Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR FCC CERTIFICATION

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

Samsung Electronics
416, Maetan-3Dong,Paldal-Gu
Suwon City, Kyunggi-Do, Korea, 442-743
+82-31-200-7925

Model: Wireless LAN Card (Sens 950)

FCC ID: A3LS950WT
Canada: 649104504A3 17

August 20, 2001

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	RADIO FREQUENCY DEVICES
FCC 97-114	GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
RSS-210; ISSUE 5 (DRAFT 3)	LOW POWER LICENCE-EXEMPT RADIOCOMMUNICATION DEVICES (ALL FREQUENCY BANDS
RSS-102; ISSUE 1 (PROVISIONAL)	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS WITH RESPECT TO HEALTH CANADA'S SAFETY CODE 6 FOR EXPOSURE OF HUMANS TO RADIO FREQUENCY FIELDS

Frequency Range	Conducted Output Power (W)	Freq. Tolerance	Emission Designator
2410 to 2463 MHz	0.031		

REPORT PREPARED BY:

EMC Engineer: **Rachid Sehb**

Supervising Engineer: **Bruno Clavier**

Document Number: 2001224 / QRTL01-218

360 Herndon Parkway, Suite 1400
Herndon, VA 20170
Phone: 703-689-0368; Fax: 703-689-2056; Metro: 703-471-6441

TABLE OF CONTENTS

FIGURE INDEX

TABLE INDEX

PLOT INDEX

APPENDIX INDEX

PHOTOGRAPH INDEX

1 INTRODUCTION

The following Application for the WLAN Card intergraded into the notebook for FCC Certification and Industry Canada for a Direct Sequence Spread Spectrum transmitter is prepared on behalf of ***Samsung Electronics*** in accordance with Part 15.247 of the Federal Communications Commissions and RSS-210 for Industry Canada. The Equipment Under Test (EUT) was the Samsung **MPCI3A-20**, ***FCC ID:*** **A3LS950WT**. 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 RELATED SUBMITTAL (S)/GRANT (S)

This application is a new application for FCC ID: A3LS950WT. This device is the same device that was certified under FCC ID: A3L5350WL except that there are two additional internal antennas (dipole antenna and micro strip antenna) added for the FCC ID A3LS950WT application. Refer to FCC ID A3L5350WL for the following tests: FCC Part 15.247(a)(2) Modulated Bandwidth, FCC Part 15.247(c) Antenna Conducted Spurious Emissions and FCC Part 15.247(d) Power Spectral Density.

1.2 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.

1.3 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 SYSTEM TEST CONFIGURATION

2.1 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst-case emission. Channel 1 at 2.410 GHz, Channel 6 at 2.437 GHz and Channel 11 at 2.463 GHz were tested and investigated from 9kHz to 24GHz. All three channels were investigated and tested. Data for all three channels are presented in this report.

To complete the configuration required by the FCC, the transmitter was tested in a note computer with an internal antenna connected to the antenna port similar to its intended use.

The EUT was investigated with the external antenna. The worst-case data taken in this report represents the highest data rate at 11 MBPS. Data rates of 5.5MBPS, 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 EUT EXERCISE SOFTWARE

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

2.3 SPECIAL ACCESSORIES

N/A.

2.4 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:

