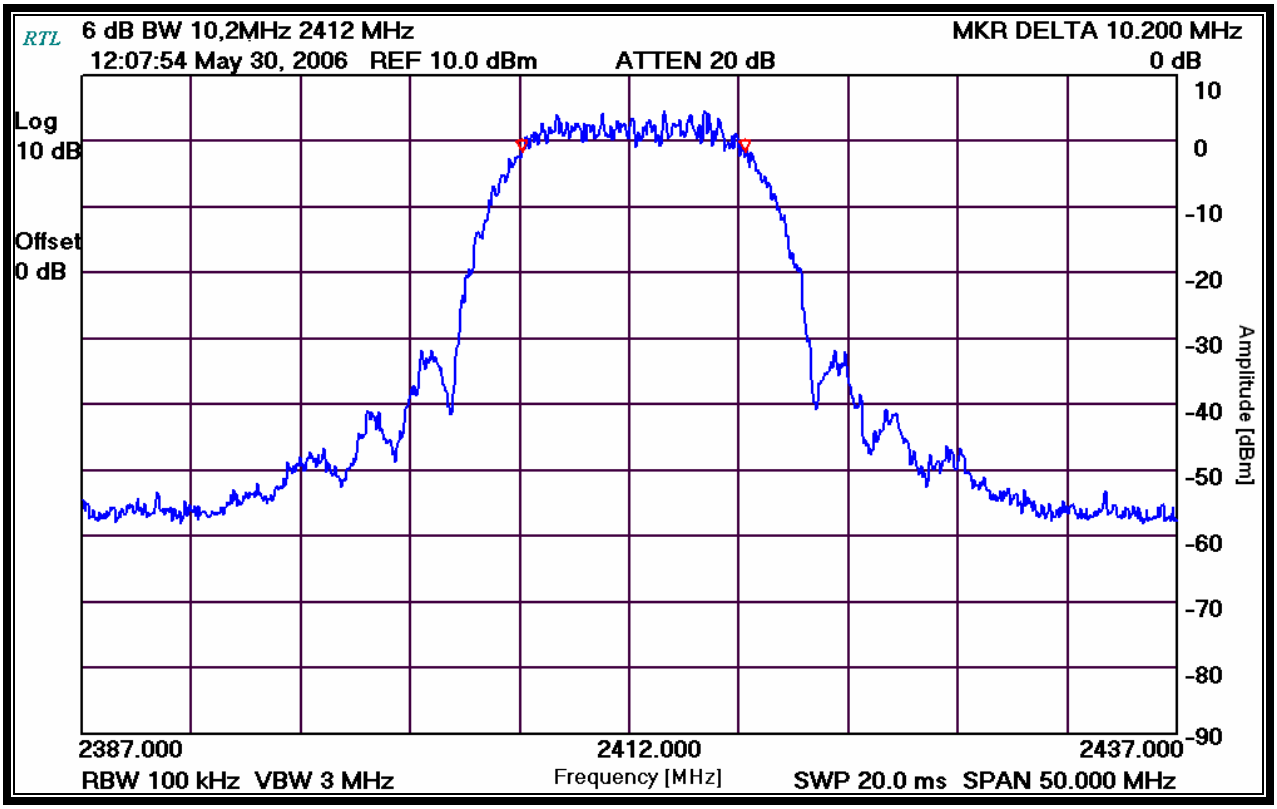
Table 6-2: 6 db Bandwidth Test Data – DSSS WLAN

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
1	2412	10.1	0.5	Pass
6	2437	10.2	0.5	Pass
11	2462	10.25	0.5	Pass

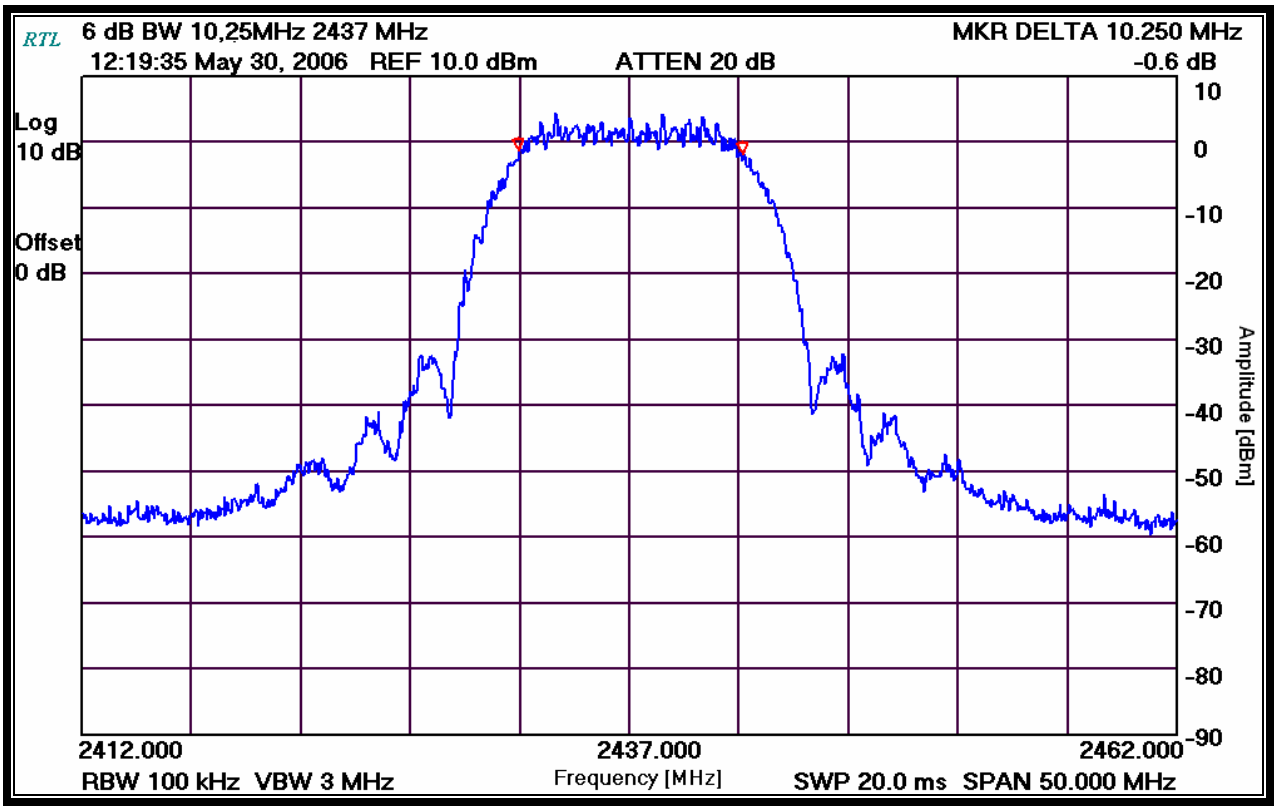
Plot 6-1: 6 dB Bandwidth Channel 1 (TX Frequency: 2412 MHz)



Plot 6-2: 6 dB Bandwidth Channel 6 (TX Frequency: 2437 MHz)



Plot 6-3: 6 dB Bandwidth Channel 11 (TX Frequency: 2462 MHz)



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	May 30, 2006
Test Engineer	Signature	Dates Of Test

7 Power Spectral Density – FCC §15.247(e); RSS-210 §A8.2

7.1 Power Spectral Density Test Procedure

The power spectral density per FCC 15.247(d) was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 3 kHz, the video bandwidth set at 30 kHz, and the sweep time set at 500 seconds. The spectral lines were resolved for the modulated carriers at 2.412 GHz, 2.437 GHz, and 2.462 GHz respectively. These levels are below the +8 dBm limit. See the power spectral density table and plots.

