

# Tantalus Systems Corp.

# TUNET NC-2202

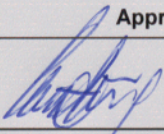
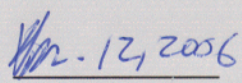
## Report of Measurements

per

### CFR47, FCC Part 15, Subpart C and FCC Part 90 Subpart I and T

Revision 1.0

April 12, 2006

Approvals		
Checked by:	 _____ Robert Stirling, P.Eng.	 _____ Date

Protocol Datasystems Inc., Labs, Abbotsford B.C., Canada  
FCC Registration Number 96437  
Industry Canada Registration Number IC3384

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## Section I: Information for Test Report of Measurements

### Testing Details

TESTED BY: David Johanson  
 TEST CONDITIONS: Temperature and Humidity: 6°C, 63%  
 TEST VOLTAGE: 120Vac, 60Hz

### Test Facilities

Protocol Datasystems Inc., Labs  
 28945 McTavish Rd.  
 Abbotsford B.C., Canada, V4X 2E7

FCC Registration Number 96437  
 Industry Canada Registration Number IC3384

### Test Equipment List:

EMISSIONS:

Manufacturer	Model	Equipment Description	Serial No.	Last Cal	Next Cal
HP	85650A	CDN Quasi-Peak Adapter	2043A00240	22/03/05	22/03/06
HP	85662A	Spectrum Analyzer Display	2318A05184	22/03/05	22/03/06
HP	8566B	Spectrum Analyzer RF Section	2241A02102	22/03/05	22/03/06
HP	85685A	RF-Preselector	3107A01222	22/03/05	22/03/06
A.H. Systems	SAS-200/510	Antenna Log Periodic	761	04/03/05	04/03/06
EMCO	3105	Antenna DRG Horn (Med)	2024	25/02/05	25/02/06
LaPlace Instruments	AC1000	Low Distortion Power Source	138041	12/12/05	12/12/06
Thurby Thandar	HA1600	Power and Harmonics Analyzer	140108	13/12/05	13/12/06
EMCO	3825 2	LISN(25A 50ohm 50/250uH 10k-100M)	9509-2470	20/07/05	20/07/06
EMCO	3110B	Antenna Biconical (Type 3)	9401-1850	01/03/05	01/03/06
Rhientech	Custom	Antenna Mast	N/A	N/A	N/A
Protocol EMC	Custom	Turntable	N/A	N/A	N/A

### Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Total RF power, conducted	$\pm 1,5$ dB
RF power density, conducted	$\pm 3$ dB
Spurious emissions, conducted	$\pm 3$ dB
All emissions, radiated	$\pm 6$ dB
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 3$ %

**Company Under Test**

NAME: Tantalus Systems Corp.  
ADDRESS: 4224 Manor St.  
Burnaby, BC V5G 1B2  
CONTACT PERSON: Mr. Mark Fairburn  
EMAIL: mfairburne@tantalus.com  
PHONE NUMBER: 604-299-0458 ext. 229

**Equipment Under Test**

THE TEST SYSTEM: EUT: TUNET NC-2202 Transceiver Ver. 1.0  
Manufacturer: Tantalus Systems Corp.  
Part Number: NC- 2202  
Serial Number: ENG001

## CABLING:

Cable	Description	Shielded	Ferrite
Power	AC Input Power Cable	No	No
CAT5	Ethernet Cable	No	No

TEST SETUP: For all conducted and radiated emission testing, the EUT was placed in transmit mode since the equipment is keyed at all times during normal operation.

MODIFICATIONS: This unit requires no modifications for it to pass.

CONCLUSION: NC-2202 tested complies with the requirements of FCC CFR47 part 15/B,C and FCC Part 90 Subpart I and T ( Private land mobile radio services)

## **Section II: Report of Measurements of FCC CFR47 Part 15 Subpart C**

### **General**

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15 – Subpart C - Intentional Radiators as well as FCC Part 90 – Subpart I and T.

### **Test Results**

<b>Test</b>	<b>Standard</b>	<b>Description</b>	<b>Result</b>
Conducted Emissions	FCC 15.107 ,15.207 Class A Limits	The Conducted Emissions are measured on the phase and Neutral Power lines in the 0.15 - 30.0 MHz range.	Complies
Radiated Emissions	FCC15.109 15.209 Class A Limits	The Radiated Emissions are measured from 30 MHz to 1000 MHz	Complies
Radiated Spurious	FCC 2.103/2.1053	The radiated emissions are measured up to the 10 <sup>th</sup> Harmonic	Complies

**Part 1 – Conducted Emissions A.C. MAINS**

DATE: January 18, 2006

TEST STANDARD: FCC CFR47, Part 15, Subpart B section 15.107 Class A

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus.

