Engineering and Testing for EMC and Safety Compliance

CERTIFICATION APPLICATION REPORT
FCC PART 15.247 CERTIFICATION & INDUSTRY CANADA CERTIFICATION

Test Lab:	Applicant Information:
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FCC ID:	I28-QL420352	**GRANTEE FRN NUMBER:**	0006-3040-75
PLAT FORM:	N/A	**RTL WORK ORDER NUMBER:**	2003016
MODEL(S):	QL420	**RTL QUOTE NUMBER:**	QRTL03-716
DATE OF TEST REPORT:	March 31, 2003		

Standards and Procedures:	ANSI 63.4, DA00-705 (FHSS) and FCC 97-114 (DSSS)
FCC Classification:	DSSS Direct Sequence Spread Spectrum
FCC Rule Part(s):	Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System
Industry Canada Standard:	RSS-210: Low Power License-Exempt Radio Communication Devices (All Frequency Bands)
Digital Interface Information	Digital Interface was found to be compliant
Receiver Information	Receiver was found to be compliant

Frequency Range (MHz)	Output Power*(W)	Frequency Tolerance	Emission Designator
2412-2462	0.157	N/A	N/A

* output power is maximum peak conducted

We, 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. See Modifications, Section 1.4, for information on the changes that 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 FCC Part 2, FCC Part 15, Industry Canada RSS-210, ANSI 63.4, DA00-705 (FHSS) and FCC 97-114 (DSSS).

Signature: _____ Date: March 31, 2003

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

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.

IC RSS-210 Section 6.2.2(o): 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.

A direct sequence (DS) system is a spread spectrum (SS) system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high-speed code sequence dominates the "modulating function" and is the direct cause of the wide spreading of the transmitted signal.

1.2 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 1992).

1.3 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for Certification for M/N: QL420, FCC ID: I28-QL420352. The IF, LO and up to the 2nd LO were investigated and tested.

1.4 MODIFICATIONS

Modifications were implemented to improve grounding around the PCMCIA WLAN card. The grounding between the PCMCIA frame and PCB ground was improved using gasket material and copper tape below the PCMCIA PCB. Additionally, plastic standoffs between the PCMCIA frame and PCB were replaced with metal standoffs. These changes resulted in at least a 9 dB reduction in signals emanating from the PCMCIA card, which previously did not meet FCC Part 15.209 emission limits.

2 TEST INFORMATION

2.1 TEST JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. Channel 1 at 2412 MHz, Channel 6 at 2437 MHz and channel 11 at 2462 MHz were tested and investigated from 9 kHz to 24 GHz. Data for all three channels are presented in this report.

The EUT contains an internal patch antenna. The patch antenna transmits, receives, and is connected to the antenna port available.

The worst-case data taken in this report represents the highest data rate at 11 MBPS. Data rates of 5.5 MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance. The change in envelope did not cause the EUT to be non-compliant in any of the aforementioned modes.

2.2 EXERCISING THE EUT

The EUT was provided with the software to continuously transmit during testing. The carrier was also checked to verify that the information was being transmitted.

2.3 TEST RESULT SUMMARY

TABLE 2-1: TEST RESULT SUMMARY WITH FCC RULES AND REGULATIONS

STANDARD	TEST	PASS/FAIL OR N/A
FCC 15.205	Compliance with the Restricted Band Edge	Pass
FCC 15.207	Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(a)(2)	Modulated Bandwidth	Pass
FCC 15.247(b)	Power Output	Pass
FCC 15.247(c)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Power Spectral Density	Pass

2.4 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment and descriptions of all cables used in the tested system are:

TABLE 2-2: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
WIRELESS PRINTER	ZEBRA TECHNOLOGIES	QL420	XXJS03-01-0015	I28-QL420352	N/A	015009
WIRELESS LAN ADAPTER	CISCO SYSTEMS	AIR-LMC352	VEM064405A1	LDK102040	N/A	N/A

2.5 CONFIGURATION OF TESTED SYSTEM

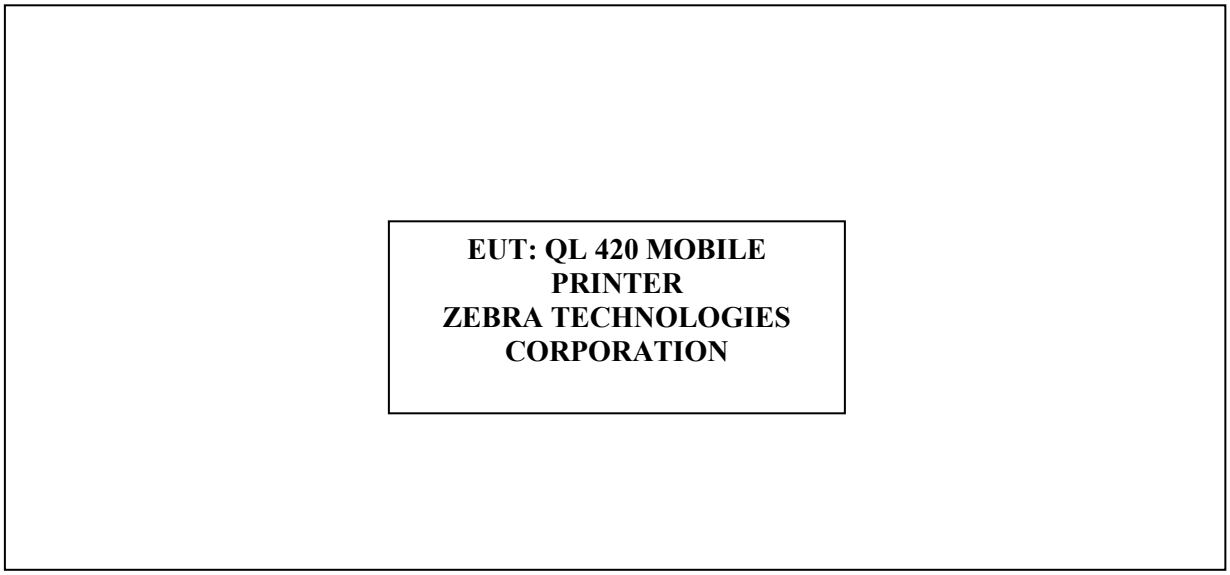


FIGURE 1: WORST CASE CONFIGURATION OF SYSTEM UNDER TEST

3 COMPLIANCE WITH THE RESTRICTED BAND EDGE - §15.205

3.1 TEST PROCEDURE

Compliance with the band edges was performed using the FCC's "Radiated Measurement at a Band Edge" guidance document. The final data derived below were from radiated measurements only. The data taken in this report represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance.

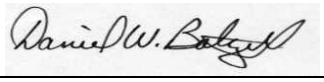
3.2 COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA

Operating Frequency (MHz): 2412-2462
Channel: 1 & 11
Distance: 3 meters
Limit: 54 dBuV/m

TABLE 3-1: COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBµV/m)	Corrected Field Strength Level (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	54.0	43.0	54.0	-11.0
11	2483.5	Absolute measurement	55.4	44.4	54.0	-9.6

TEST PERSONNEL:



Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

3.3 RESTRICTED BAND EDGE PLOTS

Calculation of Lower Band Edge

The level 104.3 dBuV/m is the average field strength measurement, from which the delta measurement of 59.0 dB is subtracted (reference plots), which is equivalent to a level of 45.3 dB. This level has a margin of 8.7 dB below the limit of 54 dBuV/m.

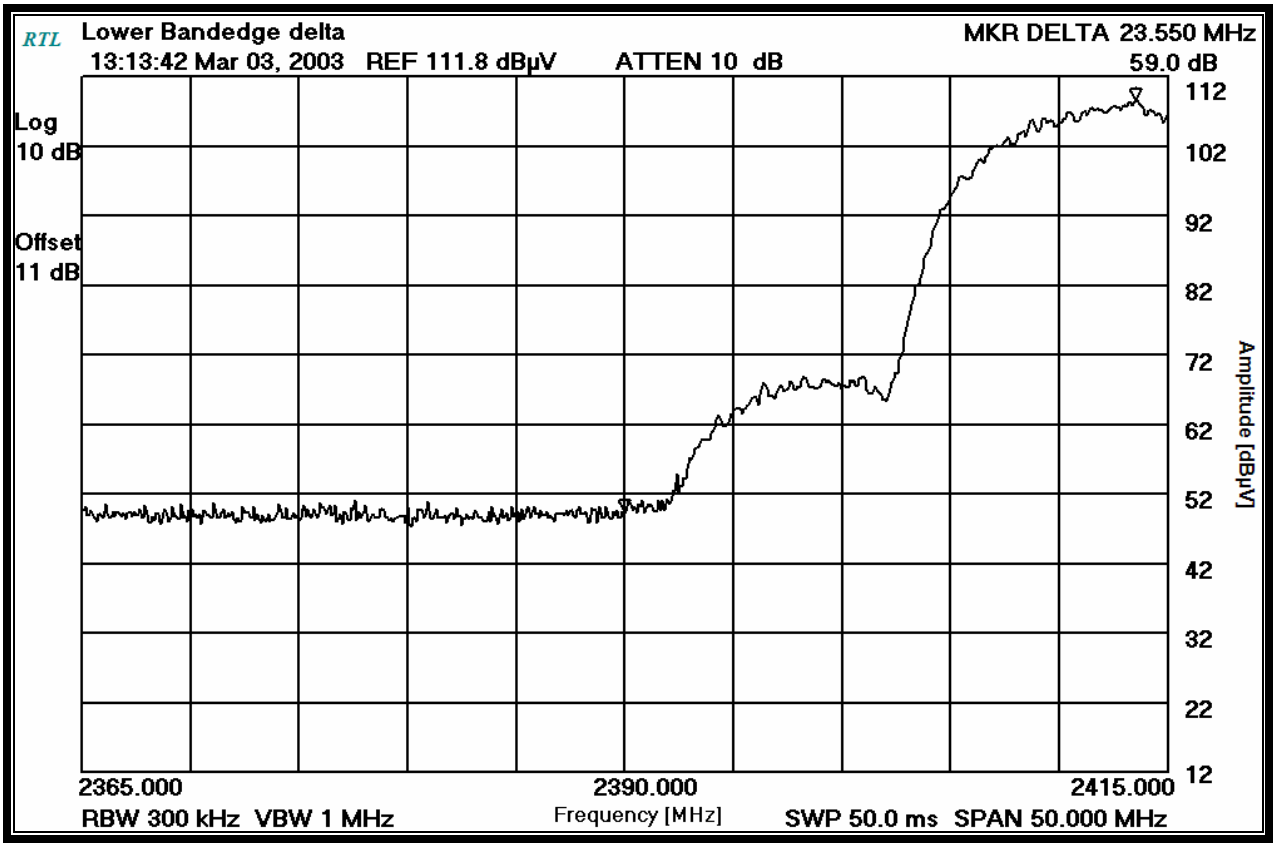
Calculation: 104.3 dBuV/m – 59.0 dB – 54 dBuV/m = -8.7 dB

