Engineering and Testing for EMC and Safety Compliance

CLASS II PERMISSIVE CHANGE FOR A

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

CISCO Systems Inc.
170 West Tasman Drive
San Jose, CA 95134-1706

Model: AIR-LMC350

FCC ID: LDK102040
CANADA: 2461391186A

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-139; Issue 1 (Provisional)	LICENSED RADIOCOMMUNICAITONS DEVICES IN THE BAND 2400-2483.5
RSS-102, Issue 1: 1999	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS

Frequency Range	EIRP (W)	Freq. Tolerance	Emission Designator
2412-2462 MHz	0.038	N/A	

REPORT PREPARED BY:

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Document Number: 2001212 / 2001228 / QRTL01-202

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1 INTRODUCTION

The following Application for Class II permissive change for a Direct Sequence Spread Spectrum transmitter is prepared on behalf of **Cisco Systems Inc** in accordance with the Federal Communications Commissions and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the PCMCIA card, ***FCC ID: LDK102040 and CANADA: 2461391186A.*** 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, with Federal Communications Commissions Rules and Regulations Part 15.247, 1999, and with Industry Canada RSS210 and RSS102. 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.

1.1 RELATED SUBMITTAL (S)/GRANT (S)

This is a Class II Permissive Change.

1.2 CHANGE INFORMATION

This PCMCIA Card was tested with Itronix IX250 and IX550 laptops. The change in the IX250 is the car cradle and 2 external antennas. The change in the IX550 is the car cradle, 2 external antennas, one internal antenna and the IX550 PC.

1.3 TEST METHODOLOGY

Radiated testing was 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.

1.4 TEST FACILITY

The open area test site 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).

1.5 EMISSIONS EQUIPMENT LIST

RTL Asset Number	Manufacturer	Model	Part Type	Serial Number
900969	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2412A00414
900929	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2811A01276
900901	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	3145A01599
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2521A00743
900042	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2521A01032
900924	Amplifier Research	75A220	Amplifier (10 kHz – 220 MHz)	
900933	Hewlett Packard	11975A	Power Amplifier (2 - 8 GHz)	2304A00348
901067	Hewlett Packard	8903B	Audio Analyzer	2303A00307
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102
900718	Voltech	PM3000A	Power Analyzer	6836-002-10
900397	Associated Research, Inc.	6554SA	Electrical Safety Compliance Analyzer	940281
900926	Hewlett Packard	8753D	RF Vector Network Analyzer	3410A09659
901089	Hewlett Packard	HP875ET	Transmission/Reflection Network Analyzer	US39170052
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2602A00160
900903	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2841A00614
900897	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2727A00535
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771
900912	Hewlett Packard	8568A	RF Spectrum Analyzer (100 Hz – 1.5 GHz)	2634A02704
900824	Hewlett Packard	8591E	RF Spectrum Analyzer (9 KHz – 1.8 GHz)	3710A06135
900724	ARA	LPB-2520	Log Periodic / Biconical Antenna (25-1000 MHz)	1037
900725	ARA	LPB-2520	Log Periodic / Biconical Antenna (25-1000 MHz)	1036
900967	A.H. Systems	TDS-206/535-1 through TDS-206/535-4	Tuned Dipole set (30 – 1000 MHz)	126, 128, 129, 132
900154	Compliance Design	Roberts Dipole	Adjustable Elements Dipole antenna (30-1000MHz)	N/A
900814	Electro-Metrics	RGA-60	Double Ridges Guide Antenna (1-18 GHz)	2310
900081	EMCO	3146	Log-Periodic Antenna (200-1000 MHz)	1850
900800	EMCO	3301B	Active Monopole (Rod antenna) (30 Hz – 50 MHz)	9809-4071
900151	Rohde@ Schwarz	HFH@-Z2	Loop Antenna (9kHz-30 MHz)	82825/019
900791	Schaffner –Chase	CSL6112	Bilog antenna (30 MHz – 2GHz)	2099
901053	Schaffner –Chase	CBL6112B	Bilog Chase antenna (200 MHz – 2 GHz)	2648
900060	Hewlett Packard	86634B	Auxiliary Section for External Pulse Modulator	1314A02913
901041	ACO Pacific	511E	Sound Level Calibrator	028751
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	254211239
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839
900911	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A12739
900902	Hewlett Packard	85662A	Spectrum Analyzer Display	2848A17585
900896	Hewlett Packard	85662A	Spectrum Analyzer Display	2816A16471
900914	Hewlett Packard	8546OA	RF Filter Section, (100 KHz to 6.5 GHz)	3330A00107
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585
900059	Hewlett Packard	8660C	Signal Generator (9 KHz – 3200 MHz)	1947A02956
900960	Hewlett Packard	8444A	Tracking Generator (0.5 –1500MHz)	2325A07827
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 KHz – 3200 MHz)	3537A01741
900821	Hewlett Packard	33120A	15 MHz Function / Arbitrary Waveform Generator	US36029992
900059	Hewlett Packard	8660C	Synthesized. Signal Generator (9 kHz –3200 MHz)	1947A02956
900560	Haefely	PESD 1600	ESD Generator	H 703146