MINIMUM STANDARD: 15.107 Conducted Limits Class A

Frequency	Maximum Level Quasi-Peak	Maximum Level Average
(MHz)	(dB $\mu$ V)	(dB $\mu$ V)
0.15-0.5	79	66
0.5-30	73	60

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer, Peak detector. Any emissions that are close to the limit are measured using a test receiver, CISPR Quasi-Peak detector. The NC-2202 was tested for conducted emission in both Quiescent/Receive and Transmitting mode at 120 VAC 60 Hz.

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLE DESCRIPTIONS:

Cable	Name	Ferrite	Shielded
Power	AC Input Power Cable	No	No
CAT5	Ethernet Cable	No	No

MEASUREMENT DATA: See Appendix B for Plots,

EMISSIONS DATA: See Tables 1 to 4 in Appendix B for corresponding data.

PERFORMANCE: Complies.

**Part 2 - Radiated Emission Testing**

DATE: January 18, 2006

TEST STANDARD: FCC CFR47, Part 15, Subpart B section 15.109 Class A

TEST SETUP: The equipment was set up in a 3 Meter and 10-meter open field test site. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

MINIMUM STANDARD: Class A Limits:

Frequency	Maximum Field Strength
(MHz)	dB $\mu$ V/m at 10m
30 - 88	39.0
88 - 216	43.5
216 - 960	46.5
960 - up	49.5

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLE DESCRIPTIONS:

Cable	Name	Ferrite	Shielded
Power	AC Input Power Cable	No	No
CAT5	Ethernet Cable	No	No

MEASUREMENT DATA: See Appendix B for Plots

EMISSIONS DATA: See Table 5 Appendix B for corresponding frequencies.

PERFORMANCE: Complies.

**Part 3 - Radiated Spurious Emissions**

DATE: January 20, 2006

TEST STANDARD: FCC CFR47, Part 2, 2.103, 2.1053; Part 90 90.210(e)

TEST SETUP: The equipment was set up at a 3 m measurement distance, and the EUT was connected to a 200W 50Ohm load. Spurious emissions were measured in both horizontal and vertical polarization's with signal strength and the results recorded on the attached graph and tables. The Signal Strength was measured using the Substitution Method as outlined in TIA/EIA-603-A-2001

MINIMUM STANDARD: 90.210(f)(3) – emissions are to be attenuated by  $55 + 10\log(P)$  dB below the mean power output of the transmitter

Frequency	Measured Output Power	Field Strength	Attenuation Levels for this EUT $55+10\log(P)$
(MHz)	(W)	(dBm)	(dB)
220.0025 Lo Power	19.07	42.8	67.8
220.0025 Hi Power	49.40	46.9	71.9
220.9975 Lo Power	20.83	43.2	68.2
220.9975 Hi Power	52.12	47.2	72.2

METHOD OF MEASUREMENT: The EUT was provided with 2 Duplexer modules for each of the test Frequencies. Each Frequency was measured at 2 power levels to ensure compliance. A Biconical, a Log Periodical and a Horn antenna located 3 meters away from the transmitter was used to measure the levels detected. Then calibrated Antenna's were used with a Signal Generator and substituted the EUT to measure the output levels in accordance with the procedures as outlined in TIA/EIA-603-A-20012.2.12 .

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

CABLING DETAILS: The EUT was Set up using the manufacturer's specified normal cabling configuration.

EMISSIONS DATA: See page 9 for Harmonics Data and Plots

PERFORMANCE: Complies.