Note: This test is not applicable for the Bluetooth transmitter.

Table 7-1: Power Spectral Density Test Equipment

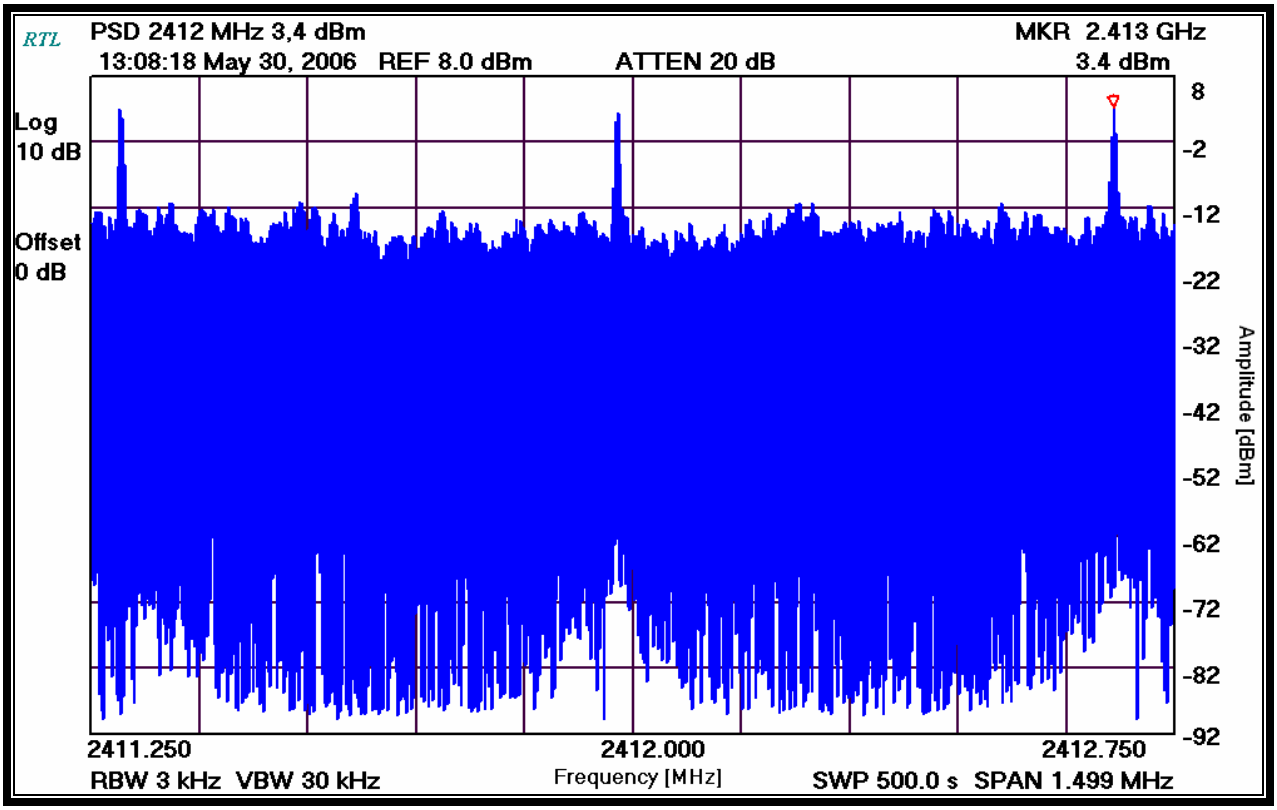
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	8/3/06

7.2 Power Spectral Density Test Data – DSSS WLAN

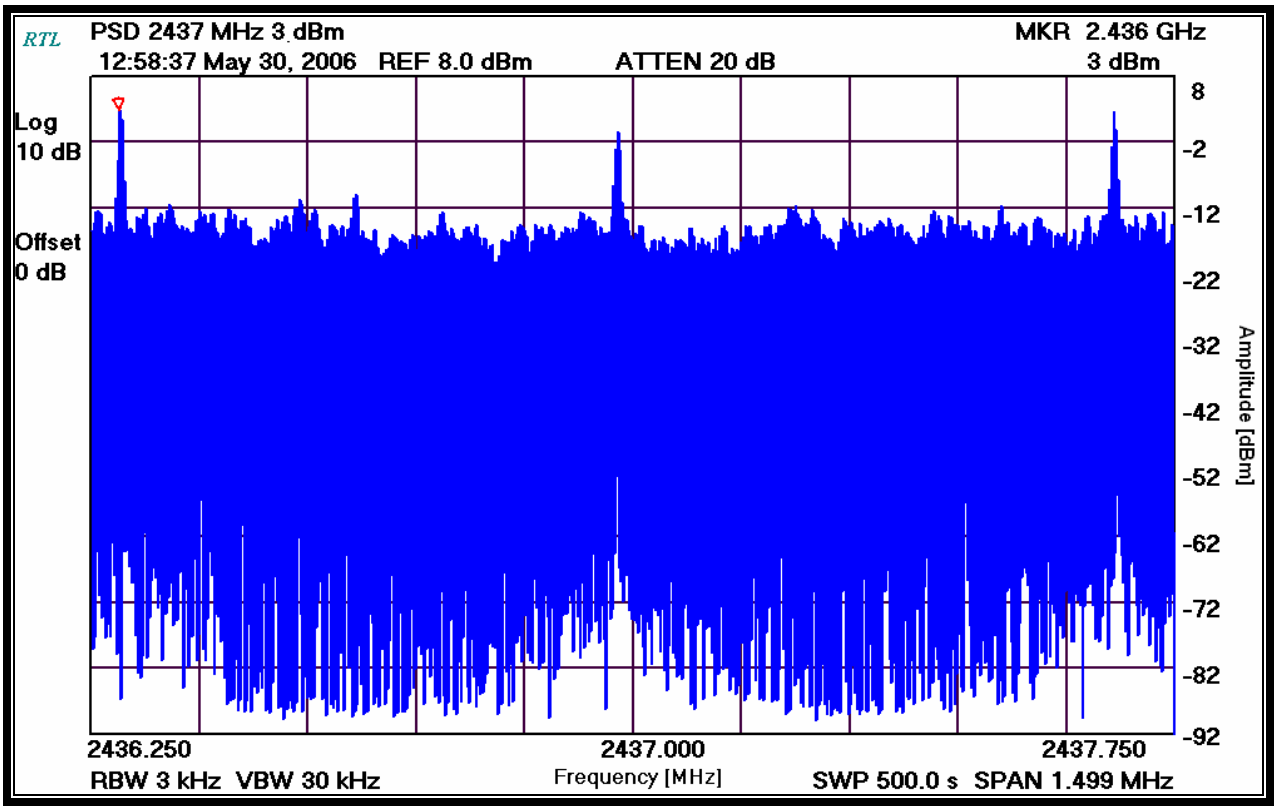
Table 7-2: Power Spectral Density Test Data – DSSS WLAN