Peak field strength of Channel 1(1 MHz RBW/1 MHz VBW) = 111.7 dBuV/m
Average field strength of Channel 1(1 MHz RBW/10 Hz VBW) = 104.3 dBuV/m

Delta measurement: 59.0 dB

Channel Number:	1
Frequency:	2412 MHz
Resolution Bandwidth:	300 kHz
Video Bandwidth:	1 MHz
Sweep Time:	50.0 ms

PLOT 3-1: LOWER BAND EDGE: DELTA MEASUREMENT

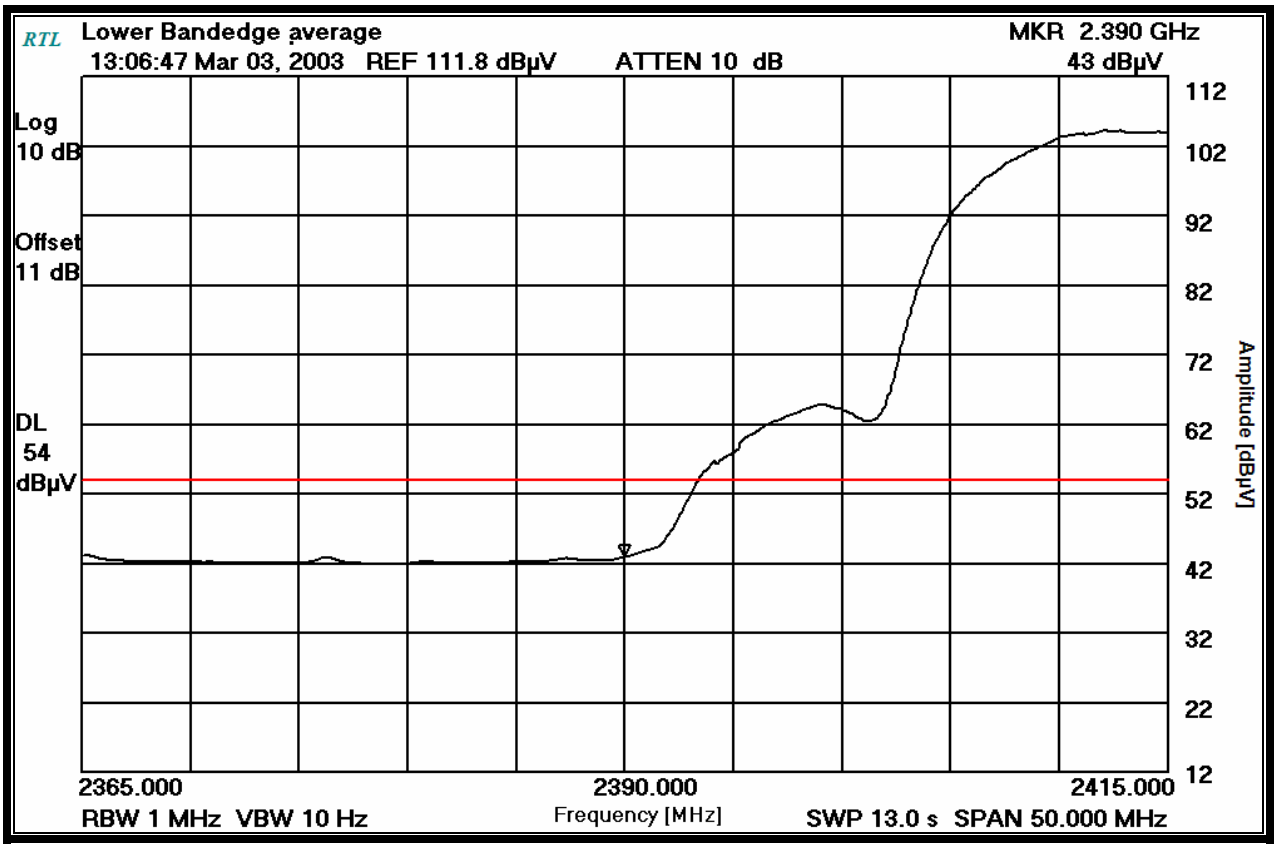


TEST PERSONNEL:

Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

Channel Number:	1
Frequency:	2412 MHz
Resolution Bandwidth:	1 MHz
Video Bandwidth:	10 Hz
Sweep Time:	13.0 s

PLOT 3-2: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1

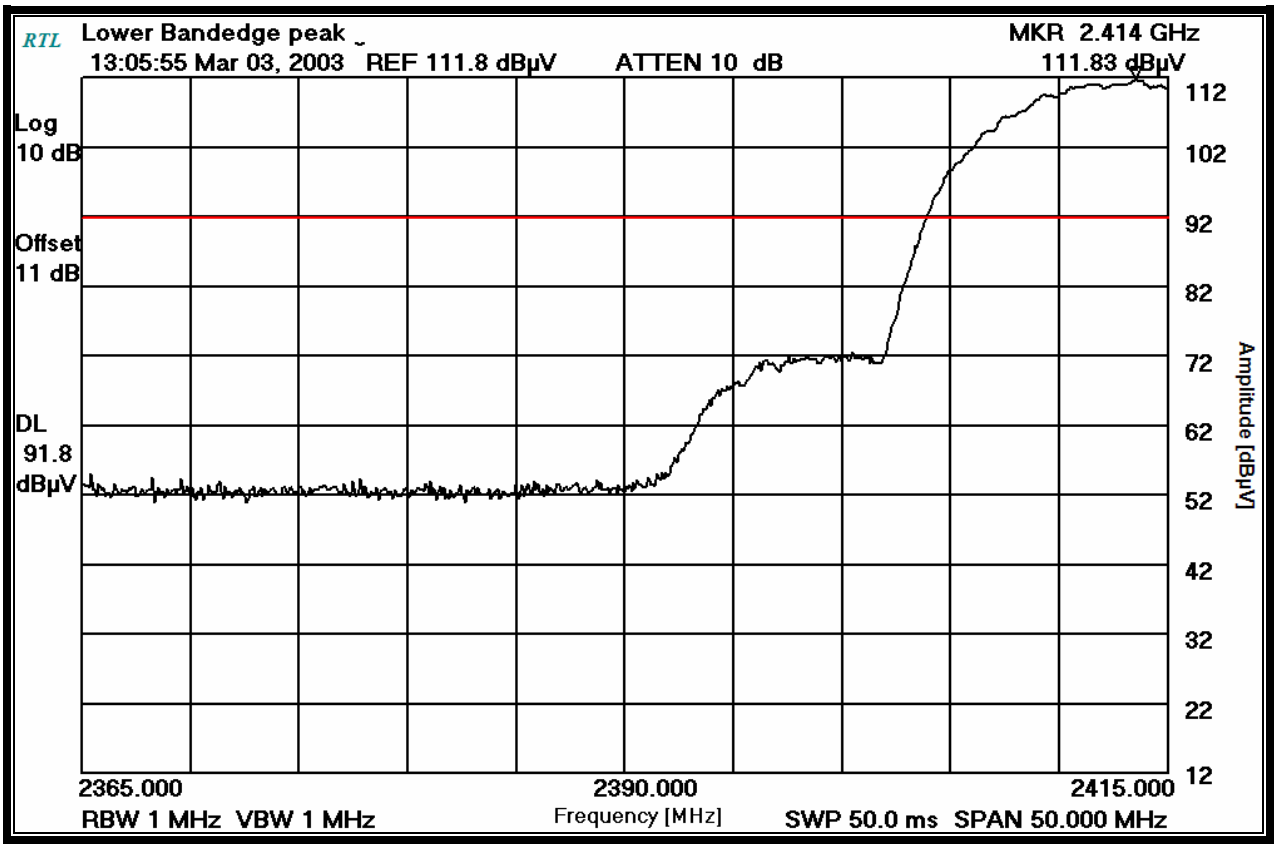


TEST PERSONNEL:

Daniel W. Baltzell	Daniel W. Baltzell	March 3, 2003
Test Engineer	Signature	Date Of Test

Channel Number:	1
Frequency:	2412 MHz
Bandwidth Resolution:	1 MHz
Video Bandwidth:	1 MHz
Sweep Time:	50.0 ms

PLOT 3-3: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1



TEST PERSONNEL:

Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

Calculation of Upper Band Edge

The level 102.9 dBuV/m is the average field strength measurement, from which the delta measurement of 58.0 dB is subtracted (reference plots), which is equivalent to a level of 44.9 dB. This level has a margin of 9.1 dB below the limit of 54 dBuV/m.

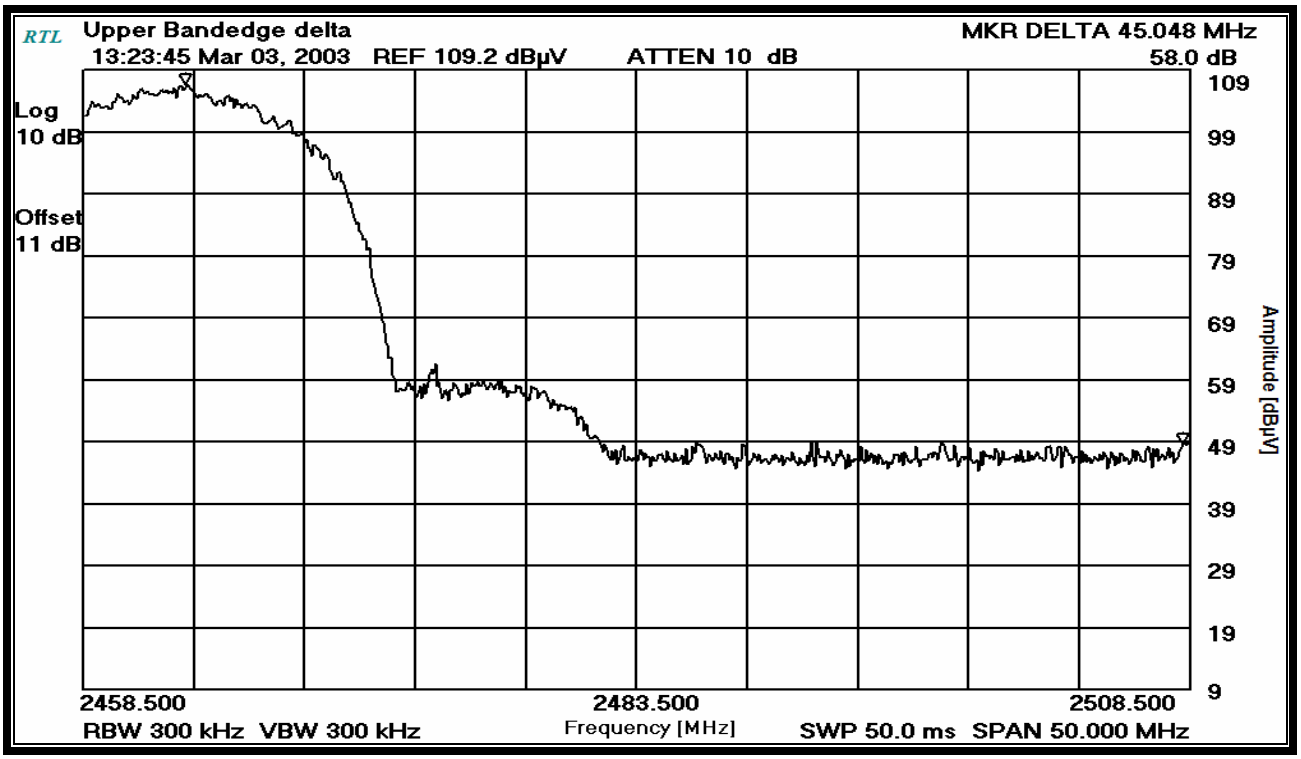
Calculation: 102.9 dBuV/m – 58.0 dB – 54 dBuV/m = -9.1 dB

