CERTIFICATE OF COMPLIANCE
FCC PART 15.247 CERTIFICATION & INDUSTRY CANADA CERTIFICATION

Test Lab:	Applicant Information:
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FCC ID:	P6GWLERVA	**GRANTEE FRN NUMBER:**	0006-2131-10
PLAT FORM:	N/A	**RTL WORK ORDER NUMBER:**	2002050
MODEL(S):	Vehicle Extended Range Amplified WLAN System	**RTL QUOTE NUMBER:**	QRTL01-346D
DATE OF TEST REPORT:	July 17, 2002		

American National Standard Institute:	ANSI/TIA/EIA603 and ANSI/TIA/EIA 603-1
FCC Classification:	DSS – Spread Spectrum Transmitter
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-139: Licensed Radiocommunications Devices in the Band 2400-2483.5
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
2422-2452	0.87	N/A	N/A

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. 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 FCC Part 2, FCC Part 15, Industry Canada RSS-139, ANSI/TIA/EIA603, and ANSI/TIA/EIA 603-1.

Signature: _____ Date: July 17, 2002

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

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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-139: Licensed Radiocommunications Devices in the Band 2400-2483.5, employing spread spectrum modulation technology.

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 on Model: NGIT Vehicle Extended Range Amplified WLAN System, FCC ID: P6GWLERVA, a system composed of the WLAN card with amplifier, DC power injector, and cabling. The IF, LO and up to the 2nd LO were investigated and tested.

2 TEST INFORMATION

2.1 TEST JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. Channel 3 at 2422 MHz, Channel 6 at 2437 MHz and channel 9 at 2452 MHz were tested and investigated from 9 kHz to 24 GHz. Data for all three channels is presented in this report.

In order to complete the configuration required for testing, a WLAN PCMCIA card Cisco 352 series, inserted in a laptop computer, and the Access Point configured with a Cisco 352 WLAN card, was connected to a notebook computer through its Ethernet port. The PCMCIA WLAN radio output port was connected to a DC injector, the DC injector in turn was connected to a 1Watt amplifier, the output of the amplifier was connected to an external antenna (3 and 5dBi omni) . The DC injector and the amplifier were connected directly, and the cable length between the amplifier and the antenna used for the testing was minimized to provide a worst case configuration. The antenna transmits, receives, and connects to the only antenna port available. The worst-case data shown 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 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, plus 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
WLAN SYSTEM	NORTHROP GRUMMAN CORPORATION INFORMATION TECHNOLOGY, DEFENSE MISSION SYSTEMS	VEHICLE EXTENDED RANGE AMPLIFIED WLAN SYSTEM	N/A	P6GWLERVA	N/A	014241
AMPLIFIER	TELECTRONICS	SMART AMP 1W	N/A	N/A		14530
DC INJECTOR	TELECTRONICS	DC INJECTOR	N/A	N/A		14531
ACCESS POINT	CISCO	AP 350 SERIES	VDF0536517K	LDK102040		14315
ANTENNA	MOBILE MARK	3 DBI			N/A	14303
ANTENNA	MOBILE MARK	5DBI				14305
CABLE	N/A	RG-142	N/A	N/A	24''	NA

TABLE 2-3: EXTERNAL COMPONENTS IN TEST CONFIGURATION

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
NOTEBOOK PC	SAMSUNG ELECTRONICS	STORM	019492/B	A3LSQ10	N/A	

2.5 CONFIGURATION OF TESTED SYSTEM

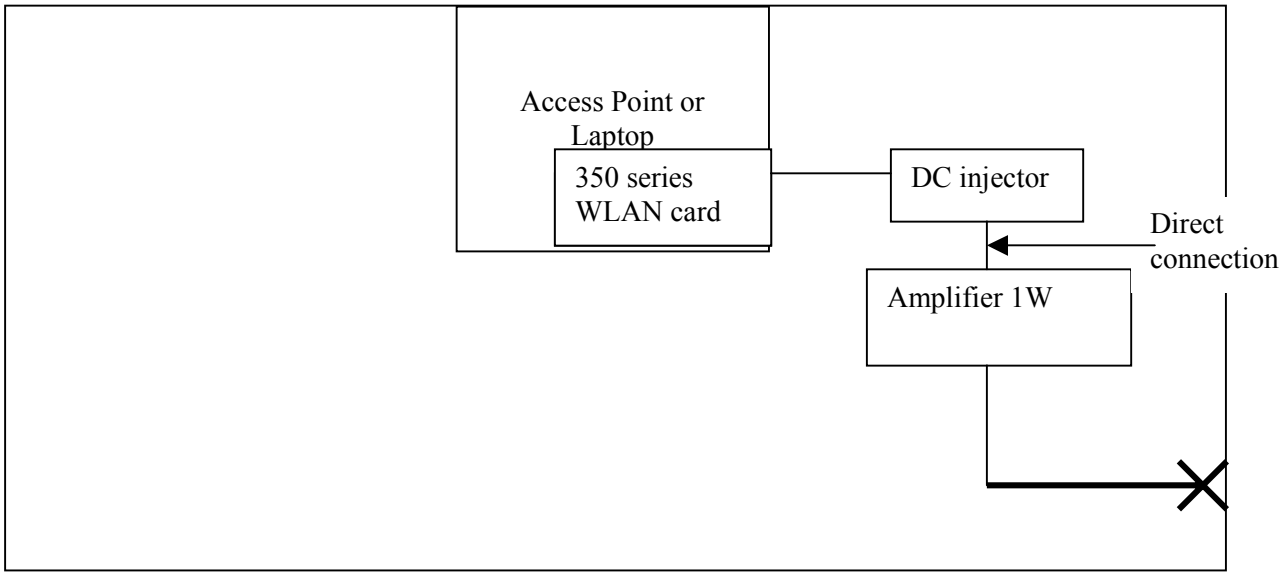


FIGURE 1: WORST CASE CONFIGURATION OF SYSTEM UNDER TEST

3 COMPLIANCE WITH THE RESTRICTED BAND EDGE - §15.205

3.1 TEST PROCEDURE

Compliance with the band edges was performed using the rules found in FCC parts 15.205 and 15.209 respectively. The final data derived below was from radiated measurements applying absolute detector values only. The data shown 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): 2422-2452
Channel: 3 & 9
Distance: 3 meter
Limit: 54 dBuV/m

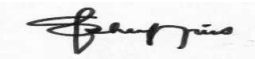
TABLE 3-1: COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA 3 dBi

Channel Set to	Frequency tested (MHz)	Detector	Field Strength Level (dBµV/m)	Level Corrected (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
3r	2390.0	Absolute measurement	24.5	50.9	54.0	-3.1
9	2483.5	Absolute measurement	21.8	48.2	54.0	-5.8

TABLE 3-2: COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA 5 dBi

Channel Set to	Frequency tested (MHz)	Detector	Field Strength Level (dBµV/m)	Level Corrected (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
3	2390.0	Absolute measurement	25.4	51.8	54.0	-2.2
9	2483.5	Absolute measurement	22.6	49.0	54.0	-5.0

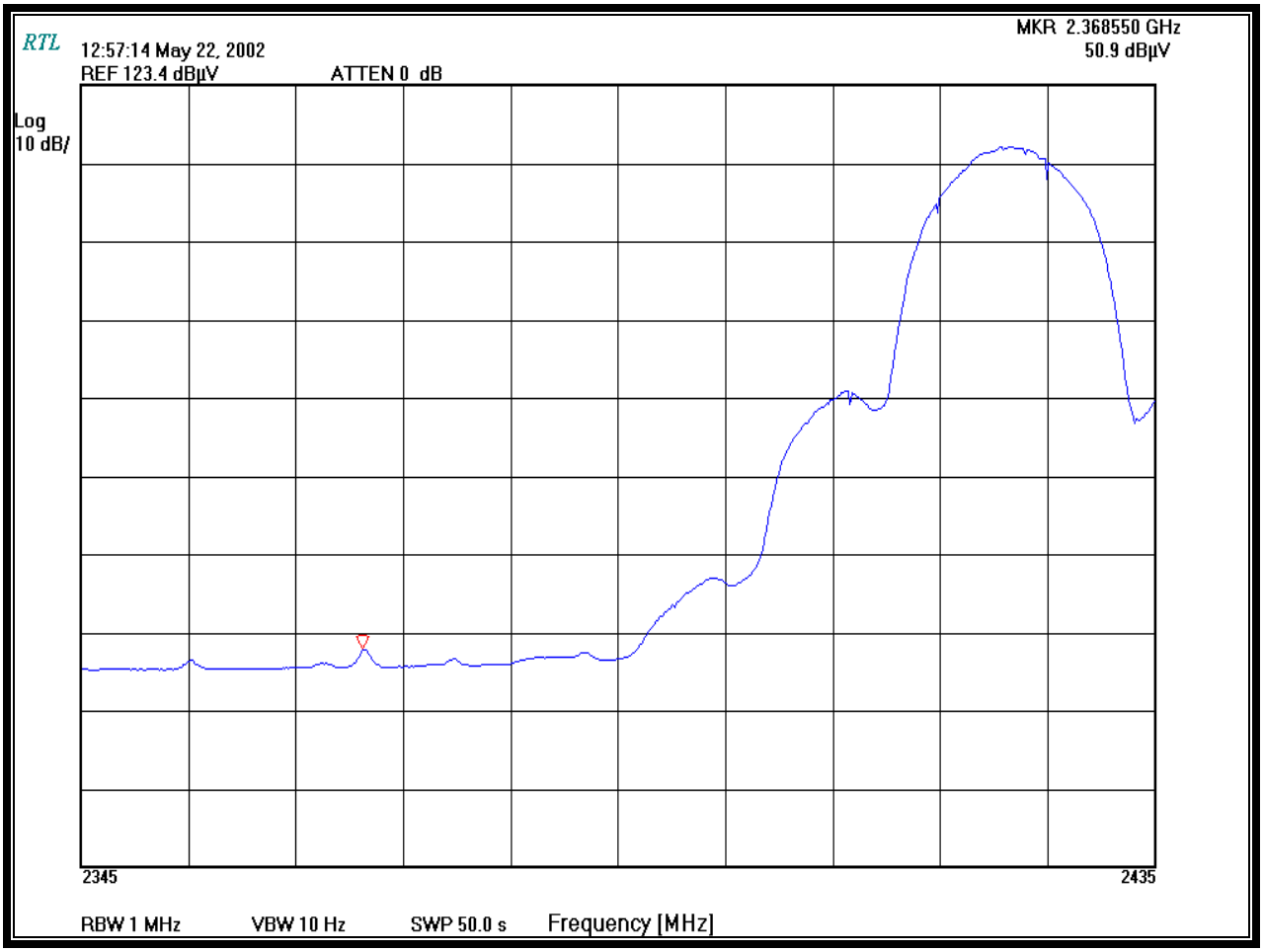
TEST PERSONNEL:

Franck Schuppius		5/22/2002
Test Technician/Engineer	Signature	Date Of Test

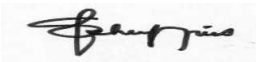
3.3 BAND EDGE PLOTS

Channel Number:	3
Frequency (MHz):	2422
Resolution Bandwidth (MHz):	1
Video Bandwidth (Hz):	10
Sweep Time (s):	50.0

PLOT 3-1: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 3 (3dBi antenna)

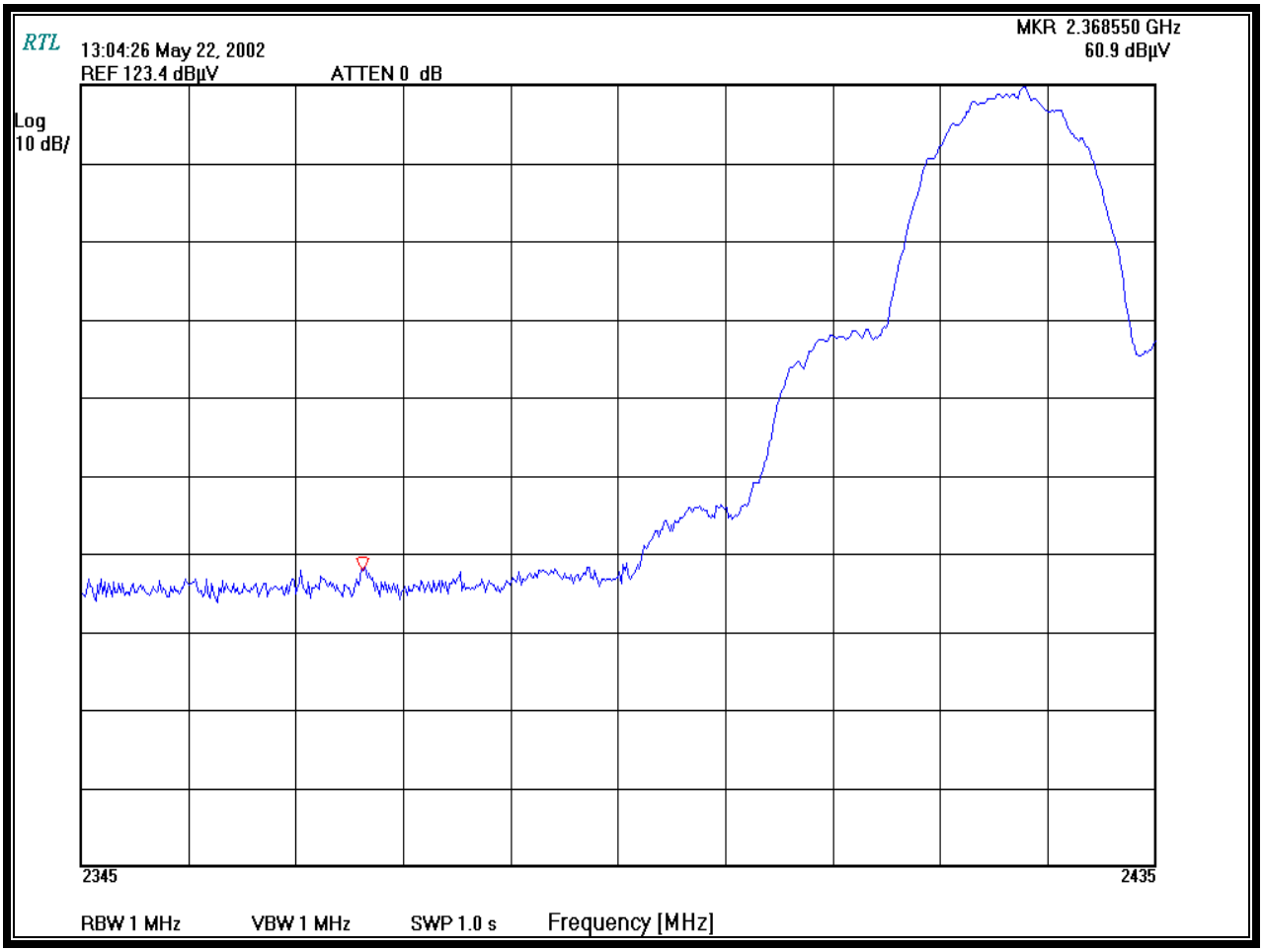


TEST PERSONNEL:

Franck Schuppius		5/22/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	3
Frequency (MHz):	2422
Bandwidth Resolution (MHz):	1
Video Bandwidth (MHz):	1
Sweep Time (s):	1.0

PLOT 3-2: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 3 (3 dBi antenna)

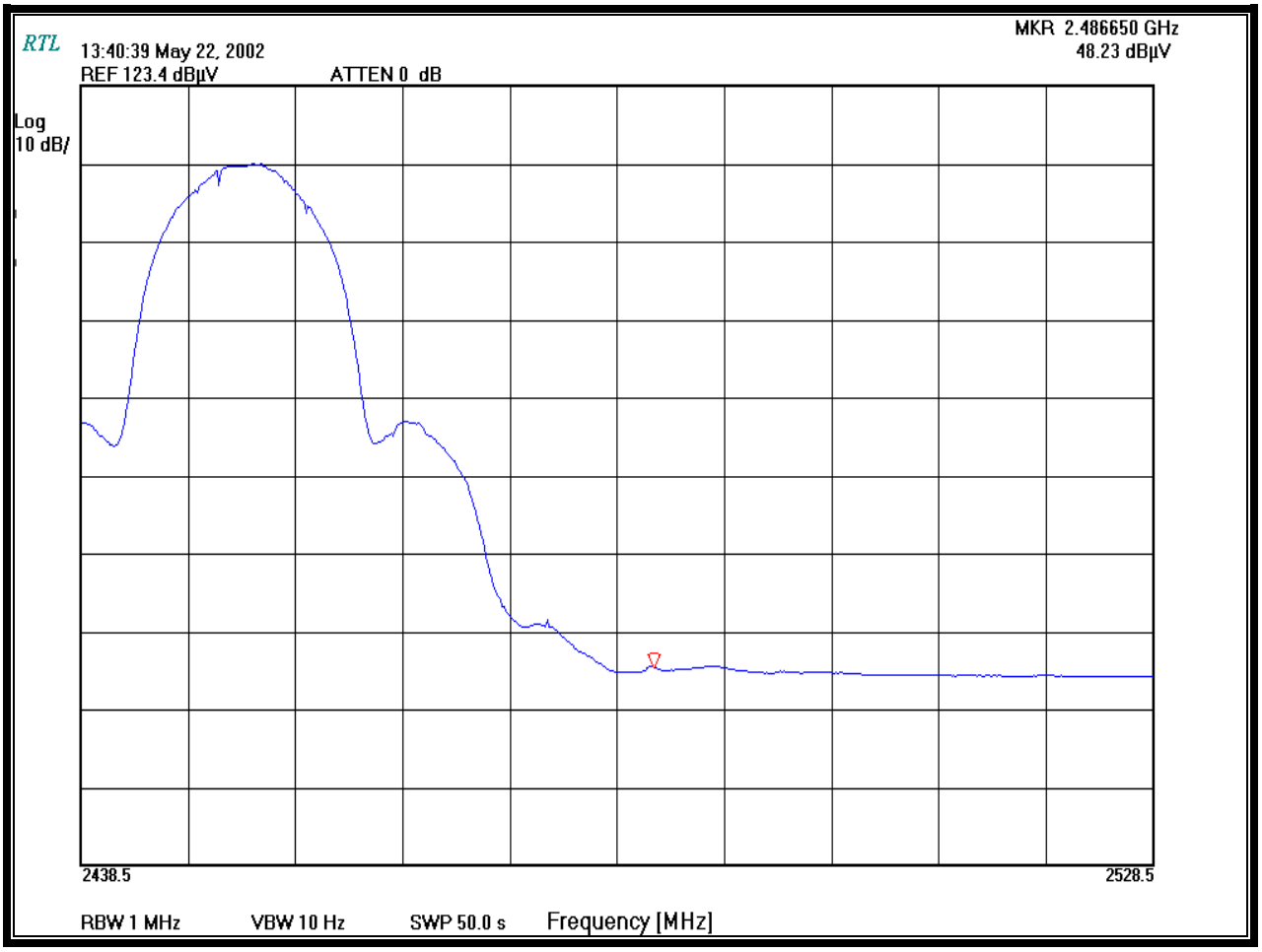


TEST PERSONNEL:

Franck Schuppius		5/22/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	9
Frequency (MHz):	2452
Resolution Bandwidth (MHz):	1
Video Bandwidth (Hz):	10
Sweep Time (s):	50.0

PLOT 3-3: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 9 (3 dBi antenna)