**Spurious Emissions: Low Channel, 220.0025MHz, Low Power**

Frequency (MHz)	Harmonic	Raw Measured Signal (dBμV)	Corrected signal level using Substitution (dBμV)	Corrected Signal Level (dBm)	Radiated Emission below Carrier (dBc)
220.0025*	1st			42.8	
440.0050	2nd	23.0	54.8	-52.2	95.0
660.0075	3rd	18.2	58.5	-48.5	91.3
880.0100	4th	33.2	75.8	-31.2	74.0
1100.0125	5th	13.0	65.7	-41.3	84.1
1320.0150	6th	4.2	50.2	-56.8	99.6
1540.0175	7th	12.8	63.7	-43.3	86.1
1760.0200	8th	1.4	58.8	-48.2	91.0
1980.0225	9th	-1.3	49.4	-57.6	100.4
2200.0250	10th	-8.0	43.7	-63.3	106.1

Notes: \* - Fundamental measured using Conducted Measurement at Antenna Terminals

**Spurious Emissions: Low Channel, 220.0025MHz, High Power**

Frequency (MHz)	Harmonic	Raw Measured Signal (dBμV)	Corrected signal level using Substitution (dBμV)	Corrected Signal Level (dBm)	Radiated Emission below Carrier (dBc)
220.0025*	1st			46.9	
440.0050	2nd	28.6	60.6	-46.4	93.3
660.0075	3rd	24.4	64.9	-42.1	89.0
880.0100	4th	38.9	81.2	-25.8	72.7
1100.0125	5th	19.8	72.5	-34.5	81.4
1320.0150	6th	8.6	54.8	-52.2	99.1
1540.0175	7th	17.9	69.1	-37.9	84.8
1760.0200	8th	8.7	66.8	-40.2	87.1
1980.0225	9th	8.6	57.2	-49.8	96.7
2200.0250	10th	-3.6	49.2	-57.8	104.7

Notes: \* - Fundamental measured using Conducted Measurement at Antenna Terminals

**Spurious Emissions: High Channel, 220.9975MHz, Low Power**

Frequency (MHz)	Harmonic	Raw Measured Signal (dBμV)	Corrected signal level using Substitution (dBμV)	Corrected Signal Level (dBm)	Radiated Emission below Carrier (dBc)
220.9975*	1st			43.2	
441.993	2nd	23.5	55.3	-51.7	94.9
662.989	3rd	14.2	52.8	-54.2	97.4
883.887	4th	32.1	73.8	-33.2	76.4
1104.858	5th	12.1	64.7	-42.3	85.5
1325.834	6th	1.3	47.8	-59.2	102.4
1546.803	7th	9.9	60.8	-46.2	89.4
1767.778	8th	2.1	59.9	-47.1	90.3
1988.600	9th	-12	30.4	-76.6	119.8
2209.730	10th	-12	36.7	-70.3	113.5

Notes: \* - Fundamental measured using Conducted Measurement at Antenna Terminals

**Spurious Emissions: High Channel, 220.9975MHz, High Power**

Frequency (MHz)	Harmonic	Raw Measured Signal (dBμV)	Corrected signal level using Substitution (dBμV)	Corrected Signal Level (dBm)	Radiated Emission below Carrier (dBc)
220.9975*	1st			47.2	
441.993	2nd	30.1	62.3	-43.8	91.0
662.989	3rd	17.4	56.4	-50.6	97.8
883.887	4th	39.1	80.8	-26.2	73.4
1104.858	5th	19.1	72.0	-35.0	82.2
1325.834	6th	6.2	52.8	-54.2	101.4
1546.803	7th	12.8	63.7	-43.3	90.5
1767.778	8th	2.1	59.9	-47.1	94.3
1988.600	9th	-12	30.4	-76.6	123.8
2209.730	10th	-12	36.7	-70.3	117.5

Notes: \* - Fundamental measured using Conducted Measurement at Antenna Terminals

## Appendix A: EUT Photos



Emissions Test Setup Front View



Emissions Test Setup inside Front, bottom View



Emissions Test Setup Rear View



Emissions Test Setup Inside Top Rear View



Emissions Test Setup Inside Bottom Rear View

## Appendix B: Measurement Data and Plots FCC Part 15/C

Tantalus Systems – TUNet NC –2202 Conducted Emissions: 120VAC 60Hz

### Receive Mode

**Table 1:** Line 1 – Hot- FCC Class A

Frequency	Peak	DelLim-Avg
(MHz)	(dB $\mu$ V)	(dB)
0.3931	59.4	-6.6
0.4278	57.8	-8.2
0.7497	50.6	-9.4
0.3283	54.1	-11.9
0.4583	53.4	-12.6
4.30	44.6	-15.4

**Table 2:** Line 2 FCC Class A

Frequency	Peak	DelLim-Avg
(MHz)	(dB $\mu$ V)	(dB)
0.7537	53.7	-6.3
0.3931	58.7	-7.3
0.4255	58.3	-7.7
0.5231	49.4	-10.6
0.3611	55.2	-10.8
4.277	44.2	-15.8