Peak field strength of Upper Band Edge (1 MHz RBW/1 MHz VBW) = 109.2 dBuV/m
Average field strength of Upper Band Edge(1 MHz RBW/10 Hz VBW) = 102.9 dBuV/m

Delta measurement = 58.0 dB

PLOT 3-4: UPPER BAND EDGE: DELTA MEASUREMENT

Channel Number: 11
Frequency: 2462 MHz
Resolution Bandwidth: 300 kHz
Video Bandwidth: 300 kHz
Sweep Time: 50.0 ms

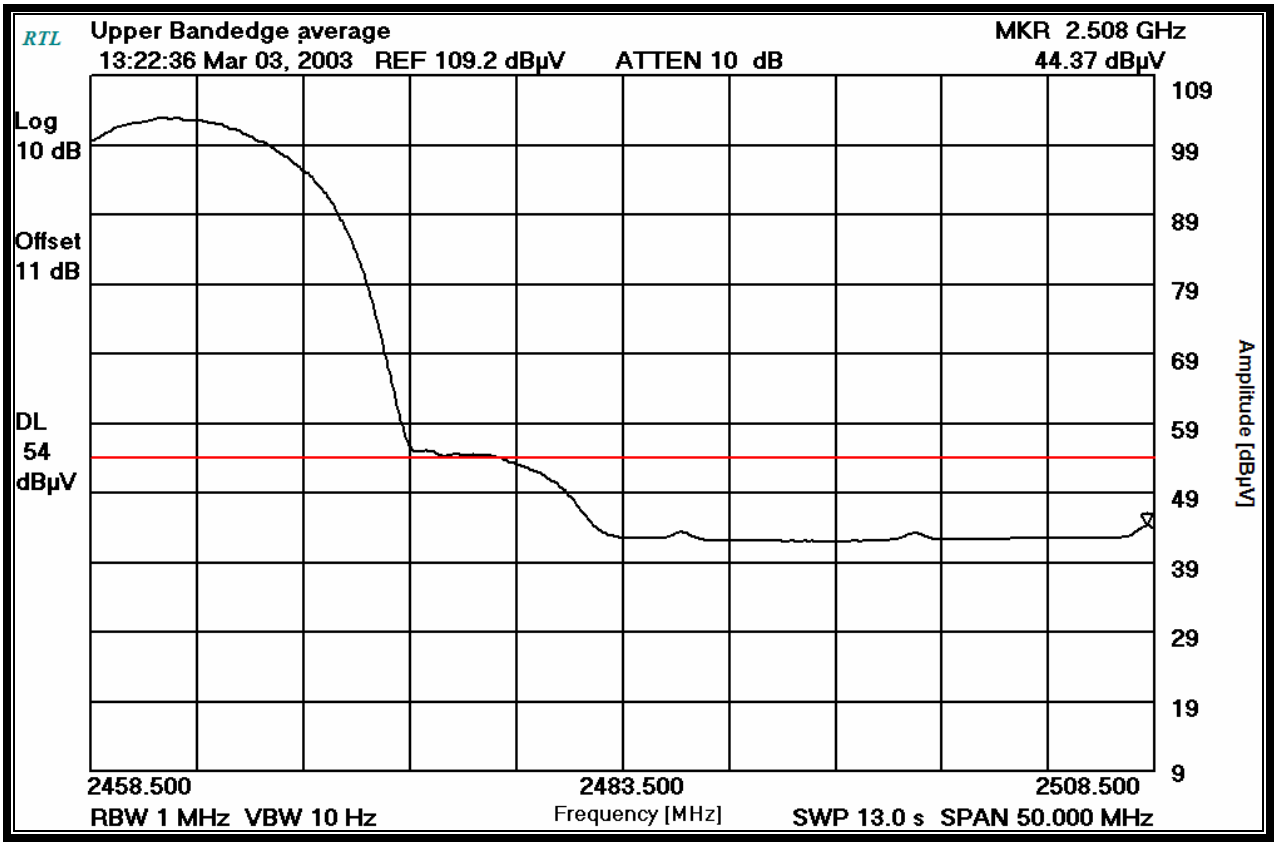


TEST PERSONNEL:

Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

Channel Number:	11
Frequency:	2462 MHz
Resolution Bandwidth:	1 MHz
Video Bandwidth:	10 Hz
Sweep Time:	13.0 s

PLOT 3-5: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11

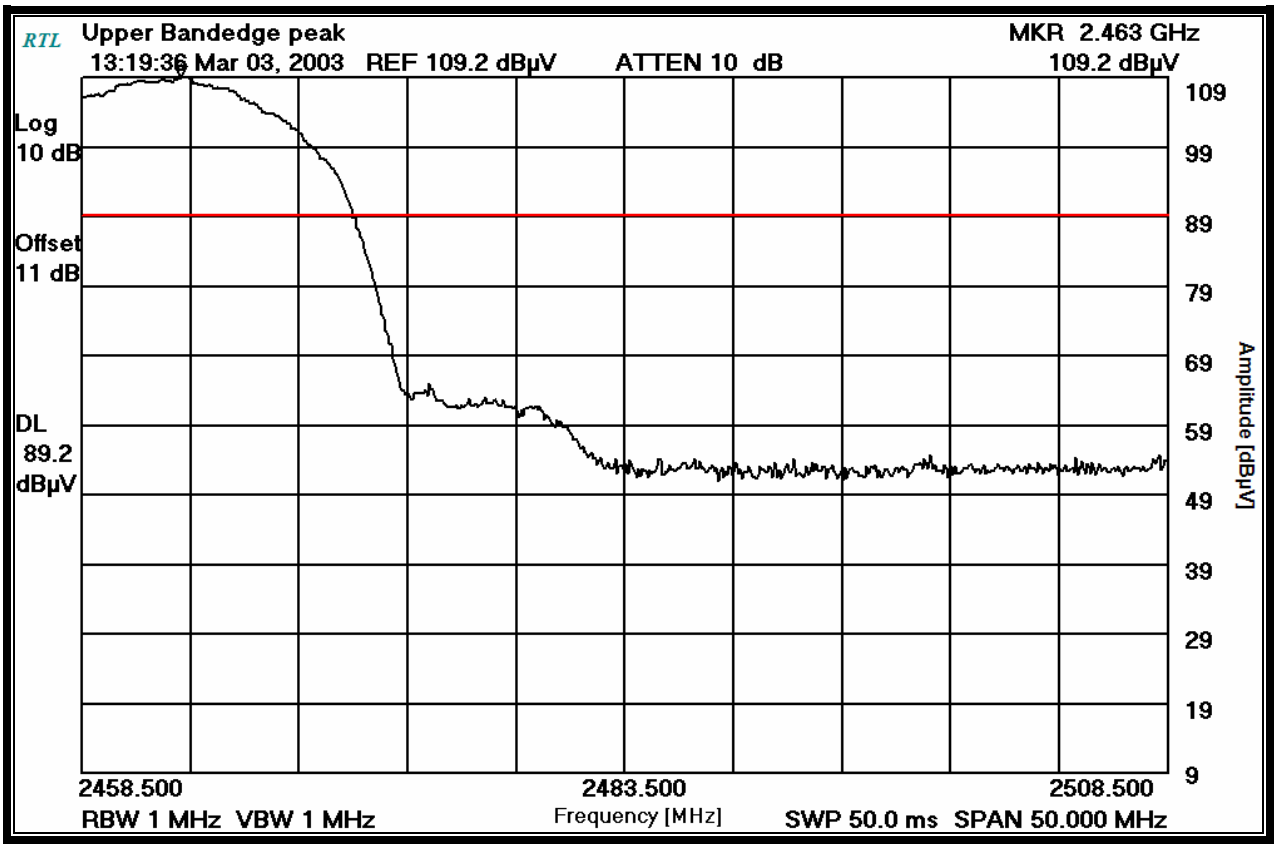


TEST PERSONNEL:

Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

Channel Number:	11
Frequency:	2462MHz
Resolution Bandwidth:	1MHz
Video Bandwidth:	1MHz
Sweep Time:	50.0 ms

PLOT 3-6: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11



TEST PERSONNEL:

Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

3.4 BAND EDGE TEST EQUIPMENT

TABLE 3-2: BAND EDGE TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	Not Required
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	Not Required
900772	EMCO	3161-02	Horn Antenna	9804-1044	Not Required
900666	Hewlett Packard	8449B	Microwave Preamplifier, 1 to 26.5 GHz	3008A00505	Not Required
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	7/2/03

4 CONDUCTED LIMITS - §15.207

4.1 TEST METHODOLOGY FOR CONDUCTED EMISSIONS MEASUREMENTS

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 microhenry 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 through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. 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.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech Quality Manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

4.2 CONDUCTED EMISSION TEST

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode. If the quasi-peak measurement is at least 6dB higher than the amplitude in the average mode, the level measured in the quasi-peak mode may be reduced by 13dB before comparing it to the limit.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE.

TABLE 4-1: CONDUCTED SPURIOUS EMISSIONS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibaration Due Date
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz - 1 GHz)	2521A00743	4/10/03
901084	AFJ international	LS16	16A LISN	16010020082	11/4/03
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz - 1.5 GHz)	2602A00160	4/10/03
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A11239	4/10/03

4.3 CONDUCTED EMISSION TEST DATA

TABLE 4-2: CONDUCTED EMISSIONS (NEUTRAL SIDE) TRANSMITTING CH 1

Temperature: 31°F Humidity: 60%								
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)
0.179	Qp	44.6	1.8	46.4	64.5	-18.1	54.5	-8.1
0.179	Av	37.8	1.8	39.6	64.5	-24.9	54.5	-14.9
0.239	Qp	38.8	1.4	40.2	62.1	-21.9	52.1	-11.9
0.239	Av	32.0	1.4	33.4	62.1	-28.7	52.1	-18.7
0.474	Pk	43.2	0.8	44.0	56.4	-12.4	46.4	-2.4
0.654	Pk	41.0	0.7	41.7	56.0	-14.3	46.0	-4.3
0.716	Pk	40.9	0.7	41.6	56.0	-14.4	46.0	-4.4
0.895	Pk	41.8	0.7	42.5	56.0	-13.5	46.0	-3.5
0.956	Pk	42.1	0.7	42.8	56.0	-13.2	46.0	-3.2
1.008	Pk	43.3	0.7	44.0	56.0	-12.0	46.0	-2.0
8.095	Pk	34.8	2.0	36.8	60.0	-23.2	50.0	-13.2
10.01	Pk	28.1	2.1	30.2	60.0	-29.8	50.0	-19.8
21.03	Pk	30.8	3.2	34.0	60.0	-26.0	50.0	-16.0

TABLE 4-3: CONDUCTED EMISSIONS (PHASE SIDE) TRANSMITTING CH 1

Temperature: 31°F Humidity: 60%								
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)
0.179	Qp	26.5	1.8	28.3	64.5	-36.2	54.5	-26.2
0.179	Av	30.7	1.8	32.5	64.5	-32.0	54.5	-22.0
0.239	Qp	21.4	1.4	22.8	62.1	-39.3	52.1	-29.3
0.239	Av	27.1	1.4	28.5	62.1	-33.6	52.1	-23.6
0.481	Pk	40.4	0.7	41.1	56.3	-15.2	46.3	-5.2
0.784	Pk	39.8	0.6	40.4	56.0	-15.6	46.0	-5.6
0.905	Pk	39.6	0.6	40.2	56.0	-15.8	46.0	-5.8
0.967	Pk	41.0	0.3	41.3	56.0	-14.7	46.0	-4.7
1.016	Pk	41.7	0.7	42.4	56.0	-13.6	46.0	-3.6
5.035	Pk	34.9	1.7	36.6	60.0	-23.4	50.0	-13.4
10.03	Pk	31.4	1.3	32.7	60.0	-27.3	50.0	-17.3
26.93	Pk	26.1	3.5	29.6	60.0	-30.4	50.0	-20.4

TABLE 4-4: CONDUCTED EMISSIONS (NEUTRAL SIDE) TRANSMITTING CH 6

Temperature: 31°F				Humidity: 60%				
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)**
0.179	Qp	45.6	1.8	47.4	64.5	-17.1	54.5	-7.1
0.179	Av	37.7	1.8	39.5	64.5	-25.0	54.5	-15.0
0.238	Qp	39.2	1.4	40.6	62.2	-21.6	52.2	-11.6
0.238	Av	31.8	1.4	33.2	62.2	-29.0	52.2	-19.0
0.481	Pk	40.7	0.7	41.4	56.3	-14.9	46.3	-4.9
0.785	Pk	40.8	0.7	41.5	56.0	-14.5	46.0	-4.5
0.846	Pk	41.2	0.7	41.9	56.0	-14.1	46.0	-4.1
1.256	Pk	41.5	0.8	42.3	56.0	-13.7	46.0	-3.7
5.76	Pk	33.7	1.7	35.4	60.0	-24.6	50.0	-14.6
10.1	Pk	31.8	2.1	33.9	60.0	-26.1	50.0	-16.1
22.01	Pk	26.7	3.2	29.9	60.0	-30.1	50.0	-20.1

TABLE 4-5: CONDUCTED EMISSIONS (PHASE SIDE) TRANSMITTING CH 6

Temperature: 31°F				Humidity: 60%				
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)**
0.179	Av	30.2	1.8	32.0	64.5	-32.5	54.5	-22.5
0.179	Qp	33.6	1.8	35.4	64.5	-29.1	54.5	-19.1
0.239	Av	26.7	1.4	28.1	62.1	-34.0	52.1	-24.0
0.239	Qp	29.4	1.4	30.8	62.1	-31.3	52.1	-21.3
0.482	Pk	40.5	0.7	41.2	56.3	-15.1	46.3	-5.1
0.908	Pk	40.6	0.6	41.2	56.0	-14.8	46.0	-4.8
0.97	Pk	41.3	0.3	41.6	56.0	-14.4	46.0	-4.4
1.256	Pk	41.3	0.8	42.1	56.0	-13.9	46.0	-3.9
5.46	Pk	34.4	1.8	36.2	60.0	-23.8	50.0	-13.8
10.34	Pk	30.9	1.6	32.5	60.0	-27.5	50.0	-17.5

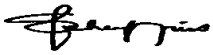
TABLE 4-6: CONDUCTED EMISSIONS (NEUTRAL SIDE) TRANSMITTING CH 11

Temperature: 31°F Humidity: 60%								
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)**
0.179	Qp	42.7	1.8	44.5	64.2	-19.7	54.2	-9.7
0.179	Av	37.5	1.8	39.3	64.5	-25.2	54.5	-15.2
0.234	Qp	39.0	1.4	40.4	62.3	-21.9	52.3	-11.9
0.236	Av	33.8	1.4	35.2	62.2	-27.0	52.2	-17.0
0.482	Pk	44.1	0.7	44.8	56.3	-11.5	46.3	-1.5
0.968	Pk	44.3	0.7	45.0	56.0	-11.0	46.0	-1.0
1.256	Pk	43.9	0.8	44.7	56.0	-11.3	46.0	-1.3
5.16	Pk	35.2	1.6	36.8	60.0	-23.2	50.0	-13.2
8.005	Pk	36.7	2.0	38.7	60.0	-21.3	50.0	-11.3
19.1	Pk	30.5	3.1	33.6	60.0	-26.4	50.0	-16.4
29.89	Pk	31.9	3.6	35.5	60.0	-24.5	50.0	-14.5

TABLE 4-7: CONDUCTED EMISSIONS (PHASE SIDE) TRANSMITTING CH 11

Temperature: 31°F Humidity: 60%								
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)**
0.178	Qp	26.8	1.8	28.6	64.6	-36.0	54.6	-26.0
0.178	Av	30.1	1.8	31.9	64.6	-32.7	54.6	-22.7
0.238	Qp	21.3	1.4	22.7	62.2	-39.5	52.2	-29.5
0.238	Av	26.6	1.4	28.0	62.2	-34.2	52.2	-24.2
0.483	Pk	41.4	0.7	42.1	56.3	-14.2	46.3	-4.2
0.846	Pk	42.3	0.7	43.0	56.0	-13.0	46.0	-3.0
0.908	Pk	41.0	0.6	41.6	56.0	-14.4	46.0	-4.4
0.971	Pk	41.6	0.3	41.9	56.0	-14.1	46.0	-4.1
1.016	Pk	42.2	0.7	42.9	56.0	-13.1	46.0	-3.1
5.165	Pk	37.1	1.7	38.8	60.0	-21.2	50.0	-11.2
10.13	Pk	30.4	1.4	31.8	60.0	-28.2	50.0	-18.2
29.05	Pk	28.0	3.6	31.6	60.0	-28.4	50.0	-18.4

TEST PERSONNEL:

Franck Schuppius		February 18, 2003
Daniel W. Baltzell		March 3, 2003
Test Engineer	Signature	Date Of Test

5 RADIATED EMISSION FOR RECEIVER/DIGITAL INTERFACE - §15.209

5.1 RADIATED EMISSION TEST PROCEDURE FOR RECEIVER/DIGITAL INTERFACE

Radiated spurious emissions for receiver/digital interface fall in the restricted and non-restricted bands between 30 MHz and up to the 2nd LO when the EUT is in the receiver/digital interface mode. The IF, LO and up to the 2nd LO of the receiver were investigated and tested. Channels 1, 6, and 11 were tested and investigated. The restricted bands are listed in FCC Part 15.205 and the maximum permitted average field strength for the restricted band is listed in Part 15.209. The data in this report represents the worst case modes.

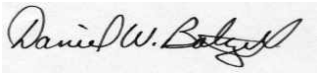
5.2 RADIATED EMISSION TEST DATA RECEIVER/DIGITAL INTERFACE

TABLE 5-1: RADIATED EMISSIONS

Temperature: 30°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)**
165.886	Qp	H	300	4.0	46.0	-13.2	32.8	43.5	-10.7
202.742	Qp	H	300	3.5	52.8	-11.2	41.6	43.5	-1.9
221.174	Qp	H	80	3.3	51.2	-9.1	42.1	46.0	-3.9
276.478	Qp	H	320	3.8	50.1	-6.0	44.1	46.0	-1.9
294.900	Qp	H	240	2.5	46.6	-7.0	39.6	46.0	-6.4
439.990	Qp	H	30	1.0	44.2	-2.2	42.0	46.0	-4.0
484.000	Qp	H	230	2.0	44.7	-0.4	44.3	46.0	-1.7
528.010	Qp	H	0	4.0	43.4	0.7	44.1	46.0	-1.9

QP: RES. =100 KHZ, VID= 100 KHZ

TEST PERSONNEL:



Daniel W. Baltzell		February 26, 2003
Test Engineer	Signature	Date Of Test

6 RADIATED EMISSION RADIATED HARMONICS/SPURIOUS NOISE - §15.247

6.1 RADIATED EMISSION TEST PROCEDURE FOR HARMONICS/SPURIOUS NOISE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted bands when the EUT is configured in the transmit mode. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. The EUT was tested in three orthogonal planes from 10 kHz to the 10th harmonic of the fundamental. The data in this report represents the worst case modes.

6.2 RADIATED EMISSIONS HARMONICS/SPURIOUS TEST DATA

TABLE 6-1: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 1 / 2412MHZ)

Channel: 1
Operating Frequency (MHz): 2412

Emission Frequency (MHz)	Peak Test Detector (dBuV)	Average Test Detector (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4824.0	33.8	19.2	13.6	32.8	54.0	-21.2
12060.0	38.5	22.8	16.7	39.5	54.0	-14.5
14472.0	37.8	22.5	20.8	43.3	54.0	-10.7

Noise floor measurements

TEST PERSONNEL:

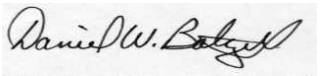
Daniel W. Baltzell		March 2, 2003
Test Engineer	Signature	Date Of Test

TABLE 6-2: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 6 / 2437MHZ)

Channel: 6
Operating Frequency (MHz): 2437

Emission Frequency (MHz)	Peak Test Detector (dBuV)	Average Test Detector (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.0	33.5	18.9	13.9	32.8	54.0	-21.2
7311.0	32.7	17.6	12.0	29.6	54.0	-24.4
12185.0	38.5	22.8	16.7	26.9	54.0	-27.1

Noise floor measurements

TEST PERSONNEL:

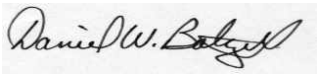
Daniel W. Baltzell		March 2, 2003
Test Engineer	Signature	Date Of Test

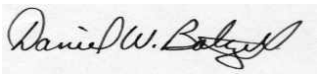
TABLE 6-3: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 11 / 2462MHZ)

Channel: 11
Operating Frequency (MHz): 2462

Emission Frequency (MHz)	Peak Test Detector (dBuV)	Average Test Detector (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4924.0	33.8	19.2	14.3	33.5	54.0	-20.5
7386.0	32.7	17.6	11.7	29.3	54.0	-24.7
12310.0	38.5	22.8	16.6	39.4	54.0	-14.6

