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Measured Radio Frequency Emissions
From

Hyperlink Technologies 802.11b DSS System
FCC ID: MYF-XI-325X
IC: 2837A-XI-2325X

Report No. 415031-213
May 7, 2004

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Summary

Tests for compliance with FCC Regulations, Part 15.247, and with Industry Canada Regulations, RSS-210, Section 6.2.2 (o), were performed on Hyperlink spread spectrum RF Extended Range LAN System. The DUT is subject to the Rules and Regulations as a transmitter, a receiver, and a digital device. This link uses an FCC certified spread spectrum PCMCIA radio, but adds combinations of amplifiers, a filter, and antennas. Here we report on measurements of combinations of antennas and amplifiers to demonstrate compliance. We also report on the AC line conducted emissions for the power supply used by the power amplifier.

In testing completed on May 4, 2004, worst case radiated emissions in the restricted bands were met by 0.6 dB at a frequency of 2390 MHz (see p. 12). Power supply conducted emissions, Class B, were met by 4.7 dB at a frequency of 1.49 MHz (see p. 12).

Introduction

Hyperlink extended range radio configurations were tested for compliance with FCC Regulations, Part 15, adopted under Docket 87-389, April 18, 1989, and with Industry Canada RSS-210, Issue 5, November, 2001. The tests were performed at the University of Michigan Radiation Laboratory Willow Run Test Range following the procedures described in ANSI C63.4-1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The Site description and attenuation characteristics of the Open Site facility are on file with FCC Laboratory, Columbia, Maryland (FCC Reg. No: 91050) and with Industry Canada, Ottawa, ON (File Ref. No: IC 2057).

1. Test Procedure and Equipment Used

The test equipment commonly used in our facility is listed in Table 2.1 below. The HP 8593E spectrum analyzer is used for primary amplitude and frequency reference.

Table 2.1 Test Equipment

Test Instrument	Eqpt. Used	Manufacturer/Model
Spectrum Analyzer (0.1-1500 MHz)		Hewlett-Packard, 182T/8558B
Spectrum Analyzer (9kHz-22GHz)	X	Hewlett-Packard 8593A SN: 3107A01358
Spectrum Analyzer (9kHz-26GHz)	X	Hewlett-Packard 8593E, SN: 3412A01131
Spectrum Analyzer (9kHz-26GHz)		Hewlett-Packard 8563E, SN: 3310A01174
Spectrum Analyzer (9kHz-40GHz)		Hewlett-Packard 8564E, SN: 3745A01031
Power Meter	X	Hewlett-Packard, 432A
Power Meter		Anritsu, ML4803A/MP
Crystal Detector	X	Hewlett-Packard, 8472A (25 ns rise-time)
Oscilloscope	X	Hewlett-Packard, 54510A
Harmonic Mixer (26-40 GHz)		Hewlett-Packard 11970A, SN: 3003A08327
Harmonic Mixer (40-60 GHz)		Hewlett-Packard 11970U, SN: 2332A00500
Harmonic Mixer (75-110 GHz)		Hewlett-Packard 11970W, SN: 2521A00179
Harmonic Mixer (140-220 GHz)		Pacific Millimeter Prod., GMA, SN: 26
S-Band Std. Gain Horn	X	S/A, Model SGH-2.6
C-Band Std. Gain Horn	X	University of Michigan, NRL design
XN-Band Std. Gain Horn	X	University of Michigan, NRL design
X-Band Std. Gain Horn	X	S/A, Model 12-8.2
X-band horn (8.2- 12.4 GHz)	X	Narda 640
X-band horn (8.2- 12.4 GHz)		Scientific Atlanta , 12-8.2, SN: 730
K-band horn (18-26.5 GHz)	X	FXR, Inc., K638KF
Ka-band horn (26.5-40 GHz)	X	FXR, Inc., U638A
U-band horn (40-60 GHz)		Custom Microwave, HO19
W-band horn(75-110 GHz)		Custom Microwave, HO10
G-band horn (140-220 GHz)		Custom Microwave, HO5R
Bicone Antenna (30-250 MHz)	X	University of Michigan, RLBC-1
Bicone Antenna (200-1000 MHz)	X	University of Michigan, RLBC-2
Dipole Antenna Set (30-1000 MHz)	X	University of Michigan, RLDP-1,-2,-3
Dipole Antenna Set (30-1000 MHz)		EMCO 2131C, SN: 992
Active Rod Antenna (30 Hz-50 MHz)		EMCO 3301B, SN: 3223
Active Loop Antenna (30 Hz-50 MHz)		EMCO 6502, SN:2855
Ridge-horn Antenna (300-5000 MHz)	X	University of Michigan
Amplifier (5-1000 MHz)	X	Avantek, A11-1, A25-1S
Amplifier (5-4500 MHz)	X	Avantek
Amplifier (4.5-13 GHz)	X	Avantek, AFT-12665
Amplifier (6-16 GHz)	X	Trek
Amplifier (16-26 GHz)	X	Avantek
LISN Box	X	University of Michigan
Signal Generator		Hewlett-Packard 8657B

2. Configuration and Identification of Device Under Test

The DUT is a spread spectrum RF wireless link operating in 2400 - 2483.5 MHz band. The system tested consists of a laptop computer, PCMCIA radio, coax cable, (choice of) amplifier, (choice of) filter, and (choice of) antenna.

There are three primary configurations for this system: 1) outdoor amplifier and separate antenna with DC injector coaxial power feed, 2) indoor amplifier (model number includes an “I”) with DC power (fed directly into the amplifier) and separate antenna, 3) no amplifier with antenna connected directly to the PCMCIA radio. The system has been designed to operate with up to 12 channels from 2412 to 2462 MHz.; however, when operated with an amplifier, channels are restricted to meet the FCC and IC emissions limits (See the *Acceptable Configurations* exhibit).

The DUT was designed and manufactured by Hyperlink Technologies Inc, 1200 Clint Moore Road, Suite 14, Boca Raton, Florida 33487. Figure 3.1 shows the block diagram of the basic system. It is identified as:

Hyperlink Technologies, Inc.
Amplifier Model(s): HA2401GXI-XXX, HA2401GX-XXX
FCC ID: MYF-XI-325X
IC: 2837A-XI-325X

XXX stands for the amplifier power rating in milliwatts.

5 configurations were fully tested for compliance. It is demonstrated in this test report that the tested configurations accurately depict the worst case emissions from the DUT out of all configurations listed in the *Acceptable Configurations* exhibit, which is included in this filing. It is the intent of this test report to demonstrate compliance for all configurations listed in the *Acceptable Configurations* exhibit. Systems using N-Type connectors will be installed by Professional Installers. Systems manufactured with RP-TNC connectors may be installed by End-Users.

Note: All amplifier models consist of the same PCB, with an input attenuator/AGC circuit that is TUNED ONLY BY THE MANUFACTURER FOR DIFFERENT OUTPUT POWER LEVELS. Since the amplifier models herein have an amplification stage biased independent from the input power level, the spectral integrity of the device is consistent across all models in this test report. Also note that THE AMPLIFIERS USED IN THIS FILING WILL ONLY BE SOLD AS A COMPLETE SYSTEM AS SHOWN WITHIN THIS APPLICATION (PCMCIA Card + DC Injector (if outdoor) + Amplifier + Filter (if required) + Antenna). Please see the *Attestations* exhibit for statements from the manufacturer.

With components evaluated:

Radio:

Z-Com Radio	SN: X3253ANU00500
Model XI-325	FCC ID: MM4Y-000325

Laptop Computer:

Dell Inspiron	SN: PP07L
Model: 5100	PN: 2U913 A02

Amplifier(s):

Table 3.1 AGC Amplifiers

Amplifier Model	Output Power (dBm)	Power Setting used in Testing
HA2401GXI-1000, HA2401GX-1000	30 (29.9 meas.)	X
HA2401GXI-800, HA2401GX-800	29	
HA2401GXI-630, HA2401GX-630	28	
HA2401GXI-500, HA2401GX-500	27	
HA2401GXI-400, HA2401GX-400	26	
HA2401GXI-250, HA2401GX-250	24	
HA2401GXI-150, HA2401GX-100	22 (21.8 meas.)	X

Power Supply, for amplifier(s)
Model: UIA324-12 FCC: Class B

DC Injector
HyperLink, Model: BT2405

Filters
Bandpass Filter, 4-pole, Model: BPF24

Cables
Antenna cable, 50 feet, WBC400, with N-connectors - 3dB/50ft loss at 2.437 GHz
Antenna cable, 0.1 m with N-connectors - 0.1 dB loss at 2.437 GHz
Pigtail cable, 18 in., RG-214, HyperLink

Antennas

Table 3.2 Antennas

Antenna Model	Construction	Gain (dBi)	Used in Testing
HG2401U	whip/monopole	1	X
HG2402RD	whip/monopole	2	
HG2403RD	whip/monopole	3	
HG2403UR	whip/monopole	3	
HG2404CU	whip/monopole	3	
RE05E	whip/monopole	5	
RE05U	whip/monopole	5	X
HG2405	whip/monopole	5	
HG2406U	whip/monopole	6	
HG2407U	whip/monopole	7	
HG2408U	whip/monopole	8	
HG2409U	whip/monopole	8.5	
HGV-2409U	whip/monopole	8.5	
HG2410U	whip/monopole	10	
HG2412U	whip/monopole	12	
HG2415U-PRO	whip/monopole	15	X

2.1 EMI Relevant Modifications

During the course of testing, amplifier (if included), filter (if included), and antenna were selected and then the available channels for the particular configuration were reduced (if necessary) to meet the band-edge and harmonic emission limits.

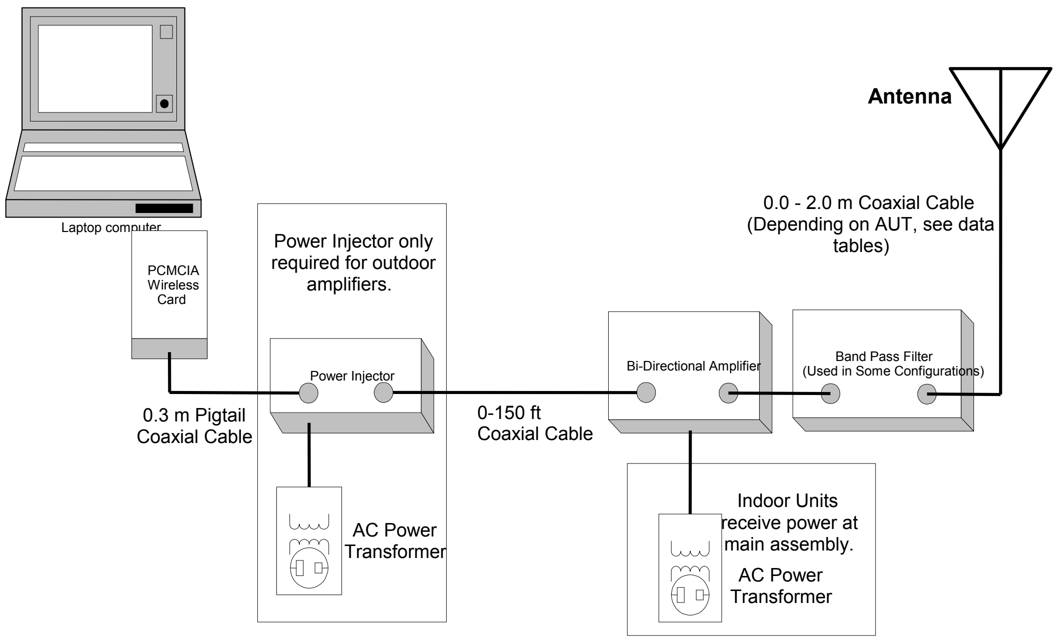


Figure 3.1 Basic block diagram of the system

3. Emission Limits

3.1 Radiated Emission Limits

Since the DUT is a spread spectrum device (15.247, 2.4 GHz), the radiated emissions are subject to emissions in restricted bands (15.205). The applicable frequencies, through ten harmonics, are given below in Table 4.1. Emission limits from digital circuitry are specified in Table 4.2.