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	3.4	8	Pass
6	2437	3.0	8	Pass
11	2462	3.5	8	Pass

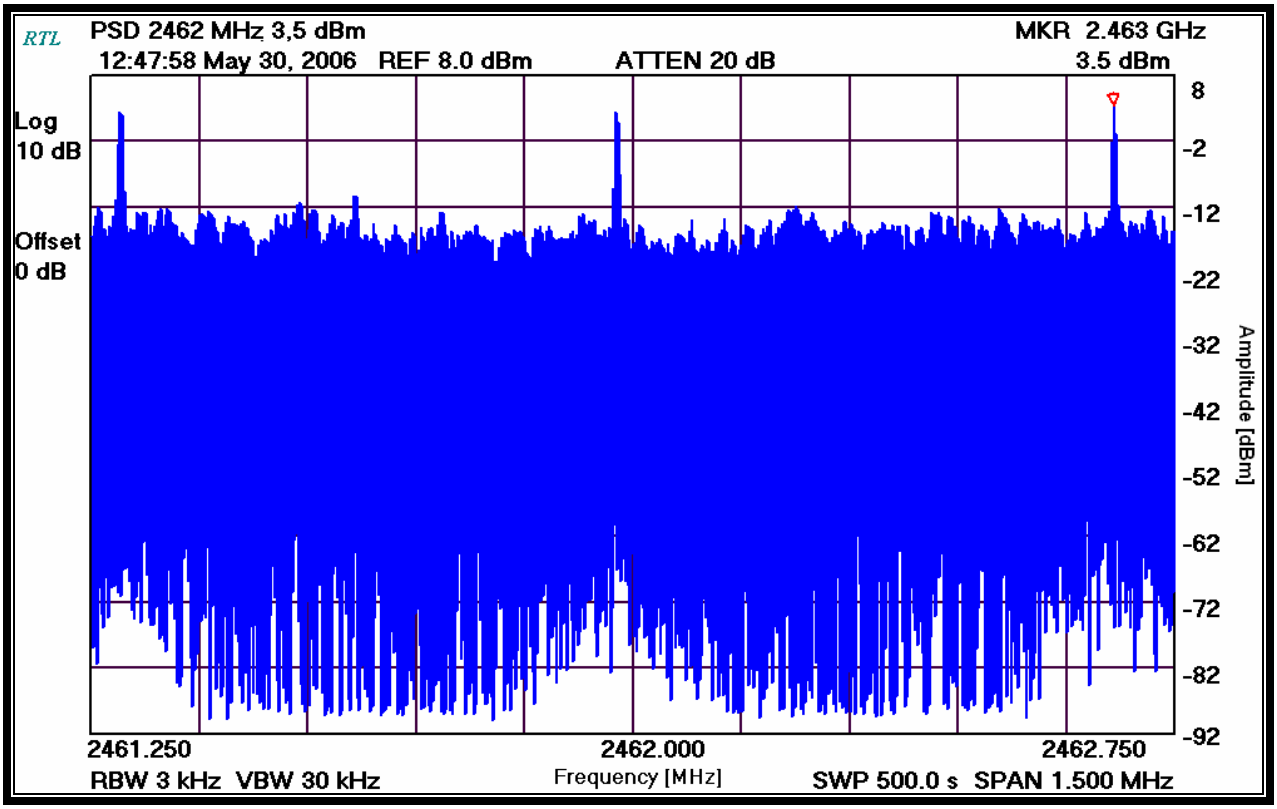
Plot 7-1: Power Spectral Density: Channel 1 (2412 MHz)



Plot 7-2: Power Spectral Density: Channel 6 (2437 MHz)



Plot 7-3: Power Spectral Density: Channel 11 (2462 MHz)



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	May 30, 2006
Test Engineer	Signature	Date Of Test

8 20 dB Bandwidth – FCC §15.247(a)(1)(ii); IC RSS-210 A8.1(1)

8.1 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 auto and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 100 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 and modulated with a 2 Mbps data rate. The table below contains the bandwidth measurement results.

Note: This test is not applicable for the DSSS WLAN transmitter.

