

APPLICATION FOR FCC CERTIFICATION
DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

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Model: Magic Wave ISA

FCC ID: E2XSWL-1000D

March 17, 1999

This report concerns (check one): Equipment Type: ISA Board	Original Grant:	Class II Change: X
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? Yes: No: X If yes, defer until: _____ <i>Date</i> Company name agrees to notify the Commission by: _____ (date) of the intended date of announcement of the product so that the grant can be issued on that date.		
Transition Rules Request per 15.37? Yes: No: X If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision..		

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Rhein Tech Laboratories, Inc.

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1.0 GENERAL INFORMATION

The following Application for FCC Certification of a Class II Permissive Change for a Direct Sequence Spread Spectrum transmitter is prepared on behalf of Samsung Electro-Mechanics in accordance with Part 15.247 of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the Samsung Electro-Mechanics Magic Wave ISA, FCC ID: E2XSWL-1000D. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech, Labs, Inc. is on the FCC accepted lab list as a Facility available to do measurement work for others on a contract basis.

1.1 PRODUCT DESCRIPTION

The model SWL-1000D (referred to as the EUT in this report) is a Direct Sequence Spread Spectrum wireless LAN, ISA network card. The EUT provides wireless communications between computers. The EUT is designed to be plugged into an ISA slot in a desktop computer. The EUT communicates with other wireless LAN cards using the frequency range from 2.4 GHz to 2.485 GHz. The EUT is powered from the desktop computer, and does not have an external power supply. The EUT uses a patch antenna attached to a left-turn SMA connector. This patch antenna has a 1.2 meter shielded coaxial cable.

1.2 RELATED SUBMITTAL(S)/GRANT(S)

The original grant is dated September 15, 1998. The EUT was tested as a digital interface card. An FCC Class B Declaration of Conformity (DoC) report is on file.

1.2.1 CLASS II PERMISSIVE CHANGES

The following are the changes for which the Class II Permissive change is sought:

Item	Old	New
IF Mod/Demod IC	HFA3724	HFA3726
Mix AM AMP	HFA3624	Discrete Mixer AT32032
AMP	AT42086 CMM2301	UPC2762T ITT2205AFI
LNA	SMP22203	MGA-85563
Rx/Tx Switch	SW239	UPG152TA

1.3 TEST SYSTEM DETAILS

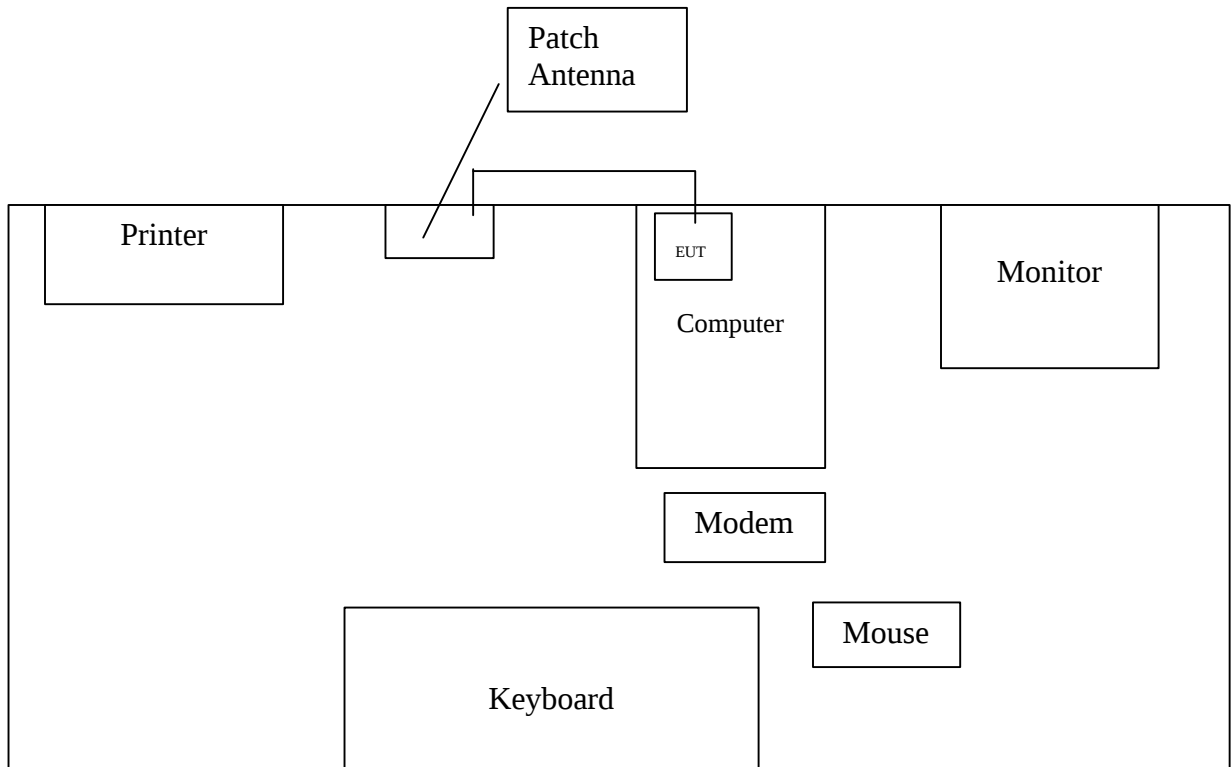
The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

External Components

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
SYSTEM	GATEWAY 2000, INC.	BATC	N/A	N/A	N/A	007547
MONITOR	IBM	6555-8E3	36-52476	AK8GDM20SH1	SHIELDED I/O, FERRITE MONITOR END, SHIELDED POWER	900649
KEYBOARD	KEYTRONIC	E06150US011-C	J97331??	DoC	SHIELDED I/O	008487
PRINTER	HEWLETT PACKARD	THINK JET 2225C	2841S26339	DSI6XU2225	SHIELDED I/O UNSHIELDED POWER	900139
MOUSE	MICROSOFT	INTELLIMOUSE 1.1A	00332324	C3KKMP5	SHIELDED I/O	900589
MODEM	US ROBOTICS	0413	839032B86PA9L	N/A	SHIELDED I/O UNSHIELDED POWER	900698
WIRELESS ANTENNA (EUT-2)	SAMSUNG	N/A	N/A	SAMPLE	SHIELDED I/O	010420

Internal Components

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
FLOPPY DRIVE	PANASONIC	JU-256A216P	F3719	N/A	INTERNAL RIBBON	007550
HARD DRIVE	SAMSUNG/YDI	SHD-3212A (426 MB)	JIMD512649 REV.A	SAMPLE	N/A	010427
POWER SUPPLY	ASTEC	ATX145-3505	2265253282	N/A	SHIELDED POWER	007548
CD-ROM DRIVE	TOSHIBA	XM-6002B	754J012883	CJ6AT96-026	INTERNAL RIBBON	007549
VIDEO CARD	STB SYSTEMS	VIRGE GX	210-0262-001	DoC	SHIELDED I/O	006657
MOTHERBOARD	INTEL	HITMAN	GRCO124721H	N/A	INTERNAL RIBBON	900602
CPU	INTEL	PENTIUM 166MHZ	CPUPENO18ABWW	IN HOUSE	N/A	900587
ISA CARD (EUT-1)	SAMSUNG	SWL-1000D WCLD200A	SWLD00AHA00A66	E2XSWL-1000D	N/A	010433

1.4 CONFIGURATION OF TESTED SYSTEM

1.5 TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters. Emissions above 1 GHz were video averaged.

1.6 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

2.0 PRODUCT LABELING

FIGURE 1: FCC ID LABEL

The information only exists in the original grant (FCC ID: E2XSWL-1000D) dated September 15, 1998.

FIGURE 2: LOCATION OF LABEL ON EUT



3.0 SYSTEM TEST CONFIGURATION

3.1 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst case emission. Channel 1 at 2.412GHz, Channel 6 at 2.437GHz and Channel 11 at 2.462GHz were tested and investigated from 9kHz to 24GHz. All three channels were found to exhibit the same signature. Channel 11 was used for final testing during antenna conducted spurious emissions measurements, radiated spurious noise measurements and conducted emissions measurements.

To complete the configuration required by the FCC, the transmitter was tested in a mini-tower computer with the patch antenna connected to the antenna port similar to its intended use.

The transmitter antenna connector is a unique reverse-thread and is non-interchangeable.

3.2 EUT EXERCISE SOFTWARE

The EUT was enabled to continuously transmit, which was verified by a receiving unit during testing. The carrier was also checked to verify that the information was being transmitted.

3.3 SPECIAL ACCESSORIES

N/A.

3.4 MODULATED BANDWIDTH

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 100 kHz. The Minimum 6 dB modulated bandwidth are the following:

Channel 1= 10.2MHz

Channel 6= 10.2MHz

Channel 11=10.2MHz

The 6dB bandwidth is listed in figures 3, 4 and 5.

3.5 POWER OUTPUT

The power output per FCC 15.247(b) was measured on the EUT using a 50 ohm spectrum analyzer with the resolution bandwidth set at 3 MHz, and the video bandwidth set at 3 MHz. The Peak power measured for modulated output power are the following:

Channel 1=14.6dBm

Channel 6=14.8dBm

Channel 11=16.7dBm

See attached power output plot in figure 6, 7, and 8.

3.6 ANTENNA CONDUCTED SPURIOUS EMISSIONS

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 were identified at 2.412GHz for Channel 1, 2.437GHz for Channel 6 and 2.462GHz for Channel 11 with peak amplitude at 121.6dBuV, 121.8dBuV and 123.7dBuV. No other harmonics or spurs were found within 20 dB of the carrier level, and from 9kHz to the carriers 10th harmonic. See antenna conducted spurious noise plots, figures 9 through 15.

3.7 RADIATED SPURIOUS EMISSIONS

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. The restricted bands are listed in Section 15.205. The maximum permitted average field strength for the restricted band is listed in Section 15.209.

Please, refer to section 3.7 for data test results.

3.8 POWER SPECTRAL DENSITY

The Power spectral density per FCC 15.247(d) was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 3kHz, and the sweep time set at 17 second. The spectral lines were resolved for the modulated carriers at 2.412GHz, 2.437GHz and 2.462GHz with amplitudes of -15.4dBm, -15.6dBm and -12.6dBm, respectively. These levels are well below the +8 dBm limit. See power spectral density plots, figures 16 through 18.

3.9 PROCESSING GAIN:

Processing gain is a measure of the increase in signal-to-noise ratio produced by the spread spectrum modulation. It must be at least 10dB. One method of measuring it, detailed in the FCC's notice, is the "CW jamming margin method." As shown in section 3.8.1, the test configuration consists of the EUT transmitter/receiver pair, a signal generator, an audio signal generator, signal-combining pad, and attenuators. The signal generator is used as an unmodulated (CW) jamming signal.

For this test, the signal generator is stepped in 50 kHz increments across the passband of the system. At each frequency, the generator level is adjusted to produce the BER desired for the system, that is 1/1000 for voice transmission. This is the jammer level (J). The output power (S) of the transmitting unit is measured at the same test point, and the jammer-to-signal ratio (J/S) is calculated. The lowest 20% of J/S data points are discarded, and the lowest remaining J/S ratio is used in calculating the processing gain.

Processing gain (Gp) is thus defined by the following equation:

$$G_p = (S/N)_o + M_j + L_{sys}$$

Processing gain = 11.4dB (measured using Channel 11)

Note: The processing gain was taken from measurements performed by the manufacturer.

3.10 CONFORMANCE STATEMENT

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made during testing to the equipment in order to achieve compliance with these standards.

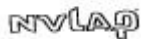
Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Typed/Printed Name: Desmond A. Fraser

Date: March 19, 1999

Signature

Position: President, (NVLAP Signatory)



Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

4.0 MEASUREMENT PLOTS

FIGURE 3: 6dB Occupied Bandwidth (Channel 1)

RBW = 100 kHz VBW = 300 kHz Sweep = 10 s Atten = 30 dB Ext. Atten = 0 dB

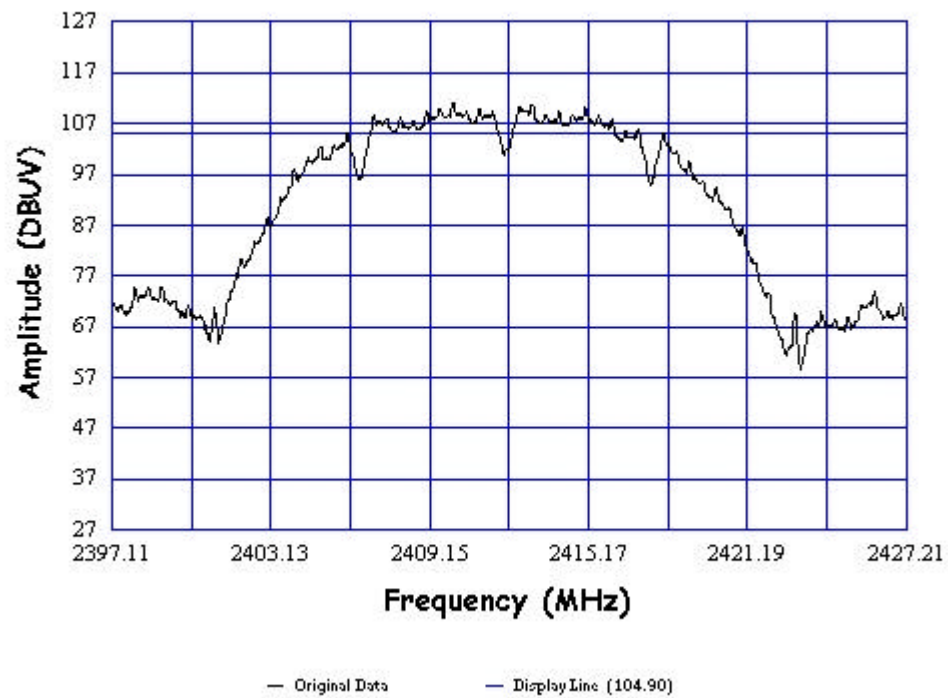


FIGURE 4: 6dB Occupied Bandwidth (Channel 6)

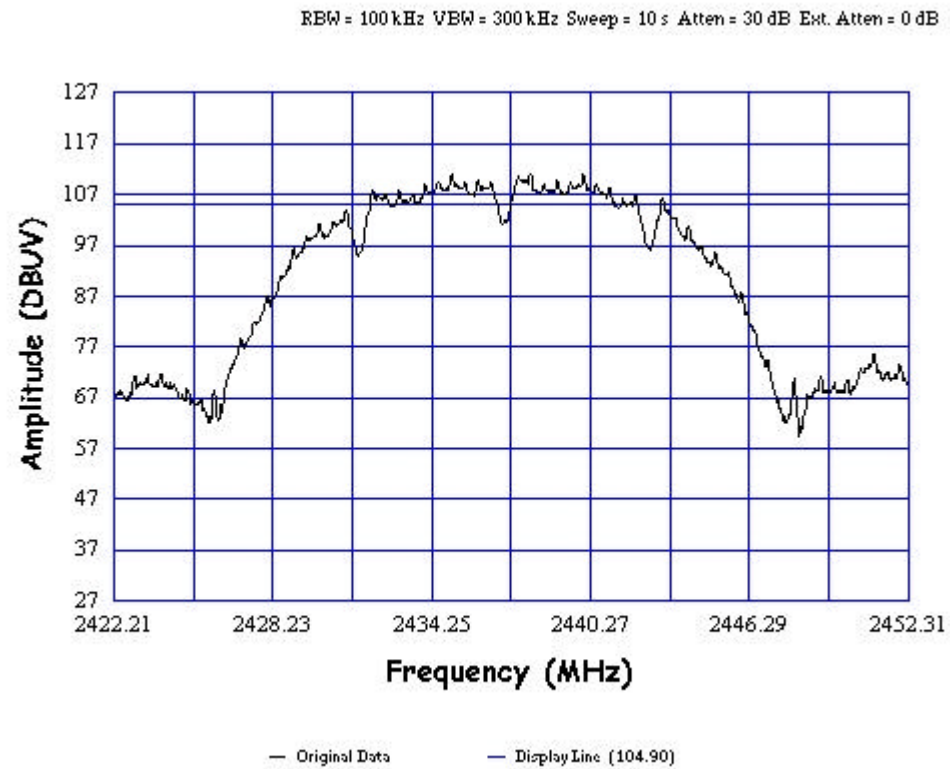


FIGURE 5: 6dB Occupied Bandwidth (Channel 11)

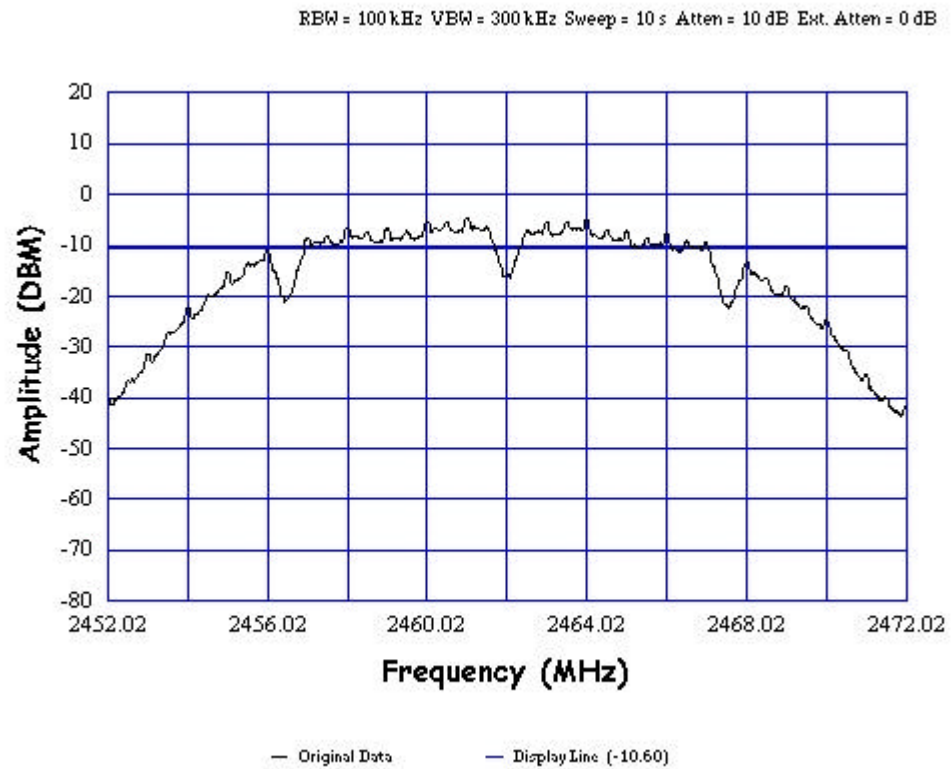


FIGURE 6: Output Power Plots (Channel 1)

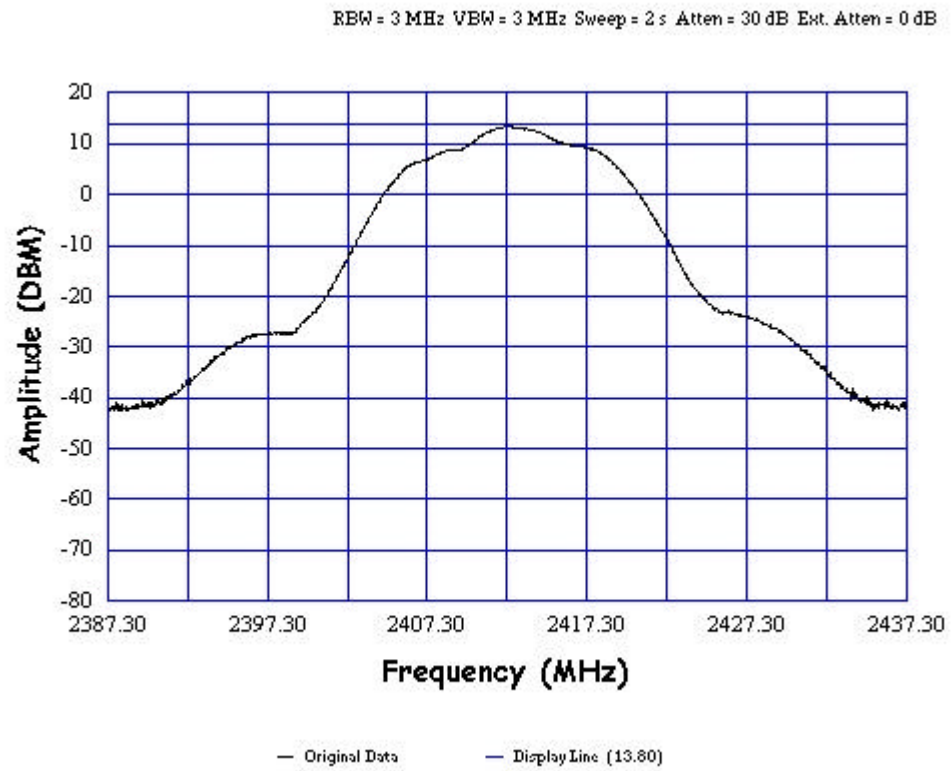


FIGURE 7: Output Power Plots (Channel 6)

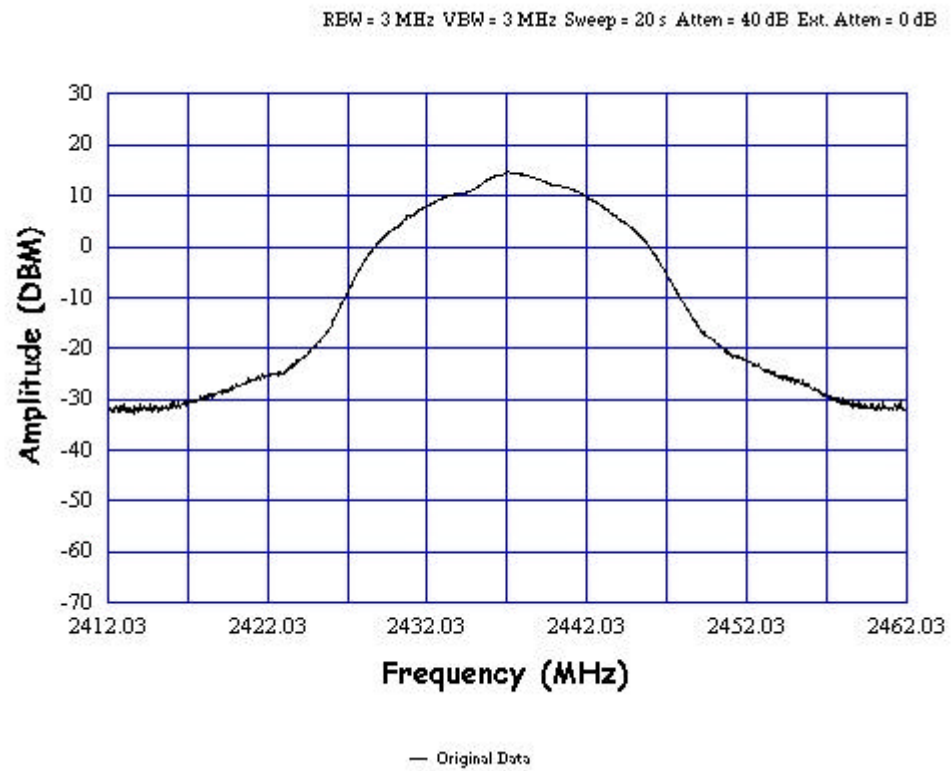


FIGURE 8: Output Power Plots (Channel 11)

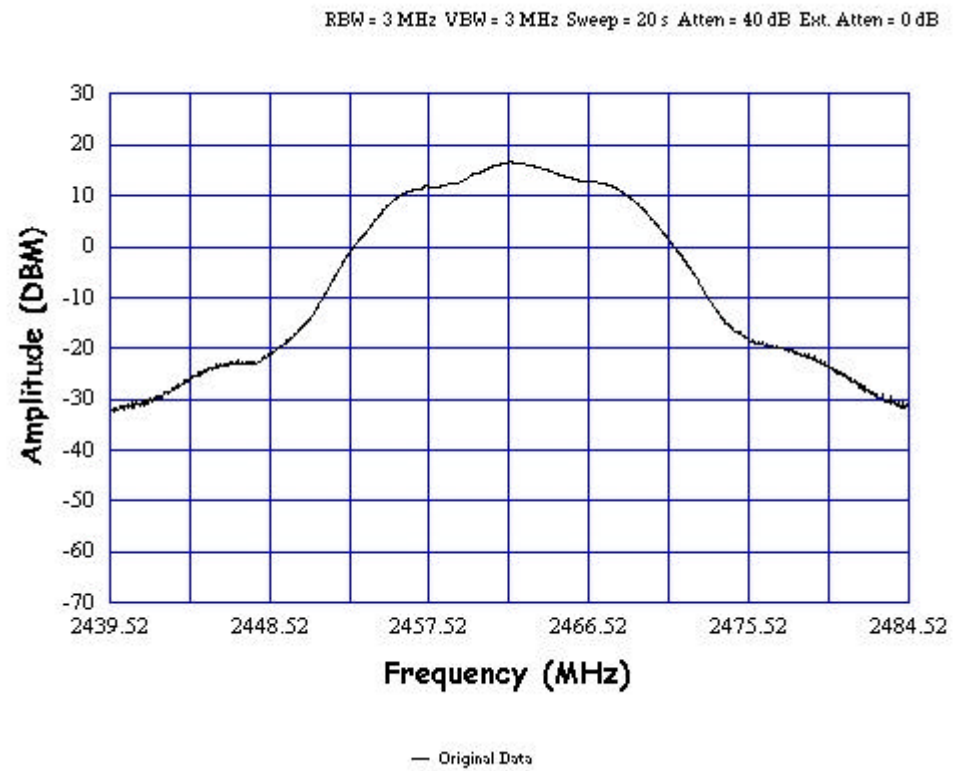


FIGURE 9: Conducted Spurious Emission (9kHz-30MHz)

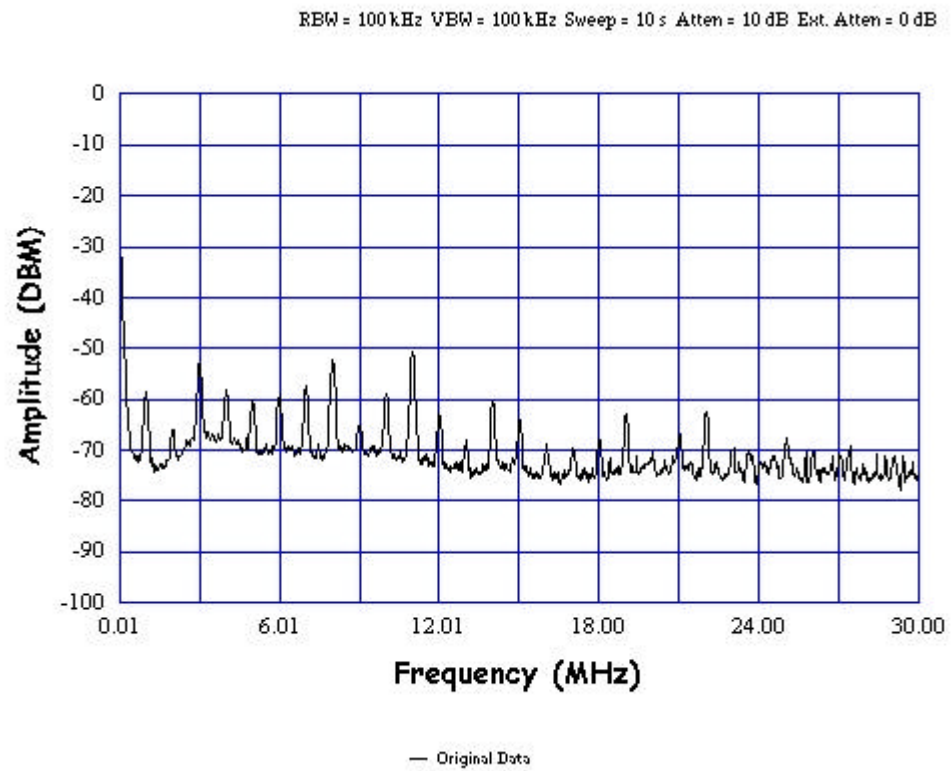


FIGURE 10: Conducted Spurious Emission (30MHz-1GHz)

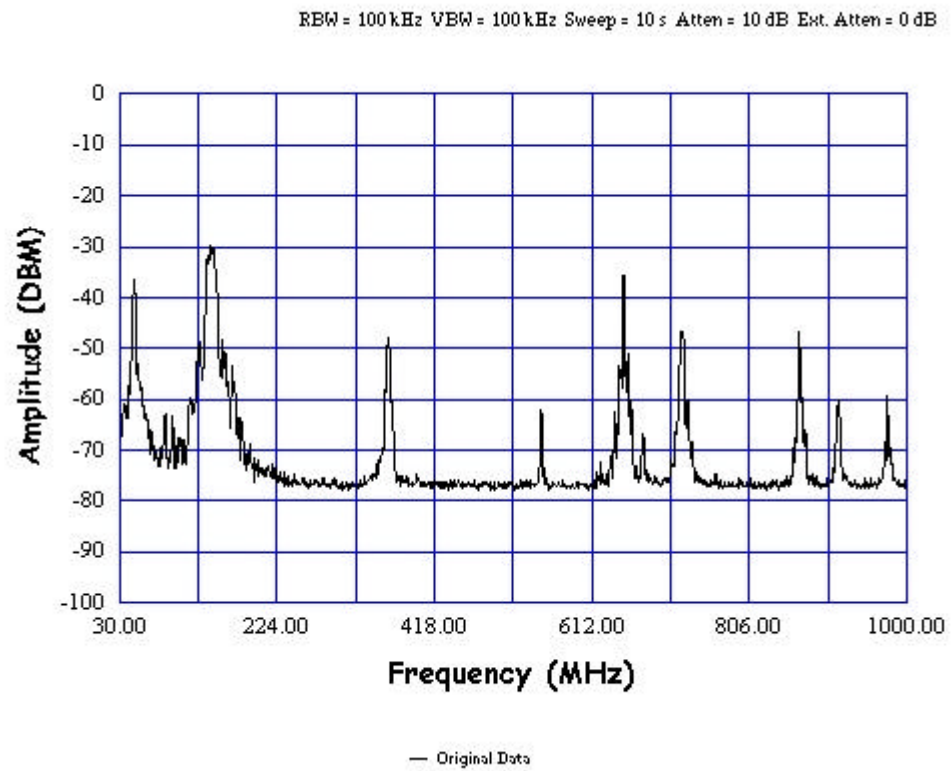


FIGURE 11: Conducted Spurious Emission (1GHz-2GHz)

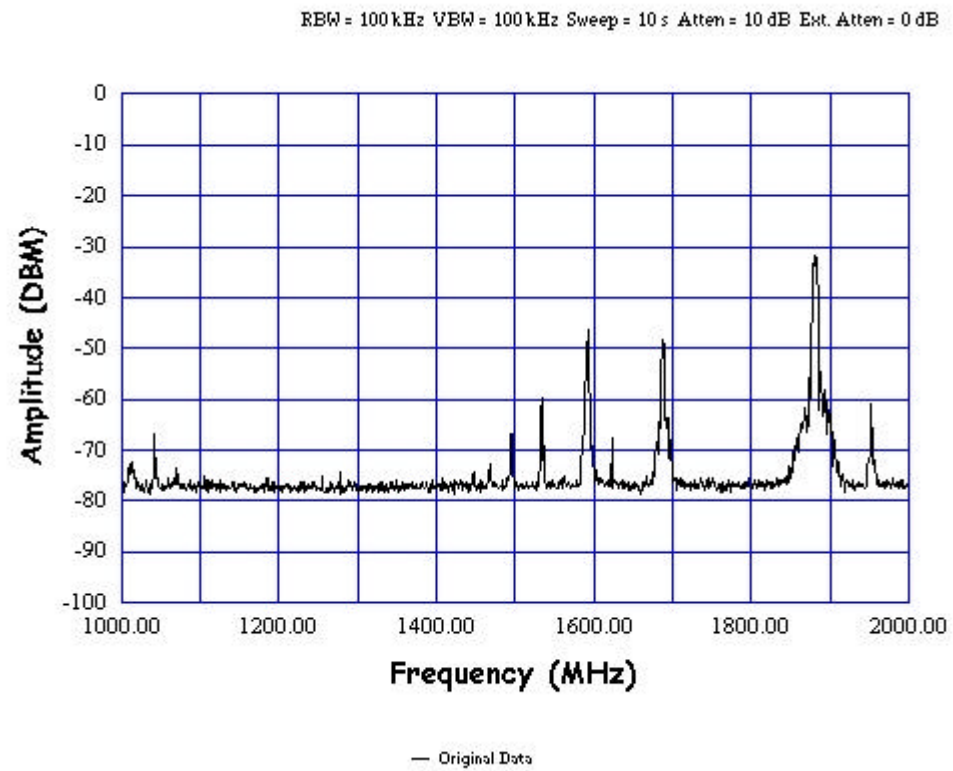


FIGURE 12: Conducted Spurious Emission (2GHz-5GHz)

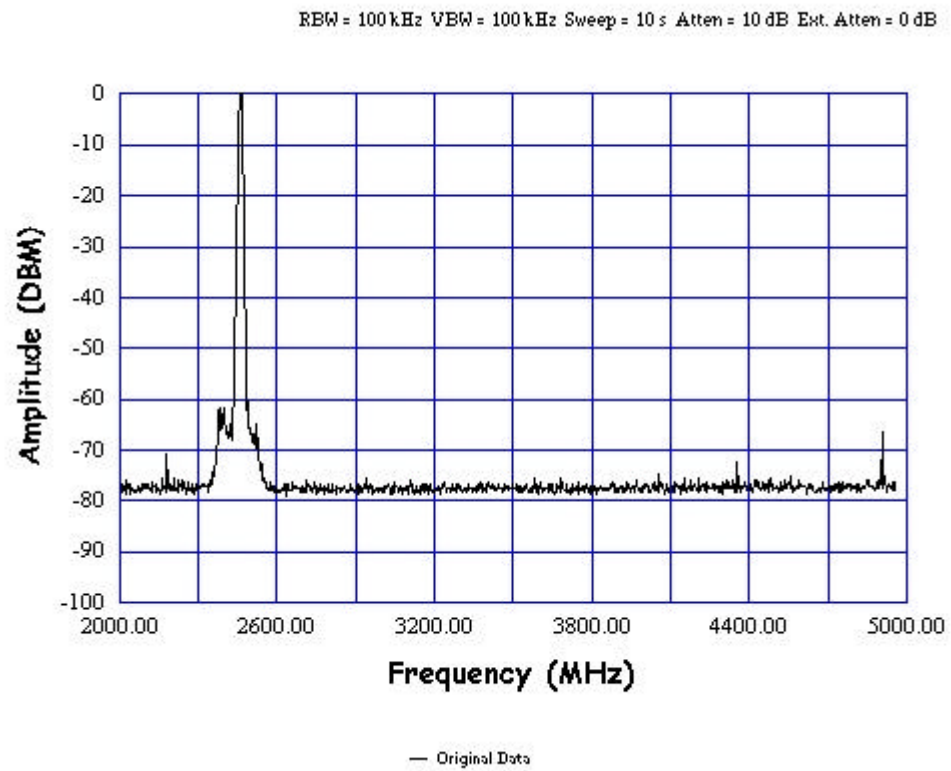


FIGURE 13: Conducted Spurious Emission (5GHz-10GHz)

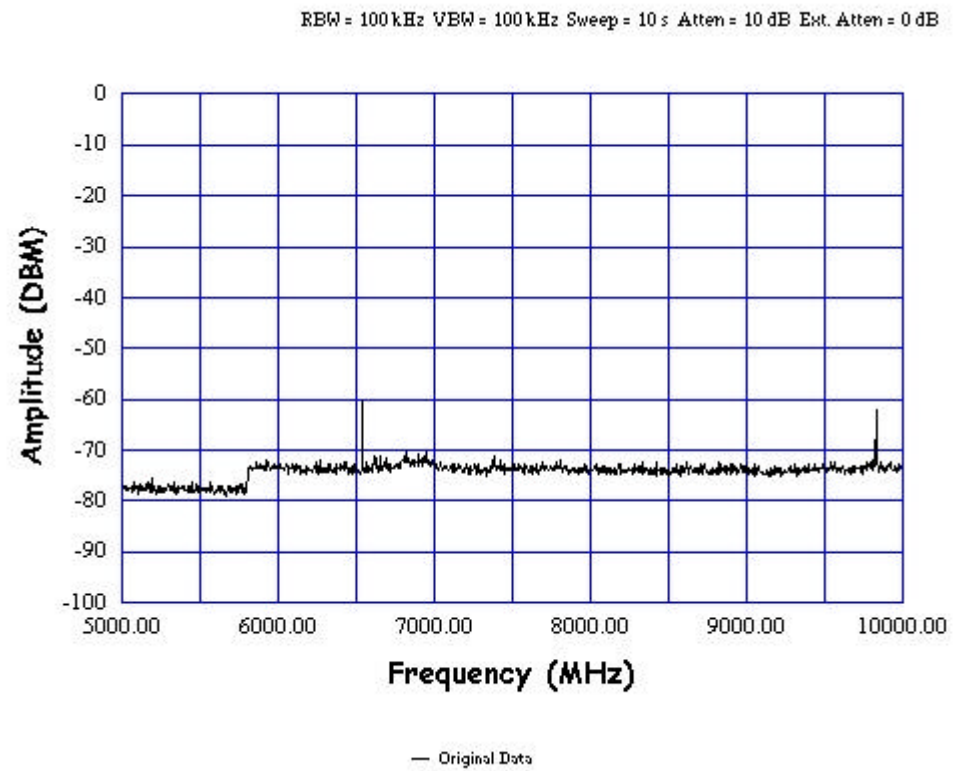


FIGURE 14: Conducted Spurious Emission (10GHz-15GHz)

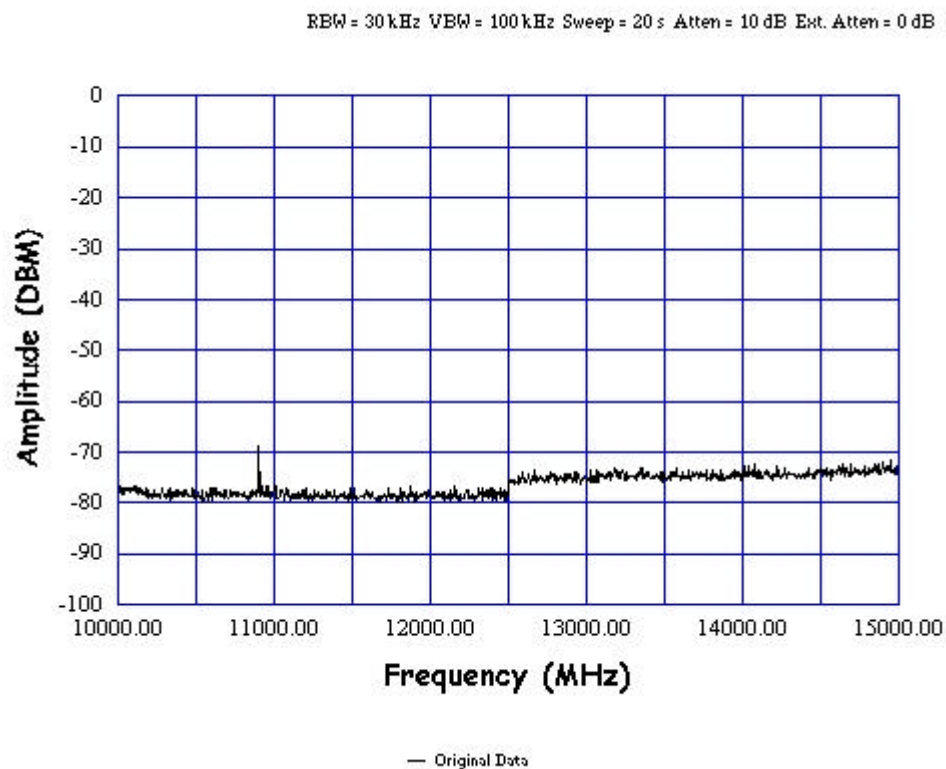


FIGURE 15: Conducted Spurious Emission (15GHz-23GHz)

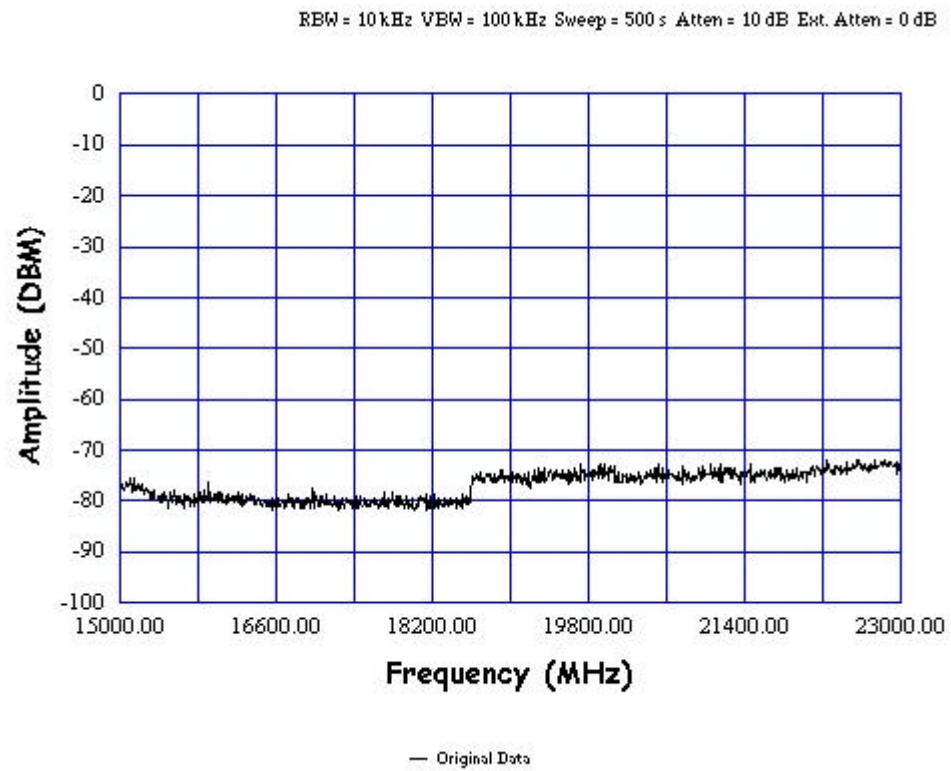


FIGURE 16: Power Spectral Density (Channel 1)

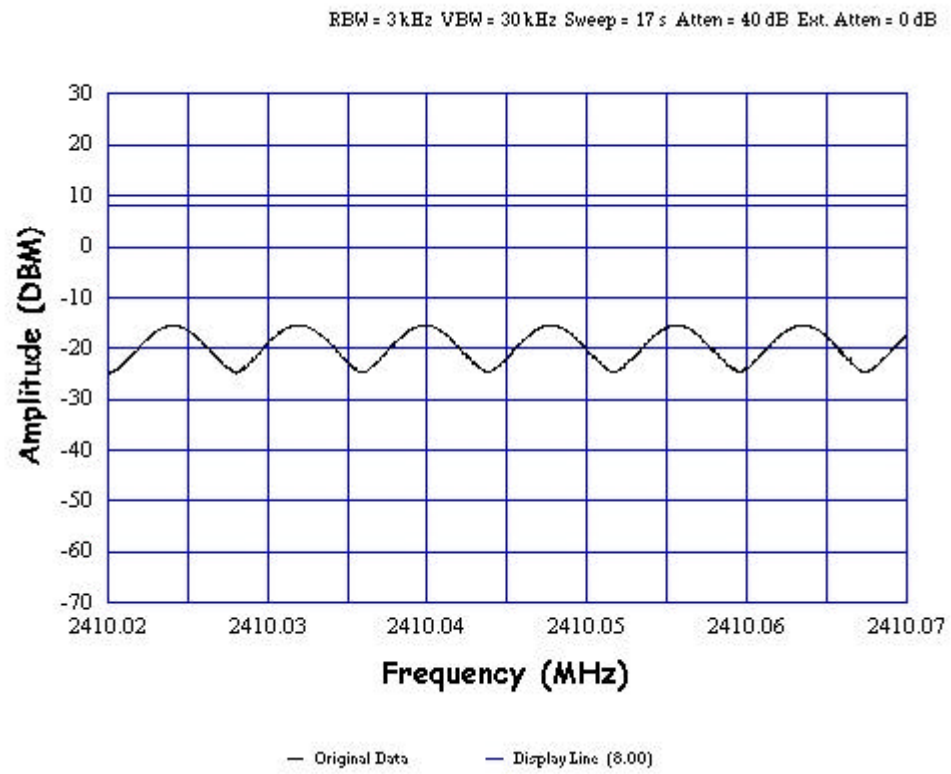


FIGURE 17: Power Spectral Density (Channel 6)

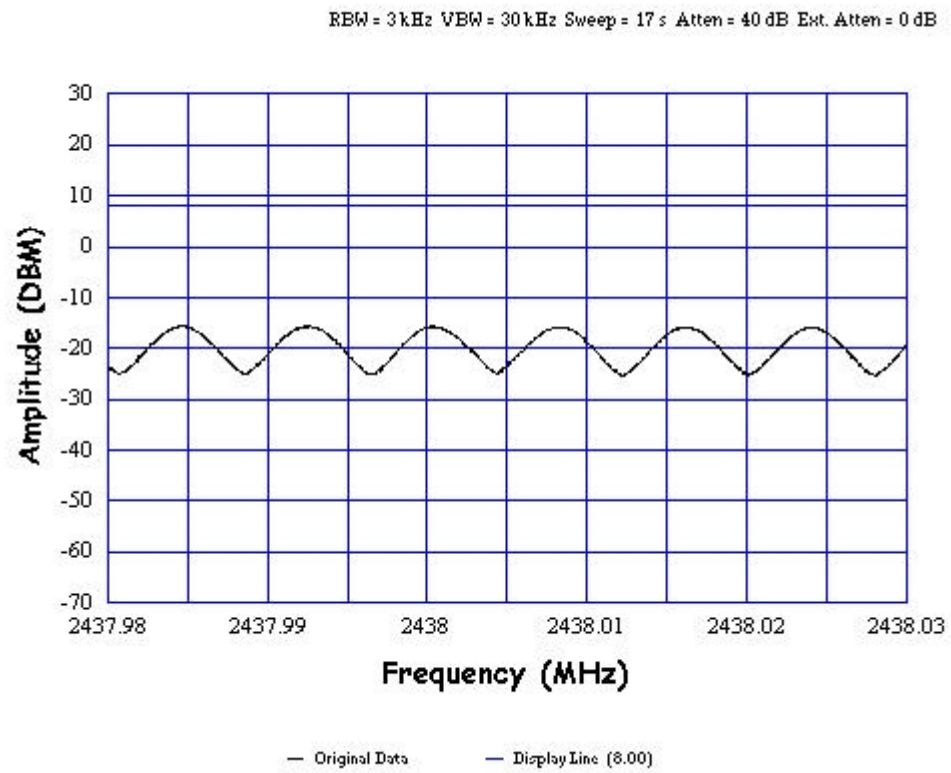
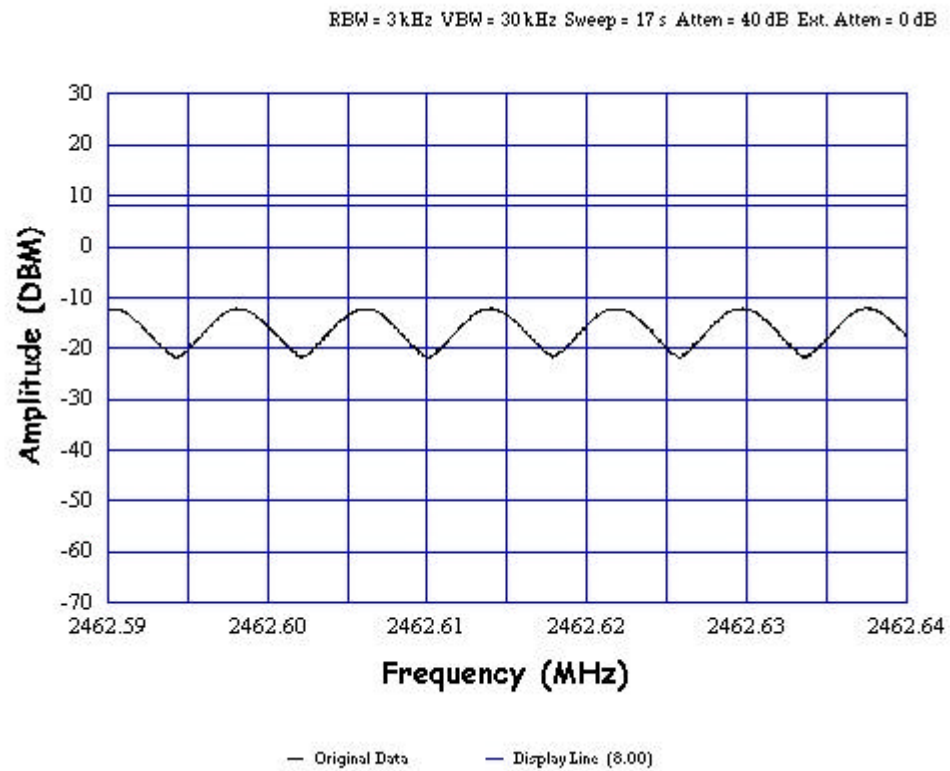
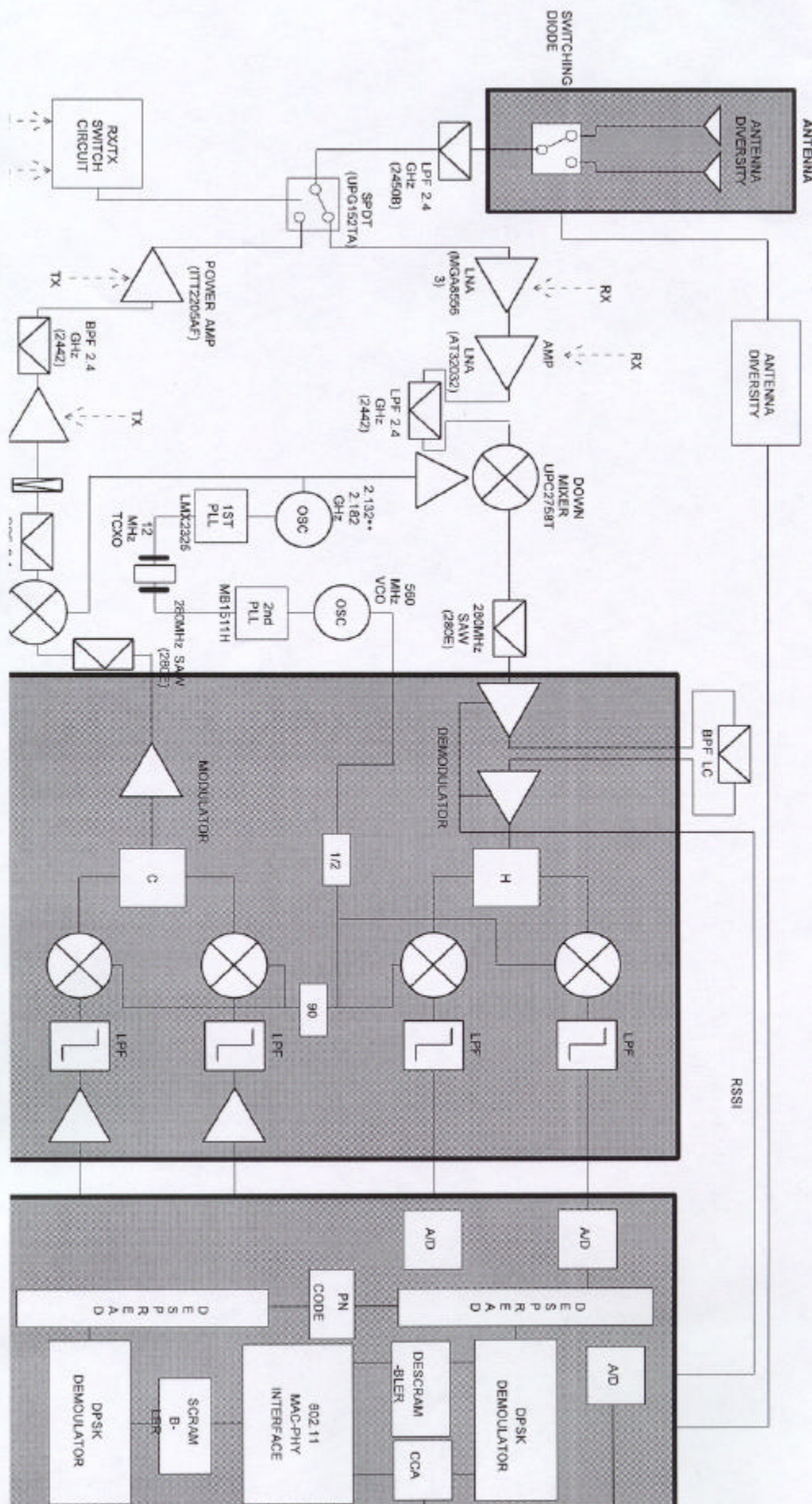
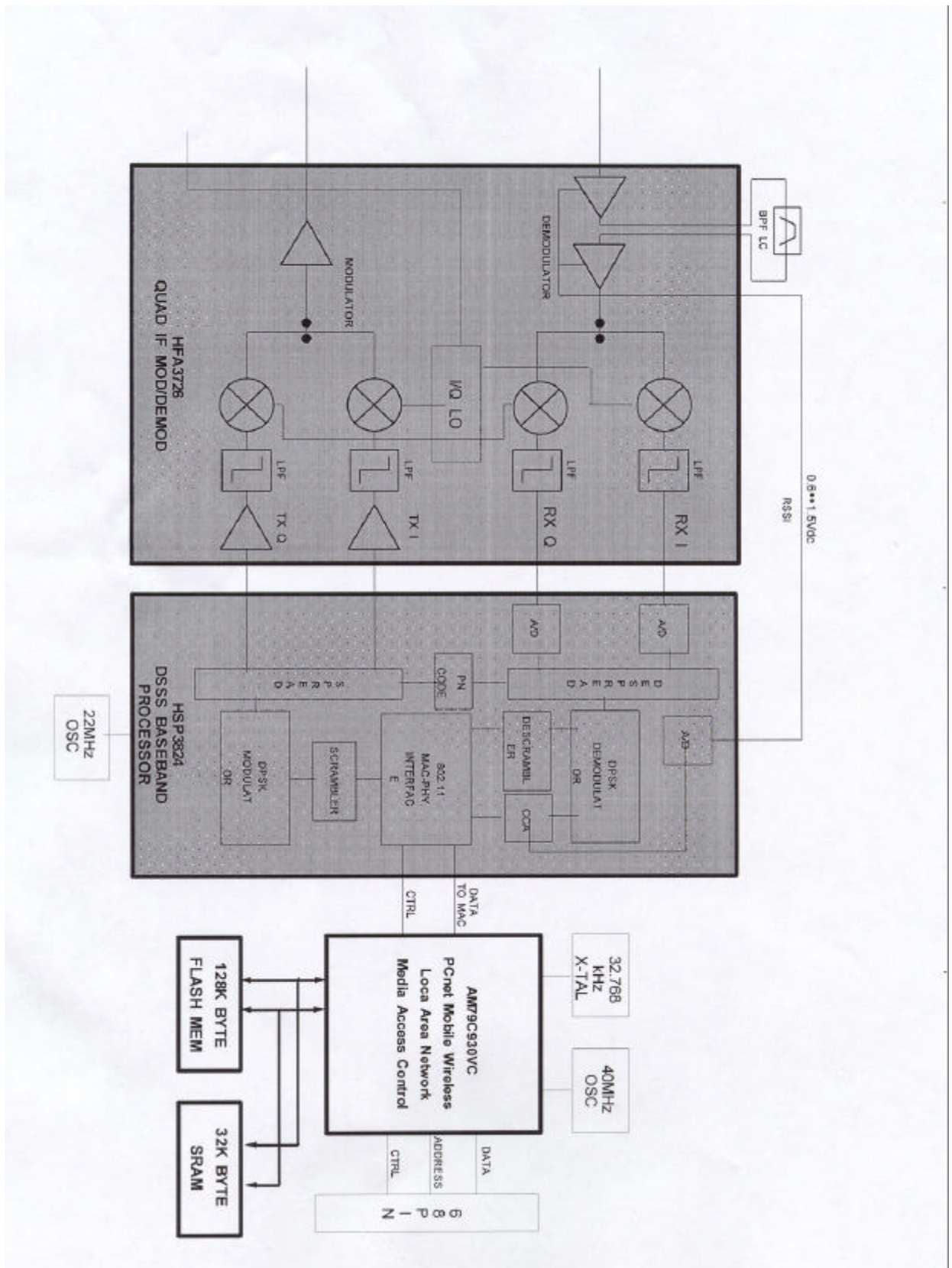