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
MINI PCI WIRELESS WLAN	SAMSUNG	MPCI3A-20	N/A	A3LS950WT	N/A	13517

TABLE 2-2: EXTERNAL COMPONENTS USED IN TEST CONFIGURATION

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
COMPUTER	SAMSUNG	MATRIX II	AR600097		AC/DC CONVERTER	

2.5 CONFIGURATION OF TESTED SYSTEM

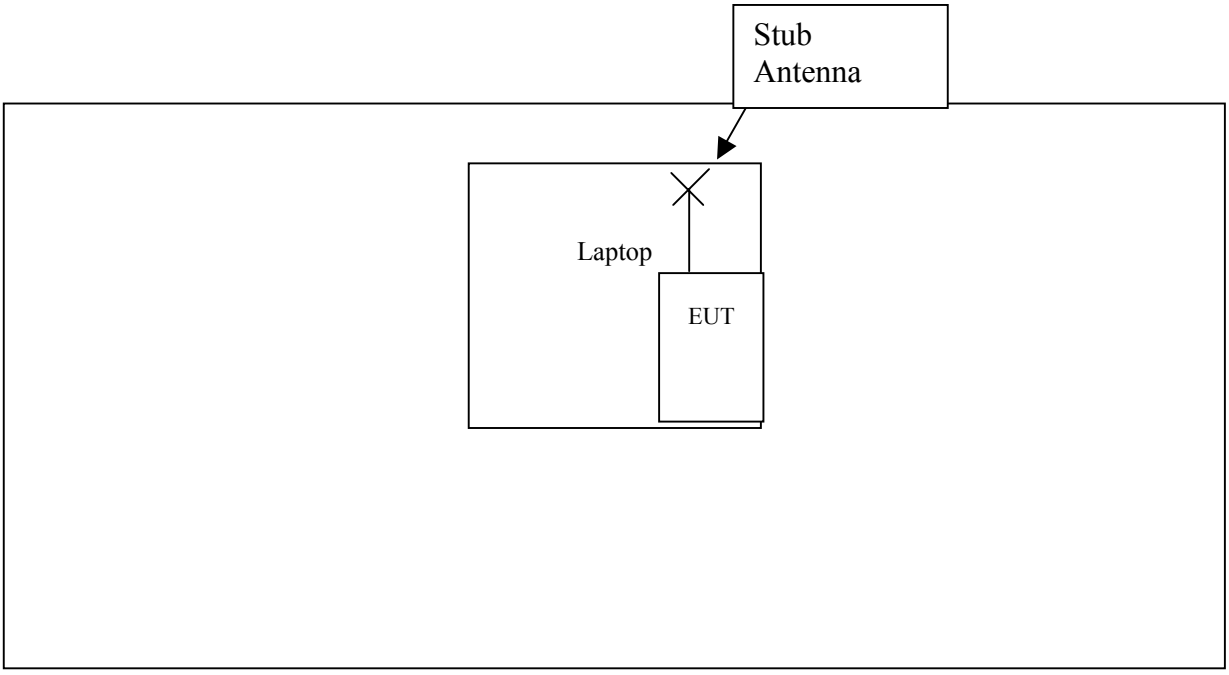


FIGURE 2-1: CONFIGURATION OF TESTED SYSTEM

3 CONFORMANCE STATEMENT

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	RADIO FREQUENCY DEVICES
FCC 97-114	GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
RSS-210; ISSUE 5 (DRAFT 3)	LOW POWER LICENCE-EXEMPT RADIOCOMMUNICATION DEVICES (ALL FREQUENCY BANDS)
RSS-102; ISSUE 1 (PROVISIONAL)	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS WITH RESPECT TO HEALTH CANADA'S SAFETY CODE 6 FOR EXPOSURE OF HUMANS TO RADIO FREQUENCY FIELDS

Frequency Range	Conducted Output Power (W)	Freq. Tolerance	Emission Designator
2410 to 2463 MHz	0.031		

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. Modifications were not 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.

Signature: 

Date: *August 20*, 2001

Typed/Printed Name: Bruno Clavier

Position: Vice President of Operation
(NVLAP Signatory)

Signature: 

Date: *August 20*, 2001

Typed/Printed Name: Rachid Sehb

Position: Test Engineer / Technician

NVLAP *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 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(dBuV/m) = SAR(dBuV) + SCF(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(dB/m) = - PG(dB) + AF(dB/m) + CL(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:

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

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 dBuV - 11.5 dB/m = 37.8 dBuV/m

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

EIRP calculation: Power from power meter in (dBm) + antenna gain in (dBi)

5 FCC PART 15 §15.109 RADIATED EMISSIONS MEASUREMENTS

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

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane.

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 bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. . **For radiated measurements above 1 GHz, a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz are used.**

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

5.1 FCC PART 15 §15.109 RADIATED EMISSIONS TEST

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit.

5.1.1 FCC PART 15 §15.109 RADIATED EMISSION DIGITAL NOISE

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)
89.501	Qp	V	90	1.0	54.5	-20.3	34.3	43.5	-9.3
132.878	Qp	V	270	1.0	52.9	-15.4	37.6	43.5	-6.1
138.385	Qp	V	90	1.0	41.4	-15.8	25.7	43.5	-17.9
219.399	Qp	V	270	1.0	44.1	-17.5	26.6	46.0	-19.5
418.000	Qp	V	90	1.0	38.7	-9.4	29.4	46.0	-16.7
849.936	Qp	V	180	1.0	39.8	-4.0	35.8	46.0	-10.3

QUASI PEAK =120 KHZ

TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

SIGNATURE

August 20, 2001
DATE OF TEST

TABLE 5-1: TEST EQUIPMENT USED FOR TESTING (RADIATED EMISSIONS)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771
901053	Schaffner@Chase	CBL6112B	Bilog antenna (20 MHz - 2 GHz)	2648
900323	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020
900889	HP	85685A	RF Preselector for HP 8566B or 8568B (20Hz-2GHz)	3146A01309

6 FCC PART 15 §15.247(B) POWER OUTPUT

The power output per FCC 15.247(b) was measured on the EUT using an HP peak power meter. EIRP measurement was performed as a radiated test (substitution test).