Table 8-1 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	8/03/2006

8.2 20 dB Modulated Bandwidth Test Data - Bluetooth

Table 8-2 20 dB Modulated Bandwidth Test Data - Bluetooth

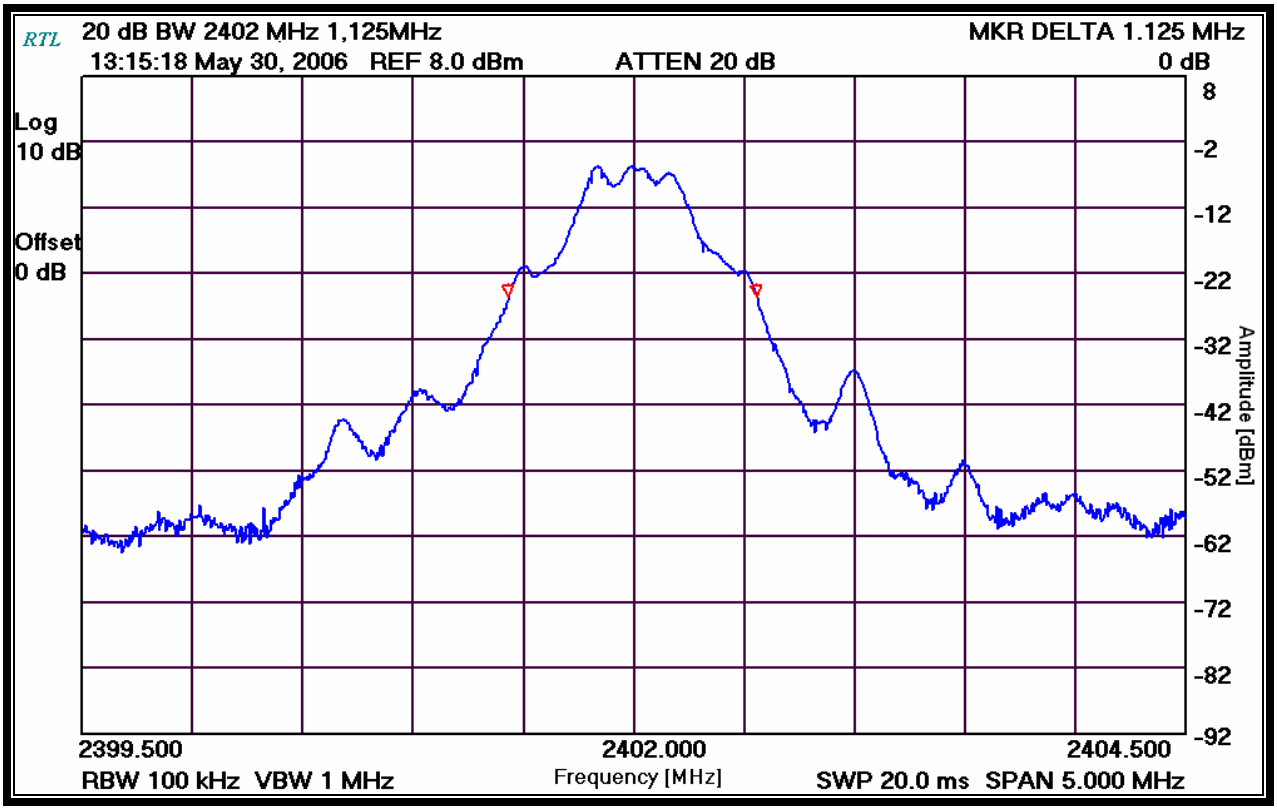
Minimum 20 dB bandwidths

Channel	20 dB Bandwidth (MHz)
0	1.125
39	1.138
78	1.140

8.3 20 dB Bandwidth Plots

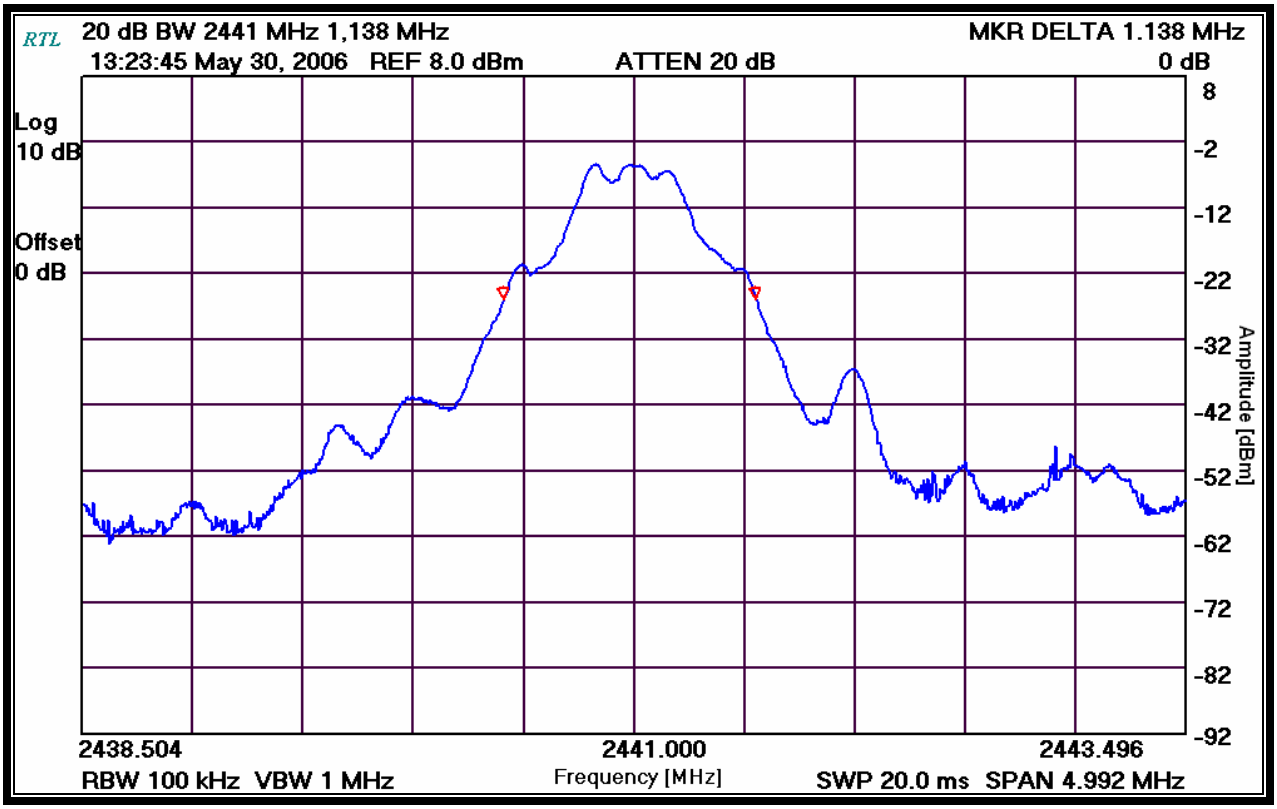
Channel:	0
Channel Frequency (MHz):	2402
Resolution Bandwidth (kHz):	100
Video Bandwidth (MHz):	1

Plot 8-1: 20 dB Bandwidth Channel 0



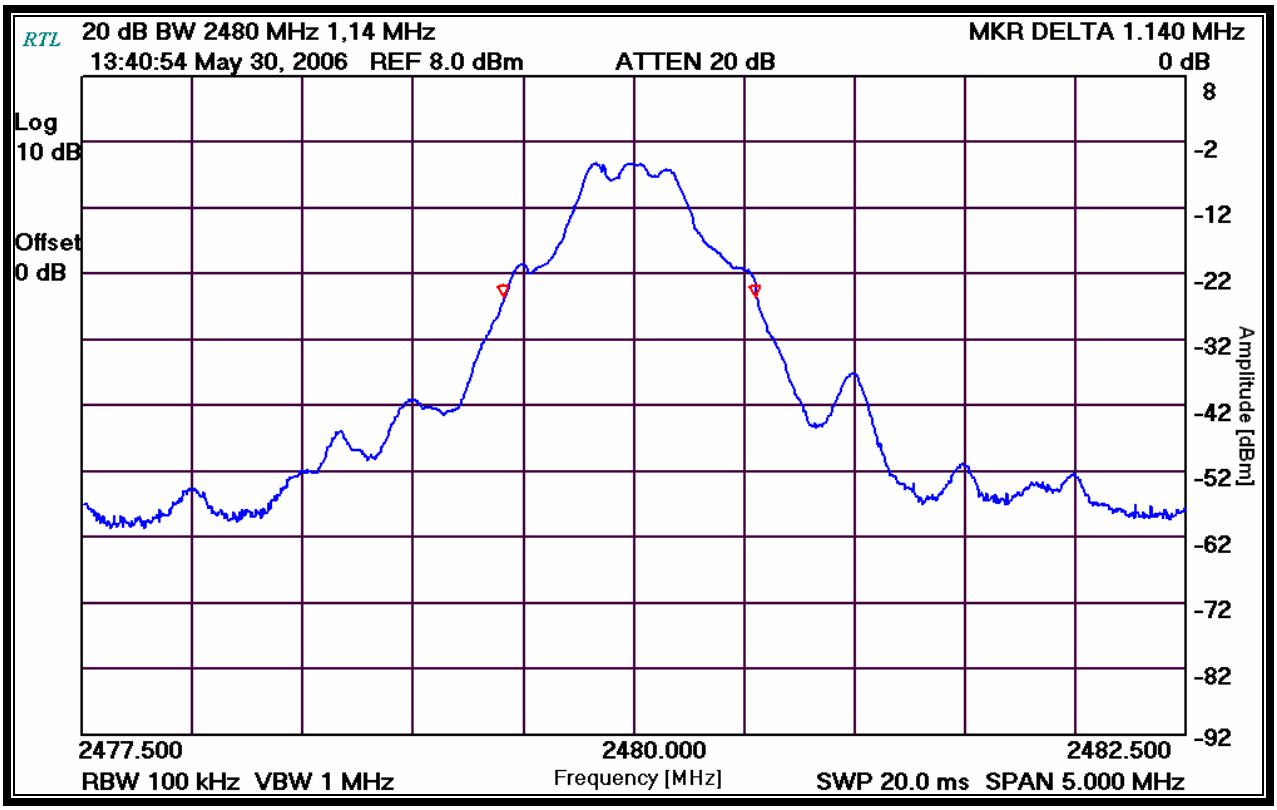
Channel:	38
Channel Frequency (MHz):	2440
Resolution Bandwidth (kHz):	100
Video Bandwidth (MHz):	1