RTL Asset Number	Manufacturer	Model	Part Type	Serial Number
900099	Marconi	52022-910E	Signal Generator (10 kHz – 1 GHz)	119044-189
900195	Tektronix	CFG280	Function Generator (0.1 Hz – 11 MHz)	TW12167
900927	Tektronix	ASG 100	Audio Signal Generator	B03274 V2.3
900935	Wavetek	3510B	Signal Generator	5372160
900660	Philips	PM5418TDS	TV Generator	LO 604891
900369	Philips	PM5418TDS	TV Generator	LR81436C
900268	Taylor	5565	Hygrometer / Thermometer	N/A
901056	Hewlett Packard	8954A, Opt.H03	Transceiver Interface	2924A00830
901088	Hewlett Packard	8954A	Transceiver Interface	2146A00139
901082	AFJ International	AFJ LS16	LISN (9 kHz – 30 MHz)	16010020081
901083	AFJ International	AFJ LS16	LISN (9 kHz – 30 MHz)	16010020082
901084	AFJ International	AFJ LS16	LISN (9 kHz – 30 MHz)	16010020080
901090	Bajog electronic	4V-100/200	LISN (150 kHz – 30 MHz)	00-44-007
900726	Solar	7225-1	LISN	N/A
900727	Solar	7225-1	LISN	N/A
900078	Solar	7225-1	LISN	N/A
900077	Solar	7225-1	LISN	N/A
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892
900770	Hewlett Packard	437B	Power Meter	2949A02966
900793	Hewlett Packard	432A	Thermistor Power Meter	1848a22632
900126	Hewlett Packard	11970A	Harmonic Mixer (26-40 GHz)	2332A01199
900396	Hewlett Packard	11970K	Harmonic Mixer (18-26 GHz)	2332A00563
900921	Haefely	IP 6.2	Coupling Network	083-334-13
900918	Voltech	IEC Standard 555	Reference Impedance Network (rented)	7701
900061	Hewlett Packard	86603A	RF Plug-in (1 to 2600 MHz)	2221A02967
900160	Pacific	112-AMX	AC Power Source (rented)	0187
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505
900045	Hewlett Packard	8447F	Preamplifier	2944A03783
901040	Industrial	SMX100	Wide Band Preamplifier (0.01-1000 MHz)	1736-0696
900721	Hewlett Packard	8447D	Preamplifier (0.1-1300 MHz)	2727A05397
900889	Hewlett Packard	85685A	RF Preselector for HP 8566B or 8568B (20Hz-2GHz)	3146A01309
900566	Amplifier Research	FP 2000	Isotropic Field Probe	20760
900174	FCC	F-120-9A	RF Injection Probe (10 kHz – 300 MHz)	N/A
901044	FCC	F-120-5	Bulk Current Injection Probe (10 kHz – 150 MHz)	17
901042	FCC	F-72-1	RF Current Probe (10 Hz – 100 MHz)	44
900704	FCC	F-14-1	Current Probe (10 Hz – 500 kHz)	33
900894	FCC	F-33-1	RF Current Probe (10 kHz – 250 MHz)	303
900854	Solar Electronics Co	9119-IN	RF Current Probe	972501
900849	Solar Electronics Co	9121-IN	Injection Probe (10 MHz – 1 GHz)	953501
900848	Solar Electronics Co	9320-IN	RF Current Probe	990521
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159
900769	Hewlett Packard	8481B	Power Sensor	2702A05059
900937	Hewlett Packard	8482H	3-watt Power Sensor (100 KHz to 4.2 GHz)	3318A08961
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380
900111	Omega Engineering	DP41-TC-DSS	Temperature Monitor	2060123
901043	FCC		Terminator for RF Current Probe F-72-1	
900731	Haefely	PEFT.1	Burst Tester with Coupling Network	082 106-29
900402	BAPCO Electro-Com	IEC 601 L	Safety Tester	000028

RTL Asset Number	Manufacturer	Model	Part Type	Serial Number
900720	Haefely	Psurge 4.1	Surge Tester	083-342-02
900839	Bird	43P	Peak Reading Wattmeter	3110

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 2.412 GHz, Channel 6 at 2.437 GHz and Channel 11 at 2.462 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 the notebook computer with the integral antenna connected to the antenna port as it is intended to be used.

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.

2.2 EUT EXERCISE SOFTWARE

The EUT was provided with software, which provides for continuous transmission 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

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
WIRELESS LAN PCMCIA CARD	**CISCO SYSTEMS, INC.**	**AIR-LMC352**	**SPL051002YW**	**LDK102040**	**N/A**	**13540**

TABLE 2-2: EXTERNAL EQUIPMENT USED IN TEST CONFIGURATION (ITRONIX IX250 NOTEBOOK COMPUTER)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
NOTEBOOK COMPUTER	ITRONIX	IX250	ZZGEG1129ZZ5957	LNQUSA40064-M6-E	UNSHIELDED POWER CORD WITH AC/DC CONVERTER	13537
19V AC ADAPTER	DELTA ELECTRONICS	ADP-60DB	NPD0037027994	DOC	UNSHIELDED	13538

TABLE 2-3: EXTERNAL EQUIPMENT USED IN TEST CONFIGURATION (ITRONIX IX550 NOTEBOOK COMPUTER)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
NOTEBOOK COMPUTER	ITRONIX	IX550	ZZGEG1177ZZ7956	NA	UNSHIELDED POWER CORD WITH AC/DC CONVERTER	13618
19V AC ADAPTER	DELTA ELECTRONICS	ADP-90AB	QQD0110000216	DOC	UNSHIELDED	13619

2.5 CONFIGURATION OF TESTED SYSTEM

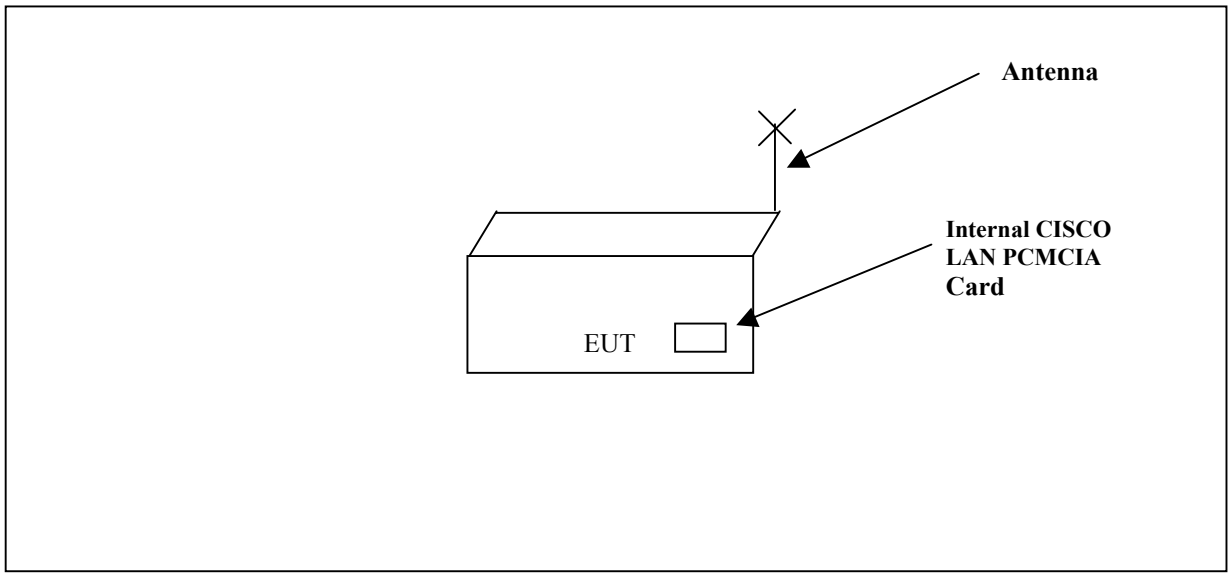

FIGURE 2-1: CONFIGURATION OF TESTED SYSTEM (ITRONIX IX550 NOTEBOOK COMPUTER)