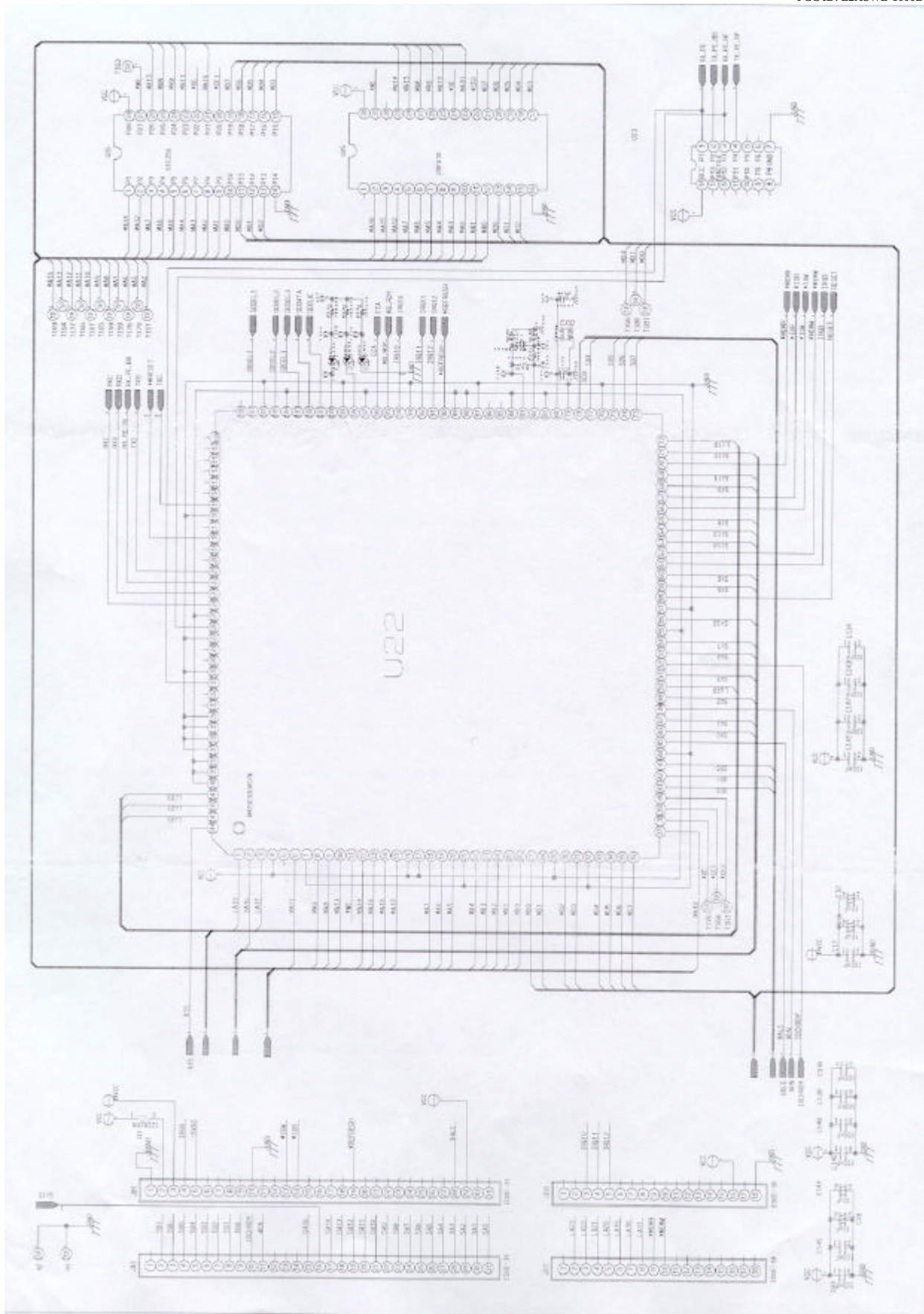
FIGURE 18: Power Spectral Density (Channel 11)



5.0 BLOCK DIAGRAM/SCHEMATICS OF MAGIC WAVE ISA







6.0 Conducted Field Strength Calculation, and Radiated Test Methodology

6.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI(\text{dBuV/m}) = SAR(\text{dBuV}) + SCF(\text{dB/m})$$

FI = Field Intensity

SAR = Spectrum Analyzer Reading

SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$SCF(\text{dB/m}) = -PG(\text{dB}) + AF(\text{dB/m}) + CL(\text{dB})$$

SCF = Site Correction Factor

PG = Pre-amplifier Gain

AF = Antenna Factor

CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(\text{uV/m}) = 10^{FI(\text{dBuV/m})/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3 \text{ dBuV} - 11.5 \text{ dB/m} = 37.8 \text{ dBuV/m}$$

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

6.2 Radiated measurement

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

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to 10GHz MHz (10th harmonic of carrier frequency) using a Hewlett Packard 8566B spectrum analyzer, a Hewlett Packard 85650A quasi-peak adapter, HP11790 mixers, and EMCO log periodic, EMCO horn antennas and biconical antenna. In order to gain sensitivity, a cougar preamplifier (from 30 to 2GHz), and an HP preamplifier (from 1GHz to 26.5 GHz) was connected in series between the antenna and the input of the spectrum analyzer.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB resolution bandwidth was set to 120 kHz for measurements below 1GHz, and 1MHz for measurements above 1GHz. The analyzer was operated in peak detection mode below 1GHz and in the peak mode with 10Hz video averaging above 1 GHz. No video filter less than 10 times the resolution bandwidth was used when measuring below 1GHz. The highest emission amplitudes relative to the appropriate limit were measured and 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 daily calibration methods, technician training, and emphasis to employees on avoiding error.

7.0 CONDUCTED EMISSION DATA

The following table lists worst case conducted emission data. Specifically: Emission Frequency, Test Detector, Analyzer Reading, Site Correction Factor, corrected Emission Level, Quasi Peak Limit and Margin, and the Average Limit and Margin.

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.

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 HOT SIDE, herein referred to as L1 and L2, respectively.

TABLE 1: CONDUCTED EMISSIONS (CHANNEL 11)

NEUTRAL SIDE (Line 1)						
EMISSION FREQUENCY (MHz)	TEST DETECTOR	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dB)	EMISSION LEVEL (dBuV)	FCC LIMIT (dBuV)	FCC MARGIN (dBuV)
0.450	Pk	32.3	0.6	32.9	48.0	-15.1
0.517	Pk	29.4	0.6	30.0	48.0	-18.0
0.588	Pk	25.2	0.6	25.8	48.0	-22.2
0.812	Pk	22.9	0.7	23.6	48.0	-24.4
0.893	Pk	24.5	0.7	25.2	48.0	-22.8
21.758	Pk	22.7	3.7	26.4	48.0	-21.6
26.103	Pk	24.3	3.9	28.2	48.0	-19.8

HOT SIDE (Line 2)						
EMISSION FREQUENCY (MHz)	TEST DETECTOR	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dB)	EMISSION LEVEL (dBuV)	FCC LIMIT (dBuV)	FCC MARGIN (dBuV)
0.451	Pk	28.8	0.6	29.4	48.0	-18.6
0.515	Pk	29.3	0.7	30.0	48.0	-18.0
0.591	Pk	24.5	0.7	25.2	48.0	-22.8
0.812	Pk	22.7	0.8	23.5	48.0	-24.5
1.184	Pk	22.7	1.0	23.7	48.0	-24.3
26.123	Pk	22.0	4.0	26.0	48.0	-22.0

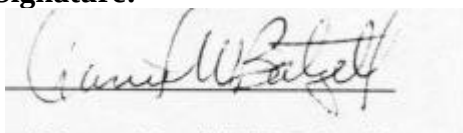
⁽¹⁾Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Typed/Printed Name: Daniel W. Baltzell

Date: March 13, 1999

Signature:



7.1 Conducted Measurement Photos



8.0 RADIATED EMISSION DATA

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit. Explanation of the Correction Factor is given in paragraph 6.3.

TABLE 2: RADIATED EMISSIONS (CHANNEL 11)

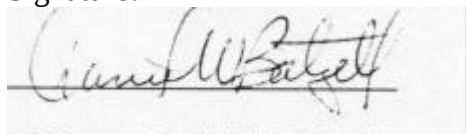
EMISSION FREQUENCY (MHz)	ANTENNA POLARITY (H/V)	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	FCC LIMIT (dBuV/m)	FCC MARGIN (dBuV/m)
132.000	V	50.8	-17.2	33.6	43.5	-9.9
153.990	V	60.1	-19.8	40.3	43.5	-3.2
197.990	V	45.2	-17.4	27.8	43.5	-15.7
240.000	V	47.5	-15.3	32.2	46.0	-13.8
263.995	V	53.3	-14.5	38.8	46.0	-7.2
400.000	V	53.7	-11.1	42.6	46.0	-3.4
505.995	V	44.4	-8.3	36.1	46.0	-9.9
681.995	V	44.5	-5.1	39.4	46.0	-6.6
703.990	H	47.1	0.3	47.4	46.0	-2.6
725.995	V	52.1	-4.0	47.1	46.0	-2.9
840.257	H	41.7	-3.0	38.7	46.0	-7.3
4363.960	V	52.1	-4.0	48.1	54.0	-5.9
4923.929	H	48.2	-3.5	44.7	54.0	-9.3
8728.040	H	43.2	4.0	48.2	54.0	-5.8
10910.020	V	37.9	5.0	42.9	54.0	-11.
13091.815	V	29.4	10.9	30.3	54.0	-23.7
17455.700	V	28.9	11.2	40.1	54.0	-13.9
4263.940	H	52.5	-3.9	48.6	54.0	-5.4
10659.980	H	34.2	4.8	39.0	54.0	-15.0
4314.000	H	55.1	-4.0	51.1	54.0	-2.9
10785.000	V	32.0	5.3	37.3	54.0	-33.3

TEST PERSONNEL:

Typed/Printed Name: Daniel W. Baltzell

Date: March 13, 1999

Signature:



8.1 Radiated Measurement Photos



APPENDIX A: Emissions Equipment List

DESCRIPTION	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. LAB
AMPLIFIER	HEWLETT PACKARD	11975A	2304A00348	TEST EQUITY
AMPLIFIER (S/A 1)	RHEIN TECH	PR-1040	00001	RTL
AMPLIFIER (S/A 2)	RHEIN TECH	RTL2	900723	RTL
AMPLIFIER (S/A 3)	RHEIN TECH	8447F	2944A03783	RTL
AMPLIFIER (S/A 4)	RHEIN TECH	8447D	2727A05397	RTL
BICONICAL/LOG ANTENNA 1	ANTENNA RESEARCH	LPB-2520	1037	LIBERTY LABS
BICONICAL/LOG ANTENNA 2	ANTENNA RESEARCH	LPB-2520	1036	LIBERTY LABS
FIELD SITE SOURCE	EMCO	4610	9604-1313	RTL
FILTER (ROOM 1)	SOLAR	8130	947305	RTL
FILTER (ROOM 2)	SOLAR	8130	947306	RTL
HARMONIC MIXER 1	HEWLETT PACKARD	11970K	2332A00563	TELOGY
HARMONIC MIXER 2	HEWLETT PACKARD	11970A	2332A01199	TELOGY
HORN ANTENNA 1	EMCO	3160-10	9606-1033	EMCO
HORN ANTENNA 2	EMCO	3160-9	9605-1051	EMCO
HORN ANTENNA 3	EMCO	3160-7	9605-1054	EMCO
HORN ANTENNA 4	EMCO	3160-8	9605-1044	EMCO
HORN ANTENNA 5	EMCO	3160-03	9508-1024	EMCO
LISN (ROOM 1/L1)	SOLAR	7225-1	900727	ACUCAL
LISN (ROOM 1/L2)	SOLAR	7225-1	900726	ACUCAL
LISN (ROOM 2/L1)	SOLAR	7225-1	900078	ACUCAL
LISN (ROOM 2/L2)	SOLAR	7225-1	900077	ACUCAL
PRE-AMPLIFIER	HEWLETT PACKARD	8449B OPT	3008A00505	TELOGY
QUASI-PEAK ADAPTER (S/A 1)	HEWLETT PACKARD	85650A	3145A01599	ACUCAL
QUASI-PEAK ADAPTER (S/A 2)	HEWLETT PACKARD	85650A	2811A01276	ACUCAL
QUASI-PEAK ADAPTER (S/A 3)	HEWLETT PACKARD	85650A	2521A00473	ACUCAL
QUASI-PEAK ADAPTER (S/A 4)	HEWLETT PACKARD	85650A	2521A01032	ACUCAL
RF PRESELECTION (S/A 1)	HEWLETT PACKARD	85685A	3146A01309	ACUCAL
SIGNAL GENERATOR (HP)	HEWLETT PACKARD	8660C	1947A02956	ACUCAL
SIGNAL GENERATOR (WAVETEK)	WAVETEK	3510B	4952044	ACUCAL
SPECTRUM ANALYZER 1	HEWLETT PACKARD	8566B	3138A07771	ACUCAL
SPECTRUM ANALYZER 2	HEWLETT PACKARD	8567A	2841A00614	ACUCAL
SPECTRUM ANALYZER 4	HEWLETT PACKARD	8567A	2727A00535	ACUCAL
TUNABLE DIPOLE	EMCO	3121	274	LIBERTY LABS
ANTENNA	ATM	WR08	08443-6	ATM
MIXER	OLESON	M08HW	F80814-1	OLESON
MIXER	OLESON	M05HW	G80814-1	OLESON
DIPLEXER	OLESON	M05HW	G80814-1	OLESON
MIXER	HEWLETT PACKARD	11970U	2332A01110	ACUCAL
MIXER	HEWLETT PACKARD	11970V	2521A00512	TELOGY
MIXER	HEWLETT PACKARD	11970W	2521A00710	TELOGY
ANTENNA	ATM	WR15	15-443-6	ATM
ANTENNA	ATM	WR10	10-443-6	ATM
ANTENNA	ATM	WR05	05-443-6	ATM
SWEEP GENERATOR	HEWLETT PACKARD	83752A	3610A00866	HEWLETT PACKARD

Calibration Certification available upon request.

9.0 PHOTOS OF TESTED EUT



Figure 19: ISA Antenna (Front)



Figure 20: ISA Antenna (Back)



Figure 21: ISA Antenna Inside Bracket & Cover



Figure 22: ISA Antenna Outside Bracket & Cover



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Figure 25: ISA Card Component Side with Cover

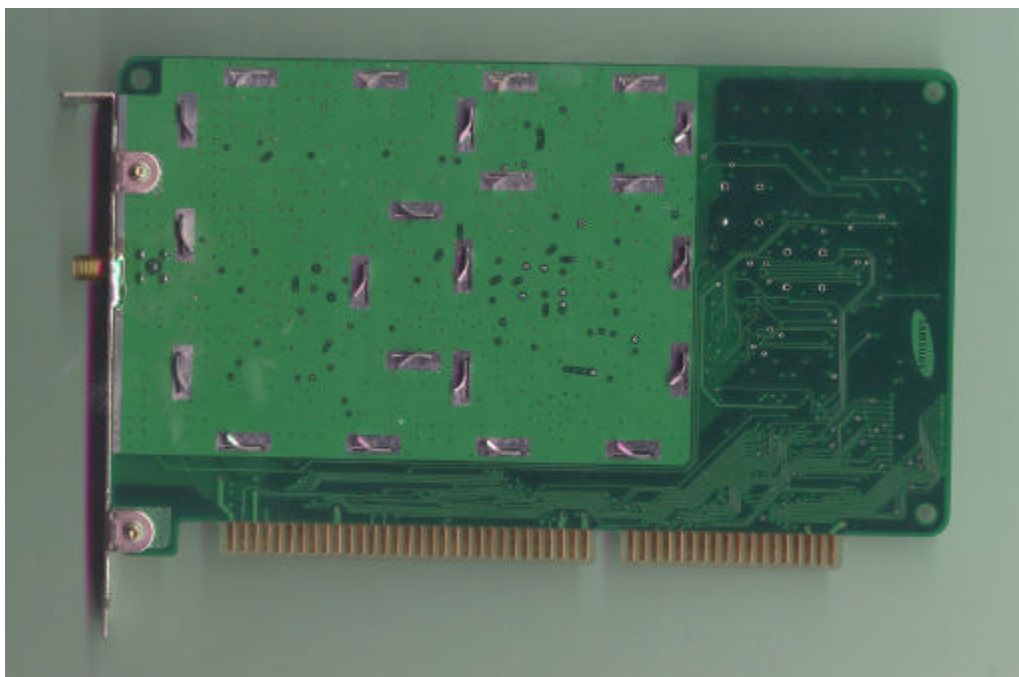


Figure 26: ISA Card Solder Side

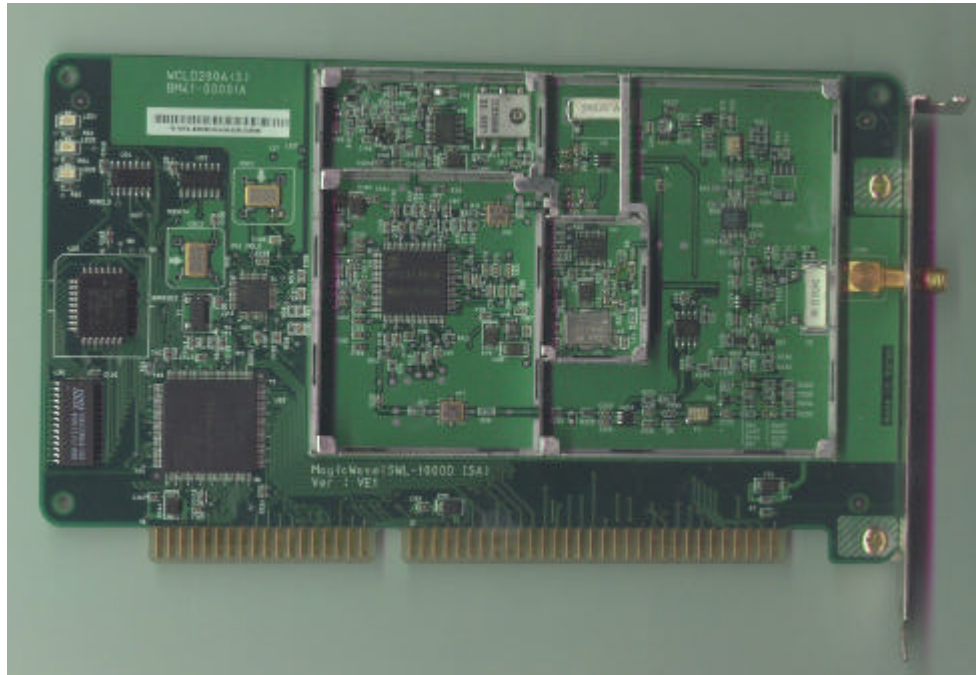


Figure 27: ISA Component Side

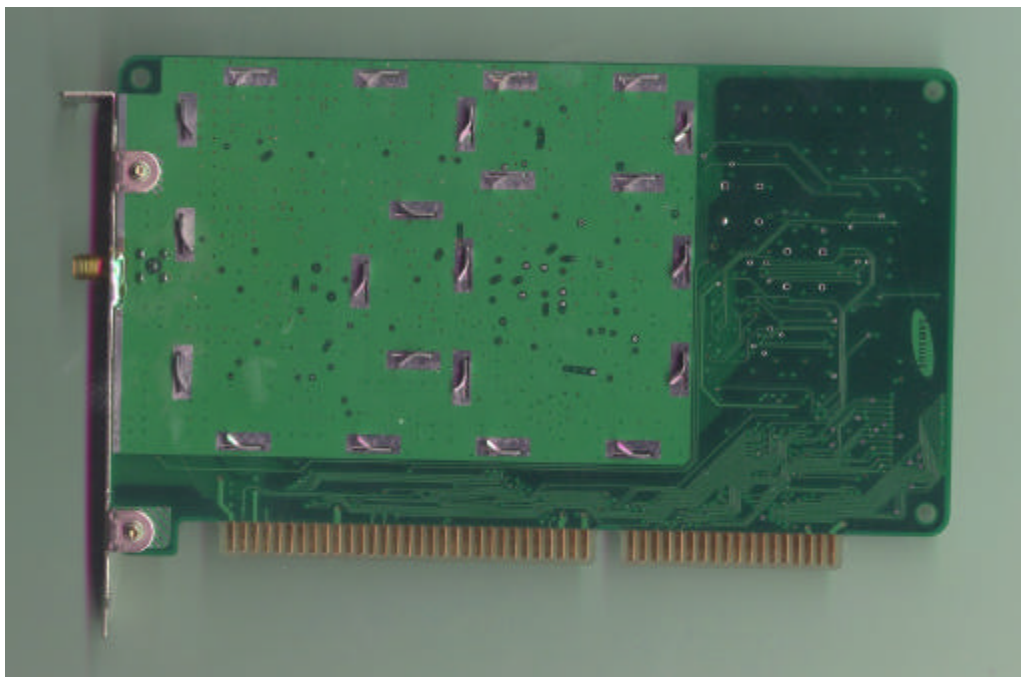


Figure 28: ISA Solder Side

APPENDIX B:

USER'S MANUAL