Plot 8-2: 20 dB Bandwidth Channel 38

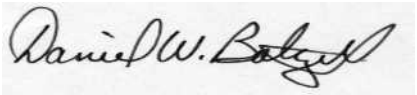


Channel:	78
Channel Frequency (MHz):	2480
Resolution Bandwidth (kHz):	100
Video Bandwidth (MHz):	1

Plot 8-3: 20 dB Bandwidth Channel 78



Test Personnel:

Daniel W. Baltzell		May 30, 2006
Test Engineer	Signature	Date Of Test

9 Carrier Frequency Separation – FCC §15.247(a)(1); IC RSS-210 A8.1(2)

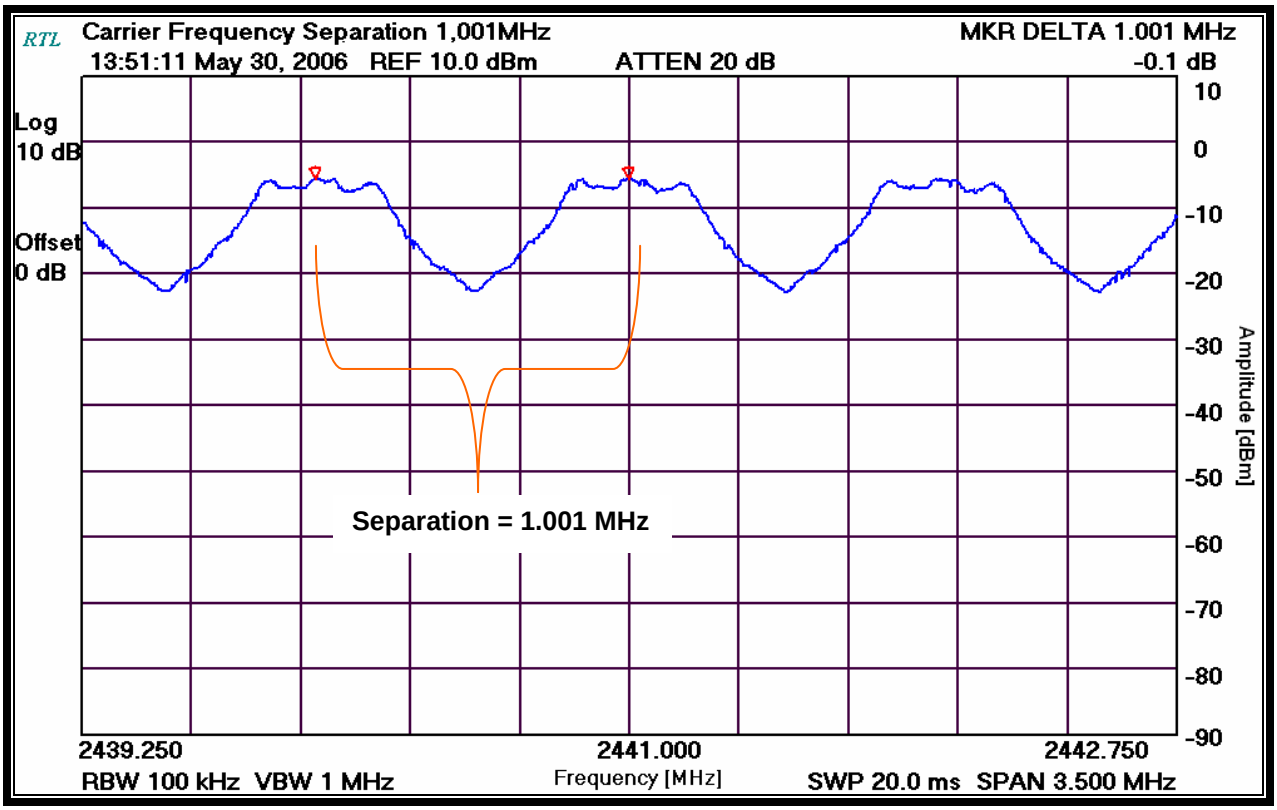
9.1 Carrier Frequency Separation Test Procedure

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.

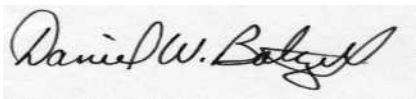
Measured frequency separation = 1.001 MHz

9.2 Carrier Frequency Separation Test Data

Plot 9-1: Carrier Frequency Separation - Bluetooth



Test Personnel:

Daniel W. Baltzell		May 30, 2006
Test Engineer	Signature	Dates Of Test

10 Hopping Characteristics – FCC §15.247(a)(1)(iii); IC RSS-210 A8.1(4)

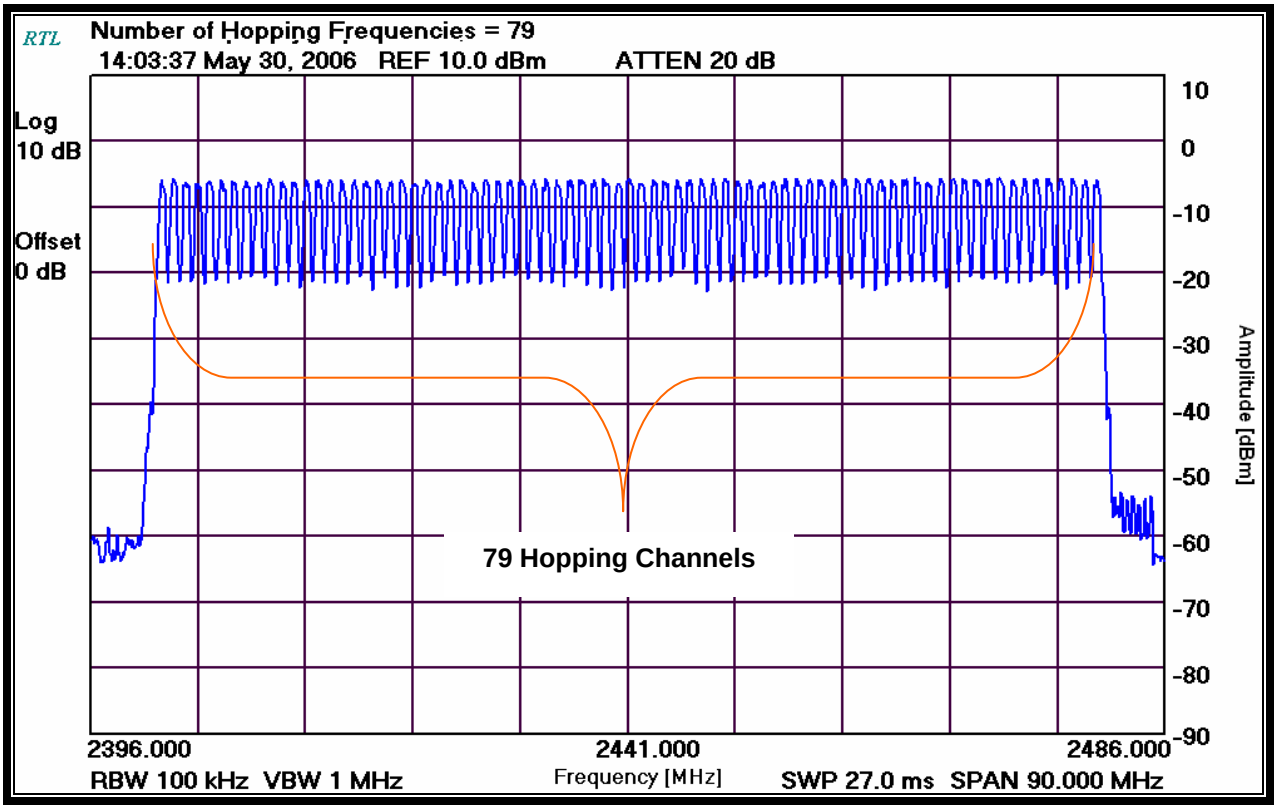
10.1 Hopping Characteristics Test Procedure

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 is used.

10.2 Number of Hopping Frequencies - Bluetooth

Measured number of hopping frequencies = 79

Plot 10-1: Number of Hopping Frequencies



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	May 30, 2006
Test Engineer	Signature	Date Of Test

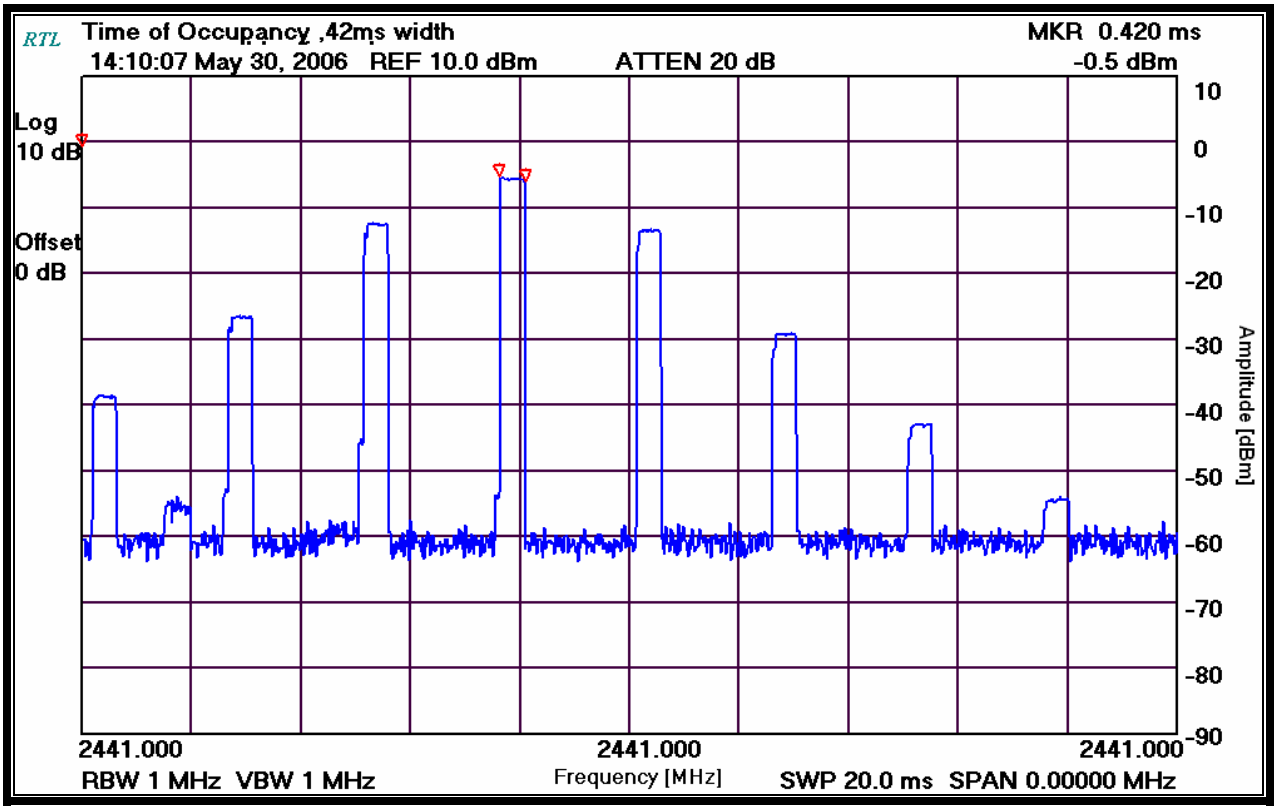
10.3 Average Time of Occupancy - Bluetooth

The spectrum analyzer sweep was set to 0.02 second, 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).