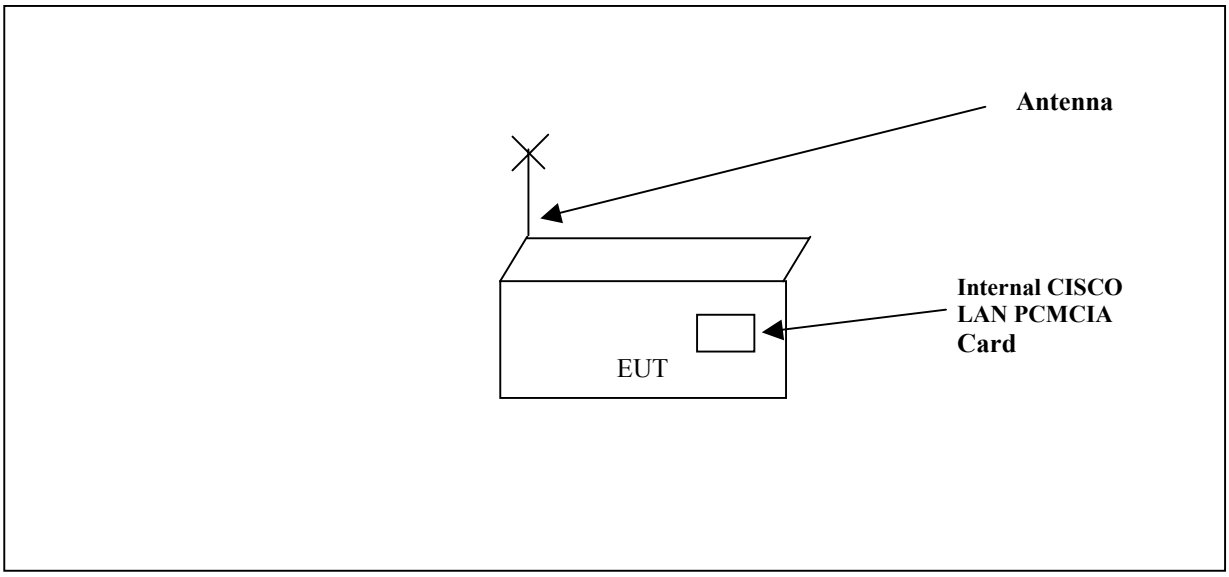

FIGURE 2-2: CONFIGURATION OF TESTED SYSTEM (ITRONIX IX550 NOTEBOOK COMPUTER)

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
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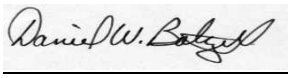
RSS-102, Issue 1: 1999	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS

Frequency Range	EIRP	Freq. Tolerance	Emission Designator
2412-2462 MHz	0.038	N/A	

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.

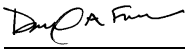
Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

EMC Engineer: Daniel Baltzell Date: July 18, 2001

Signature: 

Supervising Engineer: Desmond A. Fraser Date: July 18, 2001

Position: President (NVLAP Signatory)

Signature: 

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 CONDUCTED ANTENNA POWER MEASUREMENT

THE CONDUCTED POWER WAS MEASURED AT THE ANTENNA WITH THE EXISTING CABLE AND FOUND TO BE:

```
Channel 1 (2412 MHz) - 17.5 dBm
Channel 6 (2437 MHz) – 18.0 dBm
Channel 11 (2462 MHz) - 18.5 dBm
```

5 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)

6 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. . 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.

6.1 RADIATED EMISSION TEST RESULTS

6.1.1 Digital-Receiver Radiated Measurements Part 15.209

TABLE 6-1: RADIATED EMISSIONS (ITRONIX IX250)

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)
200.138	Qp	V	180	1.0	48.3	-17.8	30.5	43.5	-13.0
300.673	Qp	V	135	2.0	39.9	-14.1	25.8	46.0	-20.2
400.894	Qp	V	360	1.3	41.8	-10.8	31.0	46.0	-15.0
533.700	Qp	V	180	1.0	40.8	-7.7	33.1	46.0	-12.9
661.747	Qp	H	180	2.0	41.5	-5.7	35.8	46.0	-10.2
852.612	Qp	V	270	1.0	33.6	-3.8	29.8	46.0	-16.2

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

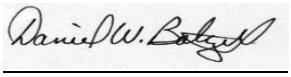
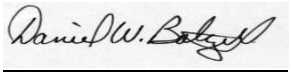
Signature: 

TABLE 6-2: RADIATED EMISSIONS (ITRONIX IX550)

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)
153.000	Qp	H	145	1.4	35.2	-17.4	17.8	43.5	-25.7
158.400	Qp	H	90	1.4	36.7	-17.6	19.1	43.5	-24.4
320.072	Qp	H	145	1.0	42.2	-12.5	29.7	46.0	-16.3
853.000	Qp	H	270	2.0	32.8	-3.1	29.7	46.0	-16.3
941.000	Qp	H	180	1.0	32.7	-2.5	30.2	46.0	-15.8
2783.000	Av	V	145	1.0	25.6	5.5	31.1	54.0	-22.9
3594.000	Av	V	0	1.0	24.2	4.6	28.8	54.0	-25.2

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** August 10, 2001

Signature: 

7 EFFECTIVE ISOTROPIC RADIATED POWER MEASUREMENTS

7.1 RADIATED POWER MEASUREMENTS (ITRNIX IX250)

TABLE 7-1: RADIATED POWER MEASUREMENTS (ITRNIX IX250)

The electric field strength of Channels 1, 6, and 11 were taken peak with a resolution bandwidth of 1 MHz and Video bandwidth of 1 MHz and found as follows:

Frequency (MHz)	Signal Generator Level (dBm)	Correction Factor (dB)	Corrected Level (dBm)	EIRP (mW)
2412	9.9	5.7	15.6	36.3
2437	9.5	5.8	15.3	33.8
2462	10.0	5.8	15.8	38.4

TABLE 7-2: RADIATED POWER MEASUREMENTS (ITRNIX IX250)

With the cradle attached and 5dBi antenna used:

Frequency (MHz)	Signal Generator Level (dBm)	Correction Factor (dB)	Corrected Level (dBm)	EIRP (mW)
2412	8.0	4.5	12.5	17.8
2437	8.2	4.5	12.7	18.6
2462	8.6	4.8	13.4	21.9