TABLE 6-1: FCC PART 15 §15.247(B) POWER OUTPUT

Channel	EIRP (dBm)*for dipole	EIRP (dBm)*for microstrip	Power conducted output (dBm)
1	12.1	12.1	15.0
6	12.6	11.1	14.8
11	12.9	11.1	15.0

*Measurement accuracy is +/- 1.5 dB

TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 6-2: TEST EQUIPMENT USED FOR TESTING (RADIATED RF OUTPUT - EIRP)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771
901186	Agilent Technologies	E9323A (50MHz-6GHz)	Peak & Avg. Power Sensor	US40410380
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573
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

7 FCC PART 15 §15.209(C) 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 for both internal antennas (dipole and microstrip).The EUT was tested in the X-Y, X-Z and Y-Z plan.

7.1 RADIATED EMISSIONS HARMONICS/SPURIOUS FOR THE DIPOLE ANTENNA

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

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)
2376.13	Av	V	20	1.2	32.1	0.0	32.1	54.0
2376.13	PK	V	20	1.2	44.0	0.0	44.0	
2411.40	Av	V	30	1.2	87.0	0.0	87.0	Fundamental
2411.40	PK	V	30	1.2	94.0	0.0	94.0	
4841.20	Av	V	10	1.2	29.8	14.3	44.1	54.0
4841.20	PK	V	10	1.2	43.1	14.3	57.4	
7253.20	Av	V	30	1.0	33.1	20.3	53.4	54.0
7253.20	PK	V	30	1.0	46.1	20.3	66.4	
9648.00	Av	V	10	1.0	32.3		NF	54.0
9648.00	PK	V	10	1.0	43.0		NF	
12060.00	Av	V	10	1.0	35.4		NF	54.0
12060.00	PK	V	10	1.0	47.1		NF	

AVERAGE: RES. =1 MHZ. VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

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)
2381.43	AV	V	15	1.2	32.5	0.0	32.5	54.0
2381.43	PK	V	15	1.2	41.2	0.0	41.2	
2437.00	AV	V	30	1.5	87.9	0.0	87.9	Fundamental
2437.00	PK	V	30	1.5	95.1	0.0	95.1	
2484.00	AV	V	20	1.5	32.8	0.0	32.8	54.0
2484.00	PK	V	20	1.5	41.5	0.0	41.5	
4874.00	AV	V	20	1.2	29.7	14.3	44.0	54.0
4874.00	PK	V	20	1.5	43.1	14.3	57.4	
7311.00	AV	V	30	1.2	33.2	20.3	53.5	54.0
7311.00	PK	V	30	1.2	46.5	20.3	66.3	
97512.00	AV	V	15	1.0	32.1		NF	54.0
97512.00	PK	V	15	1.0	43.5		NF	
12185.00	AV	V	15	1.0	35.4		NF	54.0
12185.00	PK	V	15	1.0	46.5		NF	

AVERAGE: RES. =1 MHZ, VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

SIGNATURE

August 20, 2001
DATE OF TEST

TABLE 7-3: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 11)

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)
2462.00	Av	V	90	1.2	90.3	0.0	90.3	Fundamental
2462.00	PK	V	90	1.2	97.0	0.0	97.0	
2513.00	Av	V	270	1.2	33.1	0.0	33.1	54.0
2513.00	PK	V	270	1.2	44.3	0.0	44.3	
4883.20	Av	V	90	1.0	29.5	14.3	43.8	54.0
4883.20	PK	V	90	1.0	43.6	14.3	57.9	
7386.00	Av	V	90	1.0	33.2	20.3	53.5	54.0
7386.00	PK	V	90	1.0	46.5	20.3	66.8	
9851.52	Av	V	90	1.0	33.6		NF	54.0
9851.52	PK	V	135	1.0	43.8		NF	
12314.40	Av	V	90	1.0	36.5		NF	54.0
12314.40	PK	V	90	1.0	47.8		NF	

AVERAGE: RES. =1 MHZ, VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

7.2 RADIATED EMISSIONS HARMONICS/SPURIOUS FOR THE MICROSTRIP ANTENNA

TABLE 7-4: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 1)

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)
2410.75	Av	V	20	1.2	87.1	0.0	87.1	Fundamental
2410.75	PK	V	20	1.2	95.2	0.0	95.2	
2499.9	Av	V	30	1.2	29.7	0.0	29.7	54.0
2499.9	PK	V	30	1.2	40.5	0.0	40.5	
4841.20	Av	V	10	1.2	29.5	14.3	43.8	54.0
4841.20	PK	V	10	1.2	42.5	14.3	56.8	
7253.20	Av	V	30	1.0	33.4	20.3	53.7	54.0
7253.20	PK	V	30	1.0	45.1	20.3	65.4	
9648.00	Av	V	10	1.0	32.3		NF	54.0
9648.00	PK	V	10	1.0	43.0		NF	
12060.00	Av	V	10	1.0	35.4		NF	54.0
12060.00	PK	V	10	1.0	47.1		NF	

