



EMC Test Data

Client:	Novatel Wireless	Job Number:	T39290
Model:	Ricochet PCMCIA Wireless Modem	T-Log Number:	T39304
		Proj Eng:	Chris Byleckie
Contact:	Ben Greenwood		
Emissions Spec:	FCC 15.247	Class:	B
Immunity Spec:		Environment:	

EMC Test Data

For The

Novatel Wireless

Model

Ricochet PCMCIA Wireless Modem



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TEST SUMMARY

Date	Test Performed	Level	Results	Margin
8/29/00	RE, 1 - 10 GHz - Spurious Emissions In	FCC Part 15.209 / 15.247	Pass	-2dB @ 5489.15 MHz
8/29/00	RE, Preliminary Scan 30 - 1000 MHz	FCC B	Eval	Refer to individual runs
8/29/00	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-7dB @ 99.965MHz
8/29/00	RE, 1000 - 2500 MHz Maximized Emissions	FCC B	Pass	-7.7dB @ 2332.15MHz
8/30/00	CE, AC Power 120V/60Hz	FCC Class B	Pass	-24.7dB @ 5.78MHz

Abbreviations Used: RE - Radiated Emissions, CE - Conducted Emissions, RI - Radiated Immunity, CI - Conducted Immunity, ESD - Electrostatic Discharge, EFT - Electrical Fast Transients, VDI - Voltage Dips and Interrupts



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EUT INFORMATION

General Description

The EUT is a PCMCIA FHSS wireless transceiver operating in the 902 to 928 MHz band. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during emissions testing to simulate the end user environment. The EUT receives its power from the support laptop.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Novatel Wireless	Merlin for Ricochet	FHSS PCMCIA card	D7	

Other EUT Details

EUT tested with one sleeved dipole antenna

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 5.5 cm wide by 8.5 cm deep by 0.3 cm high.

Modification History

Mod. #	Test	Date	Modification
1	15.205	8/29/00	Soldered around edges of internal shield
2			
3			



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Test Configuration Information (1)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	PA2662U	Laptop	68016230	DoC
Hewlett Packard	2225C+	Printer	3028S76892	DSI6UX2225
US Robotics	Palm5000	PDA	604719G68390	MQ90001

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

EUT Interface Ports

The EUT is a PCMCIA card which plugs directly into the support laptop

Support Interface Ports

Laptop Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Parallel	Printer	25 pin parallel	Shielded	2
Serial	PDA	9 pin serial	Shielded	2
Power	AC Mains	2 wire	Unshielded	2

EUT Operation During Emissions

During radiated transmitter testing the EUT was set to transmit continuously on either the low, middle or high channel

During digital equipment testing the EUT was set into a its normal operating mode which essentially means the radio is in a receive state and occasionally send out a pulse looking for a transmitter. The laptop was sending scrolling H's to the screen, sending data to the printer and reading and writing data to the harddrive.



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Spec:	FCC 15.247	Class:	B

Conducted Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 8/30/00	Config. Used: 1
Test Engineer: Chris Byleckie	Config Change:
Test Location: SVOATS #3	EUT Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the host system was located on a wooden table, 40 cm from a vertical coupling plane. The LISN was located 80 cm from the host system.

Ambient Conditions: Temperature: 16°C
 Rel. Humidity: 83%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 120V/60Hz	FCC Class B	Pass	-24.7dB @ 5.78MHz

Modifications Made During Testing: None



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Spec:	FCC 15.247	Class:	B

Run #2: AC Power Port Conducted Emissions, 0.15 - 30 MHz 120 V / 60 Hz

Frequency	Level	Power	FCC B		Detector	Comments
MHz	dBμV	Lead	Limit	Margin	QP/Ave	
5.790	23.3	Neutral	48.0	-24.7	QP	
6.082	21.1	Line 1	48.0	-26.9	QP	
3.052	18.9	Line 1	48.0	-29.1	QP	
4.616	12.0	Neutral	48.0	-36.0	QP	
4.021	11.9	Line 1	48.0	-36.1	QP	
2.409	11.3	Neutral	48.0	-36.7	QP	



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Spec:	FCC 15.247	Class:	N/A

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 8/29/00 Config. Used: 1
Test Engineer: Chris Byleckie Config Change:
Test Location: SVOATS #3 EUT Voltage: 120V/60Hz to the laptop

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions: Temperature: 18°C
 Rel. Humidity: 72%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 1 - 10 GHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	-2dB @ 5489.15 MHz

Modifications Made During Testing: Soldered the edges of the internal shield can to improve ground and reduce open areas. Front side, where antenna connector is located, holes were shielded (Top side of unit). Also, the left side was shielded .



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Spec:	FCC 15.247	Class:	N/A

Fundamental Pout @ 194.85 Mhz = 30 dBm measured with a power meter

Run #1a: Radiated Spurious Emissions, 1000-10000 MHz. Low Channel @ 902.15 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5412.900	51.1	v	54.0	-2.9	Avg	83	1.1	
5412.900	47.4	h	54.0	-6.6	Pk	22	1.9	
3608.600	46.9	v	54.0	-7.1	Pk	100	1.2	Peak reading, Average limit
2706.450	45.1	h	54.0	-8.9	Pk	332	1.4	Peak reading, Average limit
3608.600	44.4	h	54.0	-9.6	Pk	22	2.0	Peak reading, Average limit
4510.750	43.9	v	54.0	-10.1	Pk	117	1.1	Peak reading, Average limit
4510.750	43.6	h	54.0	-10.4	Pk	0	1.0	Peak reading, Average limit
2706.450	40.8	v	54.0	-13.2	Pk	139	1.2	Peak reading, Average limit
5412.900	54.8	v	74.0	-19.2	Pk	83	1.1	

Run #1b: Radiated Spurious Emissions, 1000-10000 MHz. Center Channel @ 914.85 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5489.100	52.0	v	54.0	-2.0	Avg	146	1.4	
4574.250	47.9	v	54.0	-6.1	Pk	116	1.1	Peak reading, Average limit
3659.400	44.9	v	54.0	-9.1	Pk	139	1.0	Peak reading, Average limit
4574.250	44.0	h	54.0	-10.0	Pk	0	1.4	Peak reading, Average limit
2744.550	43.8	v	54.0	-10.2	Pk	186	1.0	Peak reading, Average limit
5489.100	43.2	h	54.0	-10.8	Avg	36	1.6	
3659.400	43.0	h	54.0	-11.1	Pk	0	1.4	Peak reading, Average limit
2744.550	38.2	h	54.0	-15.8	Pk	0	1.4	Peak reading, Average limit
5489.100	55.5	v	74.0	-18.5	Pk	146	1.4	
5489.100	50.4	h	74.0	-23.6	Pk	36	1.6	



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Spec:	FCC 15.247	Class:	N/A

Run #1c: Radiated Spurious Emissions, 1000-10000 MHz. High Channel @ 927.45 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5564.700	51.1	v	54.0	-2.9	Avg	83	1.1	
5564.700	47.4	h	54.0	-6.6	Pk	22	1.9	Peak reading, Average limit
4637.250	45.9	v	54.0	-8.1	Avg	146	1.6	
4637.250	45.5	h	54.0	-8.5	Pk	3	1.6	Peak reading, Average limit
3709.800	44.2	v	54.0	-9.8	Pk	0	1.0	Peak reading, Average limit
2782.350	44.0	v	54.0	-10.0	Pk	304	1.0	Peak reading, Average limit
3709.800	42.8	h	54.0	-11.2	Pk	0	1.1	Peak reading, Average limit
2782.350	40.2	h	54.0	-13.8	Pk	0	1.4	Peak reading, Average limit
5564.700	54.8	v	74.0	-19.2	Pk	83	1.1	
4637.250	50.6	v	74.0	-23.4	Pk	146	1.6	Peak reading, Average limit



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Contact:	Ben Greenwood	Proj Eng:	Chris Byleckie
Spec:	FCC 15.247	Class:	B

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 8/29/00

Test Engineer: Chris Byleckie

Test Location: SVOATS #3

Config. Used: 1

Config Change:

EUT Voltage: 120V/60Hz for laptop

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

For radiated emissions testing between 30 and 1000 MHz, the measurement antenna was located at 10 meters distance from the EUT, unless otherwise noted. For testing above 1 GHz, the measurement antenna was located 3 meters from the

Ambient Conditions:

Temperature: 18°C

Rel. Humidity: 72

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-7dB @ 99.965MHz
3	RE, 1000 - 2500 MHz Maximized Emissions	FCC B	Pass	-7.7dB @ 2332.15MHz

Modifications Made During Testing: None



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Spec:	FCC 15.247	Class:	B

Run #1: Preliminary radiated emissions, 30-1000 MHz

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
99.965	36.5	h	43.5	-7.0	QP	299	1.0	
320.000	37.6	h	46.0	-8.4	QP	183	2.3	
240.000	37.1	h	46.0	-8.9	QP	93	1.8	
400.000	35.5	h	46.0	-10.5	QP	184	1.7	
240.000	35.0	v	46.0	-11.0	QP	48	1.0	
40.000	28.9	v	40.0	-11.1	QP	0	1.0	Broadband
66.646	28.4	h	40.0	-11.6	QP	173	1.0	
320.000	33.8	v	46.0	-12.2	QP	205	1.0	
300.000	33.7	h	46.0	-12.3	QP	22	2.4	
133.291	31.1	v	43.5	-12.4	QP	185	1.0	
80.000	26.2	h	40.0	-13.8	QP	142	4.0	
360.000	31.8	v	46.0	-14.2	QP	206	1.0	
420.000	31.0	h	46.0	-15.0	QP	179	1.5	
480.000	30.8	v	46.0	-15.2	QP	177	1.0	
280.000	30.5	h	46.0	-15.5	QP	250	1.2	
360.000	30.5	h	46.0	-15.5	QP	322	1.3	
300.000	29.2	v	46.0	-16.8	QP	10	1.0	
220.000	28.7	v	46.0	-17.3	QP	152	1.0	
260.000	27.5	h	46.0	-18.5	QP	109	1.2	
80.000	21.1	v	40.0	-18.9	QP	0	1.0	
140.000	24.2	h	43.5	-19.3	QP	107	1.6	
220.000	26.5	h	46.0	-19.5	QP	242	1.4	
110.000	23.8	v	43.5	-19.7	QP	111	1.0	

Note: No emission was observed from 960 to 1000 MHz

Run #2: Maximized readings from run #1

Frequency	Level	Pol	Spec	Spec	Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
99.965	36.5	h	43.5	-7.0	QP	299	1.0	
320.000	37.6	h	46.0	-8.4	QP	183	2.3	
240.000	37.1	h	46.0	-8.9	QP	93	1.8	
400.000	35.5	h	46.0	-10.5	QP	184	1.7	
240.000	35.0	v	46.0	-11.0	QP	48	1.0	
40.000	28.9	v	40.0	-11.1	QP	0	1.0	Broadband



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Spec:	FCC 15.247	Class:	B

Run #3 data taken on 8/30/00 by Chris Byleckie

Run #3: Maximized readings, 1000 - 2500 MHz. Reciever LO

Measurements made at 3m per FCC requirements.

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2332.150	46.4	v	54.0	-7.6	Pk	0	1.0	Pk Reading average limit
2332.150	46.3	h	54.0	-7.7	Pk	0	1.0	Pk Reading average limit
1166.088	43.0	v	54.0	-11.0	Pk	262	1.0	Pk Reading average limit
1166.088	42.0	h	54.0	-12.1	Pk	308	1.0	Pk Reading average limit

Radiated Emissions, 30 - 10000 MHz, 29-Aug-00 06:15 PM**Engineer: Chris**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Elliott Laboratories	300-1000 MHz Log Periodic Antenna	EL300.1000	55	11	11/3/99	10/3/00
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	12	12/21/99	12/21/00
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	9/25/99	9/25/00
Filtek	High Pass Filter	HP12/1000-5BA	956	12	3/29/00	3/29/01
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 , 9 KHz -26.5GHz	8593EM	1141	12	12/22/99	12/22/00
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263, (F303)	12	8/3/00	8/3/01
Hewlett Packard	Power Meter	432A	259, (F304)	12	2/17/00	2/17/01
Hewlett Packard	Thermistor Mount	478A	652	12	2/17/00	2/17/01
Narda West	EMI Filter 1.9 GHz, High Pass	HPF-161	248	12	3/27/00	3/27/01
Rohde &Schwarz	Test Receiver, 20-1300MHz	ESVP	213, (F196)	12	5/30/00	5/30/01

Conducted and Radiated Emissions, 30-Aug-00 11:06 AM**Engineer: Chris**

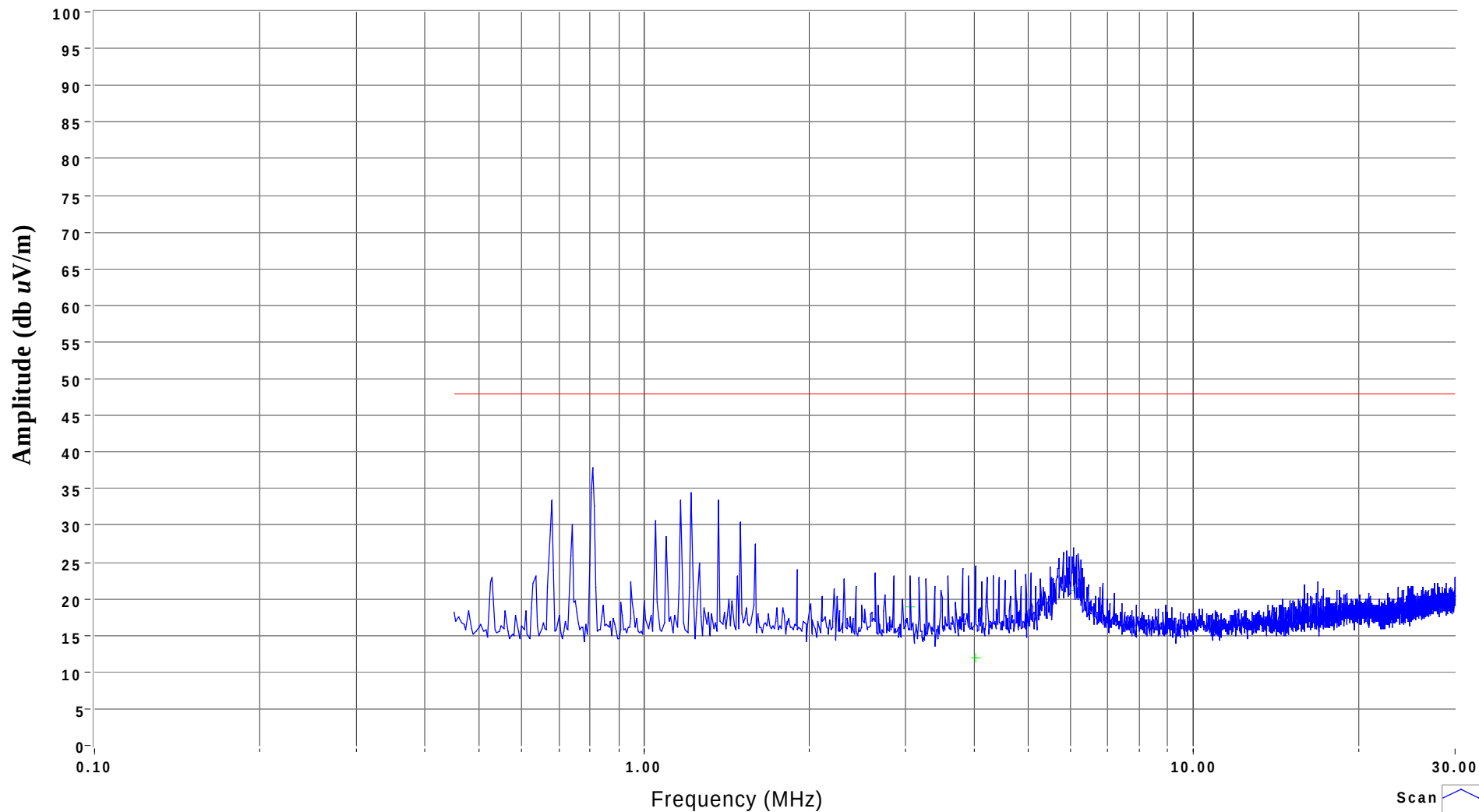
<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	9/25/99	9/25/00
Filtek	High Pass Filter	HP12/1000-5BA	955	12	3/27/00	3/27/01
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 , 9 KHz -26.5GHz	8593EM	1141	12	12/22/99	12/22/00
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263, (F303)	12	8/3/00	8/3/01
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	812	12	12/6/99	12/6/00
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	12	5/30/00	5/30/01



T39304

Mains Lead

Line 1



120V / 60 Hz

Scan

Peak

Quasi-peak

Average

QuasiPeak Limit

QuasiPeak Limit

8/31/00

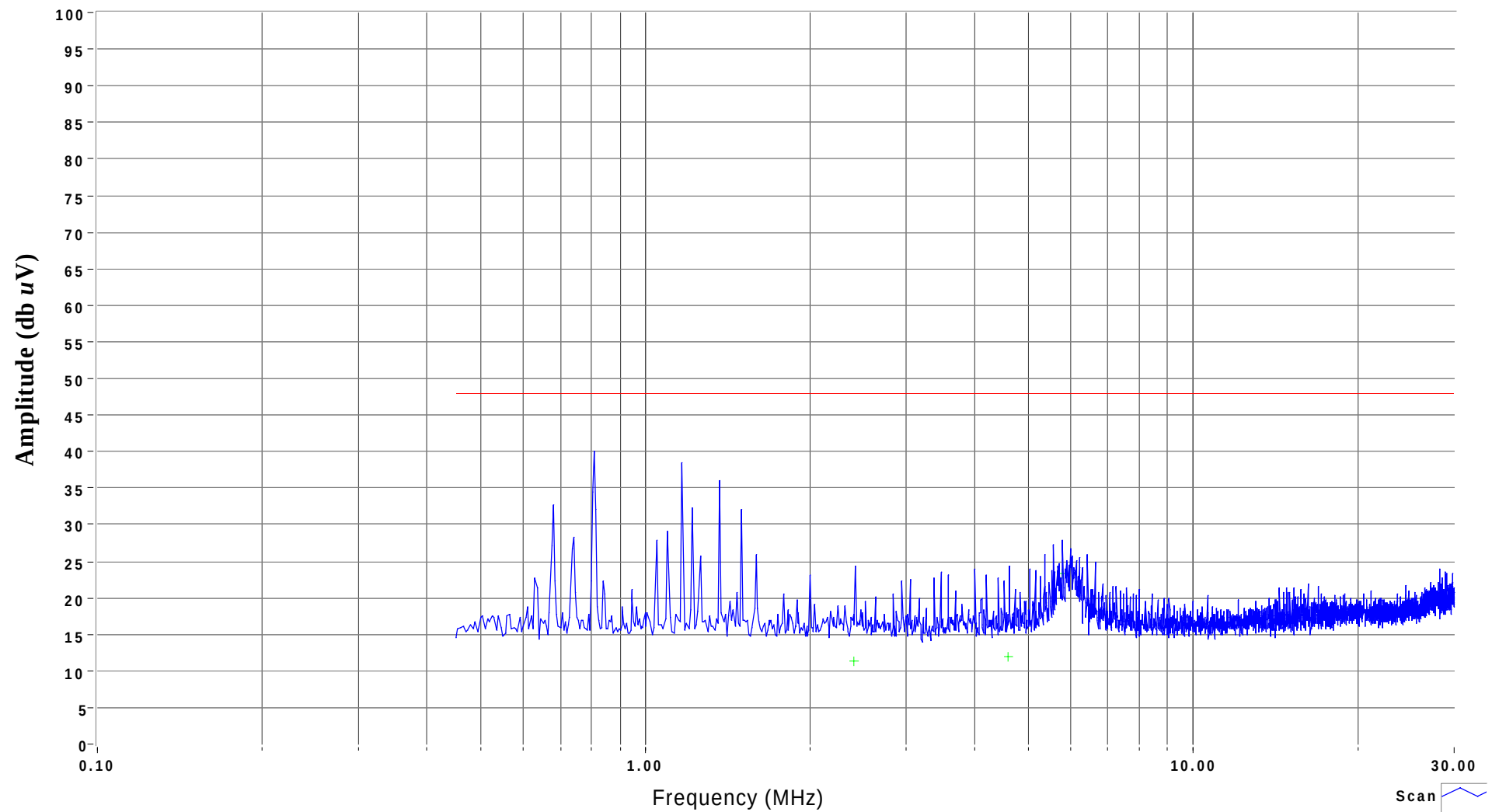
Chris Byleckie



T39304

Mains Lead

Neutral



120V / 60 Hz

Scan

Peak

Quasi-peak

Average

QuasiPeak Limit

QuasiPeak Limit

8/31/00

Chris Byleckie