7.2 RADIATED POWER MEASUREMENTS (ITRONIX IX550)

TABLE 7-3: RADIATED POWER MEASUREMENTS (ITRNIX IX550)

Internal antenna with internal antenna and associated cables and connectors:

Frequency (MHz)	Signal Generator Level (dBm)	Correction Factor (dB)	Corrected Level (dBm)	EIRP (mW)
2412	9.8	5.8	15.6	36.3
2437	9.5	5.8	15.3	33.8
2462	10.0	5.8	15.8	38.4

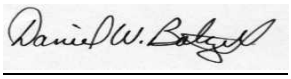
TABLE 7-4: RADIATED POWER MEASUREMENTS (ITRNIX IX250)

Mounted to the cradle with a 5 dBi antenna and cable from the cradle to antenna:

Frequency (MHz)	Signal Generator Level (dBm)	Correction Factor (dB)	Corrected Level (dBm)	EIRP (mW)
2412	8.0	4.5	12.5	17.8
2437	8.1	4.5	12.6	18.2
2462	8.7	4.8	13.5	22.4

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

Signature: 

8 RADIATED SPURIOUS EMISSIONS

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted. 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. The test was performed at 1 MHz RBW and 10 Hz(average measurement) and at 1 MHz RBW and 1 MHz (peak measurement).

TABLE 8-1: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX250 (CHANNEL 1; 2412 MHZ)

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2038.475	27.2	23.2	30.6	53.8	88.4	-34.6
2412.000	101.67	94.2	14.2	108.4		Fundamental
2443.480	28.3	27.5	33.2	60.7	88.4	-27.7
4824.000	16.2	11.3	30.3	41.6	54.0	-12.4
7236.000	NF					
9648.000	NF					
12060.000	NF					
14472.000	NF					
16884.000	NF					
19296.000	NF					
21708.000	NF					
24120.000	NF					

NF = noise floor

TABLE 8-2: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX250 (CHANNEL 6; 2437 MHZ)

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2063.474	27.4	23.2	30.6	53.8	89.0	-35.2
2437.000	102.5	94.8	14.2	109.0		Fundamental
2518.968	29.5	24.7	33.2	57.9	89.0	-31.1
4874.000	16.5	11.3	30.3	41.6	54.0	-12.4
7311.000	NF					
9748.000	NF					
12185.000	NF					
14622.000	NF					
17059.000	NF					
19496.000	NF					
21933.000	NF					
24370.000	NF					

NF = noise floor

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

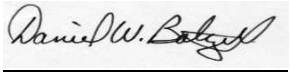
Signature: 

TABLE 8-3: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX250 (CHANNEL 11; 2462 MHZ)

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2088.473	24.3	20.3	30.6	50.9	86.9	-36.0
2462.000	100.2	92.7	14.2	106.9		Fundamental
2585.966	19.2	15.0	33.2	48.2	86.9	-38.7
4924.000	24.6	22.7	30.3	53.0	54.0	-1.0
7386.000	NF					
9848.000	NF					
12310.000	NF					
14772.000	NF					
17234.000	NF					
19696.000	NF					
22158.000	NF					
24620.000	NF					

NF = noise floor

TABLE 8-4: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX250 (CHANNEL 1; 2412 MHZ) WITH CRADLE AND 50 OHM TERMINATION

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824.000	NF					
7236.000	NF					
9648.000	NF					
12060.000	NF					
14472.000	NF					
16884.000	NF					
19296.000	NF					
21708.000	NF					
24120.000	NF					

NF = noise floor

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

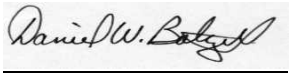
Signature: 

TABLE 8-5: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX250 (CHANNEL 6; 2437 MHZ) WITH CRADLE AND 50 OHM TERMINATION

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874.000	NF					
7311.000	NF					
9748.000	NF					
12185.000	NF					
14622.000	NF					
17059.000	NF					
19496.000	NF					
21933.000	NF					
24370.000	NF					

NF = noise floor

TABLE 8-6: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX250 (CHANNEL 11; 2462 MHZ) WITH CRADLE AND 50 OHM TERMINATION

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4924.000	NF					
7386.000	NF					
9848.000	NF					
12310.000	NF					
14772.000	NF					
17234.000	NF					
19696.000	NF					
22158.000	NF					
24620.000	NF					

NF = noise floor

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

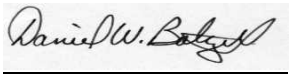
Signature: 

TABLE 8-7: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX550 (CHANNEL 1; 2412 MHZ)

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2353.993	28.1	25.0	14.5	39.5	54.0	-14.5
2412.000	101.67	94.2	14.2	108.4		Fundamental
2443.492	39.4	32.4	14.5	46.9	88.4	-41.5
2507.657	45.5	34.0	14.5	48.5	88.4	-39.9
4824.000	NF					
7236.000	NF					
9648.000	NF					
12060.000	NF					
14472.000	NF					
16884.000	NF					
19296.000	NF					
21708.000	NF					
24120.000	NF					

NF = noise floor

TABLE 8-8: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX550 (CHANNEL 6; 2437 MHZ)

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2353.993	36.4	27.2	13.9	41.1	54.0	-12.9
2397.994	33.5	29.5	14.5	44.0	89.0	-45.0
2426.994	59.8	53.5	16.3	69.8	89.0	-19.2
2437.000	102.5	94.8	14.2	109.0		Fundamental
2448.997	58.7	51.5	14.5	66.0	89.0	-23.0
2463.993	34.3	26.8	15.2	42.0	89.0	-47.0
2485.992	24.4	21.1	8.3	29.4	54.0	-24.6
4874.000	35.3	28.4	13.7	42.1	54.0	-11.9
7311.000	NF					
9748.000	NF					
12185.000	NF					
14622.000	NF					
17059.000	NF					
19496.000	NF					
21933.000	NF					
24370.000	NF					

NF = noise floor

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

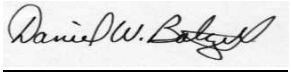
Signature: 

TABLE 8-9: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX550 (CHANNEL 11; 2462 MHZ)