AVERAGE: RES. =1 MHZ, VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 7-5: 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)
2434.00	AV	V	20	1.5	85.4	0.0	85.4	Fundamental
2434.00	PK	V	20	1.5	92.8	0.0	92.8	
4874.00	AV	V	20	1.2	29.5	14.3	43.8	54.0
4874.00	PK	V	20	1.5	43.0	14.3	57.3	
7311.00	AV	V	30	1.2	33.0	20.3	53.3	54.0
7311.00	PK	V	30	1.2	46.5	20.3	66.8	
97512.00	AV	V	15	1.0	32.1		NF	54.0
97512.00	PK	V	15	1.0	43.5		NF	
12185.00	AV	V	15	1.0	35.4		NF	54.0
12185.00	PK	V	15	1.0	46.5		NF	

AVERAGE: RES. =1 MHZ. VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

SIGNATURE

August 20, 2001
DATE OF TEST

TABLE 7-6: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 11)

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)
2380.45	Av	V	20	1.2	27.5	0.0	27.5	54.0
2380.45	PK	V	20	1.2	38.8	0.0	38.8	
2461.20	Av	V	20	1.2	85.0	0.0	85.0	Fundamental
2461.20	PK	V	20	1.2	93.8	0.0	93.8	
2487.46	Av	V	30	1..0	29.1	0.0	29.1	54.0
2487.46	PK	V	30	1.0	39.8	0.0	39.8	
2713.88	Av	V	30	1.0	27.7	0.0	27.7	54.0
2713.88	PK	V	30	1.0	37.7	0.0	37.7	
4883.20	Av	V	20	1.0	29.5	14.3	43.8	54.0
4883.20	PK	V	20	1.0	43.6	14.3	57.9	
7386.00	Av	V	10	1.0	33.2	20.3	53.5	54.0
7386.00	PK	V	10	1.0	46.5	20.3	66.8	
9851.52	Av	V	10	1.0	33.6		NF	54.0
9851.52	PK	V	10	1.0	43.8		NF	
12314.40	Av	V	10	1.0	36.5		NF	54.0
12314.40	PK	V	10	1.0	47.8		NF	

AVERAGE: RES. =1 MHZ. VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

SIGNATURE

August 20, 2001
DATE OF TEST

TABLE 7-7: TEST EQUIPMENT USED FOR TESTING (RADIATED SPURIOUS EMISSIONS)

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	NA
900791	Schaffner - Chase	CBL6112	Antenna (25 MHz - 2 GHz)	2099

8 FCC PART 15 §15.205 COMPLIANCE WITH THE RESTRICTED BAND EDGE

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

8.1 COMPLIANCE WITH THE RESTRICTED BAND EDGE FOR THE DIPOLE ANTENNA

TABLE 8-1: RESTRICTED BAND EDGE FOR THE DIPOLE ANTENNA

Channel Set to	Antenna type	Frequency tested MHz	Detector	Field Strength Level (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	Internal	2390.0	AV	32.1	54.0	-21.9
1			PK	43.9		
11	Internal	2483.5	AV	33.0	54.0	-21.0
11			PK	44.6		

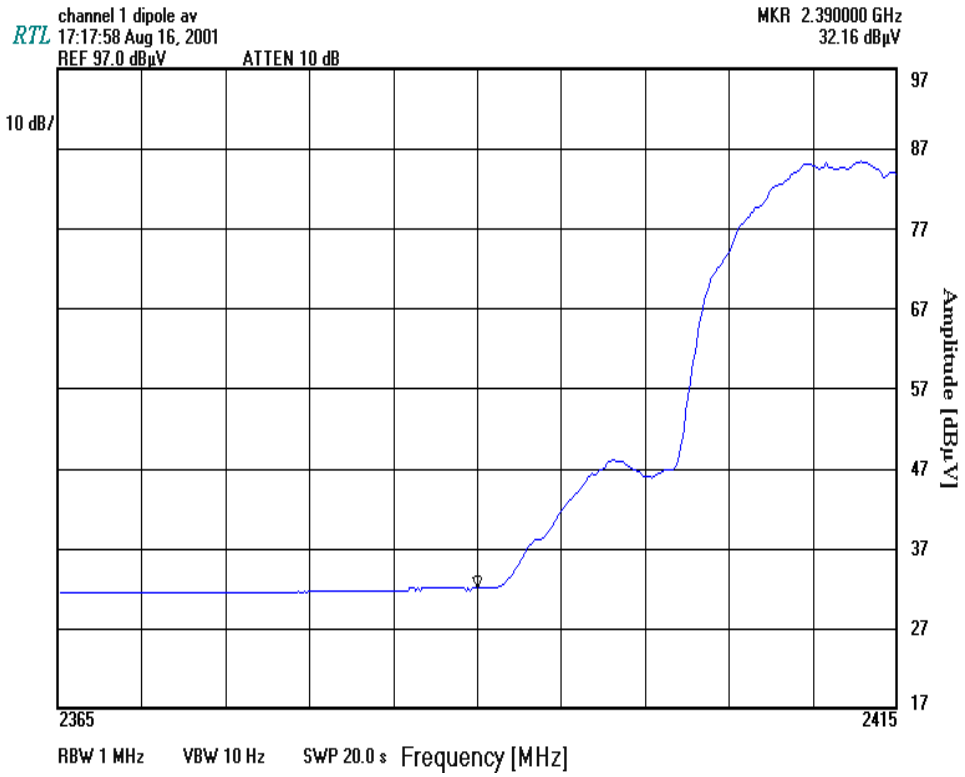
TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