Table 4.2 Radiated Emission Limits (FCC:15.205; IC:RSS-210, 6.3) - Transmitter

Frequency (MHz)	Fundamental Ave. E_{lim} (3m)		Spurious* Ave. E_{lim} (3m)	
	(μV/m)	dB (μV/m)	(μV/m)	dB (μV/m)
2400-2483.5	---		---	
2310-2390 2483.5-2500 4500-5250	Restricted Bands		500	54.0
7250-7750 14470-14500 17700-21400 22010-23120 23600-24000	Restricted Bands		500	54.0

* Measure up to tenth harmonic; 1 MHz res. BW, 100 Hz video BW (for average detection)

Table 4.2 Radiated Emission Limits (FCC:15.109;IC: RSS-210, 7.3) - Digital device.

Frequency (MHz)	Class A ds = 10 m		Class B ds = 3 m	
	(μV/m)	dB (μV/m)	(μV/m)	dB (μV/m)
30-88	90	39.0	100	40.0
88-216	150	43.5	150	43.5
219-960	210	46.4	200	46.0
960-	300	49.5	500	54.0

120 kHz BW up to 1 GHz, 1 MHz BW above 1 GHz

3.2 Conductive Emission Limits

Table 4.3 Conducted Emission Limits (FCC/CISPR:15.107; IC: RSS-210, 6.6).

Frequency MHz	Class A (dBμV)		Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
.150 - 0.50	79	66	66 - 56*	56 - 46*
0.50 - 5	73	60	56	46
5 - 30	73	60	60	50

Notes:
1. The lower limit shall apply at the transition frequency
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15-0.50 MHz:

*Class B Quasi-peak: dBμV = 50.25 - 19.12*log(f)
*Class B Average: dBμV = 40.25 - 19.12*log(f)

3. 9 kHz RBW

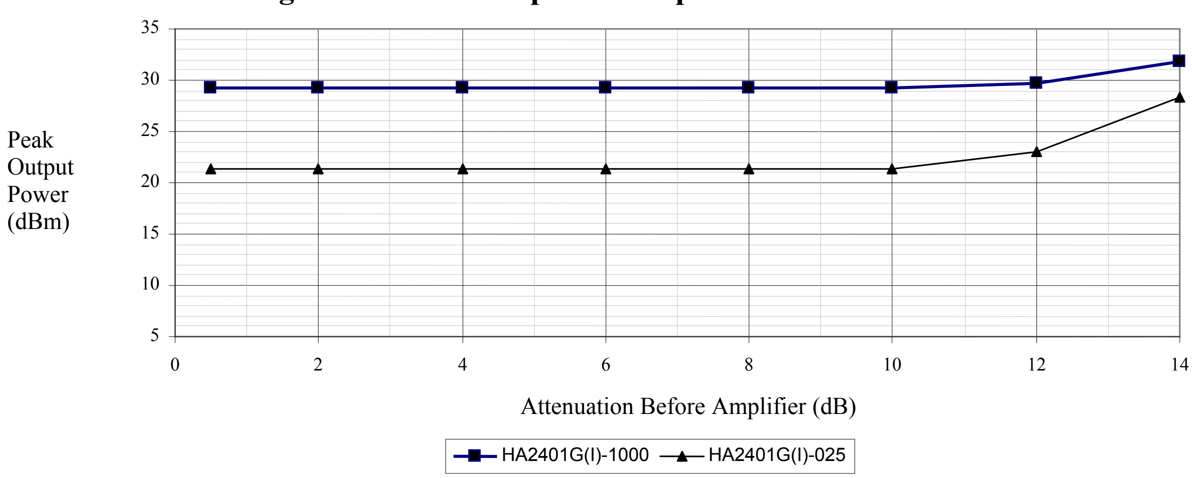
4. Radiated Emission Tests and Results

THROUGOUT TESTING, ATTENUATION (SIMULATING INCREASED CABLE LENGTH) BETWEEN THE RADIO AND AMPLIFIER WAS VARIED BETWEEN 0 AND 10 DB, AND THE WORST CASE EMISSIONS WERE RECORDED.

4.1 AGC Amplifier Performance

AGC amplifier compliance must be demonstrated over a range of input power levels. From the peak power measurements (See section 5.3 for measurement method) in Fig. 4.1, it was determined that THE AGC AMPLIFIERS SHOULD NOT BE OPERATED WITH GREATER THAN 10 DB (150 FT) OF COAXIAL CABLE BETWEEN THE RADIO AND AMPLIFIER. For attenuation greater than 10 dB, the amplifier begins to shutdown as the input signal is not detected, thus causing the emissions to be sporadic/transient and rendering the system non-functional.

Figure 4.1 Peak Amplifier Output Power vs. Cable Attenuation



4.2 Anechoic Chamber Measurements

In our chamber, there is a set-up similar to that of an outdoor 3-meter site, with a turntable, an antenna mast, and a ground plane. Instrumentation includes spectrum analyzers and other equipment as needed. For these tests the receiver antennas were mounted on the antenna mast at about 1.2 m height, and the DUT on a turntable with foam blocks at a 3 meter distance. Standard gain horn antennas were used for the measurements. At 2.4 GHz the horns were connected directly to a spectrum analyzer via RG-214 coaxial cable, and above 2.4 GHz a pre-amp was added. The cables and the pre-amplifier used were specially calibrated for these tests using a spectrum analyzer with built in sweep generator.

The DUT antenna and radio were rotated in all possible ways and the maximum emission recorded. Photographs in the *Test Setup Photos* exhibit demonstrate the measurement set-up.

4.3 Outdoor Measurements

Measurements to verify that the DUT meets FCC Class B digital radiated emission limits, 30 to 1000 MHz were performed on an OATS. See the radiated emissions table on page 12 of this report.

4.4 Computations and Results

To convert the dBm measured on the spectrum analyzer to dB(μV/m), we use expression

$$E_3(\text{dB}\mu\text{V/m}) = 107 + P_R + K_A - K_G + K_E$$

where P_R = power recorded on spectrum analyzer, dB, measured at 3m
K_A = antenna factor, dB/m
K_G = pre-amplifier gain, including cable loss, dB
K_E = pulse operation correction factor, dB

When presenting data, the dominant measured emissions at each frequency, under all of the possible orientations, are given. A listing of systems tested for emissions compliance is given in Table 5.0. Computations and results are given in Tables 5.1(a) through 5.1(e). There we see that in the worst case the DUT meets the limit by 0.6 dB at 2390 MHz in Table 5.1(b). Note, that besides the emission measurements, each table contains the frequency range of operation (in upper left section of the table). Please also note that these tables simply indicate that the configurations listed meet the restricted band limits set forth by the FCC and IC, and do not alone demonstrate compliance to all FCC/IC radiated emissions guidelines. Specifically, these configurations are still subject to FCC Part 15.247(b)(4)(i). A complete listing of FCC/IC compliant configurations is listed in the *Acceptable Configurations* exhibit.

4.5 Duty Factor for Normal Operation

No Duty Factor was used during testing of this device, as it was programmed to transmit continuous.

5. Other Measurements and Computations

THROUGOUT TESTING, ATTENUATION (SIMULATING INCREASED CABLE LENGTH) BETWEEN THE RADIO AND AMPLIFIER WAS VARIED BETWEEN 0 AND 10 DB, AND THE WORST CASE EMISSIONS WERE RECORDED.

5.1 Peak-to-Average Ratio (15.35(b))

For the measurements presented here (for emissions in restricted bands), the DUT was programmed to transmit continuous, and such was verified with spectrum analyzer set to zero-span mode. See Figure 6.1. Average measurements were made using 1 MHz RBW and 100 Hz VBW. The peak measurements were made using 1 MHz RBW and 3 MHz VBW. Typically the difference between peak and average was 13 to 14 dB, and never exceeded the 20 dB limit.

5.2 Potential Health Hazard EM Radiation Level

Please see the RF Exposure exhibit for a detailed listing of the potential health hazard radiation levels and appropriate safe operating distances for the configurations in this test report.

5.3 Peak Output Power (15.247(b))

For this measurement, the DUT was set in a test mode for continuous data transmission. A direct comparison measurement was made between a known CW source and the radio/amplifier/filter setup using calibrated attenuators, an HP 8472A Crystal Detector (with HP 54510A, 250 MHz digitizing oscilloscope) and an HP 432A average power meter. The known CW source power was first verified using the HP 432A and correlated with the DC output voltage from the HP 8472A Crystal Detector. Next, the radio/amplifier/filter peak output power was recorded from the HP 8472A Crystal Detector's output waveform for the 802.11b radio at the channels indicated below. The maximum input rise/fall time of the 802.11b waveforms was measured to be 120 ns, which is sufficiently greater than the calibrated <10 ns rise/fall time of the HP 8472A Crystal Detector when properly loaded with the 50 Ω input of the HP 54510A oscilloscope.

Since the DUT transmits in continuous mode, there is no adjustment needed to the readings. Table 6.2, below, presents the results. The peak output power limit is 30dBm.

Table 6.2 Peak and Average Output Power (Antenna Conducted)

Freq (MHz)	Peak Power (dBm)	Comment
	IEEE 802.11b	
2437	29.9	HA2401GX(I)-1000
2437	21.8	HA2401GX(I)-150
2412	14.8	
2437	15.5	Radio Alone
2462	14.4	

5.4 Power Line Conducted Emissions (15.207)

The RF amplifier is powered from a switching power supply (UIA324-12). Conducted emissions were measured using a LISN in the standard set-up. Photographs of the set-up are in the *Setup Photos* exhibits.

Prior certification of the PCMCIA radio demonstrates that the FCC Class B line conducted emissions limits are met by the PCMCIA card and an associated computer. Since the manufacturer of the system we are testing is not responsible for the sale or distribution of the computer/access point used with the PCMCIA card, measurement of conducted emission from the particular computer used during testing has little relevance. In addition, since the amplifiers used in these configurations contain no internal oscillators or low frequency sources, it is unlikely that these added components could corrupt the AC conducted emissions demonstrated in the PCMCIA card filing. Essentially, the computer used in our emissions testing is a peripheral device, whose compliance has already been demonstrated in the PCMCIA radio filing and its own Document of Conformity. See the equipment list for PCMCIA card and Laptop FCC/IC identifier information. The original PCMCIA test report has been included in this filing for reference.

NOTE: This device has shown compliance with the conducted emissions limits in 15.107, 15.207, or 18.307 adopted under FCC 02-157 (ET Docket 98-80) and may be marketed after July 11, 2005 and is not affected by the 15.37(j) or 18.123 transition provisions.

5.5 Bandwidth (15.247(a)(2))

For this test, the DUT was put in a test mode for continuous data transmission, and the amplifier was attached, including 0-10 dB of attenuation, to the radio. The spectrum analyzer was connected where the antenna attaches to the system. The analyzer was set for RBW=100 kHz, VBW=300 kHz, SPAN=30 MHz. The 6-dB bandwidth was measured for lowest, middle, and highest channels that could be used in a given configuration. Since the amplifier itself is identical, despite changes in the configured output power levels, results for only the highest and lowest power settings are reported here. It was verified that these reported emissions are consistent across all power settings. Plots are shown in Figures 6.7-6.8. The readings obtained are:

29.9 dBm, AGC Amplifier (HA2401GX(I)-1000)

Frequency	802.11b 6 dB Bandwidth
2.437 GHz	11.33 MHz

21.8 dBm, AGC Amplifier (HA2401GX(I)-100)

Frequency	802.11b 6 dB Bandwidth
2.437 GHz	11.18 MHz

Radio Alone

Frequency	802.11b 6 dB Bandwidth
2.412 GHz	10.03 MHz
2.437 GHz	11.10 MHz
2.462 GHz	12.75 MHz

5.6 Peak Output Power Reduction (15.247(b)(4)(i))

For any configuration with a total EIRP greater than 36 dBm, the FCC and IC rules state that the peak output power of the device must be decreased by 1 dB for every 3 dB that the EIRP is greater than 36 dBm. In this test report, this rule part is applied once all other rule parts are demonstrated compliant. See the *Peak Output Power Reduction* exhibit for tables relating the decrease in peak output power for the configurations deemed compliant in the *Acceptable Configurations* exhibit.