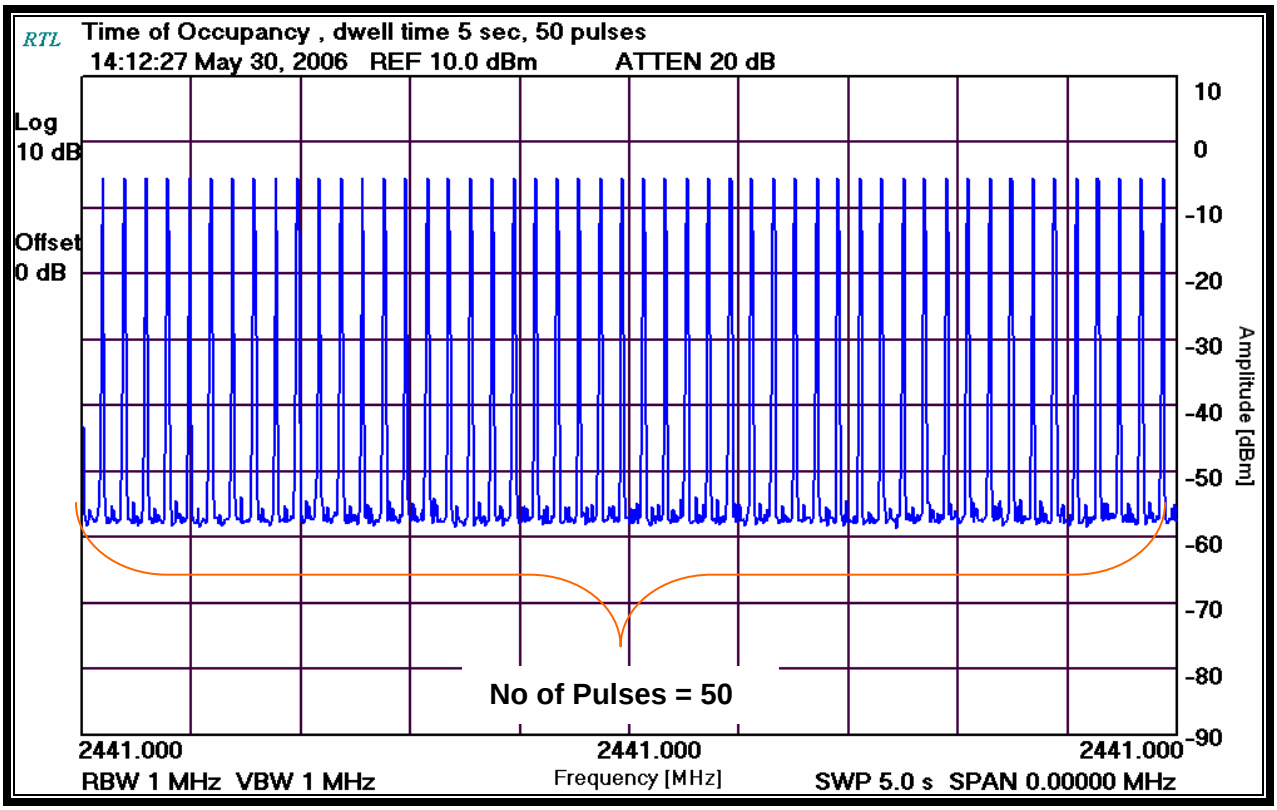
The number of pulses in 5 s was 50. Therefore, the number of pulses in a period of 0.4 seconds x 79 hopping channels (31.6 s) would be 316 pulses.

The average time of occupancy in the above period (31.6 s) is equal to 316 pulses x 0.42 ms = 133 ms, which meets the limit as defined by 15.247(a)(1)(iii) of 0.4 seconds.

Plot 10-2: Time of Occupancy (Dwell Time)



Plot 10-3: 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:

Daniel W. Baltzell	Daniel W. Baltzell	May 30, 2006
Test Engineer	Signature	Dates Of Test

11 Conducted Emissions Measurement Limits – FCC §15.207; RSS-Gen

11.1 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

11.2 Conducted Emissions Measurement Test Procedure

The conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 0.8 meters high. Power was fed to the EUT through a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an AC 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 AC 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 AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 7 kHz high-pass filter. The filter was used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average 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 were performed in a linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by decreasing the sweep time in order to obtain a calibrated measurement. The highest emissions amplitudes relative to the appropriate limits were measured and have been recorded in this report.

Table 11-1: Conducted Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	8/3/06
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	8/3/06
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/06
900889	Hewlett Packard	85685A	RF Preselector (20 Hz - 2 GHz)	3146A01309	4/12/07
901083	AFJ International	LS16	16A LISN (110 V)	16010020080	3/28/08
N/A	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Emissions testing software Rev. 14.0.2	N/A	N/A

11.3 Conducted Emissions Test Results

11.3.1 Conducted Emissions Transmit Channel 6 FHSS/DSSS

Table 11-2: Conducted Emissions Transmit Channel 6 FHSS/DSSS Neutral Side (Line 1)

Temperature: 74°F Humidity: 40%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.152	Pk	49.0	0.2	49.2	65.9	-16.7	55.9	-6.7	Pass
0.210	Pk	40.9	0.2	41.1	63.2	-22.1	53.2	-12.1	Pass
0.391	Pk	34.3	0.3	34.6	58.0	-23.4	48.0	-13.4	Pass
0.657	Pk	35.9	0.2	36.1	56.0	-19.9	46.0	-9.9	Pass
1.004	Pk	35.4	0.4	35.8	56.0	-20.2	46.0	-10.2	Pass
2.760	Pk	28.6	0.9	29.5	56.0	-26.5	46.0	-16.5	Pass
6.000	Pk	28.4	1.4	29.8	60.0	-30.2	50.0	-20.2	Pass

Table 11-3: Conducted Emissions Transmit Channel 6 FHSS/DSSS Hot Side (Line 2)

Temperature: 74°F Humidity: 40%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.200	Pk	41.6	0.2	41.8	63.6	-21.8	53.6	-11.8	Pass
0.228	Pk	39.1	0.1	39.2	62.5	-23.3	52.5	-13.3	Pass
0.726	Pk	33.1	0.4	33.5	56.0	-22.5	46.0	-12.5	Pass
1.011	Pk	33.1	0.4	33.5	56.0	-22.5	46.0	-12.5	Pass
3.040	Pk	29.2	1.0	30.2	56.0	-25.8	46.0	-15.8	Pass
6.510	Pk	29.2	1.5	30.7	60.0	-29.3	50.0	-19.3	Pass

11.3.2 Conducted Emissions Receive Channel 6 FHSS/DSSS

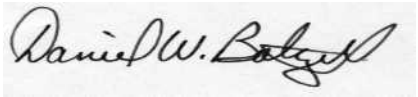
Table 11-4: Conducted Emissions Receive Channel 6 FHSS/DSSS Neutral Side (Line 1)

Temperature: 74°F Humidity: 40%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.156	Pk	47.4	0.2	47.6	65.7	-18.1	55.7	-8.1	Pass
0.214	Pk	40.1	0.2	40.3	63.0	-22.7	53.0	-12.7	Pass
0.702	Pk	36.2	0.4	36.6	56.0	-19.4	46.0	-9.4	Pass
1.157	Pk	35.0	0.4	35.4	56.0	-20.6	46.0	-10.6	Pass
2.810	Pk	27.9	0.9	28.8	56.0	-27.2	46.0	-17.2	Pass
6.120	Pk	27.8	1.4	29.2	60.0	-30.8	50.0	-20.8	Pass

Table 11-5: Conducted Emissions Receive Channel 6 FHSS/DSSS Hot Side (Line 2)

Temperature: 74°F Humidity: 40%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.164	Pk	42.4	0.2	42.6	65.3	-22.7	55.3	-12.7	Pass
0.216	Pk	40.7	0.2	40.9	63.0	-22.1	53.0	-12.1	Pass
1.008	Pk	33.2	0.4	33.6	56.0	-22.4	46.0	-12.4	Pass
1.502	Pk	32.3	0.6	32.9	56.0	-23.1	46.0	-13.1	Pass
2.980	Pk	28.9	1.0	29.9	56.0	-26.1	46.0	-16.1	Pass
5.980	Pk	30.0	1.4	31.4	60.0	-28.6	50.0	-18.6	Pass

Test Personnel:



Daniel W. Baltzell		May 30, 2006
Test Engineer	Signature	Date Of Test

12 Radiated Emissions – FCC §15.209; RSS-210 §A8.5 and RSS-Gen

12.1 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.

12.2 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 10^{th} 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.

Table 12-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Antenna (Loop, 9 kHz - 30 MHz)	827525/019	8/25/06
901365	Miteq	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28 dB gain, power 5 dB	1094152	3/24/07
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900905	Rhein Tech Labs	PR-1040	OATS 1 Preamplifier 40 dB (30 MHz – 2 GHz)	1006	3/15/07
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
901218	EMCO	3301B	Horn Antenna (18 - 26.5 GHz)	960281-003	5/20/07
900392	Hewlett Packard	1197OK	Harmonic Mixer (18 – 26.5 GH)z	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	4/12/07

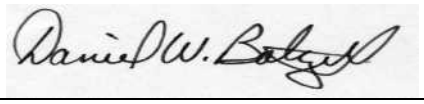
12.3 Radiated Emissions Test Results

12.3.1 Radiated Emissions Digital/Receiver Test Data

Table 12-2: Digital/Receiver Radiated Emissions

Temperature: 92°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**
294.884	Qp	H	20	1.0	43.6	-13.4	30.2	46.0	-15.8	Pass
417.744	Qp	H	300	1.0	41.9	-9.0	32.9	46.0	-13.1	Pass
430.030	Qp	H	300	1.0	41.4	-8.9	32.5	46.0	-13.5	Pass
442.316	Qp	H	300	1.0	50.7	-9.1	41.6	46.0	-4.4	Pass
454.606	Qp	H	300	1.0	41.8	-8.7	33.1	46.0	-12.9	Pass
466.892	Qp	H	300	1.0	46.7	-8.2	38.5	46.0	-7.5	Pass
491.456	Qp	H	30	1.2	39.9	-8.0	31.9	46.0	-14.1	Pass

Test Personnel:



Daniel W. Baltzell		May 30, 2006
Test Engineer	Signature	Dates Of Test

12.3.2 Radiated Emissions Harmonics/Spurious Test Data - WLAN DSSS

Table 12-3: Radiated Emissions Harmonics/Spurious Channel 1 (TX Frequency: 2412 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)
4824.0	54.5	39.0	14.2	53.2	54.0	-0.8
7236.0	51.3	37.7	13.1	50.8	79.9	-29.1
9648.0	40.0	29.3	18.6	47.9	79.9	-32.0
12060.0	39.5	25.7	19.9	45.6	54.0	-8.4
14472.0	41.7	28.0	22.5	50.5	54.0	-3.5
16884.0	42.8	28.3	25.4	53.7	79.9	-26.2

Table 12-4: Radiated Emissions Harmonics/Spurious Channel 6 (TX Frequency: 2437 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)
4874.0	52.3	37.2	14.4	51.6	54.0	-2.4
7311.0	55.2	39.5	13.1	52.6	54.0	-1.4
9748.0	41.7	31.0	18.1	49.1	78.7	-29.6
12185.0	40.8	26.0	18.5	44.5	54.0	-9.5
14622.0	43.2	28.3	23.4	51.7	78.7	-27.0
17059.0	42.7	28.7	25.9	54.6	78.7	-24.1

Table 12-5: Radiated Emissions Harmonics/Spurious Channel 11 (TX Frequency: 2462 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)
4924.0	53.2	37.8	14.7	52.5	54.0	-1.5
7386.0	49.2	35.0	13.3	48.3	54.0	-5.7
9848.0	42.2	28.7	18.1	46.8	78.1	-31.3
12310.0	38.0	27.2	18.7	45.9	54.0	-8.1
14772.0	39.5	27.7	24.1	51.8	78.1	-26.3
17234.0	40.5	28.7	24.3	53.0	78.1	-25.1

12.3.3 Radiated Emissions Harmonics/Spurious Test Data – Bluetooth – Fixed Frequency

Table 12-6: 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	41.7	27.8	14.3	42.1	54.0	-11.9
7206.0	42.2	27.8	13.1	40.9	76.8	-35.9
9608.0	41.7	27.2	18.7	45.9	76.8	-30.9
12010.0	41.2	26.5	19.5	46.0	54.0	-8.0
14412.0	42.8	28.2	23.1	51.3	76.8	-25.5
16814.0	43.0	27.2	25.3	52.5	76.8	-24.3

Table 12-7: 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	42.7	27.5	14.5	42.0	54.0	-12.0
7320.0	41.8	27.8	13.1	40.9	54.0	-13.1
9760.0	41.7	26.5	18.0	44.5	78.0	-33.5
12200.0	41.0	26.2	18.4	44.6	54.0	-9.4
14640.0	43.5	28.5	23.6	52.1	78.0	-25.9
17080.0	42.5	28.5	25.6	54.1	78.0	-23.9

Table 12-8: 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	39.7	27.7	14.6	42.3	54.0	-11.7
7440.0	39.3	28.7	13.4	42.1	54.0	-11.9
9920.0	39.2	26.5	18.4	44.9	77.9	-33.0
12400.0	39.2	26.5	22.0	48.5	54.0	-5.5
14880.0	41.3	27.7	24.4	52.1	77.9	-25.8
17360.0	40.0	27.5	23.9	51.4	77.9	-26.5

12.3.4 Radiated Emissions Harmonics/Spurious Test Data – Bluetooth – Hopping

Table 12-9: Radiated Emissions Harmonics/Spurious Hopping Mode

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)
4805.8	45.3	26.7	0.3	27.0	54.0	-27.0
4824.2	46.7	27.3	0.3	27.6	54.0	-26.4
4843.0	49.3	26.7	0.5	27.2	54.0	-26.8
4863.8	45.2	26.5	0.2	26.7	54.0	-27.3
7313.3	46.8	27.7	3.0	30.7	54.0	-23.3

Test Personnel:

Daniel W. Baltzell		May 31 and June 29, 2006
Test Engineer	Signature	Dates Of Test

13 Conclusion

The data in this measurement report shows that the EUT as tested, Vocollect, Inc. Model # TT-700-100_R WF, FCC ID: MQOTT700-20000, IC: 2570A-TT700200, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and Industry Canada RSS-210.