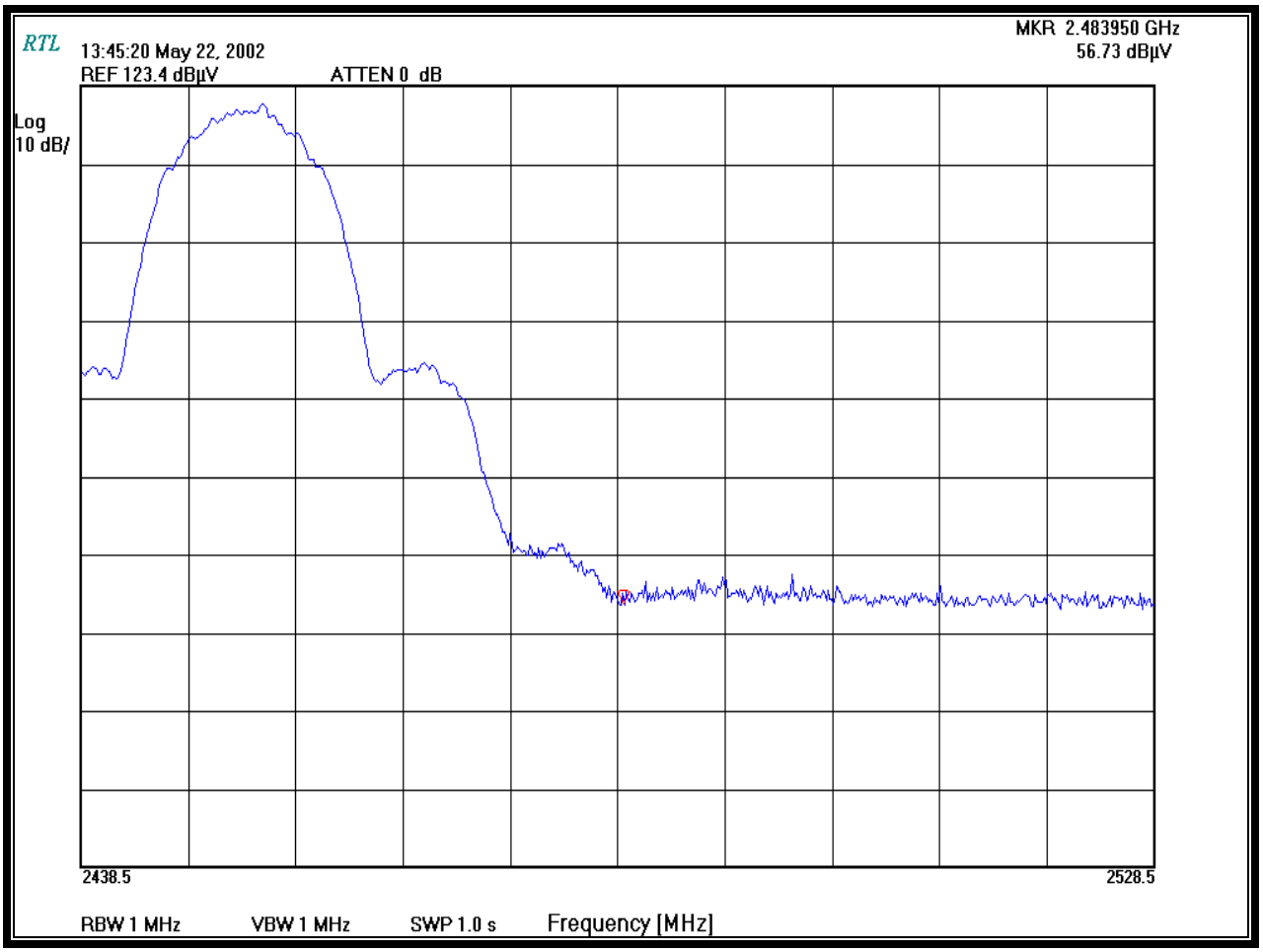


TEST PERSONNEL:

Franck Schuppius		5/22/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	9
Frequency (MHz):	2452
Resolution Bandwidth (MHz):	1
Video Bandwidth (MHz):	1
Sweep Time (s):	1.0

PLOT 3-4: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 9 (3dBi antenna)

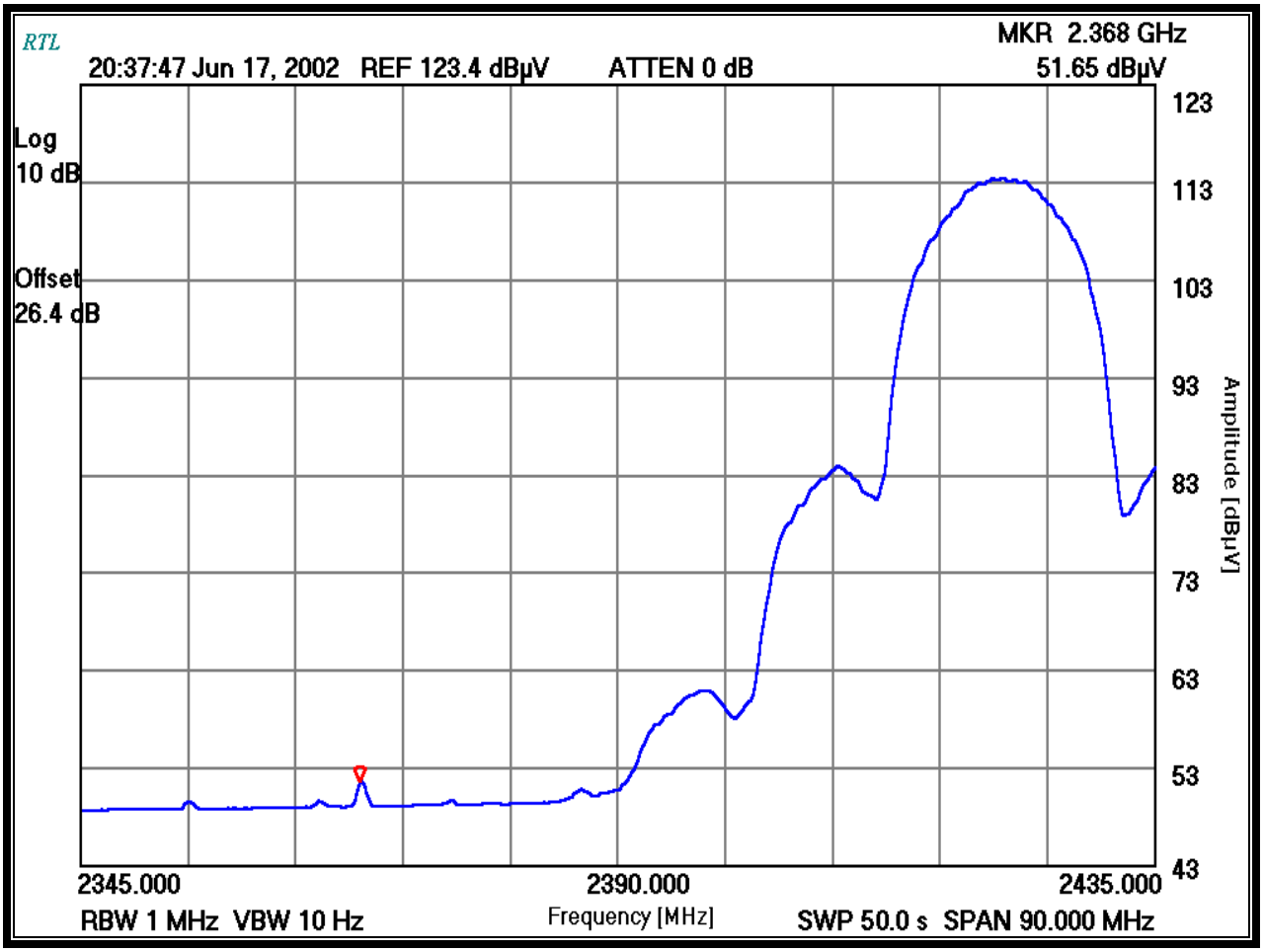


TEST PERSONNEL:

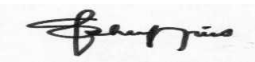
Franck Schuppius		5/22/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	3
Frequency (MHz):	2422
Resolution Bandwidth (MHz):	1
Video Bandwidth (Hz):	10
Sweep Time (s):	50.0

PLOT 3-5: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 3 (5 dBi antenna)

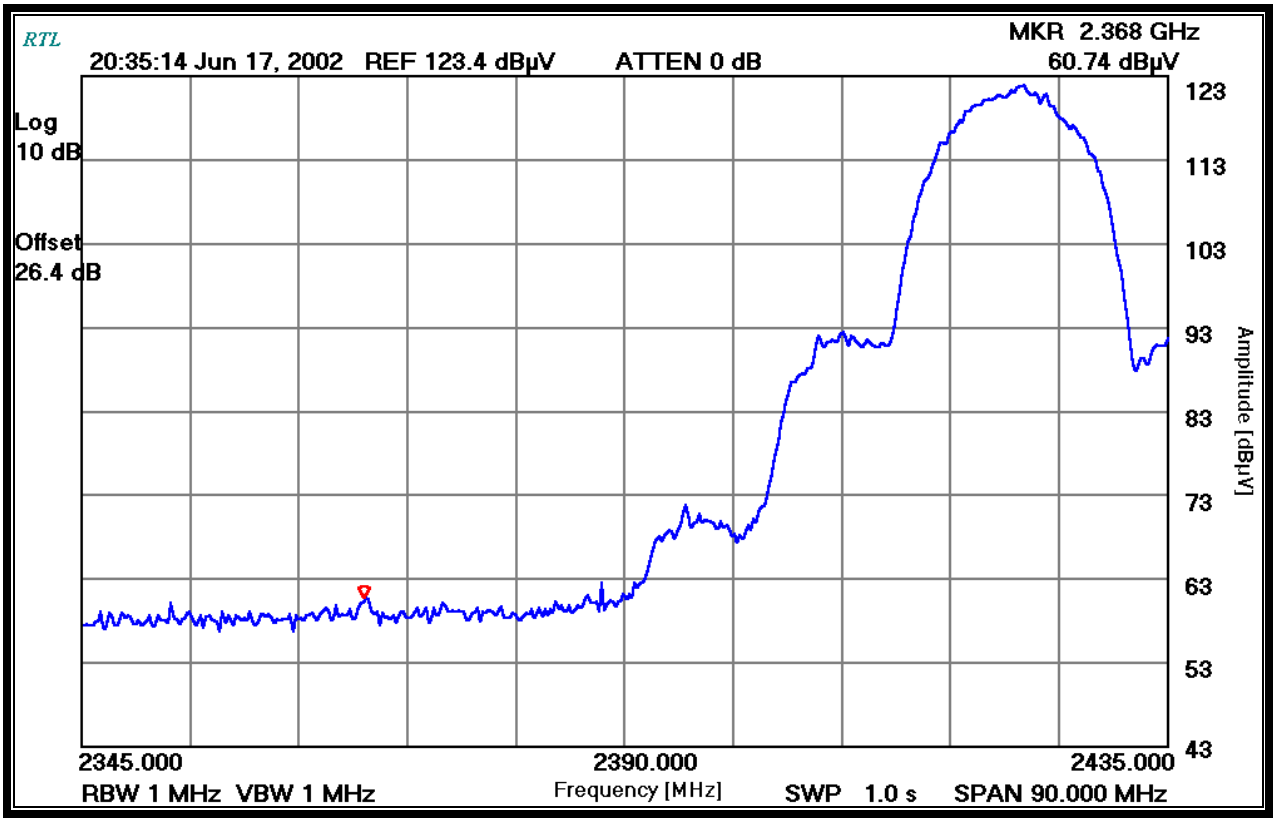


TEST PERSONNEL:

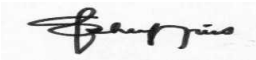
Franck Schuppius		6/17/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	3
Frequency (MHz):	2422
Bandwidth Resolution (MHz):	1
Video Bandwidth (MHz):	1
Sweep Time (s):	1.0

PLOT 3-6: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 3 (5 dBi antenna)