Noise floor measurements

TEST PERSONNEL:



Daniel W. Baltzell		March 2, 2003
Test Engineer	Signature	Date Of Test

6.3 TEST EQUIPMENT USED FOR TESTING

TABLE 6-4: RADIATED SPURIOUS EMISSIONS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	Not Required
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	Not Required
900772	EMCO	3161-02	Horn Antenna	9804-1044	Not Required
900321	EMCO	3161-03	Horn Antennas (4 - 8,2GHz)	9508-1020	Not Required
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	Not Required
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051	Not Required
900666	Hewlett Packard	8449B	Microwave Preamplifier, (1 to 26.5 GHz)	3008A00505	Not Required
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	7/2/03

7 MODULATED BANDWIDTH - §15.247(A)(2)

7.1 MODULATED BANDWIDTH TEST PROCEDURE

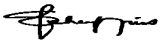
The minimum 6 dB bandwidth per FCC 15.247 (a)(2) was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The minimum 6 dB modulated bandwidths are the following:

7.2 MODULATED BANDWIDTH TEST DATA

TABLE 7-1: MINIMUM 6 DB MODULATED BANDWIDTHS

CHANNEL	6 dB BANDWIDTH (MHz)
1	9.45
6	9.90
11	9.85

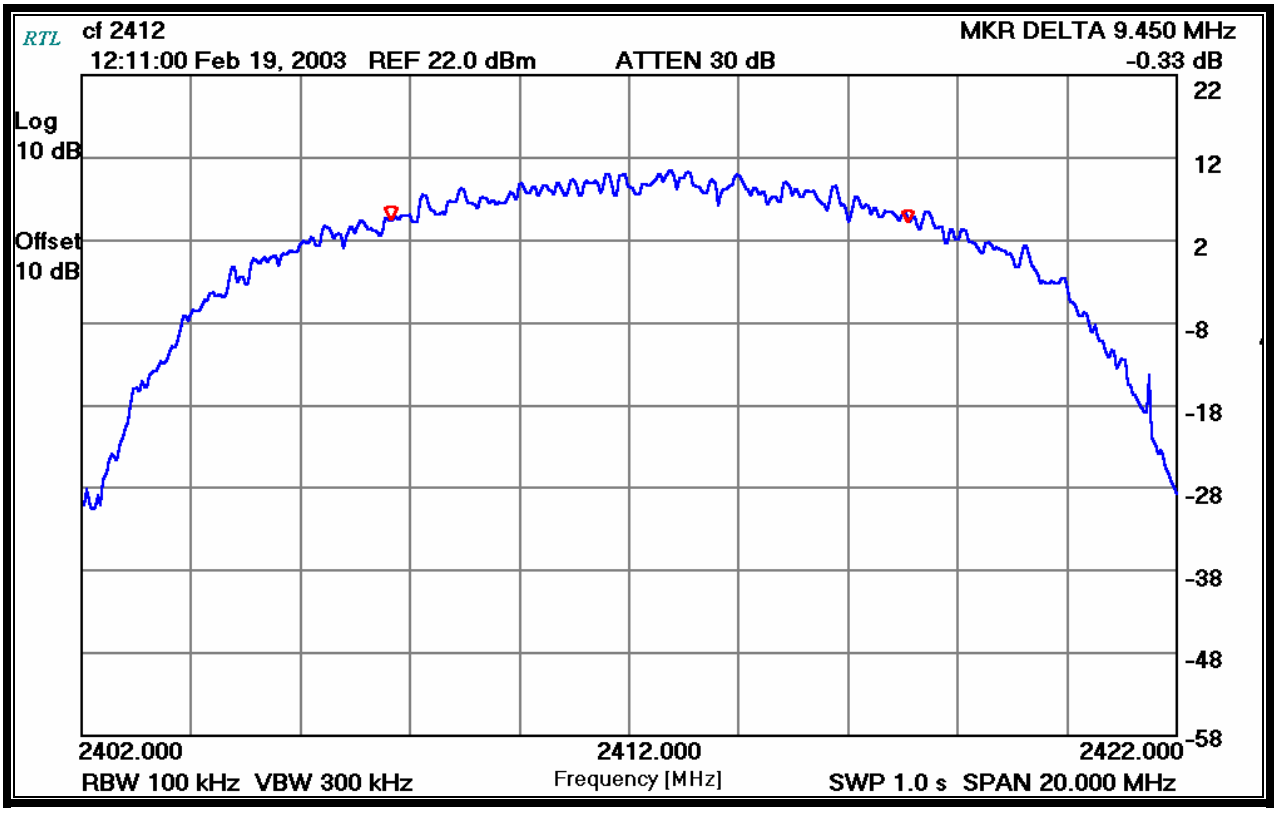
TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

7.3 MODULATED BANDWIDTH PLOTS

Channel Number: 1
Frequency (MHz): 2412
Resolution Bandwidth: 100kHz
Video Bandwidth: 300kHz
Sweep Time: 1.0s

PLOT 7-1: MODULATED BANDWIDTH CHANNEL 1

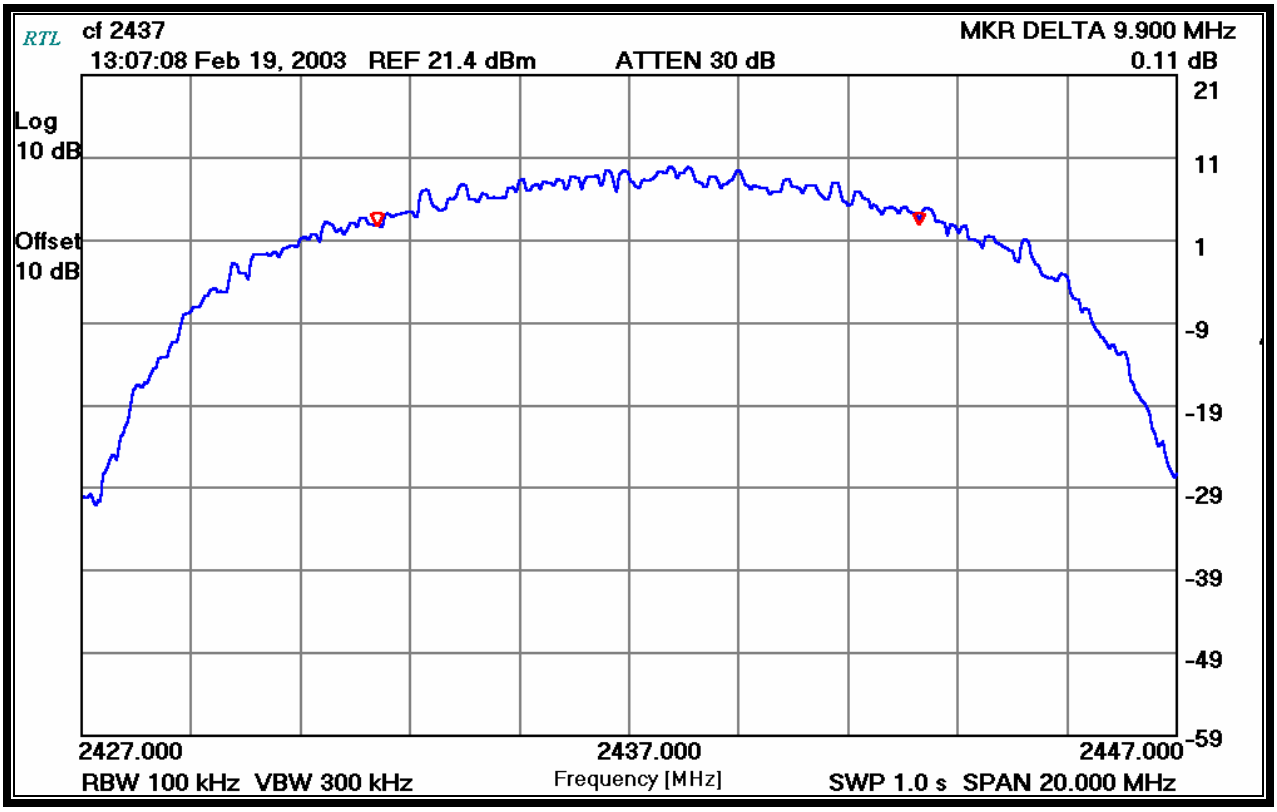


TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

Channel Number:	6
Frequency (MHz):	2437
Resolution Bandwidth:	100kHz
Video Bandwidth:	300kHz
Sweep Time:	1.0s

PLOT 7-2: MODULATED BANDWIDTH CHANNEL 6

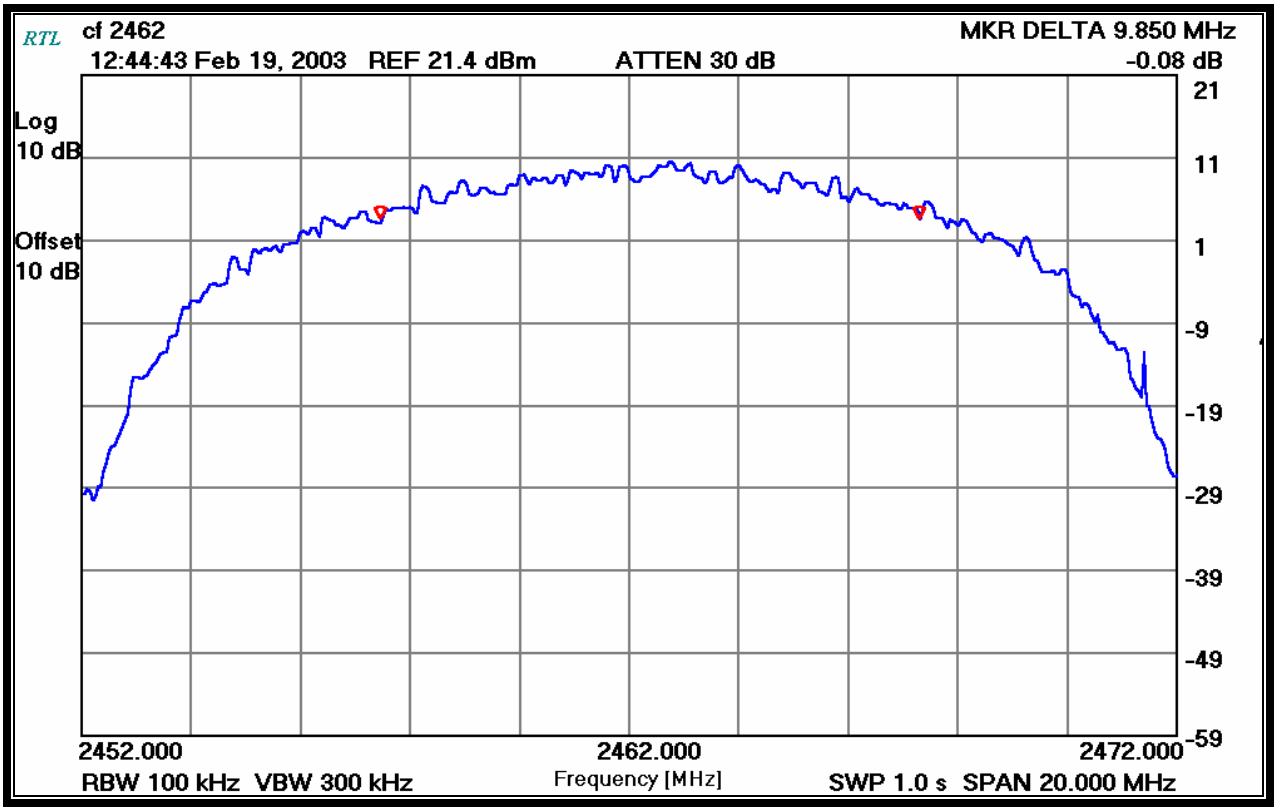


TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date of Test

Channel Number:	11
Frequency (MHz):	2462
Resolution Bandwidth:	100kHz
Video Bandwidth:	300kHz
Sweep Time:	1.0s