SIGNATURE

August 20, 2001
DATE OF TEST

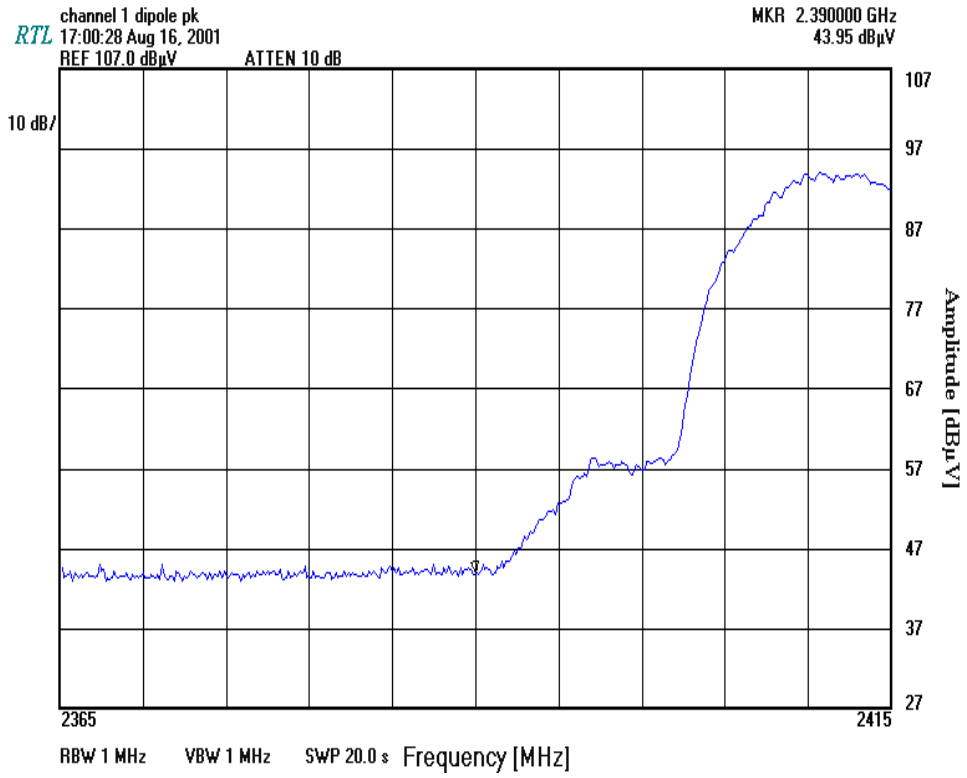
PLOT 8-1: AVERAGE MEASUREMENT FOR CHANNEL 1 (RBW1MHZ/VBW 10HZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

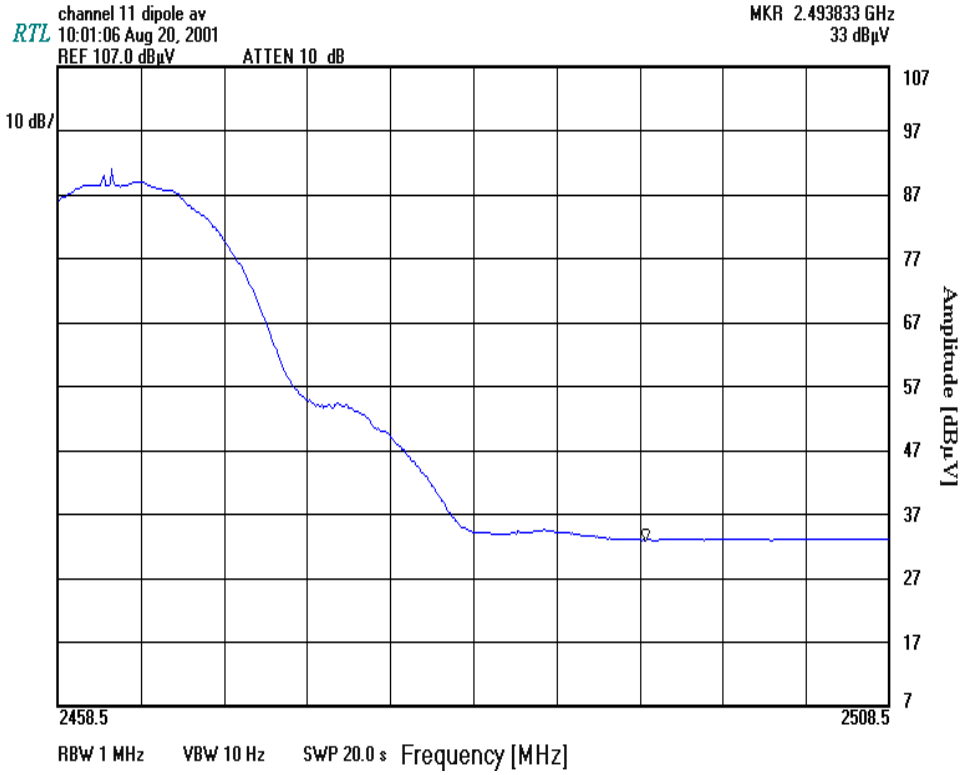
PLOT 8-2: PEAK MEASUREMENT FOR CHANNEL 1 (RBW 1MHZ/VBW 1MHZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 8-3: AVERAGE MEASUREMENT FOR CHANNEL 11 (RBW 1MHZ/VBW 10HZ)