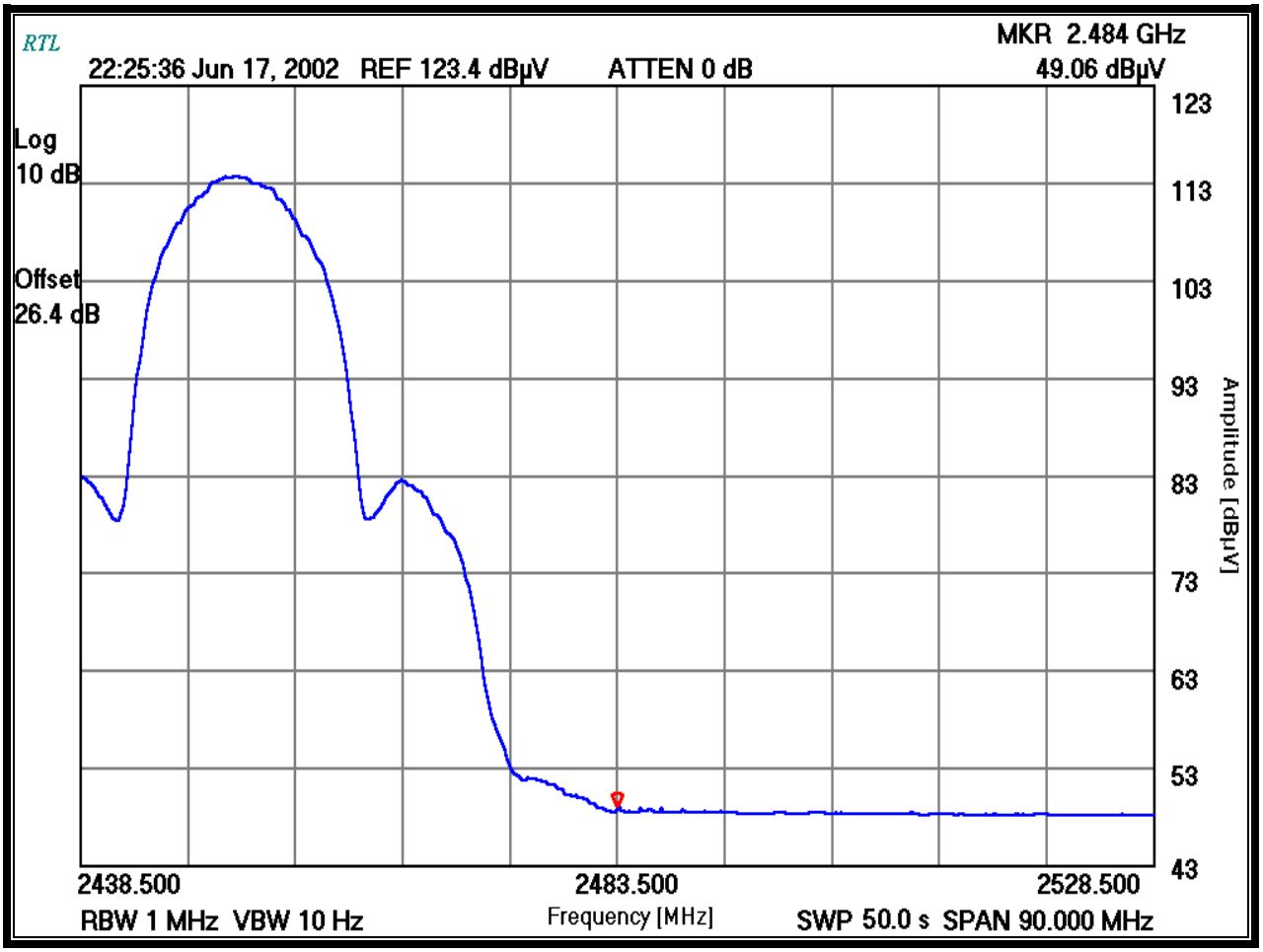


TEST PERSONNEL:

Franck Schuppius		6/17/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	9
Frequency (MHz):	2452
Resolution Bandwidth (MHz):	1
Video Bandwidth (Hz):	10
Sweep Time (s):	50.0

PLOT 3-7: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 9 (5 dBi antenna)

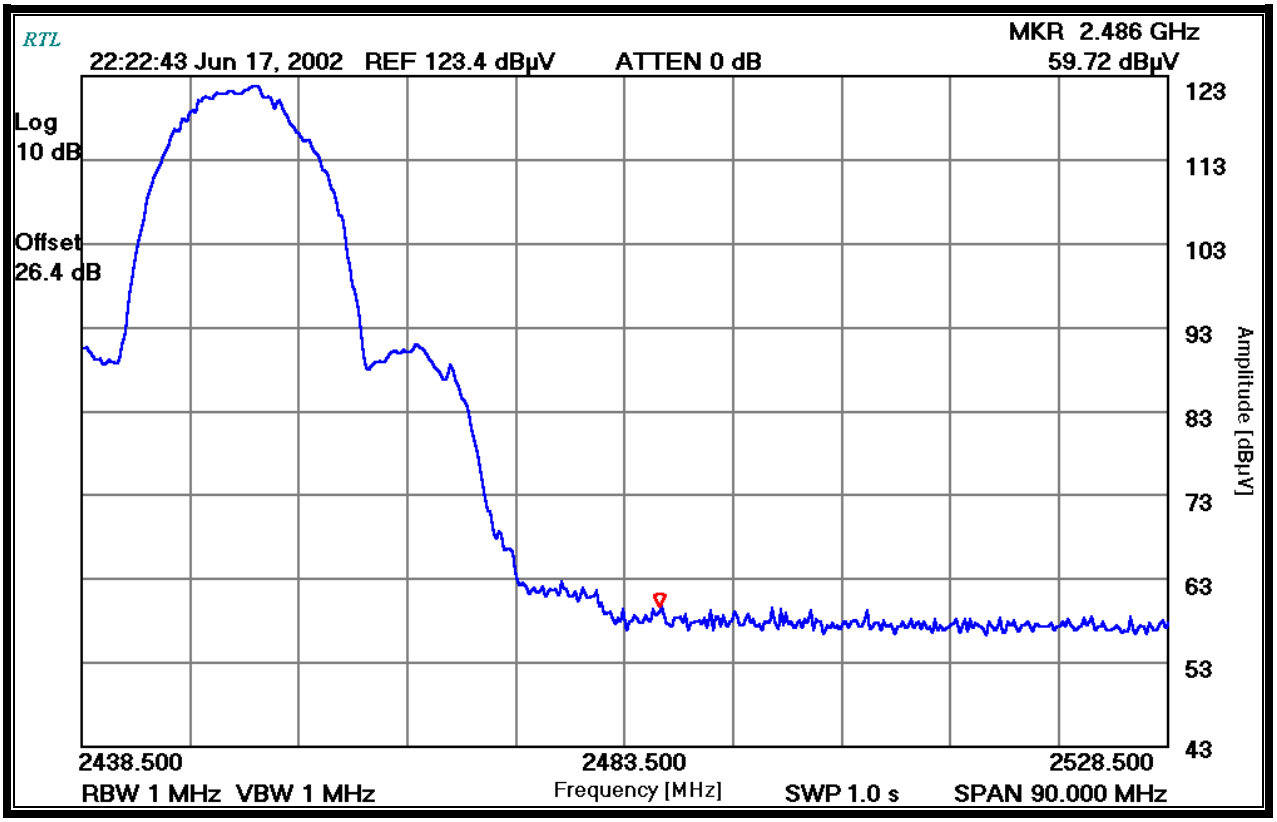


TEST PERSONNEL:

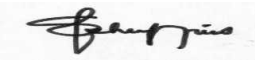
Franck Schuppius		6/17/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number:	9
Frequency (MHz):	2452
Resolution Bandwidth (MHz):	1
Video Bandwidth (MHz):	1
Sweep Time (s):	1.0

PLOT 3-8: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 9 (5 dBi antenna)



TEST PERSONNEL:

Franck Schuppius		6/17/2002
Test Technician/Engineer	Signature	Date Of Test

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 (150/450) 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 errors.

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 450 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE. The EUT was tested in channels 3, 6, and 9; worst case conducted data for both transmitting and receiving is provided for channel 6 in this report.

TABLE 4-1: CONDUCTED SPURIOUS EMISSIONS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	HP	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771
900070	Solar		LISN	

4.3 CONDUCTED EMISSIONS TEST DATA

TABLE 4-2: CONDUCTED EMISSIONS (NEUTRAL SIDE) TRANSMITTING CH 6

Temperature: 72°F Humidity: 45%								
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)
0.508	Pk	45.7	0.1	45.8	48.0	-2.2	48.0	-2.2
0.684	Pk	40.4	0.1	40.5	48.0	-7.5	48.0	-7.5
1.204	Pk	37.8	0.1	37.9	48.0	-10.1	48.0	-10.1
12.250	Pk	33.5	0.5	34.0	48.0	-14.0	48.0	-14.0
14.480	Pk	31.8	0.5	32.3	48.0	-15.7	48.0	-15.7
21.500	Pk	41.7	0.7	42.4	48.0	-5.6	48.0	-5.6

TABLE 4-3: CONDUCTED EMISSIONS (PHASE SIDE) TRANSMITTING CH 6

Temperature: 72°F Humidity: 40%								
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)
0.512	Pk	44.1	0.1	44.2	48.0	-3.8	48.0	-3.8
0.680	Pk	36.3	0.1	36.4	48.0	-11.6	48.0	-11.6
1.204	Pk	37.0	0.1	37.1	48.0	-10.9	48.0	-10.9
12.480	Pk	32.9	0.5	33.4	48.0	-14.6	48.0	-14.6
14.600	Pk	33.0	0.5	33.5	48.0	-14.5	48.0	-14.5
21.080	Pk	40.3	0.7	41.0	48.0	-7.0	48.0	-7.0

TEST PERSONNEL:

Kinh Ly	Kinh Ly	4/27/2002
Test Technician/Engineer	Signature	Date Of Test

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

Temperature: 70°F Humidity: 45%								
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)
0.508	Pk	45.1	0.1	45.2	48.0	-2.8	48.0	-2.8
0.684	Pk	38.9	0.1	39.0	48.0	-9.0	48.0	-9.0
1.204	Pk	37.8	0.1	37.9	48.0	-10.1	48.0	-10.1
12.350	Pk	33.6	0.5	34.1	48.0	-13.9	48.0	-13.9
14.580	Pk	33.5	0.5	34.0	48.0	-14.0	48.0	-14.0
20.630	Pk	39.4	0.7	40.1	48.0	-7.9	48.0	-7.9

TABLE 4-5: CONDUCTED EMISSIONS (NEUTRAL SIDE) RECEIVING CH 6

Temperature: 70°F Humidity: 45%								
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)
0.507	Pk	44.4	0.1	44.5	48.0	-3.5	48.0	-3.5
0.682	Pk	36.8	0.1	36.9	48.0	-11.1	48.0	-11.1
1.204	Pk	36.9	0.1	37.0	48.0	-11.0	48.0	-11.0
12.300	Pk	36.0	0.5	36.5	48.0	-11.5	48.0	-11.5
14.550	Pk	32.4	0.5	32.9	48.0	-15.1	48.0	-15.1
21.130	Pk	41.1	0.7	41.8	48.0	-6.2	48.0	-6.2

TEST PERSONNEL:

Kinh Ly	Kinh Ly	4/27/2002
Test Technician/Engineer	Signature	Date Of Test

5 RADIATED EMISSION LIMITS RECEIVER/DIGITAL INTERFACE - §15.209

5.1 RADIATED EMISSION LIMITS TEST PROCEDURE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. 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 IF, LO and up to the 2nd LO were investigated and tested. Channels 3, 6, and 9 were tested and investigated in the transmitting and receiving mode between 10kHz and 1GHz. The worst –case, channel 6 in both modes and both setups, (PCMCIA card in a laptop and the AP) is presented in the table below.