PLOT 7-3: MODULATED BANDWIDTH CHANNEL 11



TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

7.4 TEST EQUIPMENT USED FOR TESTING

TABLE 7-2: TEST EQUIPMENT USED FOR TESTING (MODULATED BANDWIDTH)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771	5/10/03

8 POWER OUTPUT - §15.247(B)

8.1 POWER OUTPUT TEST PROCEDURE

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

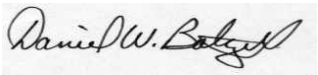
8.2 POWER OUTPUT TEST DATA

TABLE 8-1: POWER OUTPUT TEST DATA

CHANNEL	POWER CONDUCTED OUTPUT (dBm)
1	21.97
6	21.40
11	21.39

*Measurement accuracy is +/- 1.5 dB

TEST PERSONNEL:

Daniel W. Baltzell		February 12, 2003
Test Engineer	Signature	Date Of Test

8.3 TEST EQUIPMENT USED FOR TESTING

TABLE 8-2: TEST EQUIPMENT USED FOR TESTING RF POWER OUTPUT

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER	CALIBRATION DUE DATE
901186	Agilent Technologies	E9323A (50MHz-6GHz)	Peak & Average Power Sensor	US40410380	7/19/03
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	7/19/03
900931	Hewlett Packard	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771	5/10/03

9 ANTENNA CONDUCTED SPURIOUS EMISSIONS - §15.247(C)

9.1 ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST PROCEDURES

Antenna spurious emission 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 300 kHz. The modulated carrier was identified at 2.412GHz for Channel 1, 2.437GHz for Channel 6 and 2.462GHz for Channel 11. No other harmonics or spurs were found within 20 dB of the carrier level, and from 9kHz to the carriers 10th harmonic. A notch filter was not used it was found to have no effect in the levels.

Channels 1, 6, and 11 were investigated and tested.

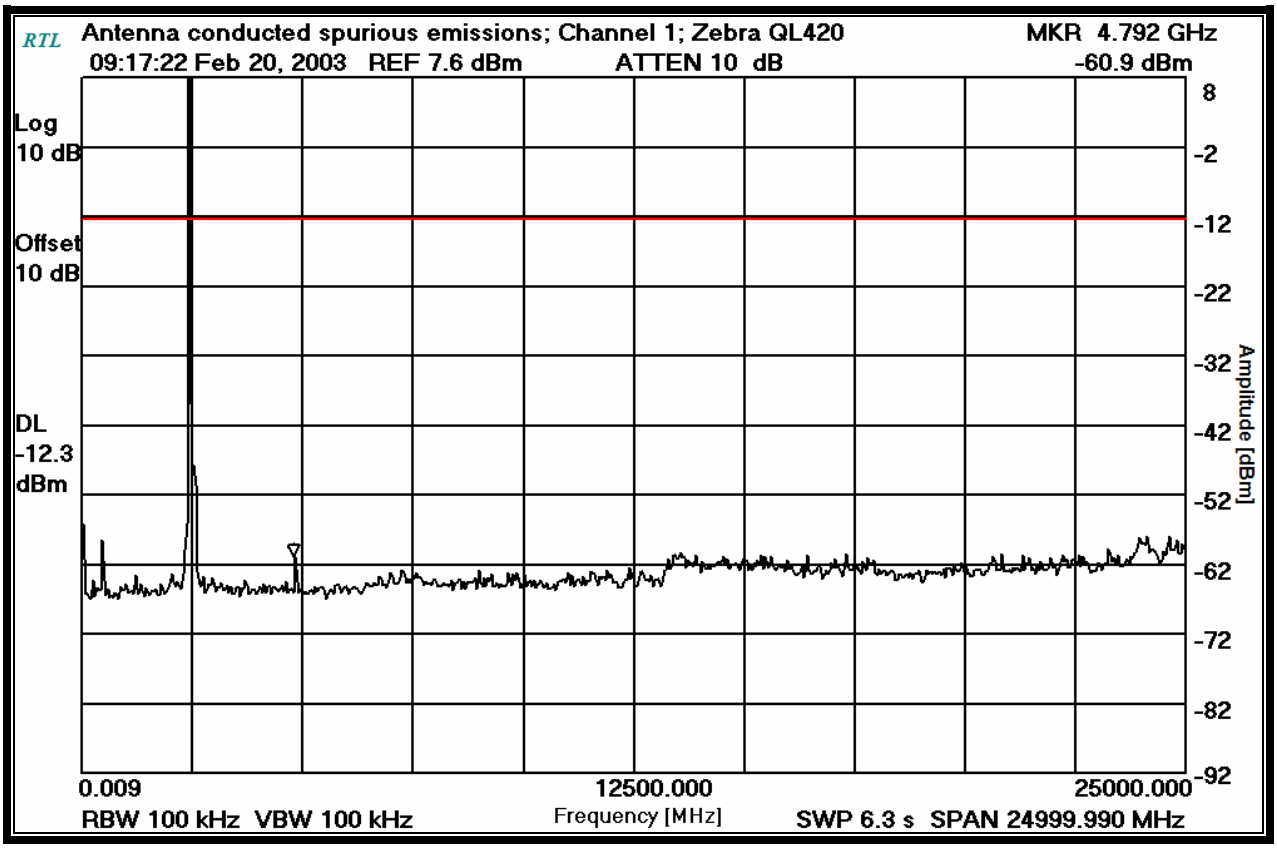
9.2 ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 1

Operating Frequency (MHz): 2412
Channel: 1
Measured Peak Conducted Power (dBm): 7.67
Conducted Spurious Limit (dBm): -12.3

TABLE 9-1: ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 1

Frequency (MHz)	Measured Level (dBm)	Measured Level (dBc)	Limits (dBc)	Margin (dB)
456.84	-58.2	65.9	20	-45.9
4824.00	-62.7	70.3	20	-50.3
7236.00	-61.3	69.0	20	-49.0
9648.00	-65.5	73.2	20	-53.2
12060.00	-66.3	74.0	20	-54.0
14472.00	-62.5	70.2	20	-50.2
16884.00	-64.2	71.8	20	-51.8
19296.00	-63.8	71.5	20	-51.5
21708.00	-63.7	71.3	20	-51.3
24120.00	-60.0	67.7	20	-47.7

PLOT 9-1: ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 1



TEST PERSONNEL:

Daniel W. Baltzell		February 20, 2003
Test Engineer	Signature	Date Of Test

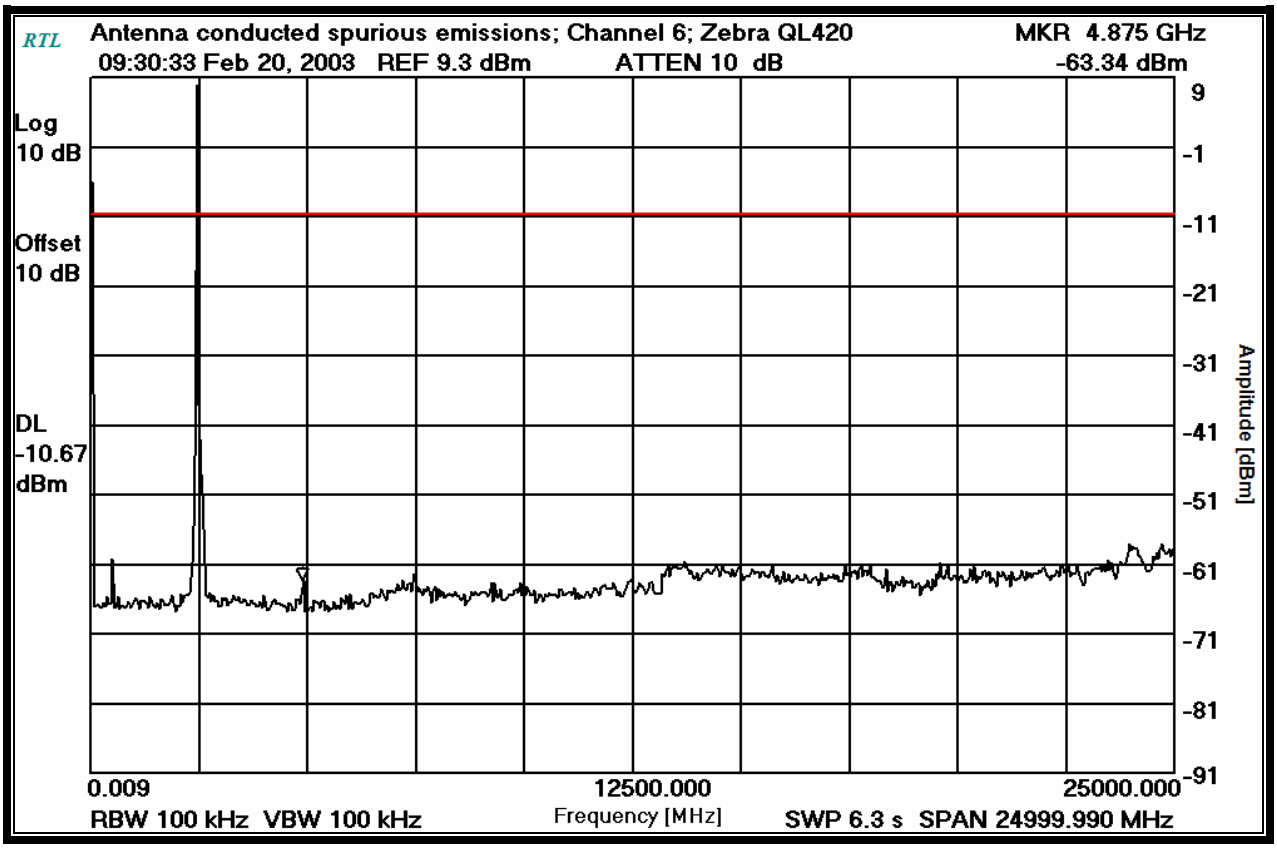
9.3 ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 6

Operating Frequency (MHz): 2437
Channel: 6
Measured Peak Conducted Power (dBm): 9.3
Conducted Spurious Limit: -10.7