5.7 RF Antenna Conducted Spurious Emissions (15.247(c))

For this test, the DUT was put in a test mode for continuous data transmission, and the amplifier was attached, including 0-10 dB of attenuation, to the radio. The spectrum analyzer was connected where the antenna attaches to the system. The analyzer was set for RBW=100 kHz, VBW=300 kHz, the frequency was swept from 0 to 25 GHz. See Figures 6.1 through 6.3. In the plots, only the fundamental is seen, the rest is noise. In all cases, the noise is at least 25 dB below the carrier. (Limit -20.0 dB below carrier). Included in Figures 6.4 through 6.6 are plots demonstrating band-edge compliance at lower and upper edges of the operating band with 0-10 dB of attenuation between the radio and the amplifier.

5.8 Power Spectral Density and Line Spacing (15.247(d))

For this test, the DUT was put in a test mode for continuous data transmission, and the amplifier was attached, including 0-10 dB of attenuation, to the radio. The spectrum analyzer was connected where the antenna attaches to the system. The spectrum was first scanned for the maximum spectrum peaks and then at these peaks the sweep was repeated with RBW=3 kHz, VBW=300 kHz, SPAN=300 kHz, and RBW=1 kHz, VBW=300 kHz, SPAN=100 kHz. See Figures 6.9-6.13. The readings obtained are:

Operating Mode: 802.11b

29.9 dBm, AGC Amplifier (HA2401GX(I)-1000)

Frequency	Analyzer Reading	Line Spacing
2.43750 GHz	6.64 dBm (Limit 8.0 dBm)	5.0 kHz

21.8 dBm, AGC Amplifier (HA2401GX(I)-100)

Frequency	Analyzer Reading	Line Spacing
2.43750 GHz	-3.85 dBm (Limit 8.0 dBm)	4.8 kHz

Radio Alone

Frequency	Analyzer Reading	Line Spacing
2.41286 GHz	-10.98 dBm (Limit 8.0 dBm)	3.8 kHz
2.43800 GHz	-10.86 dBm (Limit 8.0 dBm)	4.8 kHz
2.46250 GHz	-10.86 dBm* (Limit 8.0 dBm)	4.3 kHz

* NOTE: the external attenuation was 20 dBm, not 30 dBm as reported in the associated plot. Accordingly this amplitude value has been corrected by 10 dB

Table 5.0. Configurations Tested to Demonstrate Compliance with FCC/IC Radiated Emissions Limits. (not withstanding FCC Part 15.247(b)(3)(i))

For Amplifier(s): HA2401GXI-XXX, HA2401GX-XXX, where XXX stands for the amplifier power rating labeled in mW

		CHANNEL FREQUENCY	2412								2417							
		AMPLIFIER:	2401XL							Card Alone	2401XL							Card Alone
		POWER (dBm):	29.9	29	28	27	26	24	22		29.9	29	28	27	26	24	22	
Antenna Model	Antenna Type	Gain (dBi)																
HG2401U	whip/monopole	1																
HG2402RD	whip/monopole	2																
HG2403RD	whip/monopole	3																
HG2403UR	whip/monopole	3																
HG2404CU	whip/monopole	3																
RE05E	whip/monopole	5																
RE05U	whip/monopole	5								X								o
HG2405	whip/monopole	5																
HG2406U	whip/monopole	6																
HG2407U	whip/monopole	7																
HG2408U	whip/monopole	8																
HG2409U	whip/monopole	8.5																
HGV-2409U	whip/monopole	8.5																
HG2410U	whip/monopole	10																
HG2412U	whip/monopole	12																
HG2415U-PRO	whip/monopole	15																

		CHANNEL FREQUENCY	2422								2427							
		AMPLIFIER:	2401XL							Card Alone	2401XL							Card Alone
		POWER (dBm):	29.9	29	28	27	26	24	22		29.9	29	28	27	26	24	22	
Antenna Model	Antenna Type	Gain (dBi)																
HG2401U	whip/monopole	1																
HG2402RD	whip/monopole	2																
HG2403RD	whip/monopole	3																
HG2403UR	whip/monopole	3																
HG2404CU	whip/monopole	3																
RE05E	whip/monopole	5																
RE05U	whip/monopole	5								o								o
HG2405	whip/monopole	5																
HG2406U	whip/monopole	6																
HG2407U	whip/monopole	7																
HG2408U	whip/monopole	8																
HG2409U	whip/monopole	8.5																
HGV-2409U	whip/monopole	8.5																
HG2410U	whip/monopole	10																
HG2412U	whip/monopole	12																
HG2415U-PRO	whip/monopole	15																

		CHANNEL FREQUENCY	2432								2437							
		AMPLIFIER:	2401XL							Card Alone	2401XL							Card Alone
		POWER (dBm):	29.9	29	28	27	26	24	22		29.9	29	28	27	26	24	22	
Antenna Model	Antenna Type	Gain (dBi)																
HG2401U	whip/monopole	1									o	o	o	o	o	o	o	
HG2402RD	whip/monopole	2									o	o	o	o	o	o	o	
HG2403RD	whip/monopole	3									o	o	o	o	o	o	o	
HG2403UR	whip/monopole	3									o	o	o	o	o	o	o	
HG2404CU	whip/monopole	3									o	o	o	o	o	o	o	
RE05E	whip/monopole	5									o	o	o	o	o	o	o	
RE05U	whip/monopole	5								o	X	o	o	o	o	o	X	X
HG2405	whip/monopole	5									+	+	+	+	+	+	+	
HG2406U	whip/monopole	6									+	+	+	+	+	+	+	
HG2407U	whip/monopole	7									+	+	+	+	+	+	+	
HG2408U	whip/monopole	8									+	+	+	+	+	+	+	
HG2409U	whip/monopole	8.5									+	+	+	+	+	+	+	
HGV-2409U	whip/monopole	8.5									+	+	+	+	+	+	+	
HG2410U	whip/monopole	10									+	+	+	+	+	+	+	
HG2412U	whip/monopole	12									+	+	+	+	+	+	+	
HG2415U-PRO	whip/monopole	15									X	+	+	+	+	+	X	

		CHANNEL FREQUENCY	2442								2447							
		AMPLIFIER:	2401XL							Card Alone	2401XL							Card Alone
		POWER (dBm):	29.9	29	28	27	26	24	22		29.9	29	28	27	26	24	22	
Antenna Model	Antenna Type	Gain (dBi)																
HG2401U	whip/monopole	1																
HG2402RD	whip/monopole	2																
HG2403RD	whip/monopole	3																
HG2403UR	whip/monopole	3																
HG2404CU	whip/monopole	3																
RE05E	whip/monopole	5																
RE05U	whip/monopole	5								o								o
HG2405	whip/monopole	5																
HG2406U	whip/monopole	6																
HG2407U	whip/monopole	7																
HG2408U	whip/monopole	8																
HG2409U	whip/monopole	8.5																
HGV-2409U	whip/monopole	8.5																
HG2410U	whip/monopole	10																
HG2412U	whip/monopole	12																
HG2415U-PRO	whip/monopole	15																

		CHANNEL FREQUENCY	2452								2457							
		AMPLIFIER:	2401XL							Card Alone	2401XL							Card Alone
		POWER (dBm):	29.9	29	28	27	26	24	22		29.9	29	28	27	26	24	22	
Antenna Model	Antenna Type	Gain (dBi)																
HG2401U	whip/monopole	1																
HG2402RD	whip/monopole	2																
HG2403RD	whip/monopole	3																
HG2403UR	whip/monopole	3																
HG2404CU	whip/monopole	3																
RE05E	whip/monopole	5																
RE05U	whip/monopole	5								o								o
HG2405	whip/monopole	5																
HG2406U	whip/monopole	6																
HG2407U	whip/monopole	7																
HG2408U	whip/monopole	8																
HG2409U	whip/monopole	8.5																
HGV-2409U	whip/monopole	8.5																
HG2410U	whip/monopole	10																
HG2412U	whip/monopole	12																
HG2415U-PRO	whip/monopole	15																

		CHANNEL FREQUENCY	2462							
		AMPLIFIER:	2401XL							Card Alone
		POWER (dBm):	29.9	29	28	27	26	24	22	
Antenna Model	Antenna Type	Gain (dBi)								
HG2401U	whip/monopole	1								
HG2402RD	whip/monopole	2								
HG2403RD	whip/monopole	3								
HG2403UR	whip/monopole	3								
HG2404CU	whip/monopole	3								
RE05E	whip/monopole	5								
RE05U	whip/monopole	5								X
HG2405	whip/monopole	5								
HG2406U	whip/monopole	6								
HG2407U	whip/monopole	7								
HG2408U	whip/monopole	8								
HG2409U	whip/monopole	8.5								
HGV-2409U	whip/monopole	8.5								
HG2410U	whip/monopole	10								
HG2412U	whip/monopole	12								
HG2415U-PRO	whip/monopole	15								

NOTE: This table does not necessarily indicate compliant configurations, as FCC 15.247(b)(4)(i) has not yet been considered. Please see the Approved Configurations exhibit for a complete listing of FCC/IC compliant configurations and the channels in which they may operate.

+ Complies with FCC / IC radiated emissions limits (Filter Required)
X Tested to demonstrate compliance with FCC/IC radiated emissions limits (Filter Required); Corresponding Data Table available in the Test Report
o Complies with FCC / IC radiated emissions limits (NO Filter Required)
X Tested to demonstrate compliance with FCC/IC radiated emissions limits (NO Filter Required); Corresponding Data Table available in the Test Report

Table 5.1(a) Highest Emissions Measured - IEEE 802.11b

Radiated Emissions										29.9 dBm, 2415U
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr. (avg) dBm	Ka dB/m	Kg dB	E3 dBμV/m	E3lim dBμV/m	Pass dB	Comments
1	2437.0									Low channel
2	2437.0									Mid channel
3	2437.0									High channel
4										
5	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
6	2390.0	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	**4.2**	Mid
7	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
8	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
9	2483.5	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	4.2	Mid
10	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
11	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	Low
12	4874.0	Horn C	H/V	-48.8	25.5	37.0	46.7	54.0	7.3	Mid
13	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	High
14	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	Low
15	7311.0	Horn XN	H/V	-52.0	25.5	36.0	44.5	54.0	9.5	Mid
16	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	High
17	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Low
18	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Mid
19	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	High
20	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	Low, noise
21	12185.0	Horn X	H/V	-59.4	25.5	34.0	39.1	54.0	14.9	Mid, noise
22	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	High, noise
23	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Low
24	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Mid
25	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	High
26	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Low
27	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Mid
28	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	High
29	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	Low, noise
30	19496.0	Horn K	H/V	-70.7	32.3	32.0	36.6	54.0	17.4	Mid, noise
31	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	High, noise
32	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Low
33	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Mid
34	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	High
35	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Low
36	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Mid
37	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	High
38										
39	**Configuration:**						* Ave: measured with 1 MHz RBW and 100 Hz VBW			
40	Power Supply Used		DC Inj.	Input Attenuation		Amp / Pwr		Output Filter		Antenna
41	UIA324-12		No	0-10 dB		29.9 dBm		Yes		2415U
42										