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2353.993	28.3	20.7	5.8	26.5	54.0	-27.5
2375.993	29.1	22.3	6.8	29.1	54.0	-24.9
2397.993	28.8	21.8	5.8	27.6	86.9	-59.3
2419.993	28.7	21.7	7.2	28.9	86.9	-58.0
2441.993	27.4	23.3	6.8	30.1	86.9	-56.8
2462.000	100.2	92.7	14.2	106.9		Fundamental
2473.996	39.9	37.5	7.7	45.2	86.9	-41.7
2485.992	33.0	29.4	8.5	32.5	54.0	-21.5
2507.993	28.3	23.7	7.0	30.7	86.9	-56.2
2529.993	27.5	22.8	8.9	31.7	86.9	-55.2
2551.993	25.7	18.2	6.8	25.0	86.9	-61.9
4924.000	NF					
7386.000	NF					
9848.000	NF					
12310.000	NF					
14772.000	NF					
17234.000	NF					
19696.000	NF					
22158.000	NF					
24620.000	NF					

NF = noise floor

TABLE 8-10: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX550 (CHANNEL 1; 2412 MHZ) WITH CRADLE AND 50 OHM TERMINATION

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824.000	NF					
7236.000	NF					
9648.000	NF					
12060.000	NF					
14472.000	NF					
16884.000	NF					
19296.000	NF					
21708.000	NF					
24120.000	NF					

NF = noise floor

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

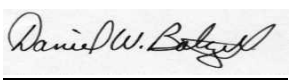
Signature: 

TABLE 8-11: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX550 (CHANNEL 6; 2437 MHZ) WITH CRADLE AND 50 OHM TERMINATION

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874.000	NF					
7311.000	NF					
9748.000	NF					
12185.000	NF					
14622.000	NF					
17059.000	NF					
19496.000	NF					
21933.000	NF					
24370.000	NF					

NF = noise floor

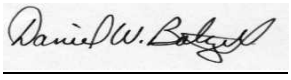
TABLE 8-12: RADIATED EMISSIONS HARMONICS/SPURIOUS: ITRONIX IX550 (CHANNEL 11; 2462 MHZ) WITH CRADLE AND 50 OHM TERMINATION

Frequency (MHz)	Peak Analyzer Reading (dBµV)	Average Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4924.000	NF					
7386.000	NF					
9848.000	NF					
12310.000	NF					
14772.000	NF					
17234.000	NF					
19696.000	NF					
22158.000	NF					
24620.000	NF					

NF = noise floor

TEST PERSONNEL:

Typed/Printed Name: Daniel Baltzell **Date:** July 18, 2001

Signature: 

9 COMPLIANCE WITH THE RESTRICTED BAND EDGE

Compliance with the band edges was performed using the procedure described in FCC's Direct Sequence Spread Spectrum 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.

TABLE 9-1: COMPLIANCE WITH THE RESTRICTED BAND EDGE (ITRONIX IX250)

Channel Set to	Frequency tested MHz	Detector	Field Strength Level (dBµV/m)	Delta Factor (dB)	Corrected Field Strength (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	2390.0	AV	108.4	60.9	47.5	54.0	-6.5
		PK	118.9				
11	2483.5	AV	106.9	56.0	50.9	54.0	-3.1
		PK	114.4				

TABLE 9-2: COMPLIANCE WITH THE RESTRICTED BAND EDGE (ITRONIX IX250)

Computer in cradle using 5 dBi antenna

Channel Set to	Frequency tested MHz	Detector	Field Strength Level (dBµV/m)	Delta Factor (dB)	Corrected Field Strength (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	2390.0	AV	97.6	45.0	52.6	54.0	-1.4
		PK	106.4				
11	2483.5	AV	101.0	48.1	52.9	54.0	-1.1
		PK	109.2				

TABLE 9-3: COMPLIANCE WITH THE RESTRICTED BAND EDGE (ITRONIX IX550)

With internal antenna:

Channel Set to	Frequency tested MHz	Detector	Field Strength Level (dBµV/m)	Delta Factor (dB)	Corrected Field Strength (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	2390.0	AV	108.4	60.9	47.5	54.0	-6.5
		PK	118.9				
11	2483.5	AV	106.9	56.0	50.9	54.0	-3.1
		PK	114.4				

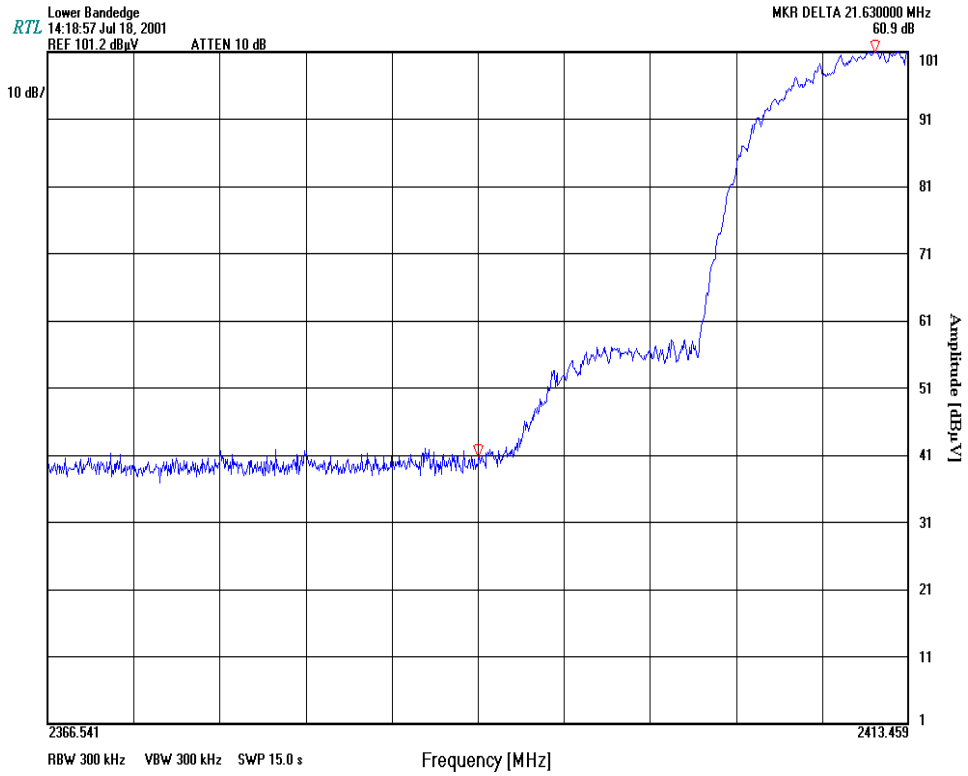
TABLE 9-4: COMPLIANCE WITH THE RESTRICTED BAND EDGE (ITRONIX IX550)