TABLE 9-2: ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 6

Frequency (MHz)	Measured Level (dBm)	Measured Level (dBc)	Limits (dBc)	Margin (dB)
481.81	-68.8	78.2	20	-58.2
4874.00	-73.6	82.9	20	-62.9
7311.00	-73.5	82.8	20	-62.8
9748.00	-75.7	85.0	20	-65.0
12185.00	-76.2	85.5	20	-65.5
14622.00	-73.2	82.5	20	-62.5
17059.00	-73.7	83.0	20	-63.0
19496.00	-73.9	83.2	20	-63.2
21933.00	-72.7	82.0	20	-62.0
24370.00	-72.7	82.0	20	-62.0

PLOT 9-2: ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 6



TEST PERSONNEL:

Daniel W. Baltzell	Daniel W. Baltzell	February 20, 2003
Test Engineer	Signature	Date Of Test

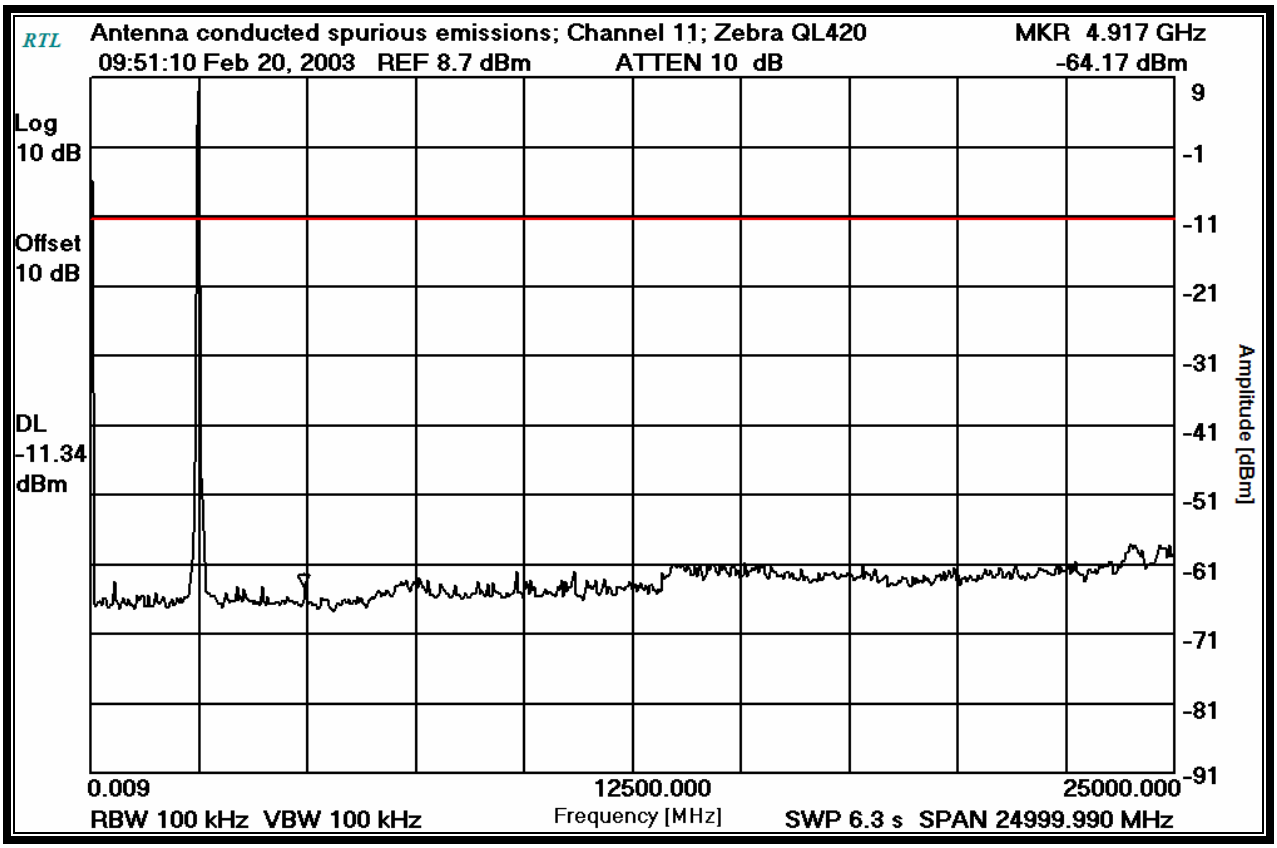
9.4 ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 11

Operating Frequency (MHz): 2462
Channel: 11
Measured Peak Conducted Power (dBm): 8.7
Conducted Spurious Limit (dBm): -11.3

TABLE 9-3: ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 11

Frequency (MHz)	Measured Level (dBm)	Measured Level (dBc)	Limits (dBc)	Margin (dB)
481.81	-71.8	80.5	20	-60.5
4924.00	-73.7	82.4	20	-62.4
7386.00	-74.5	83.2	20	-63.2
9848.00	-75.7	84.4	20	-64.4
12310.00	-75.5	84.2	20	-64.2
14772.00	-73.2	81.9	20	-61.9
17234.00	-74.2	82.9	20	-62.9
19696.00	-73.8	82.5	20	-62.5
22158.00	-73.3	82.0	20	-62.0
24620.00	-70.3	79.0	20	-59.0

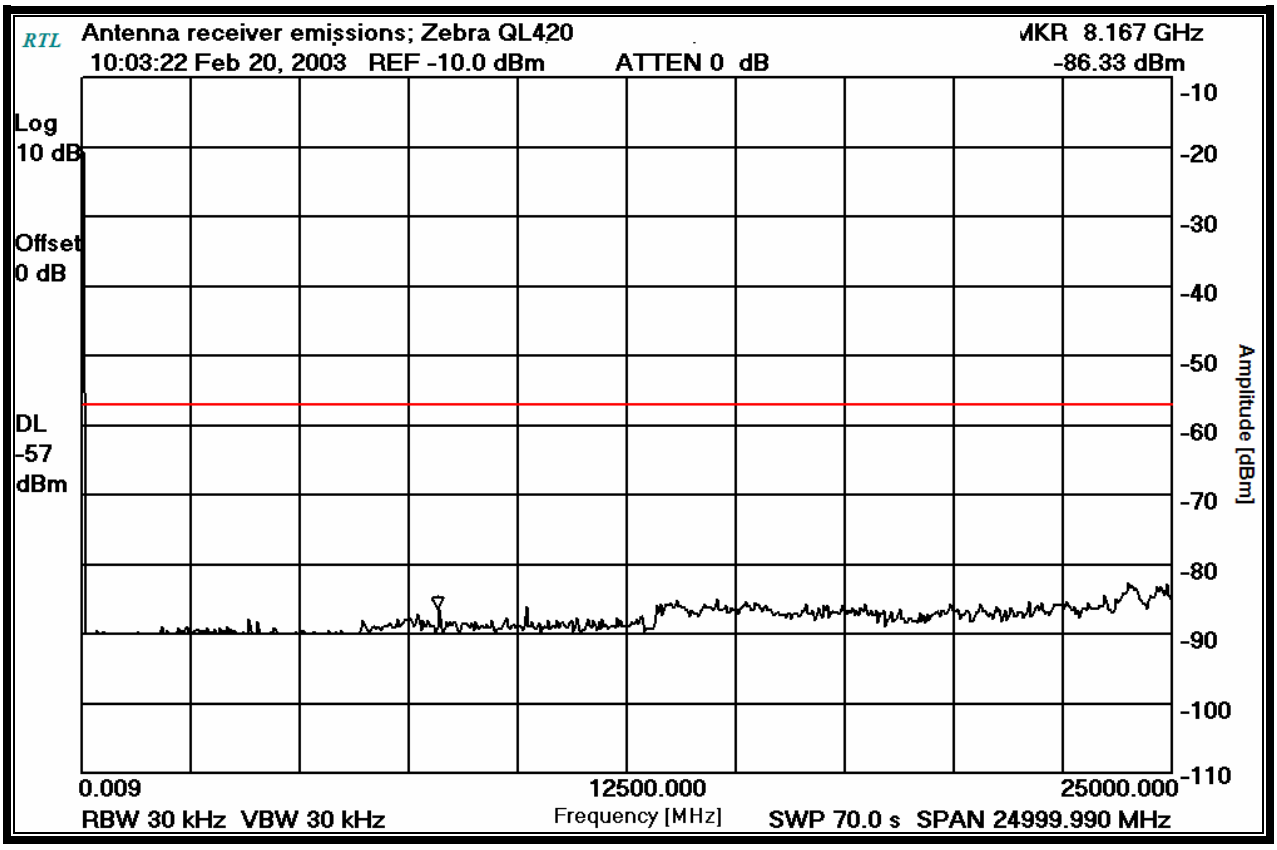
PLOT 9-3: ANTENNA CONDUCTED SPURIOUS EMISSIONS CHANNEL 11



TEST PERSONNEL:

Daniel W. Baltzell	Daniel W. Baltzell	February 20, 2003
Test Engineer	Signature	Date Of Test

PLOT 9-4: ANTENNA CONDUCTED SPURIOUS EMISSIONS (RECEIVER)



10 POWER SPECTRAL DENSITY - §15.247(D)

10.1 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 3kHz, the video bandwidth set at 30kHz, and the sweep time set at 1000 second. The test was performed as a conducted test. The spectral lines were resolved for the modulated carriers at 2.412GHz, 2.437GHz, and 2.462GHz respectively. These levels are well below the +8 dBm limit. See the power spectral density table and plots that follow.