U. of Mich; Meas. 04/12/2004 - 05/03/2004

Table 5. (b) Highest Emissions Measured - IEEE 802.11b

Radiated Emissions										29.9 dBm, RE05U
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr. (avg) dBm	Ka dB/m	Kg dB	E3 dBμV/m	E3lim dBμV/m	Pass dB	Comments
1	2437.0									Low channel
2	2437.0									Mid channel
3	2437.0									High channel
4										
5	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
6	2390.0	Horn S	H/V	-75.8	21.5	- 0.6	53.4	54.0	**0.6**	Mid
7	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
8	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
9	2483.5	Horn S	H/V	-77.8	21.5	- 0.6	51.3	54.0	2.7	Mid
10	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
11	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	Low
12	4874.0	Horn C	H/V	-53.6	25.5	37.0	41.9	54.0	12.1	Mid
13	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	High
14	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	Low
15	7311.0	Horn XN	H/V	-66.2	25.5	36.0	30.3	54.0	23.7	Mid
16	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	High
17	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Low
18	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Mid
19	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	High
20	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	Low, noise
21	12185.0	Horn X	H/V	-69.9	25.5	34.0	28.6	54.0	25.4	Mid, noise
22	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	High, noise
23	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Low
24	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Mid
25	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	High
26	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Low
27	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Mid
28	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	High
29	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	Low, noise
30	19496.0	Horn K	H/V	-72.0	32.3	32.0	35.3	54.0	18.7	Mid, noise
31	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	High, noise
32	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Low
33	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Mid
34	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	High
35	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Low
36	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Mid
37	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	High
38										
39	**Configuration:**						* Ave: measured with 1 MHz RBW and 100 Hz VBW			
40	Power Supply Used		DC Inj.	Input Attenuation		Amp / Pwr		Output Filter		Antenna
41	UIA324-12		No	0-10 dB		29.9 dBm		None		RE05U
42										

U. of Mich; Meas. 04/12/2004 - 04/21/2004

Table 5.(c) Highest Emissions Measured - IEEE 802.11b

Radiated Emissions										21.8 dBm, 2415U
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr. (avg) dBm	Ka dB/m	Kg dB	E3 dBμV/m	E3lim dBμV/m	Pass dB	Comments
1	2437.0									Low channel
2	2437.0									Mid channel
3	2437.0									High channel
4										
5	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
6	2390.0	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	**4.2**	Mid
7	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
8	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
9	2483.5	Horn S	H/V	-79.4	21.5	- 0.6	49.7	54.0	4.3	Mid
10	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
11	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	Low
12	4874.0	Horn C	H/V	-53.2	25.5	37.0	42.3	54.0	11.7	Mid
13	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	High
14	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	Low
15	7311.0	Horn XN	H/V	-50.2	25.5	36.0	46.3	54.0	7.7	Mid
16	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	High
17	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Low
18	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Mid
19	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	High
20	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	Low, noise
21	12185.0	Horn X	H/V	-66.8	25.5	34.0	31.7	54.0	22.3	Mid, noise
22	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	High, noise
23	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Low
24	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Mid
25	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	High
26	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Low
27	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Mid
28	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	High
29	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	Low, noise
30	19496.0	Horn K	H/V	-70.1	32.3	32.0	37.2	54.0	16.8	Mid, noise
31	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	High, noise
32	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Low
33	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Mid
34	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	High
35	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Low
36	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Mid
37	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	High
38										
39	**Configuration:**						* Ave: measured with 1 MHz RBW and 100 Hz VBW			
40	Power Supply Used		DC Inj.	Input Attenuation		Amp / Pwr		Output Filter		Antenna
41	UIA324-12		No	0-10 dB		21.8 dBm		Yes		2415U
42										

U. of Mich; Meas. 04/12/2004 - 05/03/2004

Table 5.(d) Highest Emissions Measured - IEEE 802.11b

Radiated Emissions										21.8 dBm, RE05U
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr. (avg) dBm	Ka dB/m	Kg dB	E3 dBμV/m	E3lim dBμV/m	Pass dB	Comments
1	2437.0									Low channel
2	2437.0									Mid channel
3	2437.0									High channel
4										
5	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
6	2390.0	Horn S	H/V	-78.8	21.5	- 0.6	50.3	54.0	**3.7**	Mid
7	2390.0	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
8	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	Low
9	2483.5	Horn S	H/V	-78.8	21.5	- 0.6	50.3	54.0	3.7	Mid
10	2483.5	Horn S	H/V		21.5	- 0.6	-	54.0	-	High
11	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	Low
12	4874.0	Horn C	H/V	-56.3	25.5	37.0	39.2	54.0	14.8	Mid
13	4874.0	Horn C	H/V		25.5	37.0	-	54.0	-	High
14	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	Low
15	7311.0	Horn XN	H/V	-63.8	25.5	36.0	32.7	54.0	21.3	Mid
16	7311.0	Horn XN	H/V		25.5	36.0	-	54.0	-	High
17	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Low
18	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Mid
19	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	High
20	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	Low, noise
21	12185.0	Horn X	H/V	-69.4	25.5	34.0	29.1	54.0	24.9	Mid, noise
22	12185.0	Horn X	H/V		25.5	34.0	-	54.0	-	High, noise
23	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Low
24	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Mid
25	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	High
26	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Low
27	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Mid
28	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	High
29	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	Low, noise
30	19496.0	Horn K	H/V	-72.0	32.3	32.0	35.3	54.0	18.7	Mid, noise
31	19496.0	Horn K	H/V		32.3	32.0	-	54.0	-	High, noise
32	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Low
33	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Mid
34	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	High
35	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Low
36	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Mid
37	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	High
38										
39	**Configuration:**						* Ave: measured with 1 MHz RBW and 100 Hz VBW			
40	Power Supply Used		DC Inj.	Input Attenuation		Amp / Pwr		Output Filter		Antenna
41	UIA324-12		No	0-10 dB		21.8 dBm		None		RE05U
42										

U. of Mich; Meas. 04/12/2004 - 04/21/2004

Table 5.(e Highest Emissions Measured - IEEE 802.11b

Radiated Emissions										Radio Alone, RE05U
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr. (avg) dBm	Ka dB/m	Kg dB	E3 dBµV/m	E3lim dBµV/m	Pass dB	Comments
1	2412.0									Low channel
2	2437.0									Mid channel
3	2462.0									High channel
4										
5	2390.0	Horn S	H/V	-78.4	21.5	- 0.6	50.7	54.0	3.3	Low
6	2390.0	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	4.2	Mid
7	2390.0	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	4.2	High
8	2483.5	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	4.2	Low
9	2483.5	Horn S	H/V	-79.3	21.5	- 0.6	49.8	54.0	4.2	Mid
10	2483.5	Horn S	H/V	-76.9	21.5	- 0.6	52.2	54.0	**1.8**	High
11	4824.0	Horn C	H/V	-74.9	25.5	37.0	20.6	54.0	33.4	Low
12	4874.0	Horn C	H/V	-75.0	25.5	37.0	20.5	54.0	33.5	Mid
13	4924.0	Horn C	H/V	-75.2	25.5	37.0	20.3	54.0	33.7	High
14	7236.0	Horn XN	H/V	-71.5	25.5	36.0	25.0	N/A	-	Low
15	7311.0	Horn XN	H/V	-71.5	25.5	36.0	25.0	54.0	29.0	Mid
16	7386.0	Horn XN	H/V	-71.4	25.5	36.0	25.1	54.0	28.9	High
17	9648.0	Horn X	H/V		25.5	34.0	-	N/A	-	Low
18	9748.0	Horn X	H/V		25.5	34.0	-	N/A	-	Mid
19	9848.0	Horn X	H/V		25.5	34.0	-	N/A	-	High
20	12060.0	Horn X	H/V	-70.3	25.5	34.0	28.2	54.0	25.8	Low, noise
21	12185.0	Horn X	H/V	-70.4	25.5	34.0	28.1	54.0	25.9	Mid, noise
22	12310.0	Horn X	H/V	-70.4	25.5	34.0	28.1	54.0	25.9	High, noise
23	14472.0	Horn Ku	H/V	-71.5	25.5	17.3	43.7	54.0	10.3	Low
24	14622.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	Mid
25	14772.0	Horn Ku	H/V		25.5	17.3	-	N/A	-	High
26	16884.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Low
27	17059.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	Mid
28	17234.0	Horn Ku	H/V		32.3	34.0	-	N/A	-	High
29	19296.0	Horn K	H/V	-71.7	32.3	32.0	35.6	54.0	18.4	Low, noise
30	19496.0	Horn K	H/V	-71.7	32.3	32.0	35.6	54.0	18.4	Mid, noise
31	19696.0	Horn K	H/V	-71.8	32.3	32.0	35.5	54.0	18.5	High, noise
32	21708.0	Horn K	H/V		32.3	32.0	-	N/A	-	Low
33	21933.0	Horn K	H/V		32.3	32.0	-	N/A	-	Mid
34	22158.0	Horn K	H/V	-68.9	32.3	32.0	38.4	54.0	15.6	High
35	24120.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Low
36	24370.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	Mid
37	24620.0	Horn Ka	H/V		32.3	32.0	-	N/A	-	High
38										
39	**Configuration:**						* Ave: measured with 1 MHz RBW and 100 Hz VBW			
40	Power Supply Used		DC Inj.	Input Attenuation		Amp / Pwr		Output Filter		Antenna
41	None		No	0 dB		None		None		RE05U
42										

U. of Mich; Meas. 04/12/2004 - 04/21/2004

Table 5.2 Highest Radiated Emissions Measured

											MYF-XI-325X; FCC/IC
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr dBm	Det. Used	Ka dB/m	Kg dB	E3 dBμV/m	E3lim dBμV/m	Pass dB	Comments
1	38.6	Bic	V	-66.2	Pk	12.7	25.7	27.7	40.0	12.3	
2	39.2	Bic	H	-73.4	Pk	12.6	25.7	20.5	40.0	19.5	
3	40.1	Bic	H	-73.6	Pk	12.5	25.7	20.2	40.0	19.8	
4	42.7	Bic	V	-66.2	Pk	12.2	25.7	27.3	40.0	12.7	
5	45.2	Bic	V	-65.7	Pk	11.9	25.6	27.6	40.0	12.4	
6	47.9	Bic	V	-63.7	Pk	11.7	25.6	29.4	40.0	10.6	
7	72.8	Bic	H	-59.2	Pk	11.0	25.2	33.6	40.0	6.4	
8	76.9	Bic	H	-58.8	Pk	11.1	25.2	34.1	40.0	5.9	
9	77.3	Bic	V	-59.2	Pk	11.1	25.2	33.7	40.0	6.3	
10	79.8	Bic	V	-58.3	Pk	11.1	25.1	34.7	40.0	5.3	
11	79.9	Bic	V	-56.7	Pk	11.1	25.1	36.3	40.0	**3.7**	
12	82.6	Bic	H	-58.6	Pk	11.2	25.1	34.5	40.0	5.5	
13	83.3	Bic	V	-59.3	Pk	11.2	25.1	33.8	40.0	6.2	
14	85.7	Bic	H	-65.7	Pk	11.3	25.1	27.6	40.0	12.4	
15	166.8	Bic	H	-68.7	Pk	15.3	24.0	29.6	43.5	13.9	
16	169.3	Bic	H	-70.2	Pk	15.3	24.0	28.2	43.5	15.3	
17	172.1	Bic	H	-70.2	Pk	15.4	23.9	28.3	43.5	15.2	
18	173.5	Bic	H	-69.7	Pk	15.4	23.9	28.8	43.5	14.7	
19	177.1	Bic	V	-70.2	Pk	15.5	23.9	28.4	43.5	15.1	
20											
21											
22											
23	All other emissions > 20 dB below FCC Class B Limit										
24											
25											
26											
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Meas. 4/21/2004; U of Mich.