### Transmit Mode, High Power – 220.9975MHz CW

**Table 3:** Line 1 – Hot- FCC Class A

Frequency	Peak	DelLim-Avg
(MHz)	(dB $\mu$ V)	(dB)
0.3931	63.2	-2.8
0.7617	54.7	-5.3
0.4583	58.6	-7.4
0.4255	58.3	-7.7
0.3266	57.9	-8.1
0.5259	51.3	-8.7

**Table 4:** Line 2 FCC Class A

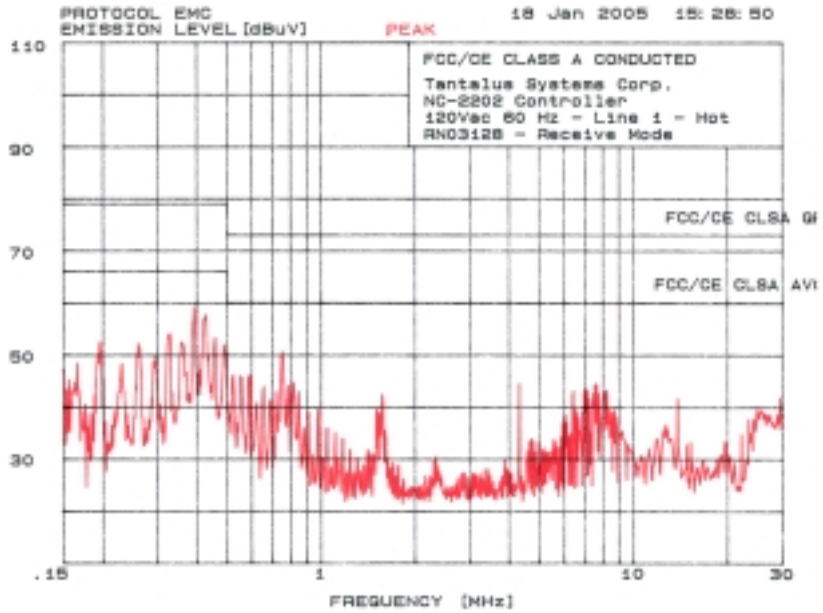
Frequency	Peak	DelLim-Avg
(MHz)	(dB $\mu$ V)	(dB)
0.7617	56.2	-3.8
0.4301	58.5	-7.5
0.3951	57.0	-9.0
0.3631	54.9	-11.1
0.3592	54.8	-11.2
0.7863	48.5	-11.5

### Radiated Emissions

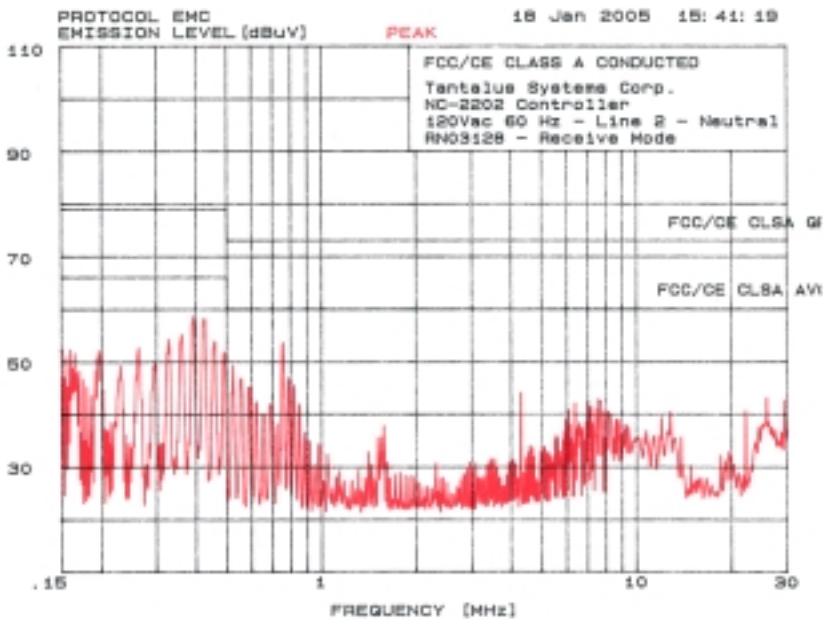
**Table 5:** Radiated Emissions sorted by frequency

Frequency	Pol	Hgt	Angle	Uncor-Pk	Tot Corr	Peak	QP Lmt	DelLim-Pk
(MHz)		(m)	(deg)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
47.92210	Vert	1.0	45	26.90	11.77	38.67	49.53	-10.86
63.89952	Vert	1.0	190	30.70	10.71	41.41	49.53	-8.12
67.54933	Vert	1.0	0	26.40	10.74	37.14	49.53	-12.39
108.12488	Vert	1.0	180	33.00	12.85	45.85	54.00	-8.15
110.59575	Vert	1.0	180	20.80	12.98	33.78	54.00	-20.22
113.04378	Vert	1.0	20	24.60	13.09	37.69	54.00	-16.31
129.00256	Vert	1.0	340	24.40	13.72	38.12	54.00	-15.88
131.00756	Vert	1.0	250	21.50	13.81	35.31	54.00	-18.69

### Conducted Emissions Plot

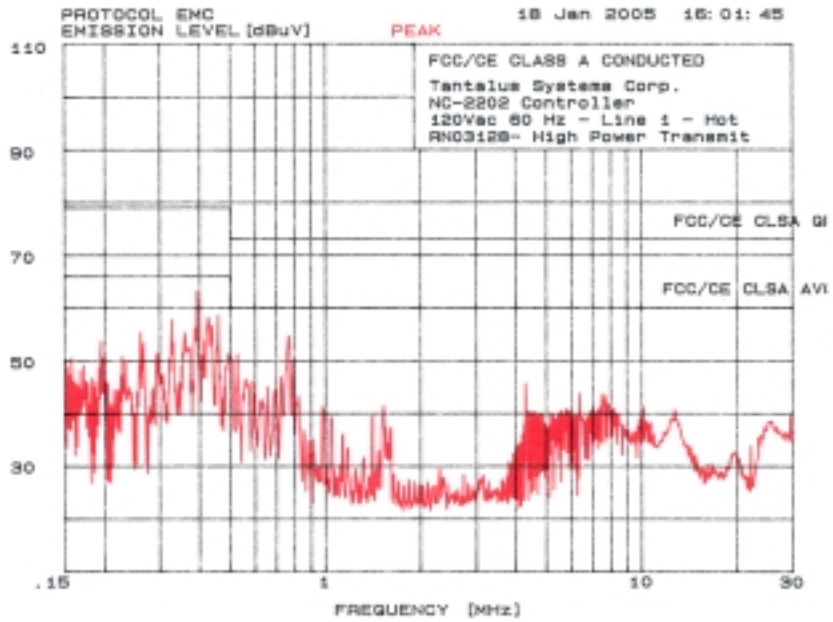