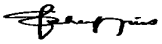
10.2 POWER SPECTRAL DENSITY TEST DATA

Operating Frequency (MHz): 2412 MHz, 2437 MHz & 2462 MHz
Channel: 1, 6 & 11
Measured Peak Conducted Power (dBm): 21.97, 21.4, 21.39
Modulation Bandwidth: 9.9 MHz
Power Spectral Density Limit: +8dBm

TABLE 10-1: POWER SPECTRAL DENSITY

CHANNEL	POWER SPECTRAL DENSITY (dBm) (LIMIT = +8dBm)
1	-4.7
6	-4.9
11	-4.6

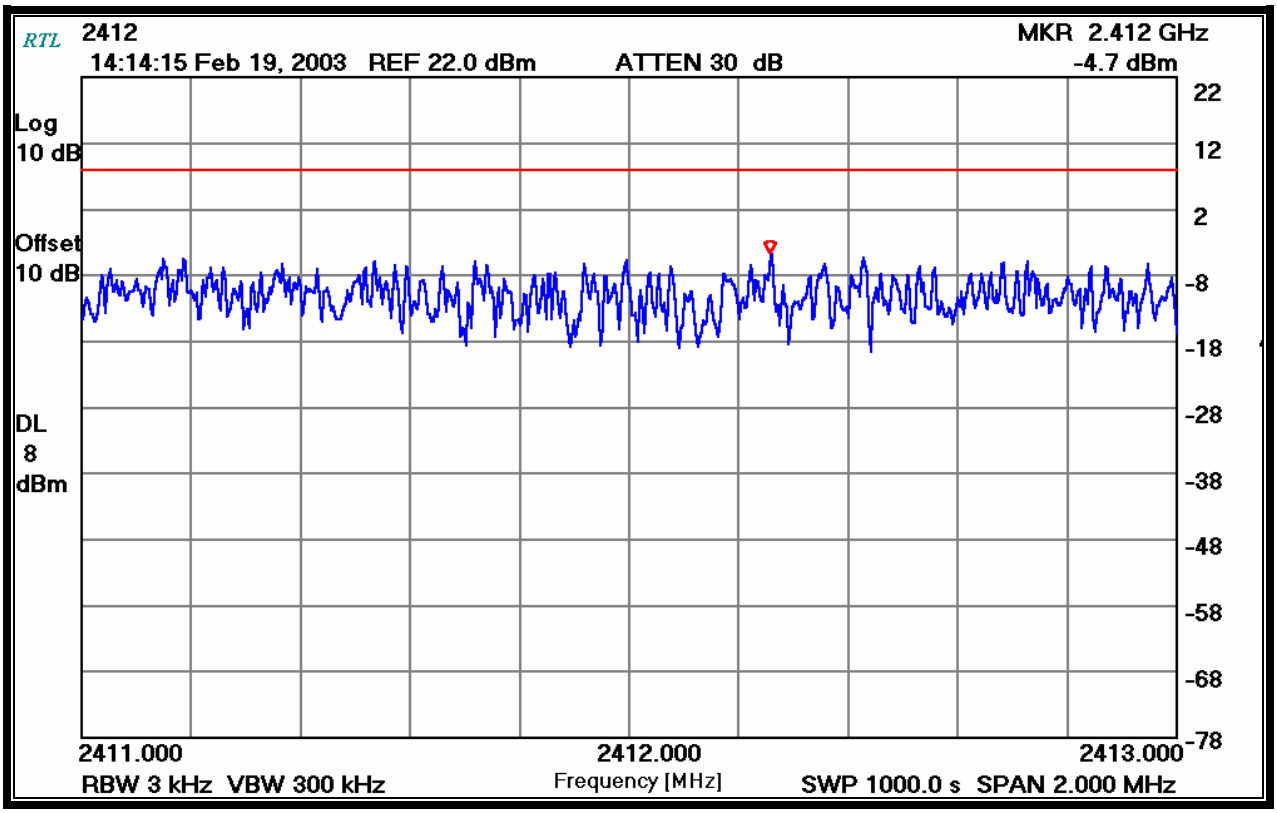
TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

10.3 POWER SPECTRAL DENSITY PLOTS

Operating Frequency (MHz):	2412
Channel:	1
Measured Peak Conducted Power (dBm):	21.97
Bandwidth Resolution:	3 kHz
Bandwidth Video:	300 kHz
Sweep Time:	1000.0 s

PLOT 10-1: POWER SPECTRAL DENSITY: CHANNEL 1

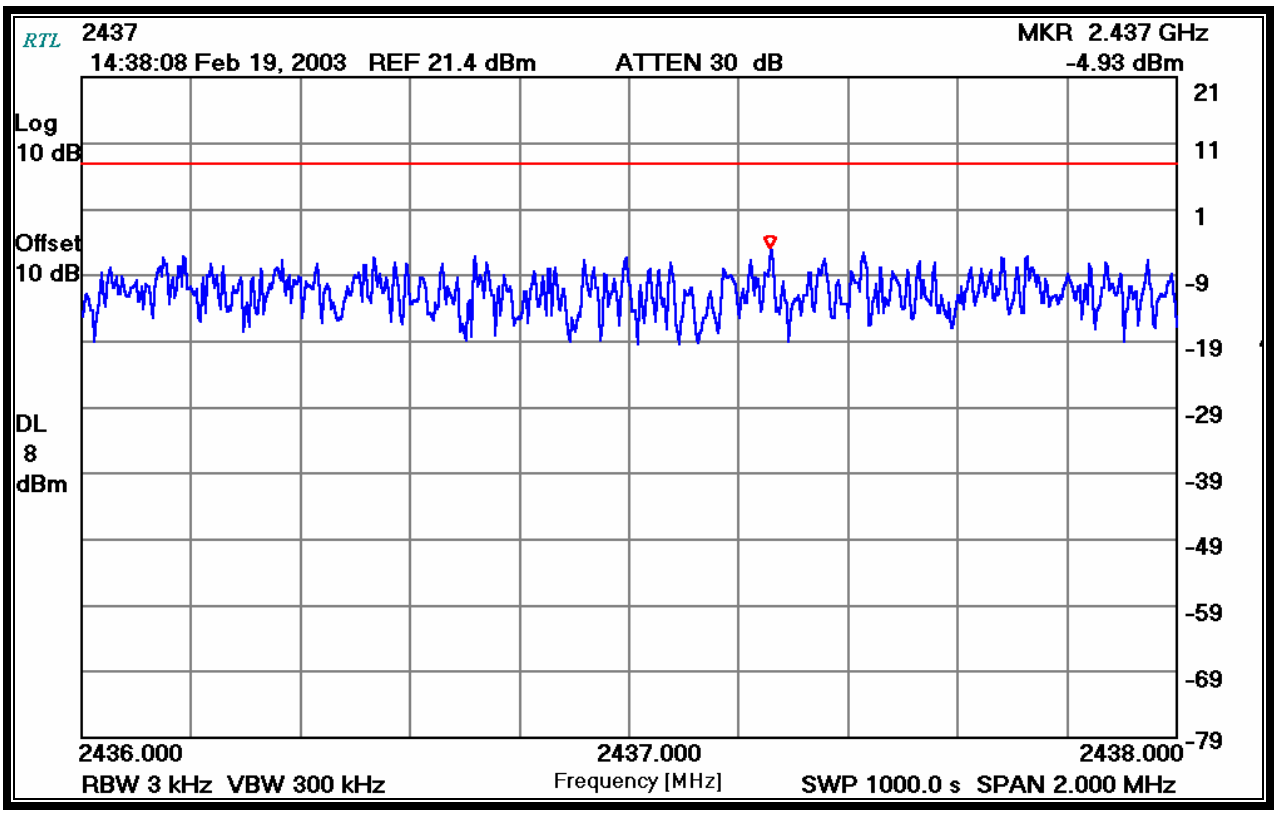


TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

Operating Frequency (MHz):	2437
Channel:	6
Measured Peak Conducted Power (dBm):	21.4
Bandwidth Resolution:	3 kHz
Bandwidth Video:	300 kHz
Sweep Time:	1000.0 s

PLOT 10-2: POWER SPECTRAL DENSITY: CHANNEL 6

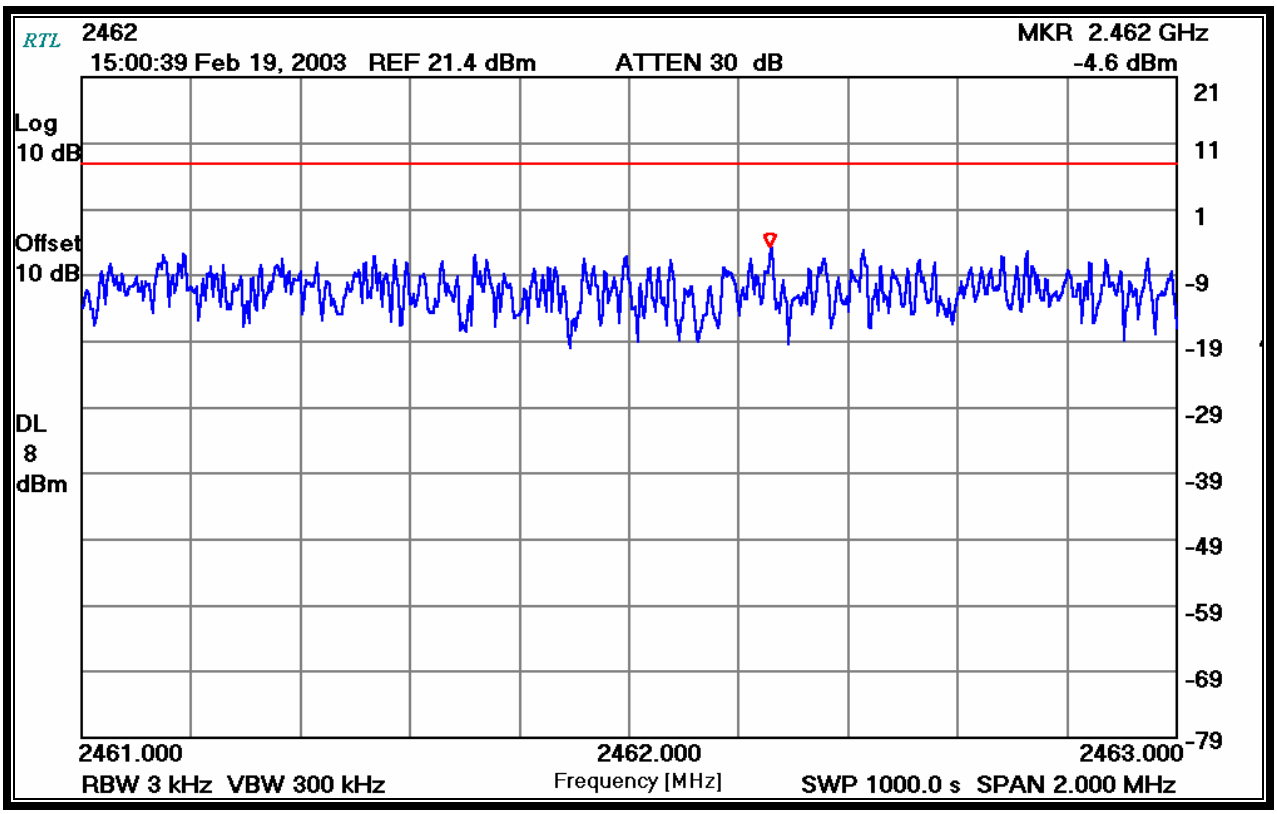


TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

Operating Frequency (MHz):	2462
Channel:	11
Measured Peak Conducted Power (dBm):	21.39
Bandwidth Resolution:	3 kHz
Bandwidth Video:	300 kHz
Sweep Time:	1000.0 s

PLOT 10-3: POWER SPECTRAL DENSITY: CHANNEL 11



TEST PERSONNEL:

Franck Schuppius		February 19, 2003
Test Engineer	Signature	Date Of Test

10.4 TEST EQUIPMENT USED FOR TESTING

TABLE 10-2: TEST EQUIPMENT USED FOR TESTING (POWER SPECTRAL DENSITY)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771	5/10/03

11 CONCLUSION

The data in this measurement report shows that Zebra Technologies Model: QL420, FCC ID: I28-QL420352, complies with all the requirements of Parts 2 and 15 of the FCC Rules, Industry Canada RSS-210, ANSI 63.4, DA00-705 (FHSS) and FCC 97-114 (DSSS).