With cradle, external cable, and 5 dBi gain antenna:

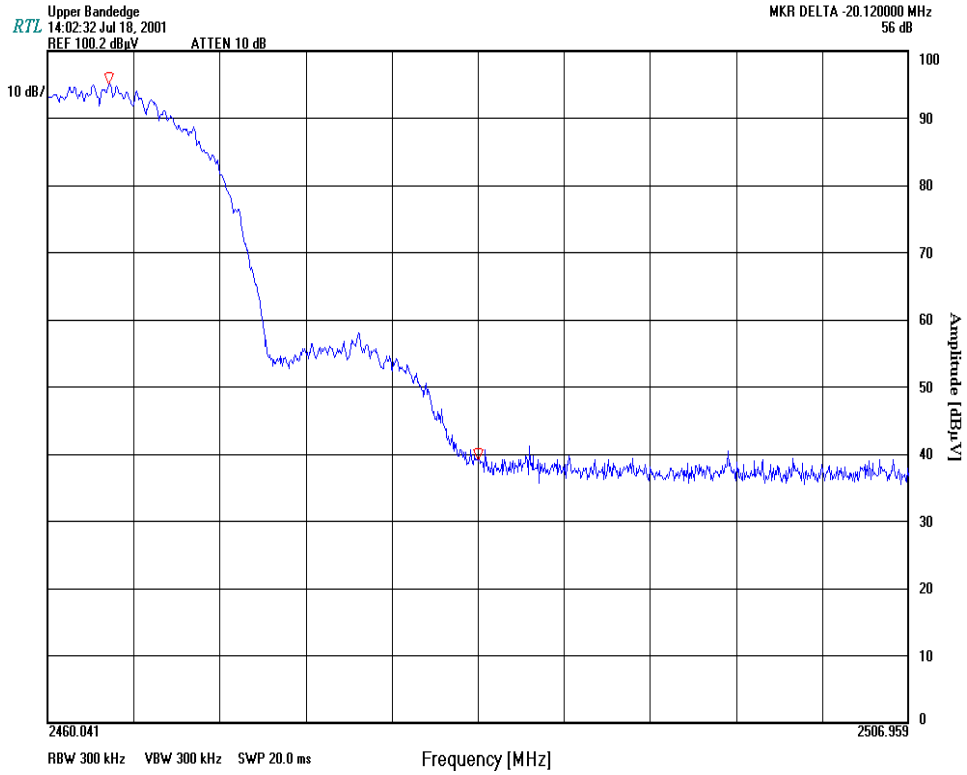
Channel Set to	Frequency tested MHz	Detector	Field Strength Level (dBµV/m)	Delta Factor (dB)	Corrected Field Strength (dBµV/m)	FCC Limit (dBµV/m)	FCC Margin (dB)
1	2390.0	AV	93.0	46.2	46.8	54.0	-7.2
		PK	105.5				
11	2483.5	AV	97.1	49.6	47.5	54.0	-6.5
		PK	105.0				

9.1 BANDEDGE PLOTS

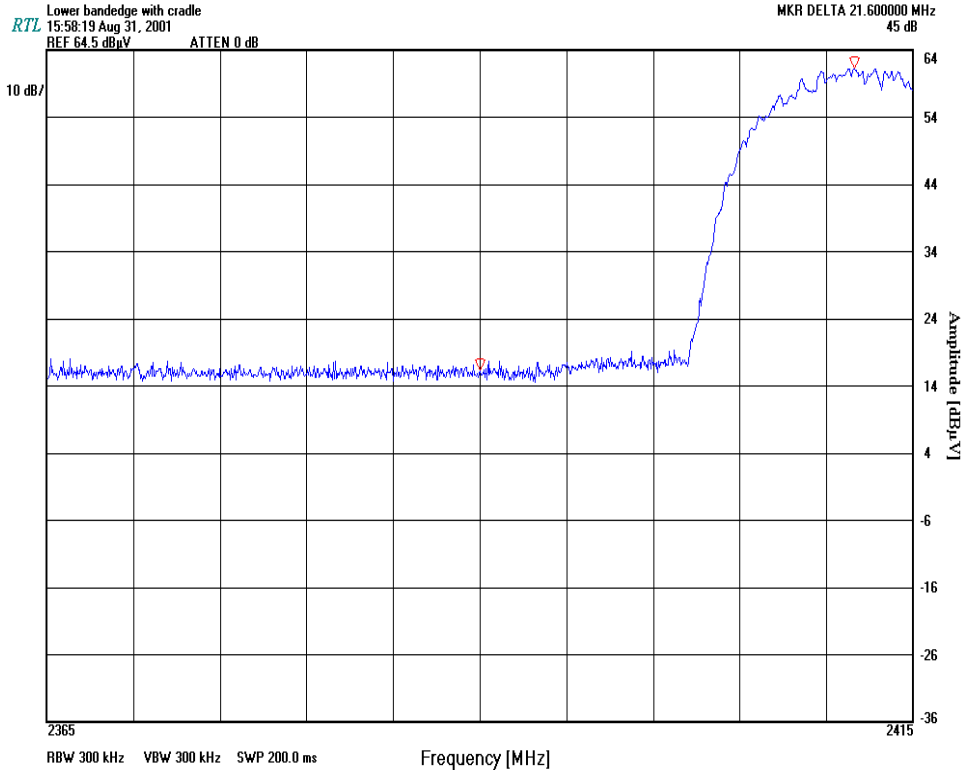
PLOT 9-1: BANDEDGE: LOWER BAND EDGE (60.9dB) CHANNEL 1 (ITRONIX IX250)



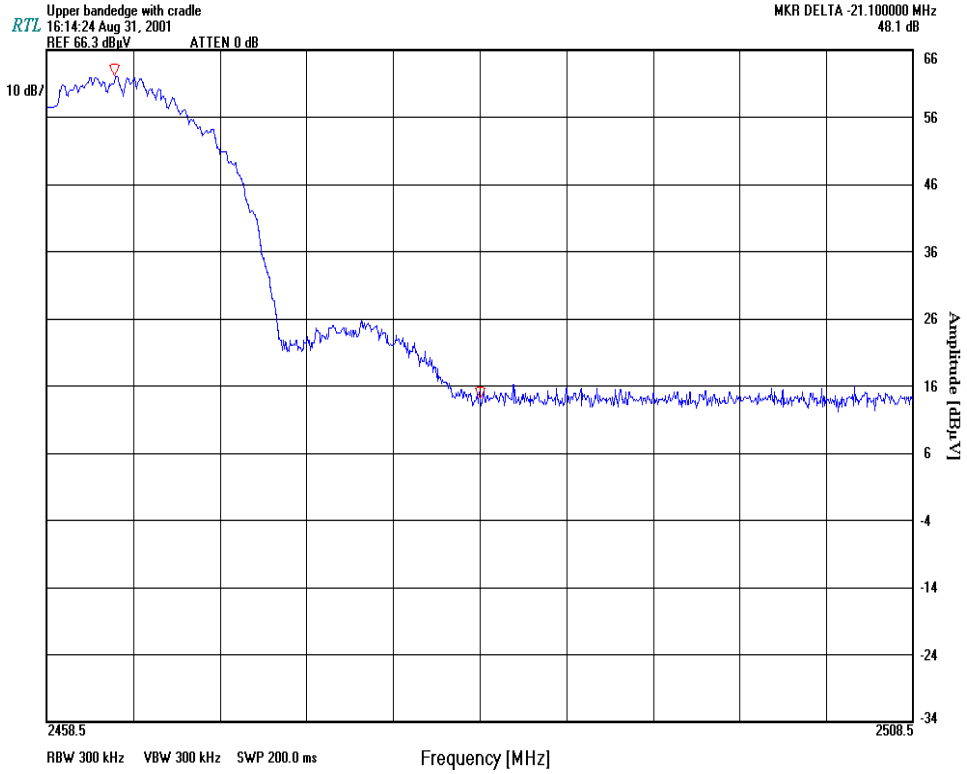
PLOT 9-2: BANDEDGE: UPPER BAND EDGE (56.0dB) CHANNEL 11 (ITRONIX IX250)



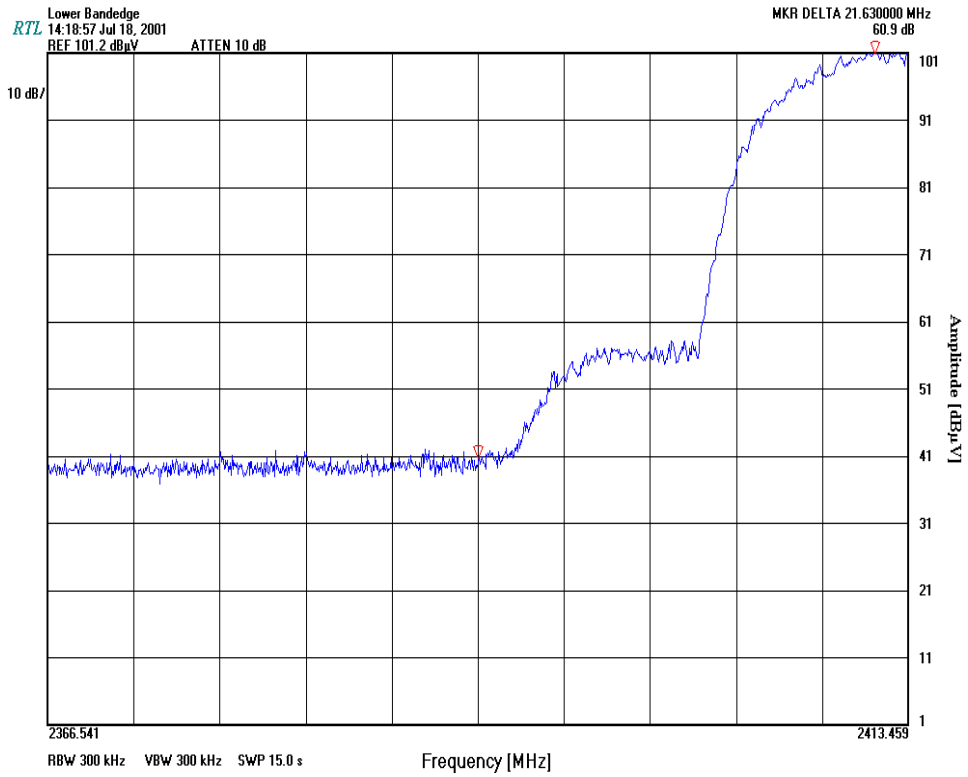
PLOT 9-3: BANDEDGE: LOWER BAND EDGE (45.0dB) CHANNEL 11 (ITRONIX IX250) WITH CRADLE



PLOT 9-4: BANDEDGE: LOWER BAND EDGE (48.1DB) CHANNEL 11 (ITRONIX IX250) WITH CRADLE

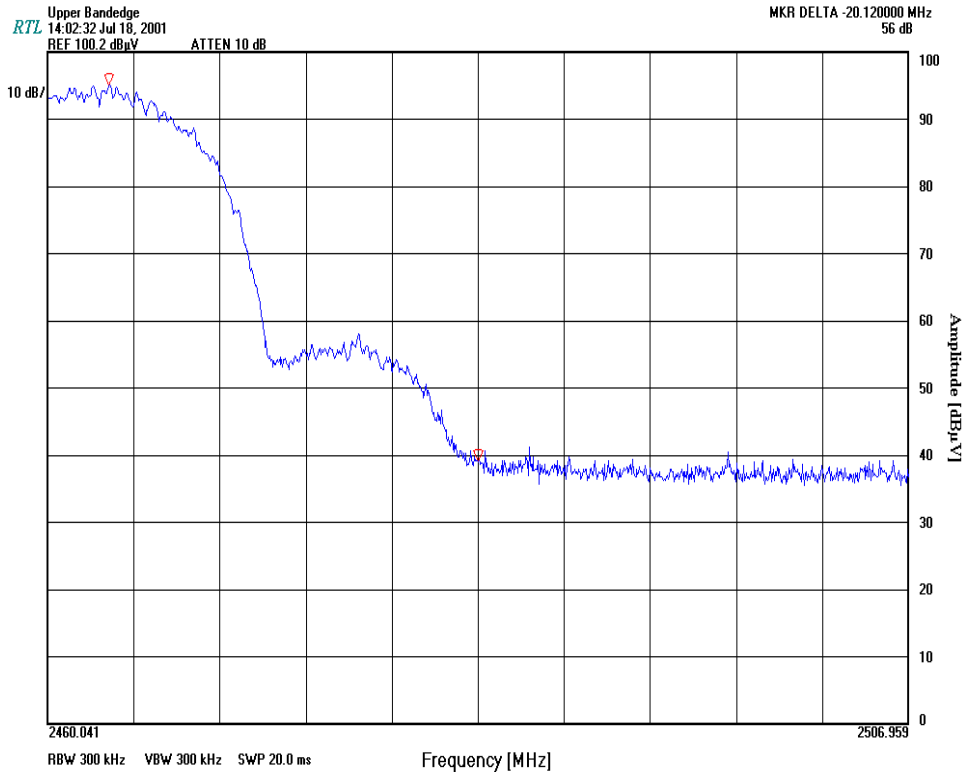


PLOT 9-5: BANDEDGE: LOWER BAND EDGE (60.9dB) CHANNEL 1 (ITRONIX IX550)



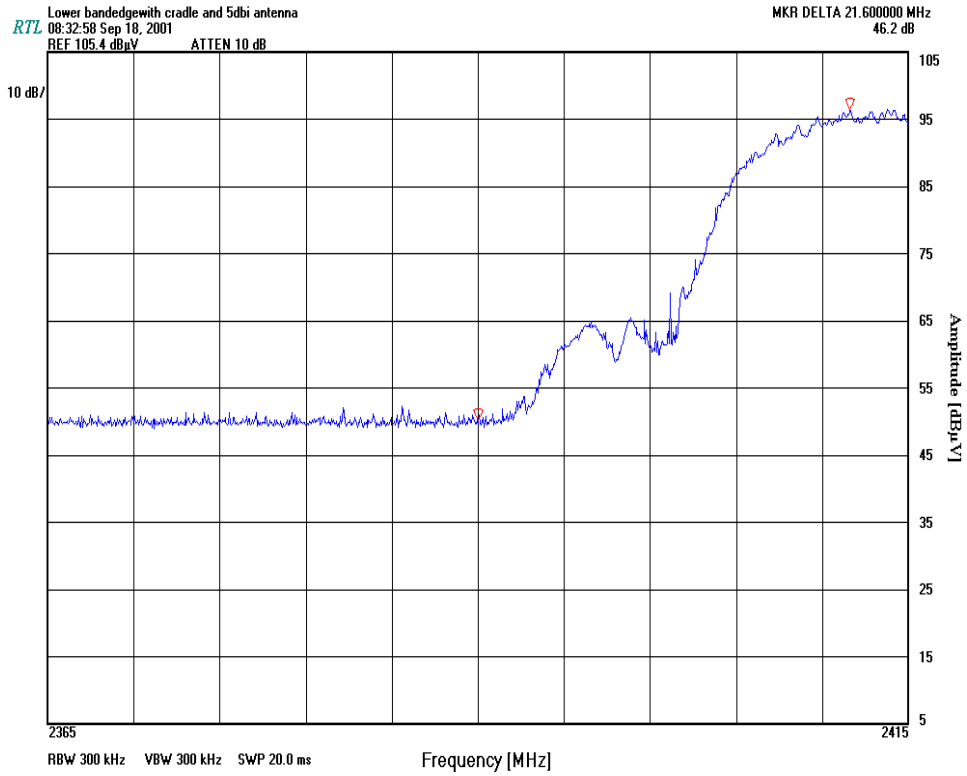
LOWER BAND EDGE WITH INTERNAL ANTENNA (60.9 DB)

PLOT 9-6: BANDEDGE: UPPER BAND EDGE (56.0dB) CHANNEL 11 (ITRONIX IX550)



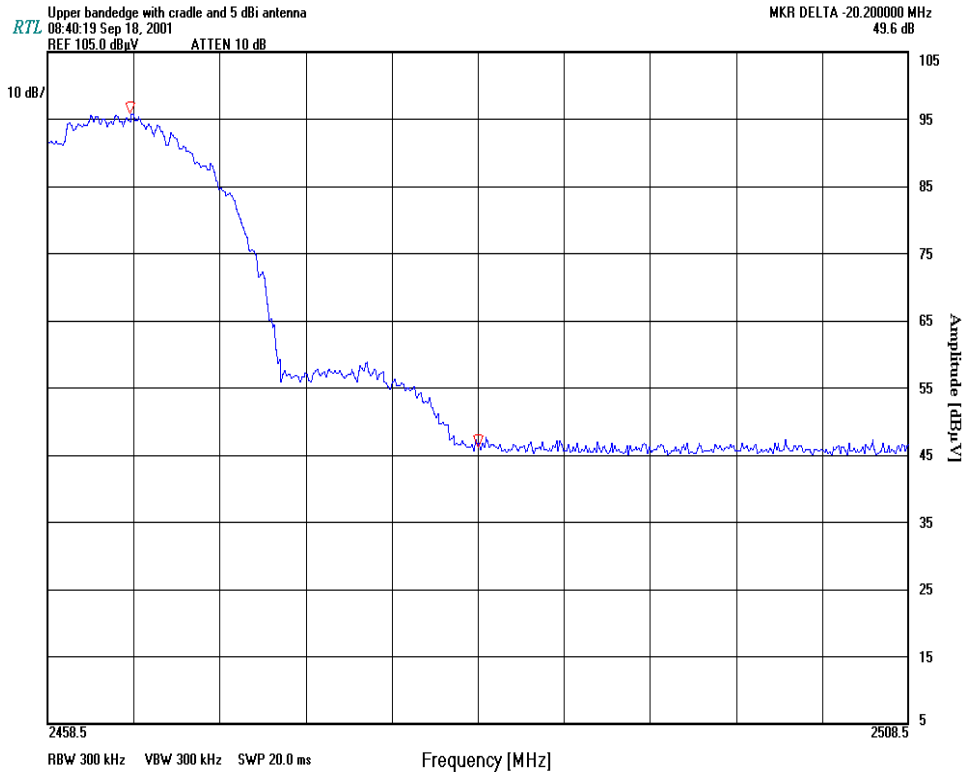
UPPER BAND EDGE WITH INTERNAL ANTENNA (Δ 56.0 DB)

PLOT 9-7: BANDEDGE: LOWER BAND EDGE (46.2dB) CHANNEL 1 (ITRONIX IX550)



LOWER BAND EDGE WITH CRADLE, EXTERNAL CABLE, AND 5 DBI ANTENNA (46.2 DB)

PLOT 9-8: BANDEDGE: UPPER BAND EDGE (49.6dB) CHANNEL 11 (ITRONIX IX550)



UPPER BAND EDGE WITH CRADLE, EXTERNAL CABLE, AND 5 DBI ANTENNA (Δ 49.6 DB)