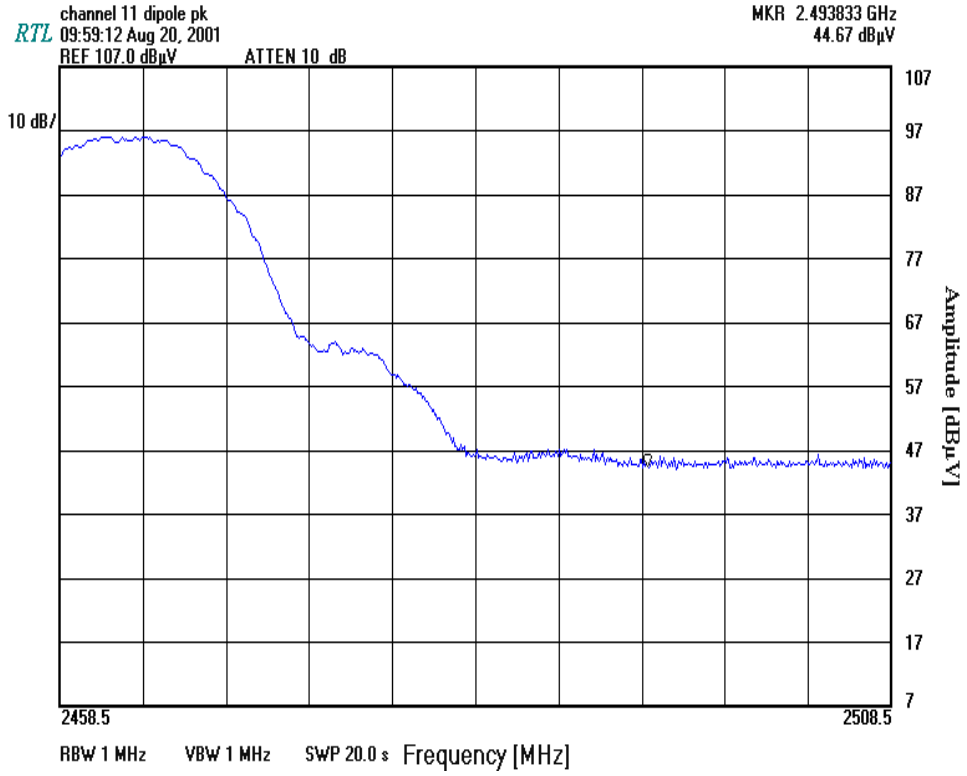


TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

PLOT 8-4: PEAK MEASUREMENT FOR CHANNEL 11 (RBW 1MHZ/VBW 1MHZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

8.2 COMPLIANCE WITH THE RESTRICTED BAND EDGE FOR THE MICROSTRIP ANTENNA

TABLE 8-2: RESTRICTED BAND EDGE FOR THE MICROSTRIP ANTENNA

Channel Set to	Antenna type	Frequency tested MHz	Detector	Field Strength Level (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	Internal	2390.0	AV	33.9	54.0	-20.1
1			PK	45.2		
11	Internal	2483.5	AV	32.7	54.0	-21.3
11			PK	43.7		