Table 5.3 Highest Conducted Emissions Measured

30 dBm, PwrSup; FCC/CISPR B												
#	Freq. MHz	Line Side	Peak Det., dBμV Vtest	Vlim*	Pass dB*	QP Det., dBμV Vtest	Vlim	Pass dB	Ave. Det., dBμV Vtest	Vlim	Pass dB	Comments
1	0.18	Lo	62.3	54.4	- 7.9	56.7	64.5	7.8	36.7	54.4	17.7	
2	0.28	Lo	51.9	50.9	- 1.0	49.2	60.9	11.7	32.1	50.9	18.8	
3	0.35	Lo	49.2	49.0	- 0.2	44.2	59.1	14.9	29.2	49.0	19.8	
4	0.41	Lo	43.5	47.6	4.1	33.4	57.7	24.3	22.6	47.6	25.0	
5	0.60	Lo	35.0	46.0	11.0		56.0			46.0		
6	1.00	Lo	36.0	46.0	10.0		56.0			46.0		
7	1.40	Lo	36.0	46.0	10.0		56.0			46.0		
8	3.80	Lo	36.0	46.0	10.0		56.0			46.0		
9	10.10	Lo	38.0	50.0	12.0		60.0			50.0		
10	11.00	Lo	39.0	50.0	11.0		60.0			50.0		
11	17.20	Lo	40.0	50.0	10.0		60.0			50.0		
12	20.00	Lo	40.0	50.0	10.0		60.0			50.0		
13	25.50	Lo	34.0	50.0	16.0		60.0			50.0		
14	29.50	Lo	34.0	50.0	16.0		60.0			50.0		
15												
16	0.18	Hi	62.9	54.4	- 8.5	57.4	64.5	7.1	37.5	54.4	16.9	
17	0.28	Hi	51.8	50.9	- 0.9	48.7	61.0	12.3	30.8	50.9	20.1	
18	0.35	Hi	47.9	48.9	1.0	42.9	59.0	16.1	31.5	48.9	17.4	
19	0.41	Hi	43.3	47.5	4.2	39.0	57.6	18.6	23.5	47.5	24.0	
20	0.48	Hi	42.3	46.3	4.0	37.3	56.3	19.0	25.5	46.3	20.8	
21	0.58	Hi	42.1	46.0	3.9	38.2	56.0	17.8	28.3	46.0	17.7	
22	0.66	Hi	39.6	46.0	6.4	35.5	56.0	20.5	24.6	46.0	21.4	
23	0.77	Hi	41.1	46.0	4.9	37.1	56.0	18.9	25.9	46.0	20.1	
24	0.77	Hi	41.0	46.0	5.0	37.2	56.0	18.8	26.0	46.0	20.0	
25	0.87	Hi	39.4	46.0	6.6		56.0			46.0		
26	1.00	Hi	40.7	46.0	5.3		56.0			46.0		
27	1.09	Hi	40.6	46.0	5.4		56.0			46.0		
28	1.19	Hi	40.8	46.0	5.2		56.0			46.0		
29	1.29	Hi	40.7	46.0	5.3		56.0			46.0		
30	1.39	Hi	40.7	46.0	5.3		56.0			46.0		
31	1.49	Hi	41.3	46.0	**4.7**		56.0			46.0		
32	1.61	Hi	40.5	46.0	5.5		56.0			46.0		
33	1.79	Hi	39.6	46.0	6.4		56.0			46.0		
34	1.93	Hi	40.8	46.0	5.2		56.0			46.0		
35	10.80	Hi	40.0	50.0	10.0		60.0			50.0		
36	17.20	Hi	38.5	50.0	11.5		60.0			50.0		
37	20.80	Hi	39.0	50.0	11.0		60.0			50.0		
38												
39												
40												
41												
42												
40												

**Average limit* Meas. 04/15/2004; U of Mich.

Since Vpeak >= Vqp >= Vave and if Vtestpeak < Vavelim, then Vqplim and Vavelim are met.

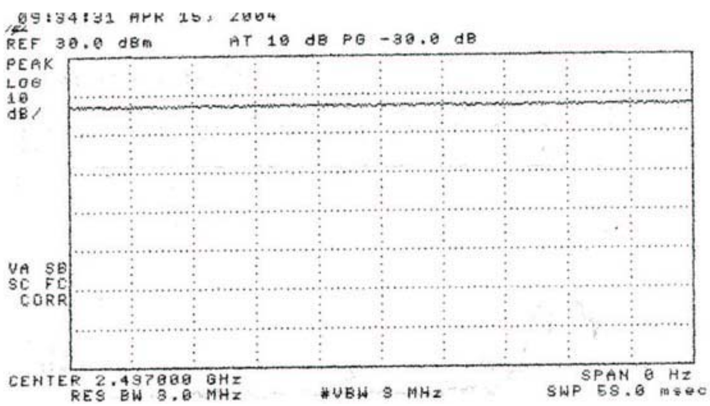


Figure 6.0. CW Mode Verification

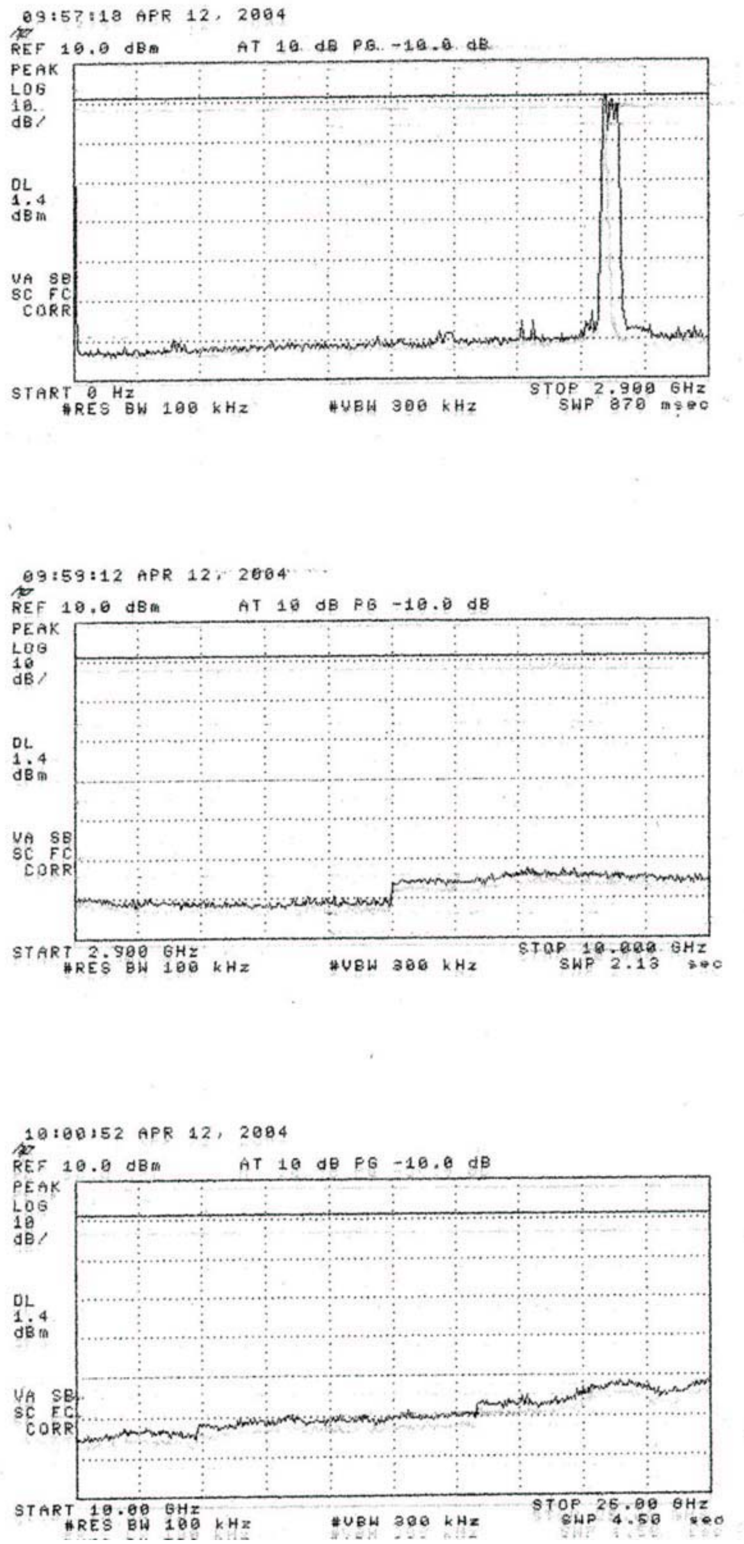


Figure 6.1. Spurious Emissions – Card Alone: CH: 2412,2437,2462

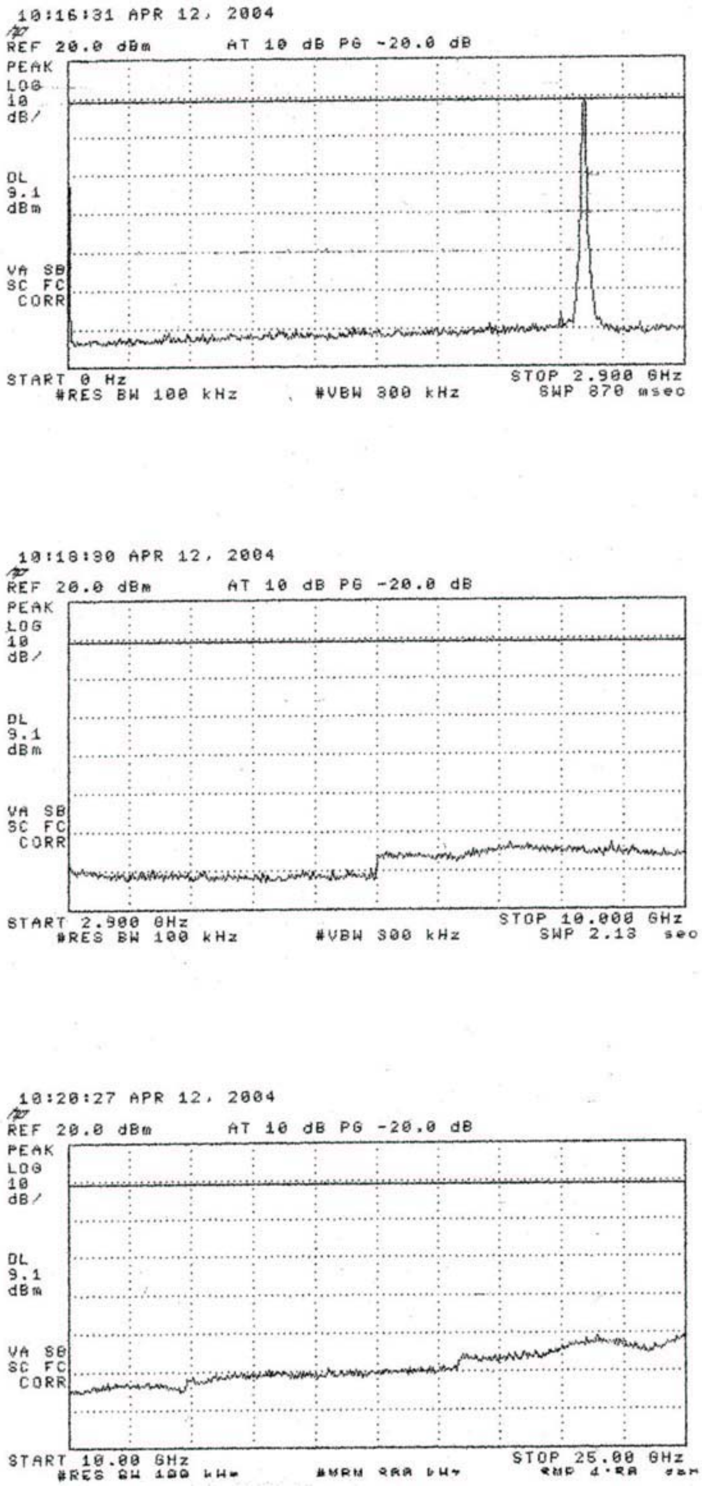


Figure 6.2. Spurious Emissions – 21.8 dBm Amp: CH: 2437

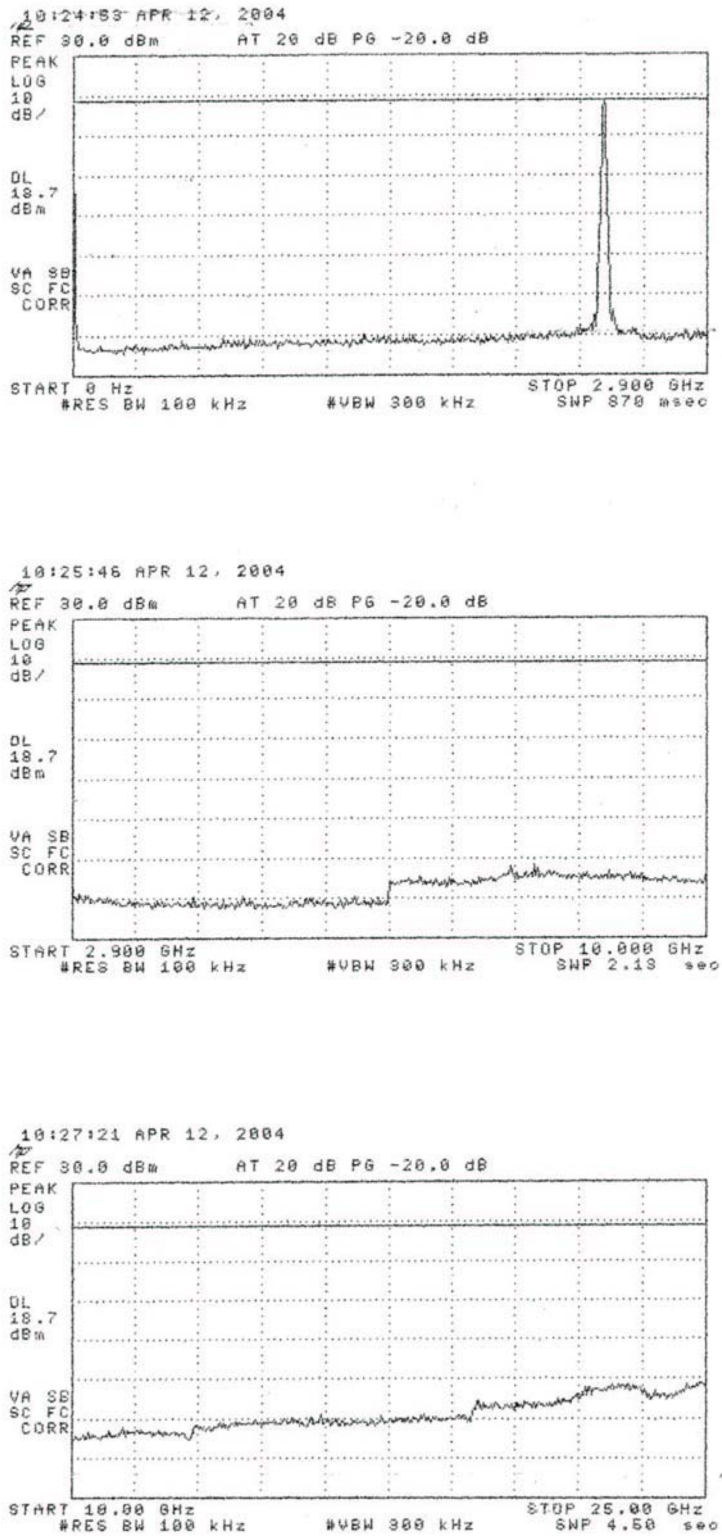


Figure 6.3. Spurious Emissions – 29.9 dBm Amp: CH: 2437

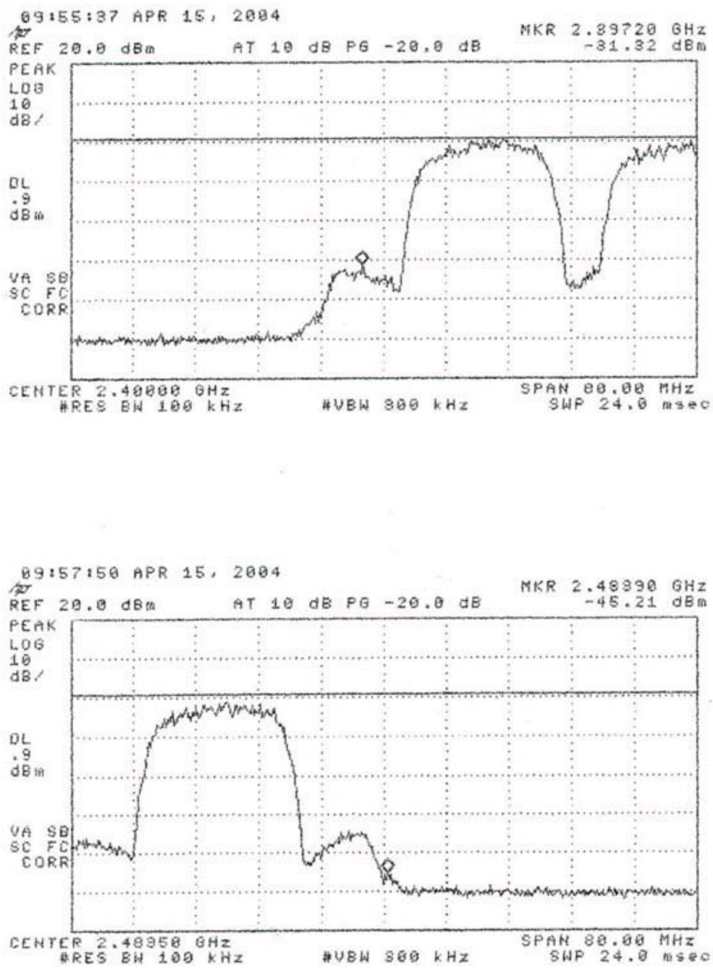
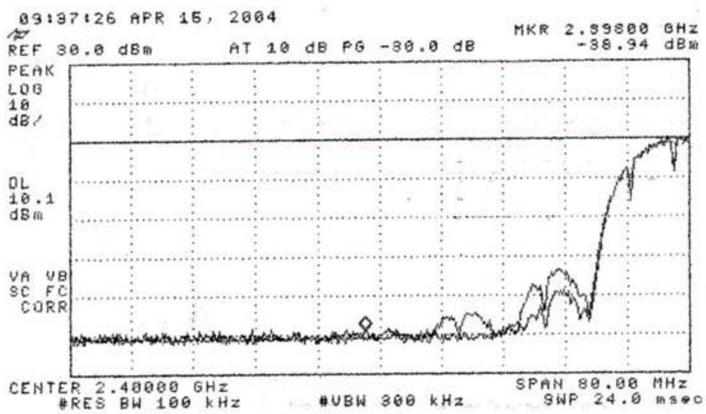


Figure 6.4. Band Edge Spurious – Card Alone: CH: 2412,2437,2462



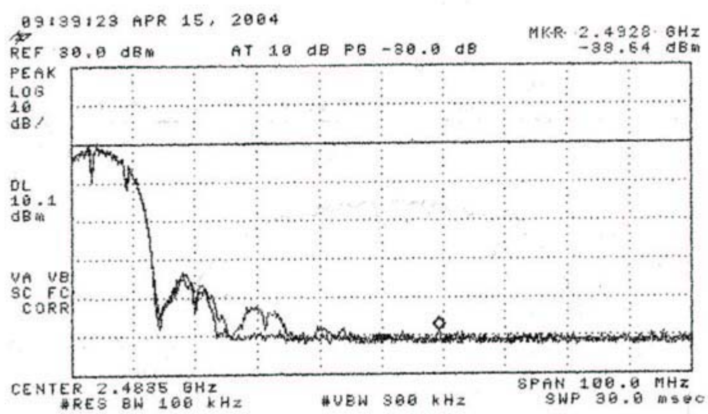
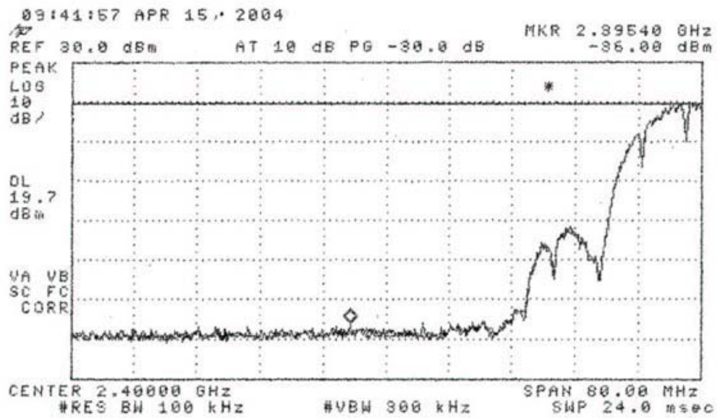


Figure 6.5. Band Edge Spurious – 21.8 dBm Amp: CH: 2437
(0 dB & 10 dB input attenuation; 10 dB worst case)



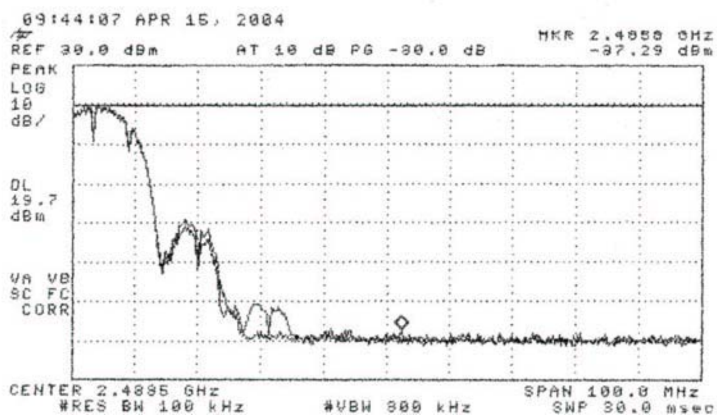
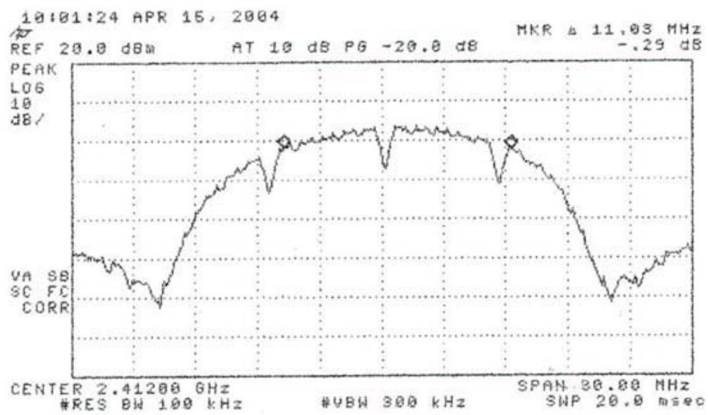
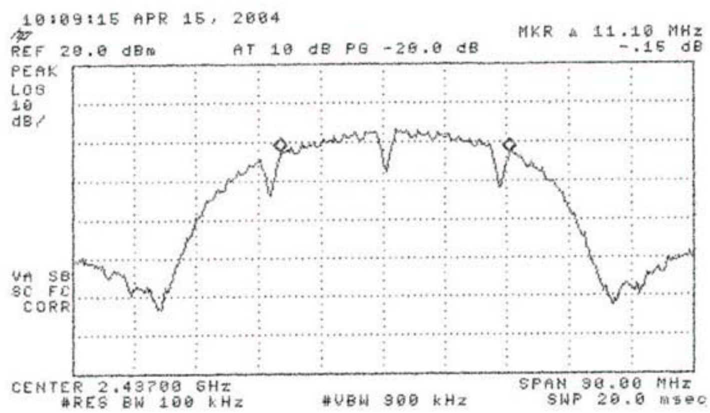


Figure 6.6. Band Edge Spurious – 29.9 dBm Amp: CH: 2437
(0 dB & 10 dB input attenuation; 10 dB worst case)





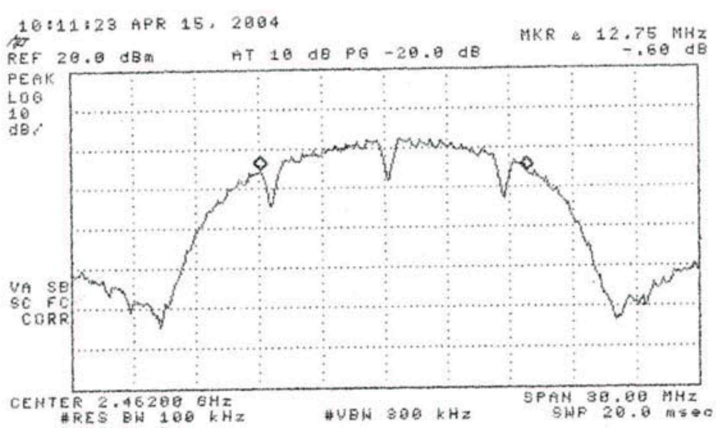
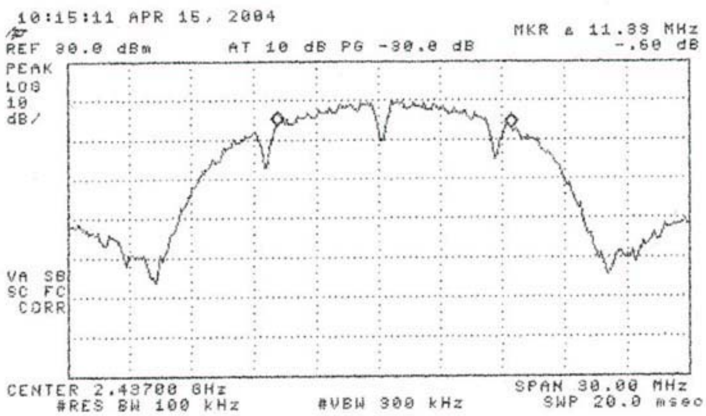


Figure 6.7. 6 dB Bandwidth – Card Alone: CH: 2412,2437,2462



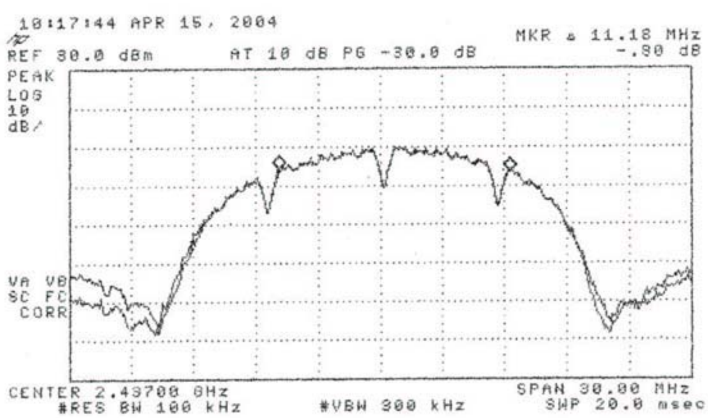


Figure 6.8. 6 dB Bandwidth – (top) 21.8 dBm Amp: CH: 2437,
(bottom) 29.9 dBm Amp: CH: 2437

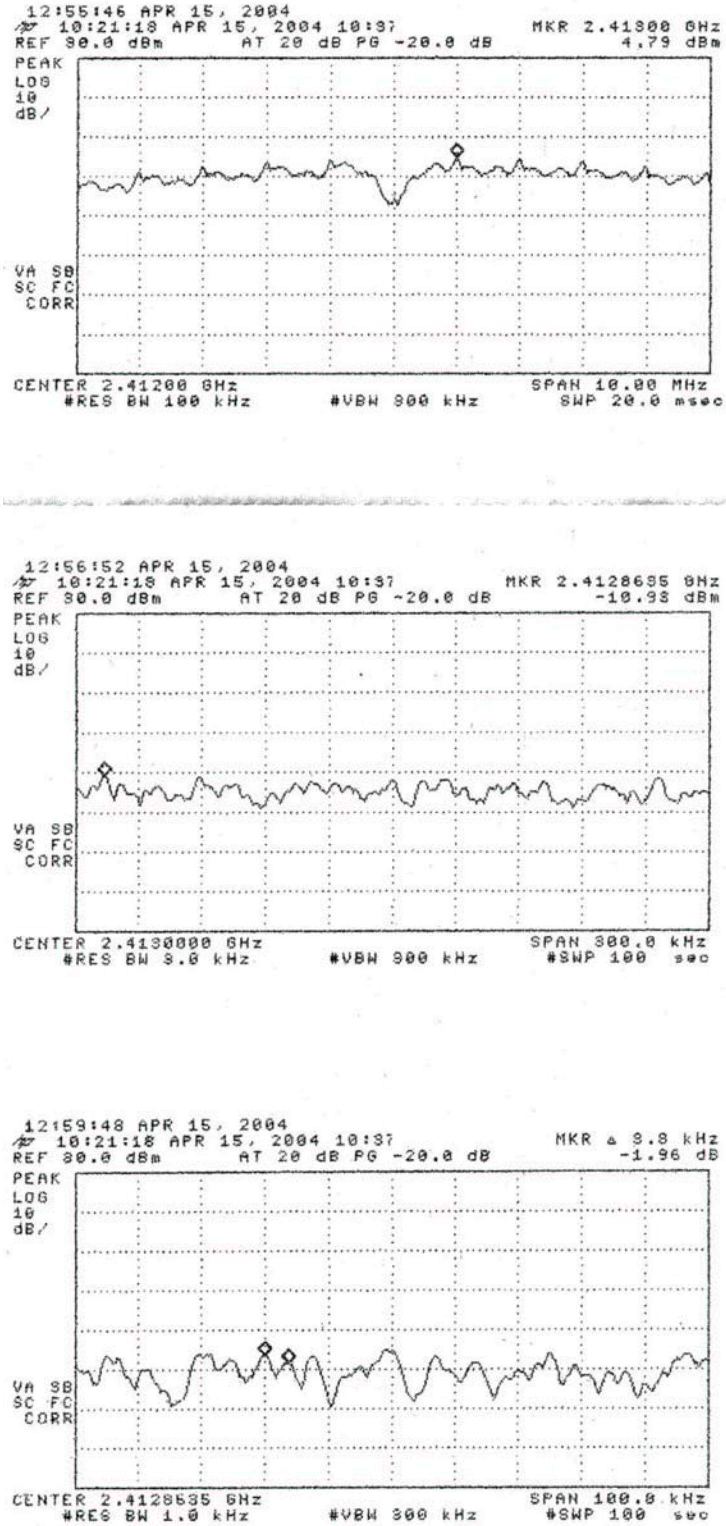


Figure 6.9. Power Spectral Density – Card Alone: CH: 2412

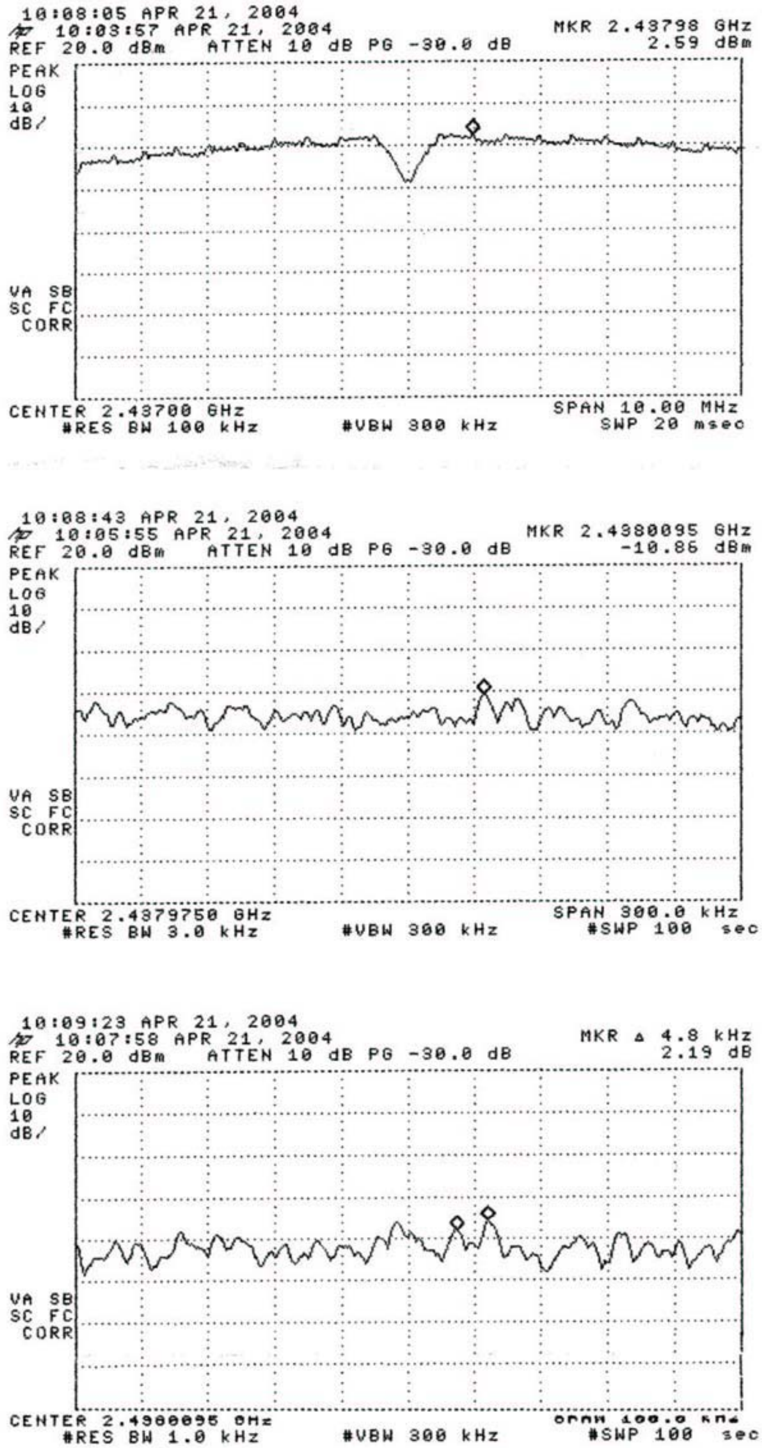


Figure 6.10. Power Spectral Density – Card Alone: CH: 2437

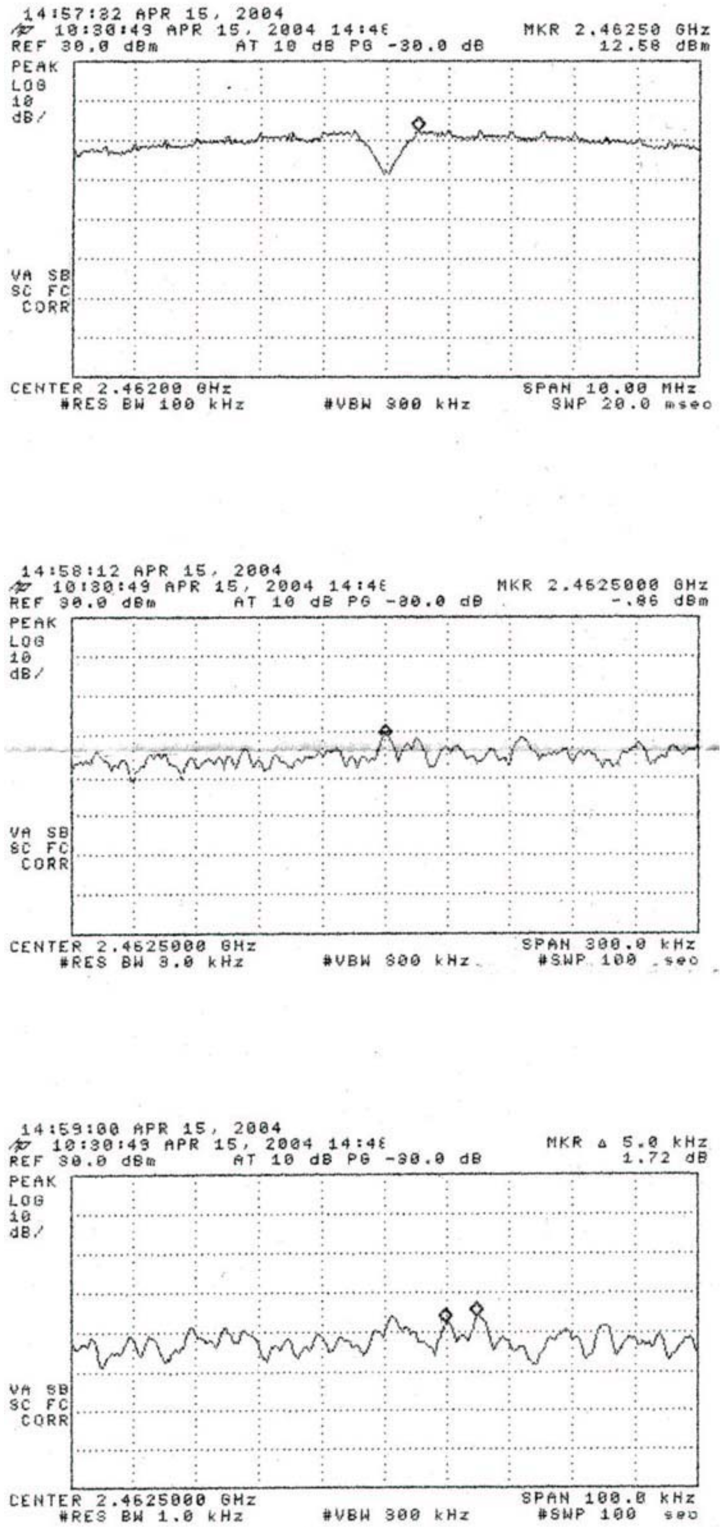
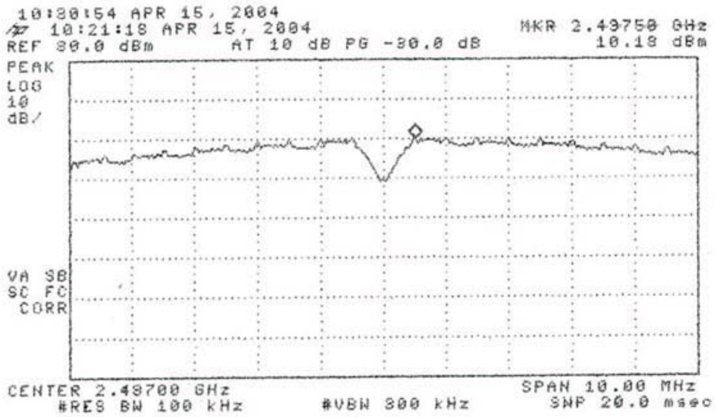
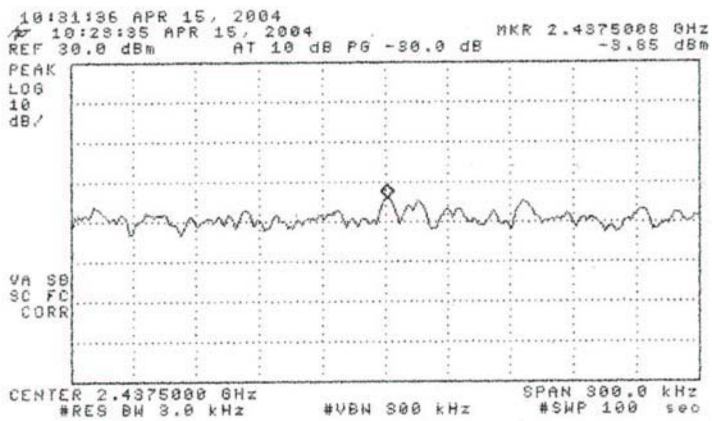


Figure 6.11. Power Spectral Density – Card Alone: CH: 2462





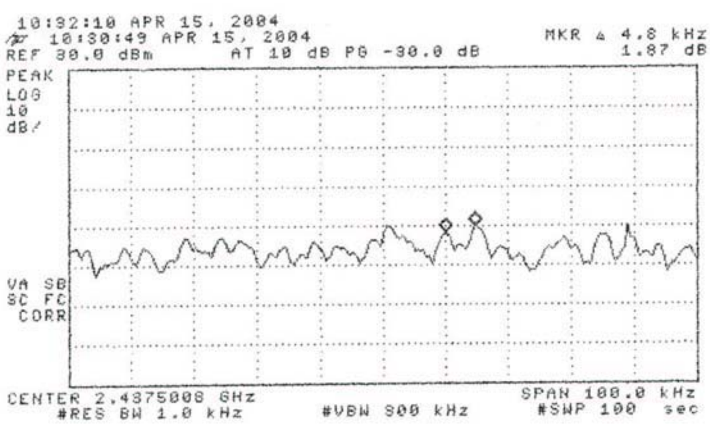


Figure 6.12. Power Spectral Density – 21.8 dBm Amp: CH: 2437

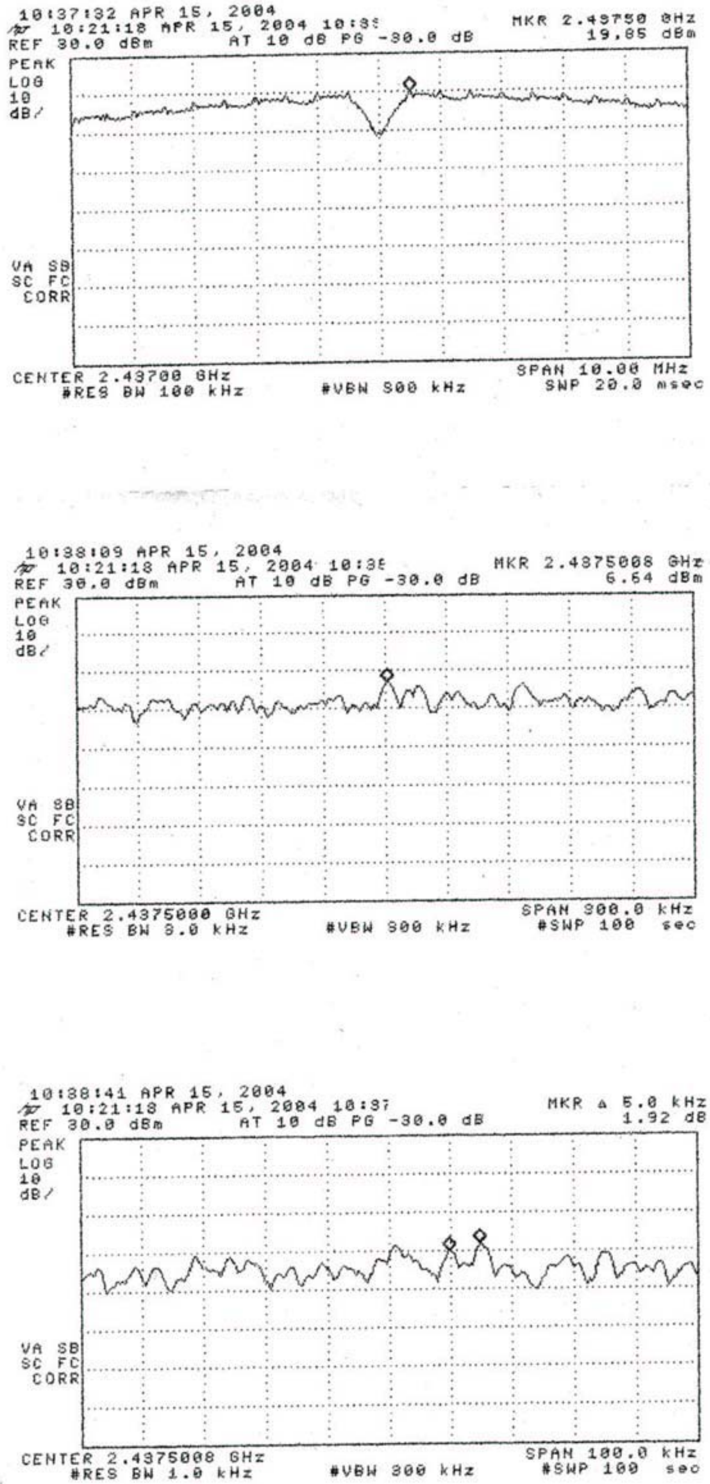
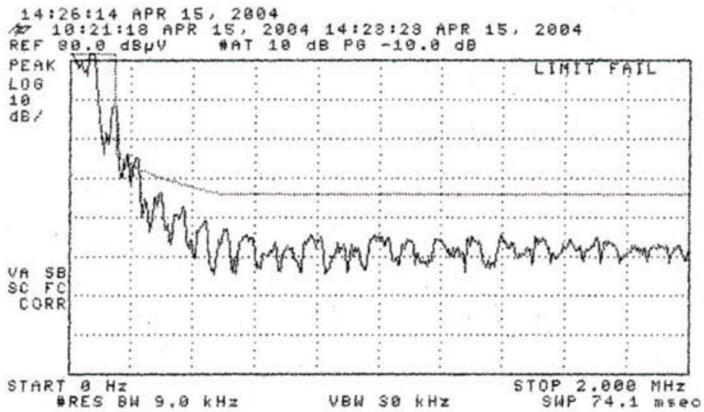


Figure 6.13. Power Spectral Density – 29.9 dBm Amp: CH: 2437



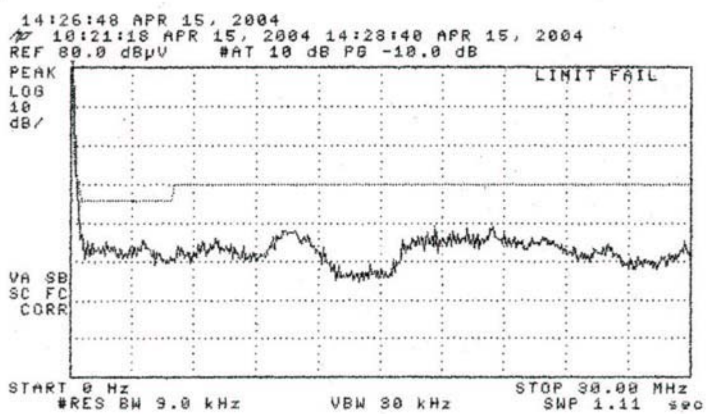
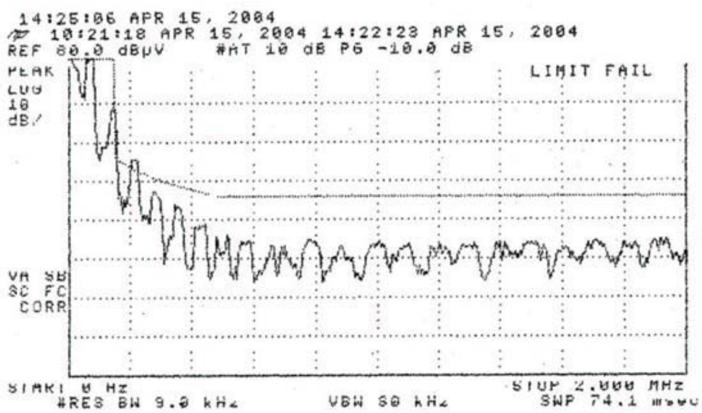


Figure 6.14. Pk AC Line Conducted Emissions – LO Side
(29.9 dBm Amplifier – CW Transmit)



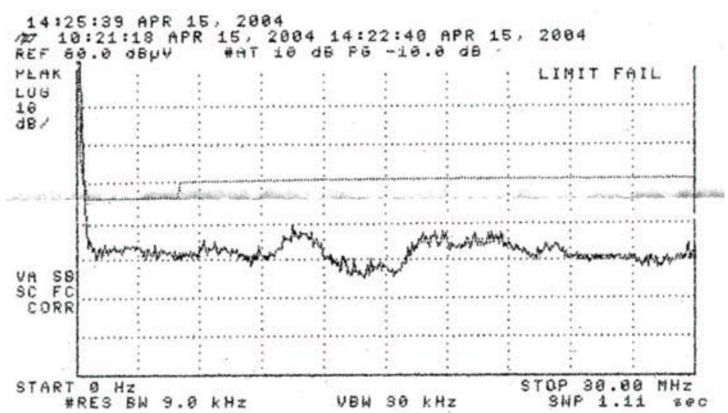


Figure 6.15. Pk AC Line Conducted Emissions – HI Side
(29.9 dBm Amplifier – CW Transmit)