5.2 RADIATED EMISSION TEST DATA

5.3 RADIATED EMISSION LIMITS TEST DATA RECEIVER/DIGITAL MODE CH6

Temperature: 48°F Humidity: 80%									
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)
47.435	Qp	H	180	1.0	29.2	-15.0	14.2	40.0	-25.8
132.006	Qp	H	180	3.0	36.8	-10.5	26.3	43.5	-17.2
189.618	Qp	H	275	2.0	32.7	-12.1	20.6	43.5	-22.9
215.210	Qp	H	275	2.0	26.0	-11.0	15.0	43.5	-28.5
220.214	Qp	H	315	1.0	26.9	-10.9	16.0	46.0	-30.0
250.377	Qp	H	180	2.0	33.7	-7.9	25.8	46.0	-20.2

5.4 RADIATED EMISSION LIMITS TEST DATA TX/DIGITAL MODE CH6

Temperature: 48°F Humidity: 80%									
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)
72.839	Qp	V	215	2.0	32.4	-18.1	14.3	40.0	-25.7
156.095	Qp	H	275	1.0	31.8	-11.5	20.3	43.5	-23.2
220.112	Qp	V	315	1.0	38.4	-11.0	27.4	46.0	-18.6
255.618	Qp	H	215	1.0	34.5	-7.5	27.0	46.0	-19.0
301.712	Qp	H	215	1.0	28.3	-6.3	22.0	46.0	-24.0
402.281	Qp	V	180	1.0	31.0	-2.9	28.1	46.0	-17.9

TEST PERSONNEL:

Kinh Ly	Kinh Ly	4/27/2002
Test Technician/Engineer	Signature	Date Of Test

6 RADIATED EMISSION LIMITS RADIATED HARMONICS - §15.247

6.1 RADIATED EMISSION LIMITS TEST PROCEDURE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. 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 the X-Y, X-Z and Y-Z orthogonal plane.

6.2 RADIATED EMISSIONS HARMONICS/SPURIOUS TEST DATA

Operating Frequency (MHz): 2422
Channel: 1
Measured Cond. Pwr. (dBm): 29.4
Antenna (dBi) 5

TABLE 6-1: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 3)

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)
4844.000	Av	H	115	1.3	36.8	13.8	50.6	54.0
4844.000	Pk	H	115	1.3	49.8	13.8	63.6	
7266.000	Av	H	95	1.2	29.2	11.6	40.8	54.0
7266.000	Pk	H	95	1.2	39.5	11.6	51.1	
9688.000	Av	H	190	1.1	32.1	15.8	47.9	54.0
9688.000	Pk	H	190	1.1	41.6	15.8	57.4	
12110.00	Av	H	215	1.0	<20 dB			54.0
14532.00	Av	V	10	1.0	<20 dB			54.0
16954.00	Av	V	10	1.0	<20 dB			54.0
19376.00	Av	V	10	1.0	<20 dB			54.0
21798.00	Av	V	10	1.0	<20 dB			54.0
24220.00	Av	V	10	1.0	<20 dB			54.0

PEAK: RES. =1 MHZ, VID= 1MHZ; AVERAGE: RES. =1 MHZ, VID= 10HZ; <20dB= 20dB BELOW THE LIMIT

TEST PERSONNEL:

Kinh Ly	Kinh Ly	7/07/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2437
Channel: 6
Measured Cond. Pwr. (dBm): 28.9
Antenna (dBi): 5

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

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)
4874.000	Av	H	22	1.4	34.7	13.9	48.6	54.0
4874.000	Pk	H	22	1.4	47.4	13.9	61.3	
7311.000	Av	H	55	1.1	>20dB			54.0
9748.000	Av	V	150	1.1	31.4	15.5	46.9	54.0
9748.000	Pk	V	150	1.1	42.7	15.5	58.2	
12185.00	Av	V	15	1.0	30.2	18.2	48.4	54.0
12185.00	Pk	V	15	1.0	41.5	18.2	59.7	
14622.00	Av	V	10	1.0	<20 dB			54.0
17059.00	Av	V	10	1.0	<20 dB			54.0
19496.00	Av	V	10	1.0	<20 dB			54.0
21933.00	Av	V	10	1.0	<20 dB			54.0
24370.00	Av	V	10	1.0	<20 dB			54.0

AVERAGE: RES. =1 MHz, VID= 10Hz; <20dB= 20dB BELOW THE LIMIT

TEST PERSONNEL:

Kinh Ly	Kinh Ly	7/07/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2452
Channel: 9
Measured Cond. Pwr. (dBm): 28.4
Antenna (dBi) 5

TABLE 6-3: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 9)

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)
4904.000	Av	H	30	1.4	36.2	13.8	50.0	54.0
4904.000	Pk	H	30	1.4	49.1	13.8	62.9	
7356.000	Av	H	65	1.1	>20dB			54.0
9808.000	Av	V	290	1.2	33.3	16.2	49.4	
9808.000	Pk	V	290	1.2	45.5	16.2	61.7	54.0
12110.00	Av	V	270	1	28.5	19.7	48.2	
12110.00	Pk	V	270	1	39.7	19.7	59.4	54.0
14712.00	Av	V	10	1.2	<20 dB			54.0
17164.00	Av	V	10	1.0	<20 dB			54.0
19616.00	Av	V	10	1.0	<20 dB			54.0
22068.00	Av	V	10	1.0	<20 dB			54.0
24520.00	Av	V	10	1.0	<20 dB			54.0

AVERAGE: RES. =1 MHz, VID= 10Hz; NF = NOISE FLOOR; <20dB= 20dB BELOW THE LIMIT

TEST PERSONNEL:

Kinh Ly	Kinh Ly	7/07/2002
Test Technician/Engineer	Signature	Date Of Test

7 RADIATED EMISSION LIMITS RADIATED HARMONICS - §15.247

7.1 RADIATED EMISSION LIMITS TEST PROCEDURE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. 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 the X-Y, X-Z and Y-Z orthogonal plane.

7.2 RADIATED EMISSIONS HARMONICS/SPURIOUS TEST DATA

Operating Frequency (MHz): 2422
Channel: 3
Measured Cond. Pwr. (dBm): 29.4
Antenna (dBi) 3 dBi

TABLE 7-1: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 3)

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)
4874.00	Av	V	10	1.2	32.7	13.3	46.0	54.0
4874.00	Pk	V	10	1.2	42.7	13.3	56.0	
7311.00	Av	H	90	1.2	39.0	11.8	50.8	54.0
7311.00	Pk	H	90	1.2	49.0	11.8	60.8	
9688.000	Av	H	190	1.1	<20 dB			54.0
12110.00	Av	V	270	1	<20 dB			54.0
14532.00	Av	V	10	1.0	<20 dB			54.0
16954.00	Av	V	10	1.0	<20 dB			54.0
19376.00	Av	V	10	1.0	<20 dB			54.0
21798.00	Av	V	10	1.0	<20 dB			54.0
24220.00	Av	V	10	1.0	<20 dB			54.0

PEAK: RES. =1 MHZ, VID= 1MHZ; AVERAGE: RES. =1 MHZ, VID= 10HZ; <20dB= 20dB BELOW THE LIMIT

TEST PERSONNEL:

Kinh Ly	Kinh Ly	7/07/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2437
Channel: 6
Measured Cond. Pwr. (dBm): 28.9
Antenna (dBi) 3 dBi

TABLE 7-2: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 6)

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)
4872.40	Av	H	215	1	29.0	13.8	42.8	54.0
4872.40	Pk	H	215	1	37.4	13.8	51.2	
7307.62	Av	V	25	1	35.3	12.0	47.3	54.0
7307.32	Pk	V	25	1	43.2	12.0	55.2	
9748.00	Av	V	15	1	30.5	16.4	46.9	54.0
9747.94	Pk	V	15	1	39.3	16.4	55.7	
12184.83	Av	V	85	1	28.7	18.5	47.2	54.0
12185.00	Pk	V	85	1	38.1	18.5	56.6	
14622.00	Av	V	10	1.0	<20 dB			54.0
17059.00	Av	V	10	1.0	<20 dB			54.0
19496.00	Av	V	10	1.0	<20 dB			54.0
21933.00	Av	V	10	1.0	<20 dB			54.0
24370.00	Av	V	10	1.0	<20 dB			54.0

AVERAGE: RES. =1 MHz, VID= 10Hz; <20dB= 20dB BELOW THE LIMIT

TEST PERSONNEL:

Kinh Ly	Kinh Ly	7/07/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2452
Channel: 9
Measured Cond. Pwr. (dBm): 28.4
Antenna (dBi) 3

TABLE 7-3: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 9)

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)
4904.30	Av	H	215	1	30.6	13.9	44.5	54.0
4904.60	Pk	H	215	1	40.2	13.9	54.1	
7356.50	Av	V	25	1	34.0	11.8	45.8	54.0
7356.50	Pk	V	25	1	42.3	11.8	54.1	
9807.30	Av	V	15	1	31.5	16.7	48.2	54.0
9807.40	Pk	V	15	1	39.8	16.7	56.5	
12264.20	Av	V	85	1	30.2	18.2	48.4	54.0
12264.20	Pk	V	85	1	38.4	18.2	56.6	
14712.00	Av	V	10	1.2	<20 dB			54.0
17164.00	Av	V	10	1.0	<20 dB			54.0
19616.00	Av	V	10	1.0	<20 dB			54.0
22068.00	Av	V	10	1.0	<20 dB			54.0
24520.00	Av	V	10	1.0	<20 dB			54.0

AVERAGE: RES. =1 MHz, VID= 10Hz; NF = NOISE FLOOR; <20dB= 20dB BELOW THE LIMIT

TEST PERSONNEL:

Kinh Ly	Kinh Ly	7/07/2002
Test Technician/Engineer	Signature	Date Of Test

7.3 TEST EQUIPMENT USED FOR TESTING

TABLE 7-4: RADIATED SPURIOUS EMISSIONS TEST EQUIPMENT

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771
900772	EMCO	3161-02	Horn ANTENNA (2-4 GHz)	900772
900321	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020
900323	EMCO	3160-7	Horn Antennas (8,2-12,4 GHz)	9605-1054
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051
900723	Miteq	NA	AMP 100MHz-26GHz	N/A
900791	Schaffner - Chase	CBL6112	Antenna (25 MHz - 2 GHz)	2099

8 MODULATED BANDWIDTH - §15.247(A)(2)

8.1 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 for the 1W configuration are listed in the table below. The worst case bandwidth plots for the 1W configuration are included in this report.

8.2 TEST EQUIPMENT USED FOR TESTING

TABLE 8-1: TEST EQUIPMENT USED FOR TESTING (MODULATED BANDWIDTH)

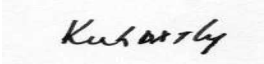
RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771

8.3 MODULATED BANDWIDTH TEST DATA

TABLE 8-2: MINIMUM 6 DB MODULATED BANDWIDTHS

CHANNEL	1W 6 dB BANDWIDTH (MHz)
3	10.5
6	10.3
9	11.0

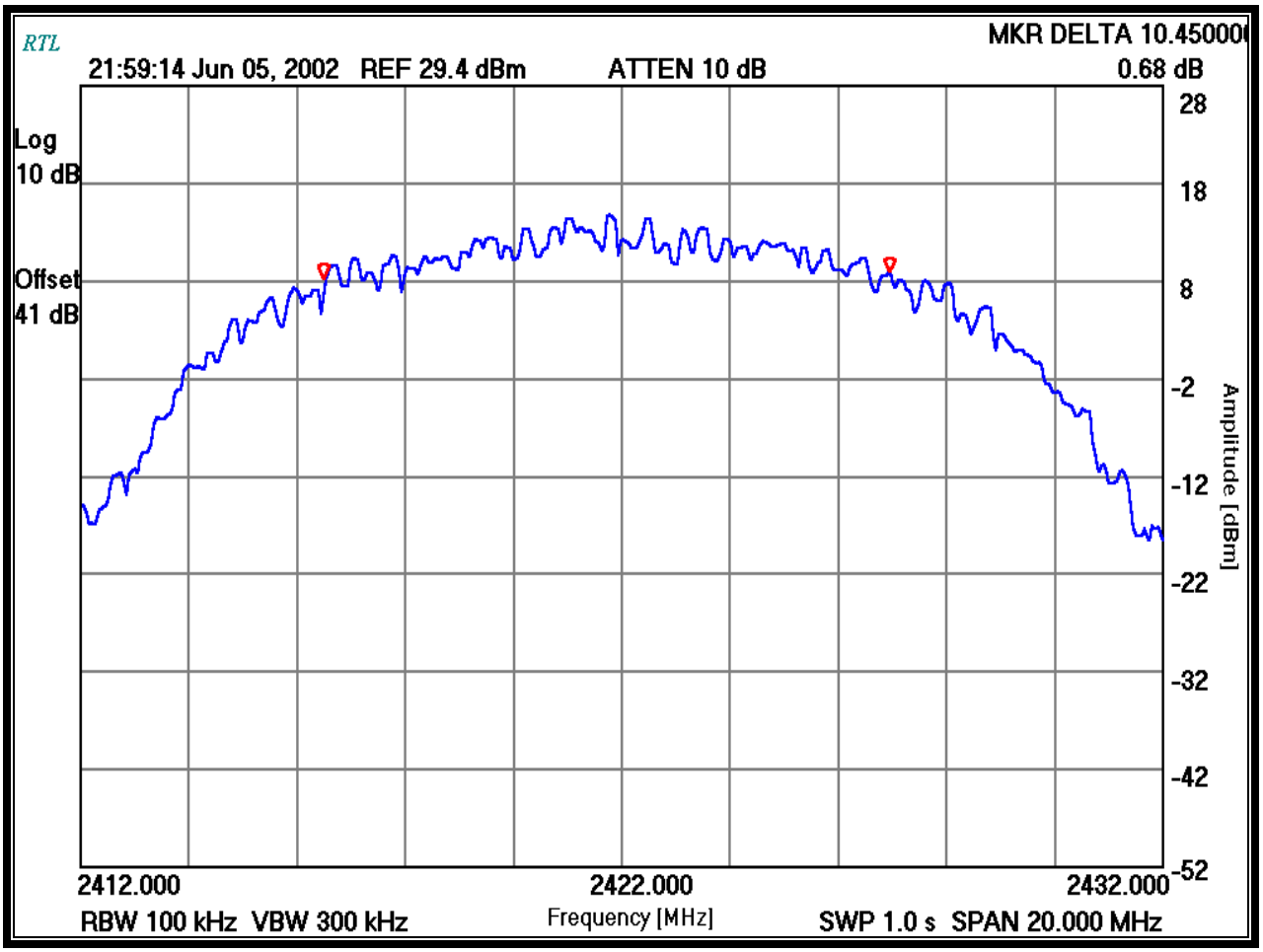
TEST PERSONNEL:

Kinh Ly		6/05/2002
Test Technician/Engineer	Signature	Date Of Test

8.4 MODULATED BANDWIDTH PLOTS

Channel Number:	3
Frequency (MHz):	2422
Resolution Bandwidth (kHz):	100
Video Bandwidth (kHz):	300
Sweep Time (s):	1.0s

PLOT 8-1: MODULATED BANDWIDTH CHANNEL 3 -1W MODE

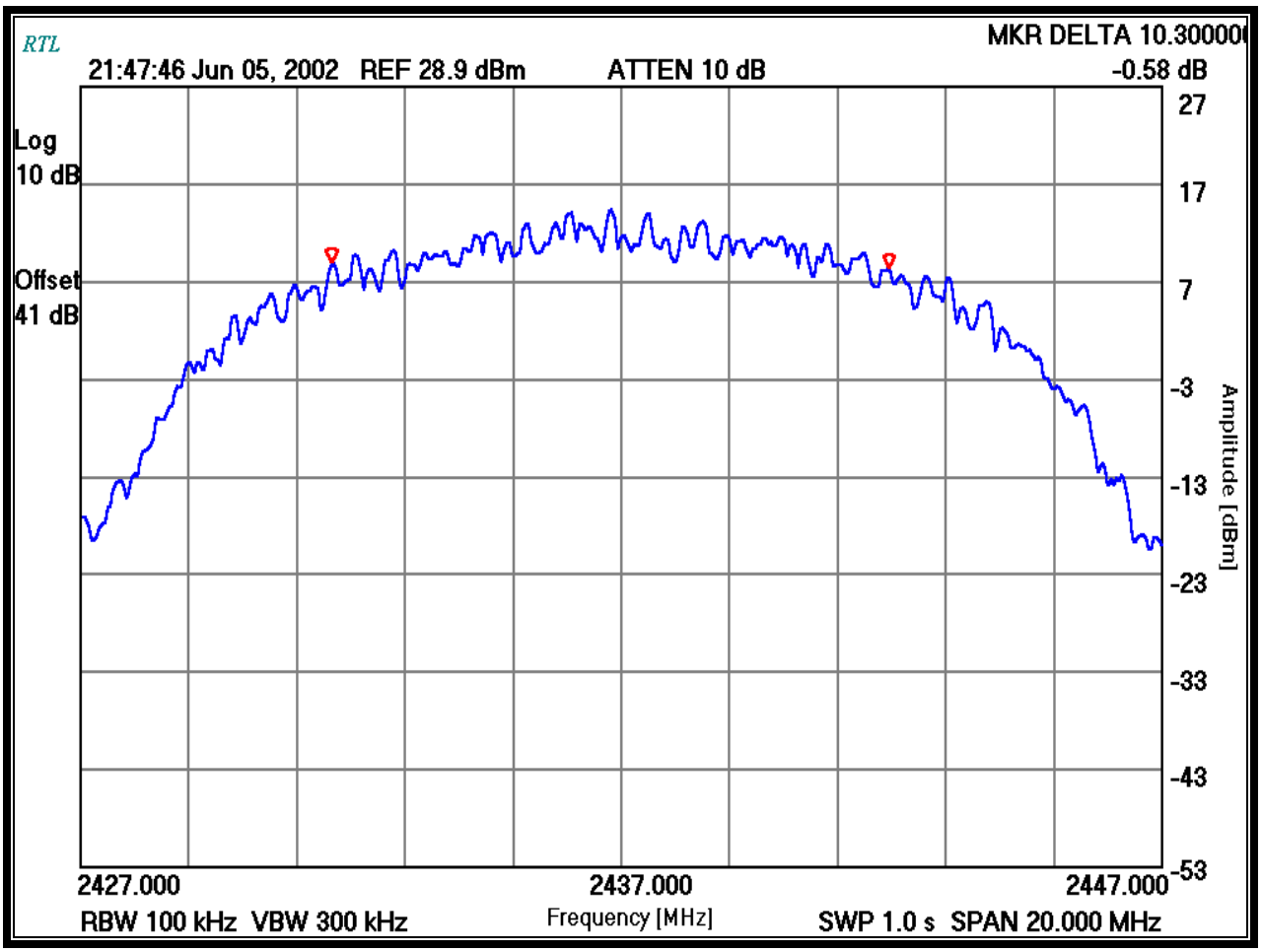


TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/5/2002
Test Engineer	Signature	Date Of Test

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

PLOT 8-2: MODULATED BANDWIDTH CHANNEL 6 - 1W MODE

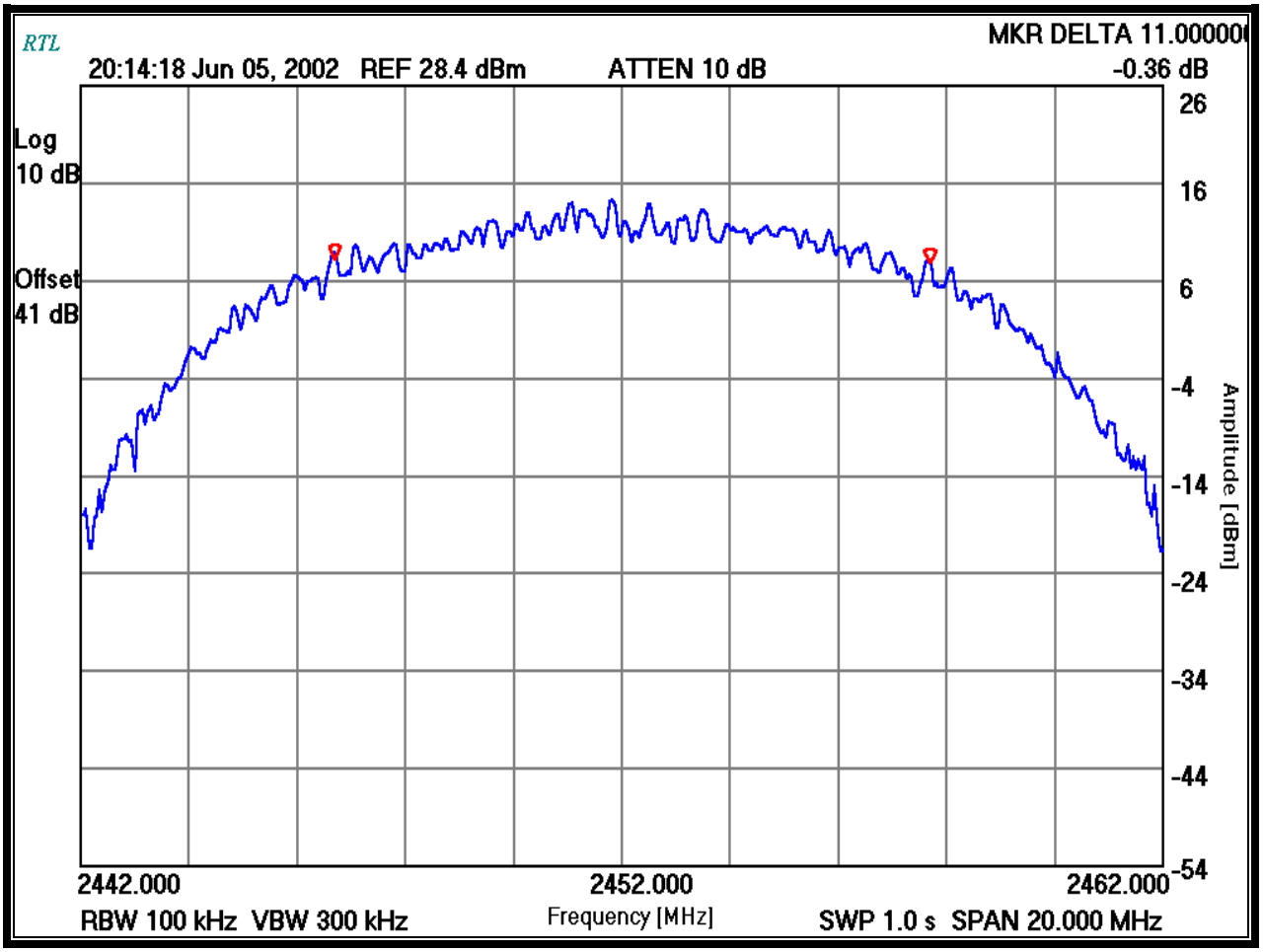


TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/5/2002
Test Engineer	Signature	Date Of Test

Channel Number:	9
Frequency (MHz):	2452
Resolution Bandwidth (kHz):	100
Video Bandwidth (kHz):	300
Sweep Time (s):	1.0

PLOT 8-3: MODULATED BANDWIDTH CHANNEL 9 - 1W MODE



TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/5/2002
Test Engineer	Signature	Date Of Test

9 POWER OUTPUT - §15.247(B)

9.1 POWER OUTPUT TEST PROCEDURE

The peak 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. The EIRP measurement was performed as a radiated test using the substitution method.

9.2 TEST EQUIPMENT USED FOR TESTING

TABLE 9-1: TEST EQUIPMENT USED FOR TESTING (RADIATED RF OUTPUT – EIRP)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901186	Agilent Technologies	E9323A (50MHz-6GHz)	Peak & Avg. Power Sensor	US40410380
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771
900772	EMCO	3161-02	Horn ANTENNA (2-4 GHz)	900772
900723	Miteq	NA	AMP 100MHz-26GHz	NA
900814	Electro-Metrics	RGA-60	Double Ridges Guide Antenna (1-18 GHz)	2310

9.3 POWER OUTPUT TEST DATA

TABLE 9-2: POWER OUTPUT TEST DATA

Operating Frequency (MHz): 2422, 2437, 2452
Channel: 3, 6 & 9
Measured Cond. Pwr. (dBm): 29.4, 28.9 & 28.4

TABLE 9-3: POWER OUTPUT TEST DATA WITH EIRP

CHANNEL	EIRP (dBm)* for 3 dBi	EIRP (dBm)* for 5 dBi	POWER CONDUCTED OUTPUT (dBm)
3	32.0	34.0	29.4
6	29.5	34.1	28.9
9	31.0	33.0	28.4

*Measurement accuracy is +/- 1.5 dB

TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/03/2002
Test Technician/Engineer	Signature	Date Of Test

10 ANTENNA CONDUCTED SPURIOUS EMISSIONS - §15.247(C)

10.1 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 2.422GHz for Channel 3, 2.437GHz for Channel 6 and 2.452GHz for Channel 9. No other harmonics or spurs were found within 20 dB of the carrier level, and from 9kHz to the carriers 10th harmonic. See the antenna conducted spurious noise table below. Channels 3, 6, and 9 were investigated and tested.

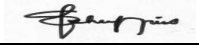
10.2 ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA

Operating Frequency (MHz): 2422
Channel: 3
Measured Cond. Pwr. (dBm): 29.4
Limit (dBm): -3

TABLE 10-1: ANTENNA CONDUCTED SPURIOUS EMISSIONS

Frequency (MHz)	Measured Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Measured Level (dBm)	Margin (dB)
4844	-30.3	2.2	-28.2	-25.2
7266	-34.0	1.5	-32.5	-29.5
9688	-35.2	6.8	-28.3	-25.3
12110	-33.5	7.8	-25.7	-22.7
14532	-31.2	4.7	-26.5	-23.5
16954	-32.5	10.3	-22.2	-19.2
19376	-32.3	11.5	-20.8	-17.8
21798	-32.7	11.3	-21.4	-18.4
24220	-30.8	11.5	-19.3	-16.3

TEST PERSONNEL:

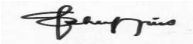
Franck Schuppius		6/06/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2437
Channel: 6
Measured Cond. Pwr. (dBm): 28.9
Limit (dBm): -2.8

TABLE 10-2: ANTENNA CONDUCTED SPURIOUS EMISSIONS

Frequency (MHz)	Measured Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Measured Level (dBm)	Margin (dB)
4874	-33.2	1.8	-31.3	-28.5
7311	-33.3	4.2	-29.1	-26.3
9748	-34.7	3.5	-31.2	-28.4
12185	-34.0	9.8	-24.2	-21.4
14622	-30.8	7.8	-23.0	-20.2
17059	-34.2	8.8	-25.3	-22.5
19496	-33.0	14.2	-18.8	-16.0
21933	-32.2	14.0	-18.2	-15.4
24370	-31.7	14.3	-17.4	-14.6

TEST PERSONNEL:

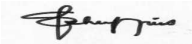
Franck Schuppius		6/06/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2452
Channel: 9
Measured Cond. Pwr. (dBm): 28.4
Limit (dBm): -3.3

TABLE 10-3: ANTENNA CONDUCTED SPURIOUS EMISSIONS

Frequency (MHz)	Measured Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Measured Level (dBm)	Margin (dB)
4904	-33.2	1.5	-31.7	-28.4
7356	-31.8	4.5	-27.3	-24.0
9808	-33.0	8.8	-24.2	-20.9
12260	-34.3	12.0	-22.3	-19.0
14712	-31.5	5.7	-25.8	-22.5
17164	-32.3	8.3	-24.0	-20.7
19616	-32.2	13.2	-19.0	-15.7
22068	-31.7	13.3	-18.4	-15.1
24520	-28.7	13.3	-15.4	-12.1

TEST PERSONNEL:

Franck Schuppius		6/06/2002
Test Technician/Engineer	Signature	Date Of Test

11 POWER SPECTRAL DENSITY - §15.247(D)

11.1 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 seconds. Since the EUT has port available to performed a test with the appropriate attenuation pad. The spectral lines were resolved for the modulated carriers at 2.422GHz, 2.437GHz, and 2.452GHz respectively. These levels are well below the +8 dBm limit. See the power spectral density table and plots that follow.

11.2 TEST EQUIPMENT USED FOR TESTING

TABLE 11-1: TEST EQUIPMENT USED FOR TESTING (POWER SPECTRAL DENSITY)

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771

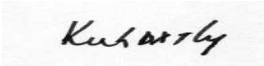
11.3 POWER SPECTRAL DENSITY TEST DATA

Operating Frequency (MHz): 2422, 2437 & 2452
Channel: 3, 6 & 9
Measured Cond. Pwr. (dBm): 29.4, 28.9 & 28.4
Limit (dBm): 8

TABLE 11-2: POWER SPECTRAL DENSITY

CHANNEL	1000mW-POWER SPECTRAL DENSITY LIMIT = +8dBm
3	1.6
6	1.4
9	0.5

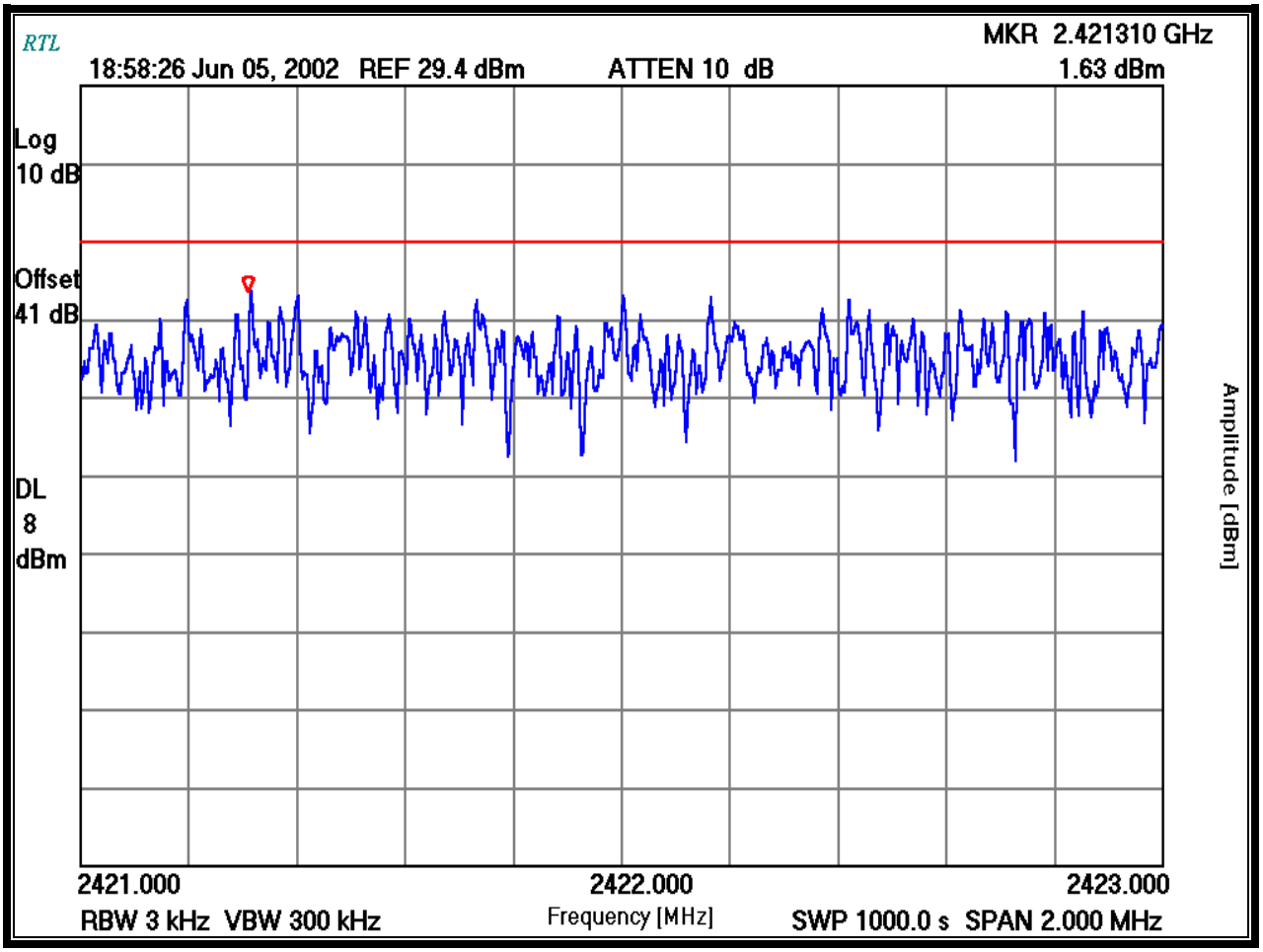
TEST PERSONNEL:

Kinh Ly		6/5/2002
Test Technician/Engineer	Signature	Date Of Test

11.4 POWER SPECTRAL DENSITY PLOTS

Operating Frequency (MHz):	2422
Channel:	3
Measured Cond. Pwr. (dBm):	29.4
Bandwidth Resolution (kHz):	3
Bandwidth Video (kHz):	300
Sweep Time (s):	1000.0

PLOT 11-1: POWER SPECTRAL DENSITY: CHANNEL 3

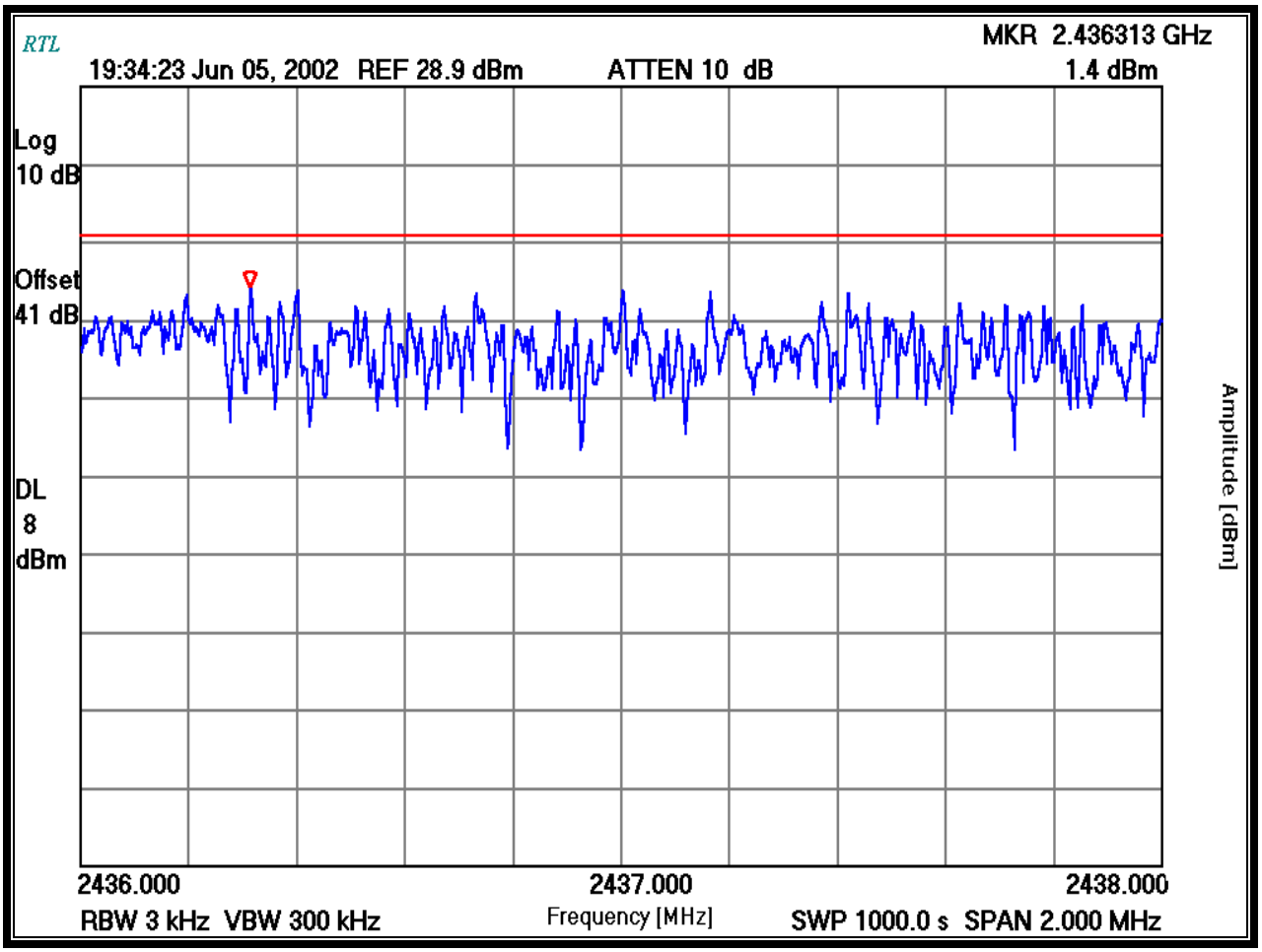


TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/5/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz):	2437
Channel:	6
Measured Cond. Pwr. (dBm):	28.9
Bandwidth Resolution (kHz):	3
Bandwidth Video (kHz):	300
Sweep Time (s):	1000.0

PLOT 11-2: POWER SPECTRAL DENSITY: CHANNEL 6

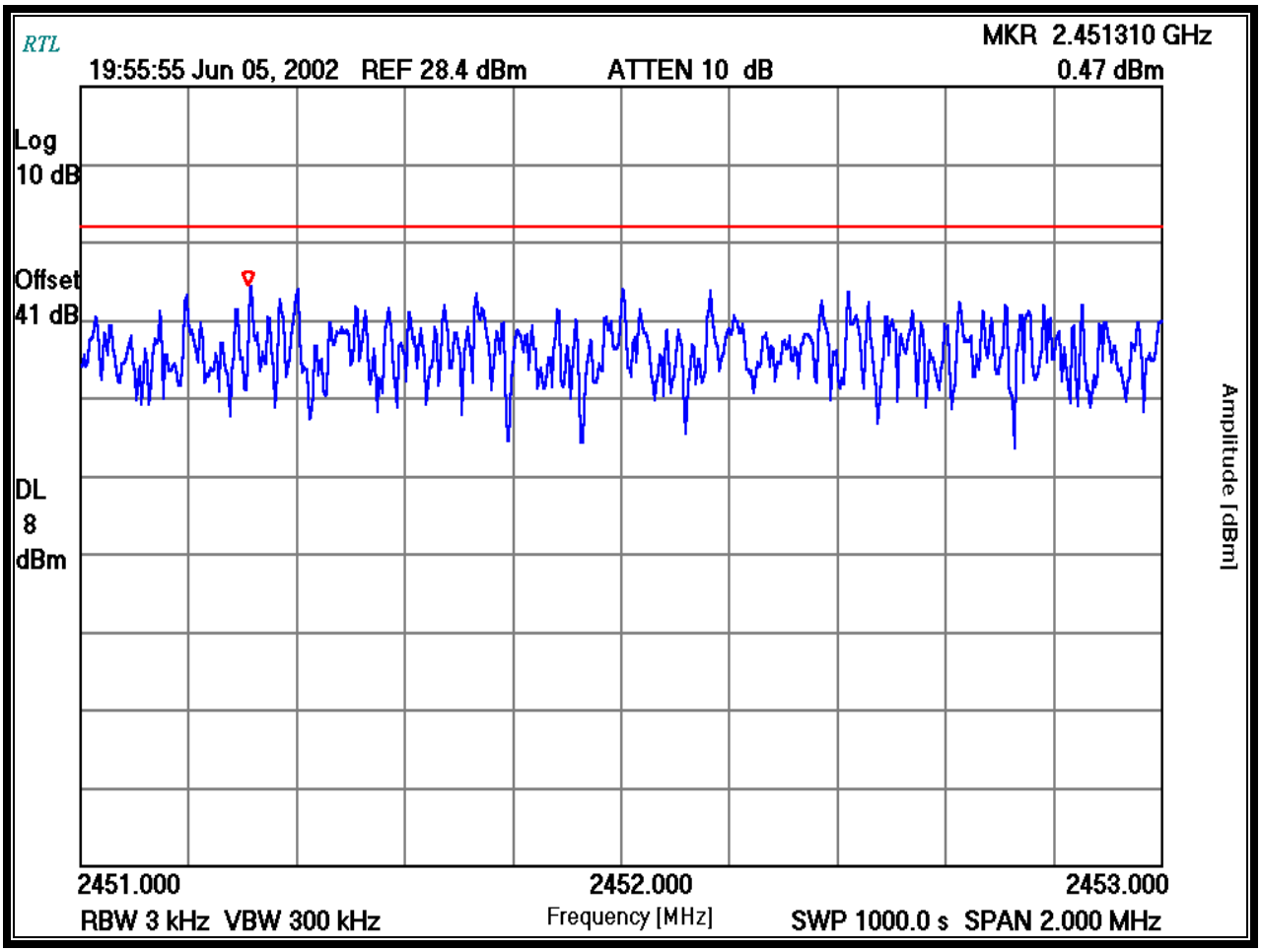


TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/5/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz):	2452
Channel:	9
Measured Cond. Pwr. (dBm):	28.4
Bandwidth Resolution (kHz):	3
Bandwidth Video (kHz):	300
Sweep Time (s):	1000.0

PLOT 11-3: POWER SPECTRAL DENSITY: CHANNEL 9



TEST PERSONNEL:

Kinh Ly	Kinh Ly	6/5/2002
Test Technician/Engineer	Signature	Date Of Test

12 CONCLUSION

The data in this measurement report shows that the Northrop Grumman Corporation Information Technology, Defense Mission Systems Model: Vehicle Extended Range Amplified WLAN System, FCC ID: P6GWLERVA, complies with all the requirements of Parts 2 and 15 of the FCC Rules and Industry Canada RSS-139.