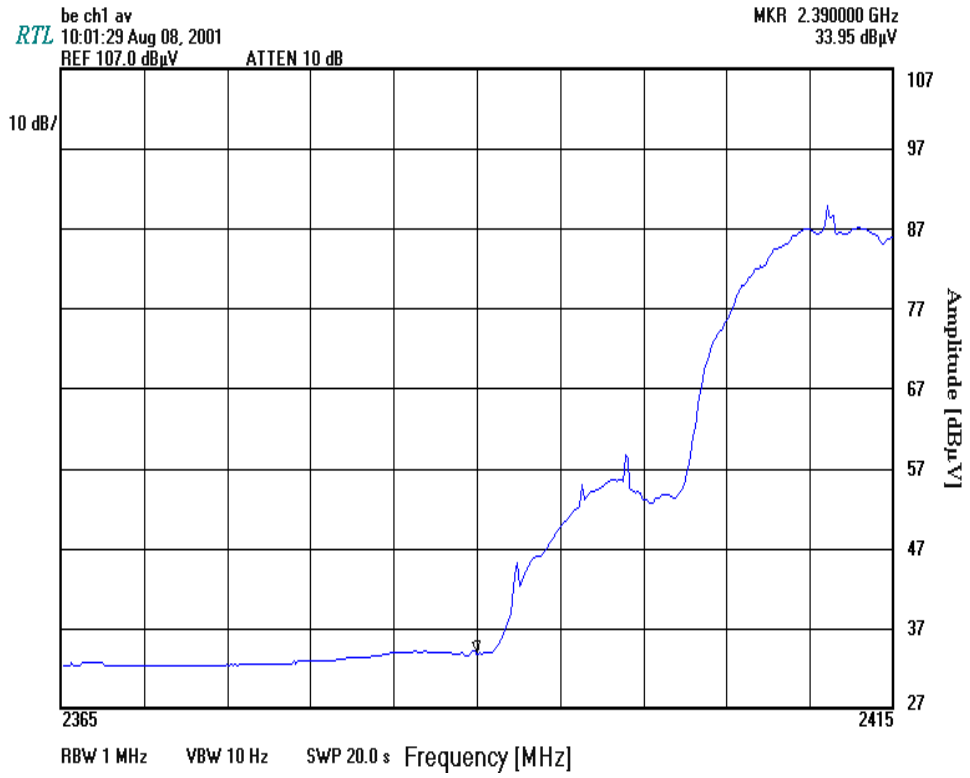
TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

SIGNATURE

August 20, 2001
DATE OF TEST

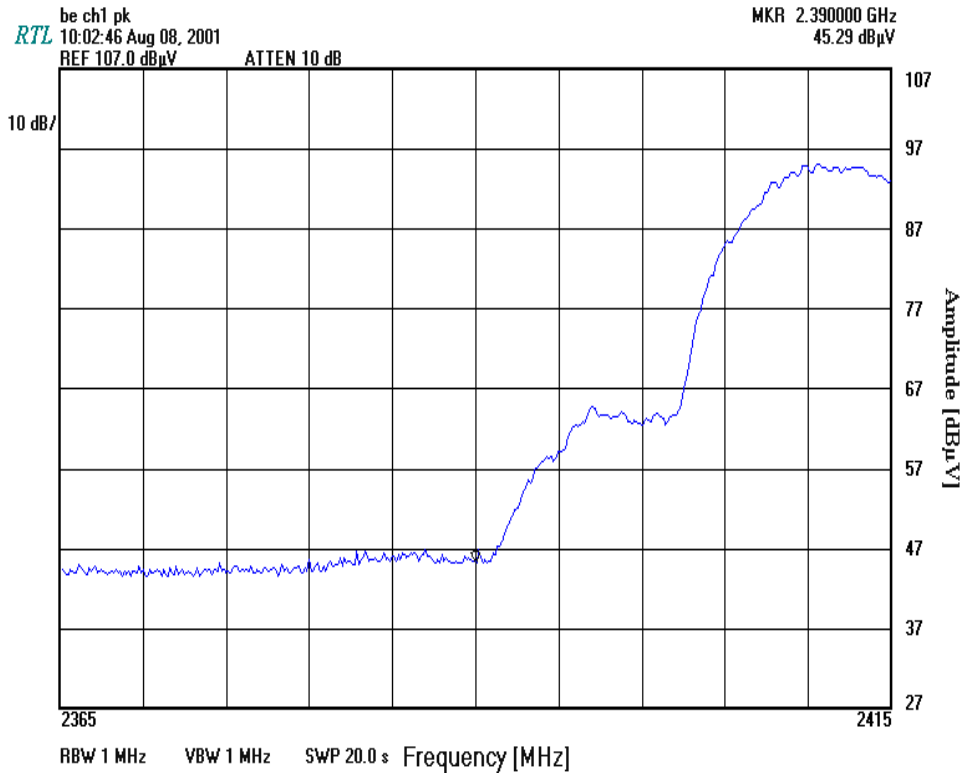
PLOT 8-5: AVERAGE MEASUREMENT FOR CHANNEL 1 (RBW 1MHZ/VBW 10HZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