Line 1 - 120 Vac 60Hz - Hot - In Receive Mode

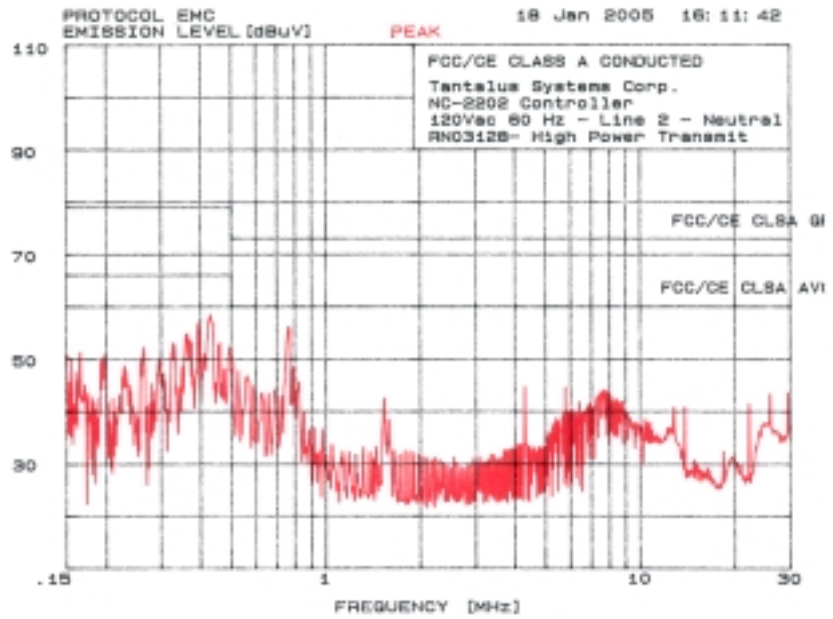


Line 2 - 120 Vac 60 Hz - Neutral - In Receive Mode





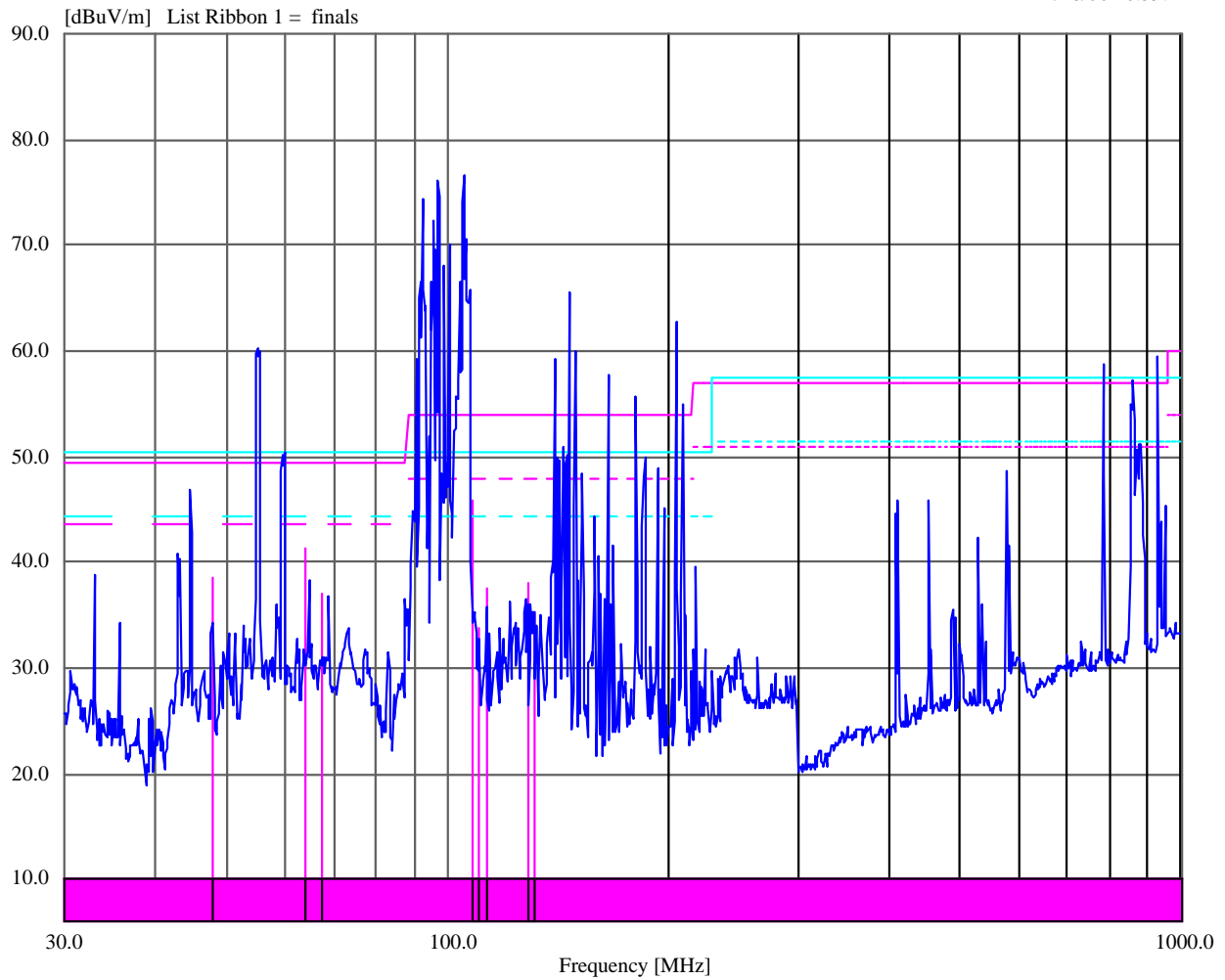
Line 1 – 120 Vac 60Hz – Hot - In Transmit Mode



Line 2 - 120 Vac 60 Hz – Neutral - In Transmit Mode

# Radiated Emissions Plot

1/18/06 16:59:12



- FCC Limit
- - - 10 dB below FCC Limit
- CISPR Limit
- - - 10 dB below CISPR Limit



(Dark Blue Traces) All Emissions including ambient noise.



(Vertical Pink Line) – Markings of each Suspect Frequency  
("X") – indicates Quasi-Peak