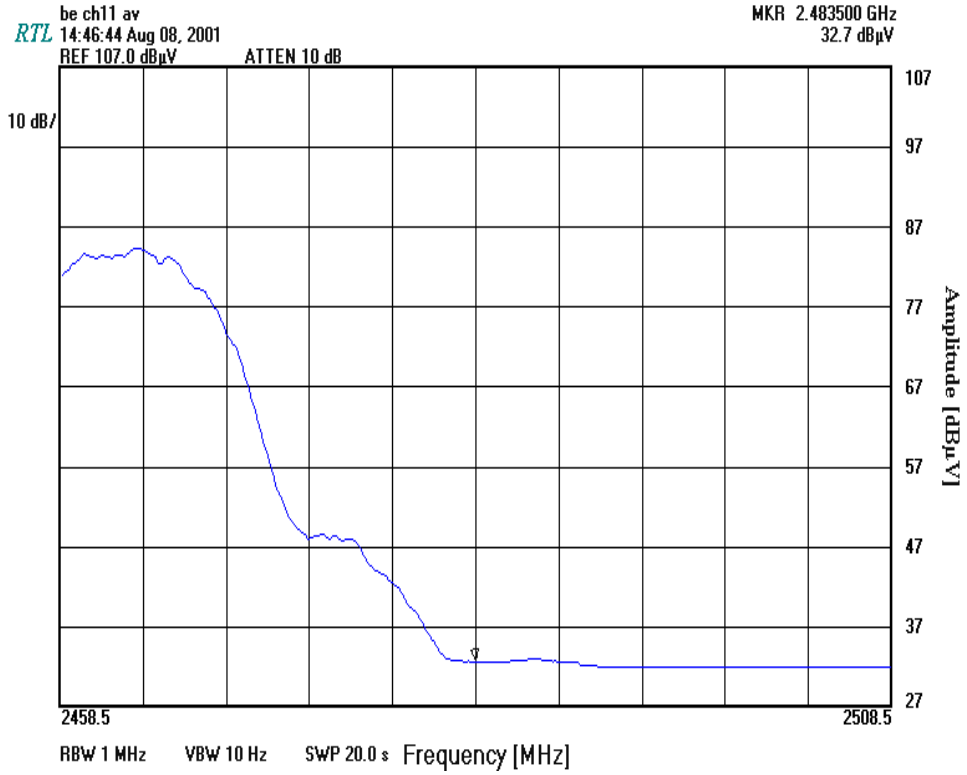
PLOT 8-6: PEAK MEASUREMENT FOR CHANNEL 1 (RBW 1MHZ/VBW 1MHZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

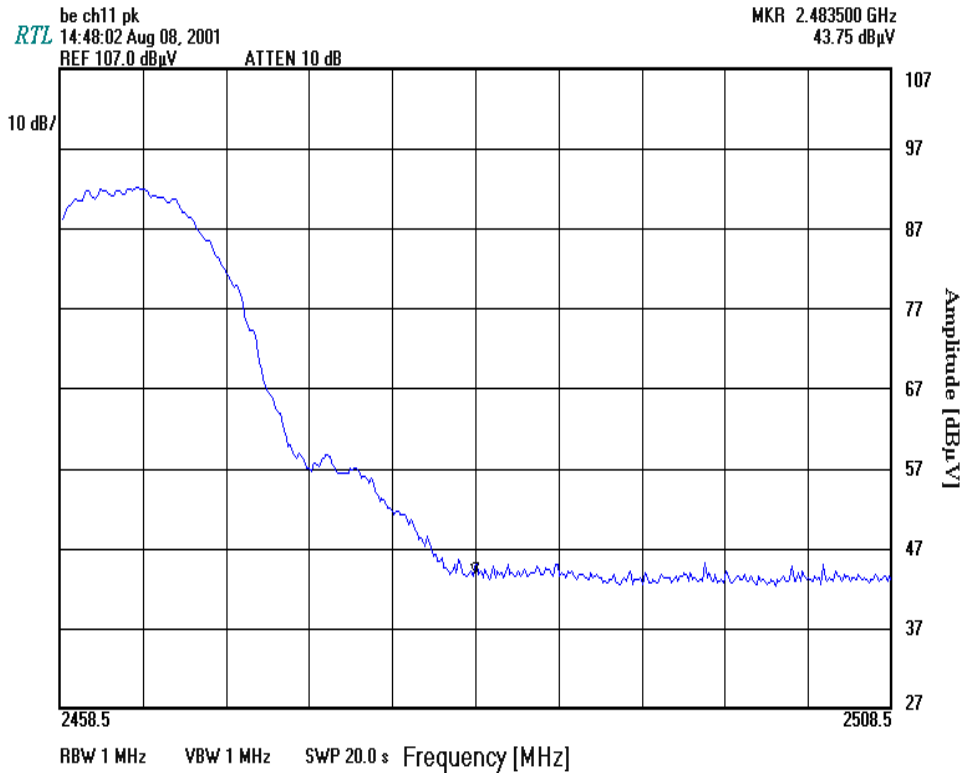
PLOT 8-7: AVERAGE MEASUREMENT FOR CHANNEL 11 (RBW 1MHZ/VBW 10HZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 8-8: PEAK MEASUREMENT FOR CHANNEL 11 (RBW 1MHZ/VBW 1MHZ)



TEST PERSONNEL:

RACHID SEHB		*August 20*, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST