LambdaMetrics, Inc.
PO Box 1029
Cedar Park, TX. 78630-1029
Voice and Fax (512) 219-8218
e-mail:benbibb@lambdametrics.com

TEST RECORD, FCC PART 15,
PROXIMITY TRANSCEIVER
SPREAD SPECTRUM TRANSCIEVER
Operating on: 902 - 928 MHz
> Certification <
TEST REPORT No. LM05158A

Client P/O No. 29971A-001, L/M Proposal 04068A

FREQUENCY HOPPING TRANSCIEVER

Grantee: ProNet, Inc.

Model: PROX-100

Grantee Code: NBI

LAB CODE 200122-0

NOTICE: (1) This report must not be used to claim product endorsement by **NVLAP**, the **FCC** or any other Agency.

(2) **ProNet, Inc.** is authorized to reproduce this copyrighted report only if it is reproduced and distributed in its entirety.

(3) The significance of this report is dependent on the representative character of the test samples submitted for evaluation. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.

Measurements Made For:
Mr. Robert Palmer, Senior ME **ProNet, Inc.** 6340 LBJ Freeway Dallas, TX, USA 75240 Tel: (972) 687-2189 Fax: (972) 774-0640

Equipment Tested:	
MFG:	**ProNet, Inc.** 6340 LBJ Freeway Dallas, TX, USA 75240
Model:	**PROX-100** Frequency hopping, spread spectrum, proximity transceiver.

REPORT APPROVED 20 May, 1998 BY: Ben Bibb

Ben Bibb, NARTE EMC-001970-NE,
President, **LambdaMetrics, Inc.**

TEST SPECIFICATION and CERTIFICATION
ProNet, Inc. Proximity Transciever, PROX-100

Tested For: Conformance to 47 CFR 15 Subpart C, Intentional Radiators

Device(s) Tested: Model: **PROX-100** (FCC ID: NBI-PROX100) frequency hopping spread spectrum transceiver.

Manufacturer: **ProNet, Inc.**
6340 LBJ Freeway
Dallas, TX, USA 75240
Tel: (972) 687-2189 Fax: (972) 774-0640

Use of Test: File with the Federal Communication Commission (FCC) for CERTIFICATION, for use as a continuing conformity guide for production control.

Test Requester: Mr. Robert H. Palmer, Senior Mechanical Engineer, **ProNet, Inc.**

Specifications:
- (a.) 47 CFR Parts 2. and 15.
- (b.) CISPR 22 : 1993-12 Limits and Methods of Measurement of Radio Disturbance Characteristics of ITE
- (c.) ANSI C63.4-1992 Methods of Measurement of Radio Noise Emissions, 9 KHz to 40 GHz
- (d.) CISPR 16-1 : 1993-08 Specifications for Radio Disturbance and Immunity Measuring Apparatus and Methods
- (a.) **LambdaMetrics™** Proposal 04068A
- (f.) **LambdaMetrics™** Test Procedure FCC15V-2, 1996
- (g.) **LambdaMetrics™** Test Procedure FCCIR-2, 1996

Test Conducted at: **LambdaMetrics™** Test Facility
Cedar Park, TX. (512) 219-8218

Test Date(s): 05 May, 1998 through 19 May, 1998

Test Result: Measurements documented herein indicate the **ProNet, INC.**, MODEL: **PROX-100** Proximity Transceiver is in compliance with 47 CFR **15.31, 15.203, 15.205, 15.209, 15.231**, pertaining to measurement standards, antenna requirements, restricted bands, general emission limits, and in-band emission limits as applicable to the product. This product is eligible for **Certification** by the FCC.

MEASUREMENT CERTIFICATION

The undersigned hereby certify that this report reflects the actual test conditions and equipment used, and that the conditions and results obtained during this test are accurately documented herein. Further, the Test Engineer certifies that, within the last year, the measurement receiver, amplifier(s), cable(s), attenuator(s), signal source(s), and antenna(s) have been calibrated and are traceable to NIST within the stated transfer tolerances. An Audited Quality Manual and procedures are in use.

Report Written By: Patricia Bibb	Date Signed: 20 May 1998 20 May, 1998
Test Engineer: Ben Bibb NARTE EMC-001970-NE	Date Signed: 20 May 1998 20 May, 1998

TABLE OF CONTENTS

1. INTRODUCTION, TEST RECORD 1

1.1 Scope 1

1.2 Purpose 1

1.3 Summary 1

2. TEST ENVIRONMENT 2

2.1 Test Sample Description 2

2.2 Test configuration Description 2
2.2.1 1.5 Meter Mode-Stirred Shielded Chamber 3
2.2.2 TEM Cell 3
2.2.3 Test Equipment and Antennas 3

2.3 Calibration 4

2.4 Measurement Uncertainty 4

2.5 Measurement Uncertainty Details 5

2.6 Order of Testing 5

3. TEST PROCEDURES AND RESULTS 7

3.1 Emission Testing 7
3.1.1 Test Description 7
3.1.2 Test Configuration, Radiated 7
3.1.3 Test Procedure, Radiated 7
3.1.4 Test Results, Radiated Emissions 8
3.1.5 Test Results, §15.207 - 15.209 Emissions 9

4. CONCLUSIONS 10

4.1 Labeling Requirements 10

4.2 RFR Safety 10

LIST OF TABLES

Table 1-1: Test Results, General 1
Table 2-1: Components Making up Test 2
Table 2-2: Test Equipment List 6
Table 3-1: 3 meter OATS Radiated Emissions Data, Transceiver, PROX-Vertical 8
Table 3-1: 3 meter OATS Radiated Emissions Data, Transceiver, PROX-Horizontal 9

LIST OF FIGURES

Figure 1: General *Campus-Trac*™ System Timing 28
Figure 2: Power Line Conducted Emissions, Worst Case 29
Figure 3: Radiated Emissions, Concentrator and PROX, 30 to 200 MHz 29
Figure 4: Radiated Emissions, Concentrator and PROX, 200 to 500 MHz 30
Figure 5: Radiated Emissions, PROX, in-band 30

LIST OF PHOTOGRAPHS

Photo 1: PROX-100, Vertical, Ceiling Mount, External View 11
Photo 2: PROX-100, Vertical, Ceiling Mount, Antenna and Ground Plane 12
Photo 3: PROX-100, Vertical, Ceiling Mount, Exploded View 13
Photo 4: PROX-100, Vertical, Ceiling Mount, , PCB, Top View 14
Photo 5: PROX-100, Vertical, Ceiling Mount, PCB, Bottom View 15
Photo 6: PROX-100, Horizontal, Wall Mount, Exterior View 16
Photo 7: PROX-100, Horizontal, Wall Mount, Patch Antenna View 17
Photo 8: PROX-100, Horizontal, Wall Mount, Exploded View 18
Photo 9: PROX-100, Horizontal, Wall Mount, PCB, Component Side 19
Photo 10: PROX-100, Horizontal, Wall Mount, PCB, Circuit Side 20
Photo 11: RF Shield Removed 21
Photo 12: RF Shield Removed 21
Photo 13: Antenna Conducted Emissions, 915 MHz to 8 GHz, PROX-V 22
Photo 14: Antenna Conducted Emissions, 915 MHz to 9.1 GHz, PROX-V 22
Photo 15: Investigation of Hop Timing 23
Photo 16: Power Line Conducted Emissios in M/S Chamber 23
Photo 17: Radiated Emission Pre-scan, M/S Chamber, 30 to 200 MHz 24
Photo 18: Radiated Emission Pre-scan, M/S Chamber, 200 MHz to 1 GHz 24
Photo 19: Spurious and Harmonic Emission Investigation, > 1 GHz 25
Photo 20: Support Computer and Concentrator in M/S Chamber 25
Photo 21: PROX-V, Maximum Emission Verification on 3 m OATS 26
Photo 22: PROX-V, Maximum Emission Verification on 3 m OATS 26
Photo 23: RFR Measurement in Laboratory 27
Photo 24: RFR Measurement, Far Field 27

LIST OF EXHIBITS

ID Label, Photo and Drawing .... **EXHIBIT A**
Campus-Trac™ Band Plan .... **EXHIBIT B**
PROX-100 Theory of Operation .... **EXHIBIT C**
PROX-100 Schematics .... **EXHIBIT D**
PROX-100 Installation Guide .... **EXHIBIT E**
PAD-1000 Theory of Operation .... **EXHIBIT F**
LambdaMetrics, Inc. Test Report, L/M 05158A .... **EXHIBIT 1**

1. INTRODUCTION, TEST RECORD

1.1 Scope

This report documents tests showing technical conformity with the FCC rules in 47 CFR 15 for intentional radiators. It details the results of the emission testing performed from 05 May, 1998 through 19 May, 1998 on the MODEL: **PROX-100,** frequency hopping, spread spectrum, proximity transceiver manufactured by **ProNet, Inc.** of Dallas Texas. The **PROX-100**, Part Numbers **CT-01000** - a ceiling mounted vertical emitter and the **CT-01100 -** a wall mounted horizontal emitter were evaluated. The two **PROX-100** versions are identical except for packaging and antenna. Photographs are provided to show the same electronics in each device and test data is provided to show the different radiated emission levels. The **PROX-100** will be called Equipment Under Test (**EUT**) in this report.

1.2 Purpose

Testing has been performed to document compliance with **47 CFR §15.247** and other relevant rules. The primary 902 to 928 MHz radiated, spurious, and harmonic emissions from the **EUT's** transmitter and receiver have been measured. System timing and power levels have been verified to be in compliance with the manufacturer's technical description. Radiated emissions from the **EUT** have been evaluated from 9 KHz through 10 GHz with particular interest in any emissions falling in certain restricted bands identified in **§15.205.** Spectrum analyzer plots, oscilloscope plots, and other technical measurement documentation is included in this report which will demonstrate conformity with the required emission limitations. This report shows that the **EUT** is qualified for FCC **CERTIFICATION.** These test results are also baseline data for continued product assessment to control emission conformity of future production units.

1.3 Summary

The **EUT** was found to conform to the current FCC emission regulations when modified as described below. The test samples, which were provided by ProNet, Inc. appear to be from a production run. The antenna arrangements for each **EUT** clearly comply with **§15.203** in that the antennas are inside the tamper resistant enclosures. The **EUT** is a DC operated, unlicensed, 1 Watt EIRP, intermittent operating proximity transceiver. This frequency hopping transceiver is part of a personal alarm locating system. The **EUT** is used with a Certified FHSS alarm transmitter called the PAD-1000 - FCC ID: NBI-PAD1000. This **EUT** is clearly commercial equipment. This **EUT** is powered using four unshielded DC conductors from a concentrator/computer interface which is Verified equipment. Some verification test data for the Concentrator is provided herein for reference only. The **EUT** is to be **CERTIFIED** by the FCC under Part 15. A complete technical description with photographs showing electrical and mechanical construction, and emission test data are included in this report. Table 1.1 summarizes the emission test results.

902 to 928 MHz Band F/H Spread Spectrum Transceiver

47 CFR 15.205, 15.209, and 15.247 Radiated Emissions, General 0.009 MHz to 10 GHz	
Results	**Modifications**
Transmitter and Receiver **PASS** requirements of the above Emission Limitations.	NONE

Table 1-1: Test Results, General

2. TEST ENVIRONMENT

2.1 Test Sample Description

The **EUT** is a DC powered alarm proximity transceiver, which is powered by and communicates to a concentrator/computer then to a security office. The system uses frequency hopping spread spectrum data in the 902 MHz to 928 MHz band. The **EUT** uses the EXACT same electronic assembly in two different tamper resistant mechanical packages to achieve convenient horizontal and vertical emissions. The electronic assembly consists of a single UL 94V-0 printed circuit board containing the RF and digital circuits. The electronic assembly is packaged in a well shielded enclosure with a patch antenna or a monopole and ground plane to achieve the desired polarization. Each version is tested and reported herein.

The electronic design of the **EUT** is very well implemented with good power bypassing, and RF energy management. Mechanical photographs are provided herein.

The Campus-Trac™ system divides the 902 to 928 MHz band into 1,040 25 KHz channels. A 112 channel (2.8 MHz) guard-band is provided at the low end of the band, which means that the first hopping channel is 904.8 MHz. The highest channel hopped to is 914.750 MHz, the high end of the band (915 to 928 MHz) is not used. The *Campus-Trac™ Band Plan* is presented in tabular form in **Exhibit A**. The associated concentrator allows the control computer to select one of four operating bands. In-band and spurious emissions were evaluated on each of the four (4) possible bands in the M/S chamber. The lowest and highest frequency bands are reported herein. Set A starts on 904.800 MHz and hops in 50 randomly picked 0.200 MHz steps to 914.600 MHz, with a dwell time of about 75 milliseconds per channel. Set D starts on 904.950 MHz and hops in 50 randomly picked 0.200 MHz steps to 914.750 MHz.

2.2 Test configuration Description

No modifications were required to configure the **EUT** for compliance testing. A laptop computer with software, which allowed access to the **EUTs** diagnostic mode for this evaluation, controlled the concentrator.

A radiated emission pre-scan was conducted in the 65 m^3 mode stirred chamber to determine possible emissions which might pose a compliance problem. The M/S chamber evaluations include all emissions quantified from the laptop, concentrator, and **EUT**(s). M/S chamber emissions are radiated power, this has been statistically converted to V/m at 3 meters for reference only. Final radiated emission measurements were made on the 3 meter OATS with the **EUT** positioned 80 cm above the ground plane. Investigation of the higher frequency harmonics was carried out at a distance of five meters and translated to 3 meters by adding $(20 * \log_{10} (5/3))$ to the 5 meter reading. Photographs of the emission test configurations are provided herein. Table 2.1 lists the components making up this test suite.

EQUIPMENT TYPE	MANUFACTURER	MODEL NO.	SERIAL NO.	AGENCY ID
* **PROX-100** Vert.	ProNet, Inc.	CT-01000	D0000136	NBI-PROX100
* **PROX-100** Hor.	ProNet, Inc.	CT-01100	D0000135	NBI-PROX100
Concentrator	ProNet, Inc.	CT-01300		MDoC
Laptop	Toshiba	CT-1950	04432068	CJ6UK192

* =EUT

Table 2-1: Components Making up Test

2.2.1 1.5 Meter Mode-Stirred Shielded Chamber

Radiated emission pre-scans, conducted emissions testing, and immunity testing are performed in a 4 meter by 5 meter (68 m^3) wood frame building, in which the floor, walls, and ceiling are covered with galvanized steel, bonded and grounded, to shield from outside ambient RF signals. This chamber is slightly larger than the small NIST M/S chamber and operates within the technical confines of NBS TN 1092. Radiated emission and susceptance measurements are normally made on the diagonal at distances of 1.5 to 2 meters. This chamber is equipped with a large rotating mode-stirrer, which is easily stowed for line-conducted measurements. Stirring efficiency data is on file for this chamber. An 80 cm clearance is maintained between all edges of an EUT and the chamber walls, except that a 40 cm clearance is maintained to the back wall for normal power line conducted measurements. LISNs are permanently bonded to the ground plane for line-conducted tests. Line power to this test facility is isolated and back-filtered.

2.2.2 TEM Cell

The 1.2 meter, **EMCO Model 5104** TEM Cell is used for field probe and sensor calibration from DC through 350 MHz. This cell can be absorber loaded for use at higher frequencies.

2.2.3 Test Equipment and Antennas

Table 2.2 contains a complete list of the test equipment routinely used for compliance testing. Each item applicable to and used for the tests documented herein are checked ✓. The remaining items were available but were not used for this test record. The measurement items affecting the accuracy of a test record are maintained in accordance with the provisions of ISO Guide 25 sub. 8 and section 8 of the **LambdaMetrics, Inc.** Quality Manual dated 07 October, 1996, last revised 1 January, 1998. The last NVLAP physical audit was 24 April, 1997. E-field measurements over the 30 to 1,000 MHz range are traceable to balanced dipoles. Broadband antennas are calibrated yearly using the IEEE three-antenna method on two different test ranges. Broadband horn antennas are calibrated using the IEEE three-antenna method on the L/M test range. Radiated power measurements above 0.5 V/m are traceable to the EMR-20C, which is verified by power applied to the TEM cell below 300 MHz and Wandel and the Goltermann (German) standards to 3 GHz. Coaxial power measurements are traceable to NIST via one of two digital power meters. GPIB controlled statistical sampling is used to reduce errors in antenna calibration and power measurement. Each digital power meter and associated sensor is calibrated on a yearly basis with one or the other being calibrated each six month interval.

2.3 Calibration

In this report, dBuV/m and dBu are the same and taken as dB above one microvolt per meter, a unit of field measurement.

Each of the three broadband antennas used was calibrated at r = 3 meters and h = 1 to 4 meters, on a different site, using the IEEE three antenna method, within the last 12 months. The standard dipoles were calibrated within the last 12 months by an independent laboratory. Resonant dipoles are used to finalize radiated emissions, which are within 3 dB of the limit.

Cable quality is monitored by regular calibration of all cables used to report emissions. Calibrated 5 dB attenuators, specified for the frequency of use, are used at the antenna terminal to provide a consistent impedance match. Pre-amplifiers are regularly tested for impedance and response, and documented over the frequency of use. Filters, isolators, and power splitters receive the same careful attention to performance documentation.

Sometimes it is necessary to decrease the specified radiated measurement distance to differentiate between **EUT** emissions and nearby signals or measure a very weak signal. When required, the published emission limit is translated to a new measurement distance by the equation:

$$\textbf{New limit}\ (\text{dBuV/m}) = \textbf{Limit}\ (\text{dBuV/m}) + 20 \log (d^{limit}/d^{measure})$$

EXAMPLE: The published limit, measured at 10 meters, for the frequency range of 30 to 230 MHz is 40 dBu. Then for 3 meters, 40 + (20 log (10/3)) = **50.46 dBu.**

Reported emission measurements are always made at distances greater than $(\lambda/2*\Pi)$.

2.4 Measurement Uncertainty

The nominal measurement uncertainty for OATS measurements is the combination of spectrum analyzer, cables, attenuators, preamplifier, and antenna factors (±1.5, ±0.3, ±0.4, ±0.6, ±1.2 dB) and is 2.07 dB plus a 1.5 dB margin for mismatch, drift, and other minor terms.

For this test, direct comparison of a calibrated power meter and the measured signal was made with a precision power splitter. This technique reduces the measurement uncertainty to 2 dB or less. The primary uncertainty term is the antenna factor. Uncertainty relating to instrumentation error and drift is virtually eliminated.

The major uncertainty term for the radiated emission **pre-scan** is in the M/S chamber, which for this size and type **EUT**, has been statistically within ±4dB. During the pre-scan it was clearly determined that all harmonics from the internal clocks were well below the emission limits. For the general emissions on the **OATS**, the **EUT** must be 2 dB, plus any desired margin, under the stated limit to assure consistent passing measurements. To guarantee radiated emissions are under the limit, for this and other identical transceivers, it is suggested that this **EUT** should test 5 dB below the limit. (2 dB to cover our uncertainty plus a 3 dB manufacturing margin. (With some statistical justification, for this **EUT**, the manufacturing margin might be reduced.)

This laboratory certifies the correctness of test results reported herein and *does not require any margins*. Measurement uncertainty is a real term and present in ALL measurements. While careful DOX and implementation can reduce errors to acceptable values, measurement uncertainty is always present.

2.5 Measurement Uncertainty Details

For the spurious emission and harmonic field strength measurements, a substitution method of calibration was used. The 6 dB attenuator and coax were removed from the measurement antenna at the OATS and looped back into the laboratory where an established reference signal from a power split signal generator was applied. The second port of the HP splitter was attached to a HP 8481D and HP 436A power meter. This provides a calibration U_c of 0.4 dB. The calibration signal was usually at 50 dBuV, traceable to the HP 436A and 8481D with no range changes, (direct substitution). Combining terms for this type of measurement yields an RSS U of 1 dB most of which is antenna uncertainty. Coverage of 3 could be applied, to obtain 95% confidence, for a final radiated emission measurement Uc of 3 dB. For this field strength test, the distance error was always such that measurements were made at less than 3.0 meters and always carefully maximized. Maximization was done using peak detection.

2.6 Order of Testing

Each **EUT**, the supporting concentrator and laptop computer were set up in the M/S chamber and the mode stirrer started. The **EUT** was evaluated for harmonic emissions from 30 MHz through 10 GHz. Antenna conducted emission measurements were made on each **EUT** in the laboratory to provide reference information. The **EUT**s were then moved to the 3 meter OATS for final emission testing over the 9 KHz to 10 GHz band. During emission testing the concentrator line supply voltage was varied from 90 to 140 VAC.

Two proximity transceiver samples were evaluated and documented, one vertical and one horizontal. The higher order harmonics from each were measured at r = 5 meter on the OATS.

Finally each of the **EUT** samples were placed on a 2 cm Styrofoam™ block inside an environmental chamber for temperature effect evaluation. The concentrator line supply voltage was varied from 90 to 140 VAC for measurement of frequency and power versus temperature. Each sample was warmed or cooled to the desired temperature then quickly placed next to the near-field sensor and activated for power and frequency measurement using a calibrated reference method.

The outside ambient temperature was 85° +/- 5° Fahrenheit and the relative humidity was about 80% during the OATS test period.

The items ✓[ed] were used to obtain the data for this test record.

✓	Equipment Description	Model #	Serial #	Last Cal
✓	OATS, 3 meter	L/M OATS-3	N/A	04 Jun 97
	OATS, 10 meter	L/M OATS-10	N/A	04 Jun 97
✓	Chamber, Test, 1.5 mtr, M/S	1.5MSTC	11223A	04 Jun 97
	Clamp, Current, 0.01 to 100 MHz	91550-2	206	21 Jun 97
✓	Chamber, Environmental	Delta MK5750	5166	03 Apr 98
	LISN, 50 Ohm, 50 uHy, 4 Amp	C63492-3-4A	071592B	02 Sep 97
	LISN, 50 Ohm, 50 uHy, 8 Amp	C63492-3-8A	810-00278	02 Sep 97
	Filter, High Pass, 10 KHz	HPF3	060192	02 Sep 97
✓	Antenna, Rod, 41", 0.01 - 30 MHz	ELMCO RVR-25	010A	02 Sep 97
✓	Antenna, Biconical, 30-200 MHz	CDI B-100	298	11 Sep 97
✓	Antenna, Log periodic, EMCO, 200-1000 MHz	3146	2766	11 Sep 97
	Antenna, Dipole Kit, EMCO, 30-1000 MHz	3121C	539	09 Sep 97
	Antenna, E-Field, 0.1-300 MHz	EFG-1	03	09 Sep 97
✓	Antenna, Dual Ridge Guide, 1-18 GHz	LM1-18-N2 "A"	110	19 Sep 97
	Antenna, Standard Horn, 18-26 GHz, 25 dB	42-7025	078	11 Nov 97
	Antenna, Standard Horn, 26-40 GHz, 25 dB	28-7025	0141	18 Sep 97
	Antenna, Standard Horn, 40 - 60 GHz, 25 dB	19-7025	035	11 Nov 97
	Antenna, Standard Horn, 75 110 GHz, 25 dB	10-7025	1107	11 Nov 97
	Antenna, Standard Horn, M'Tech, 90 - 140 GHz	SGH-08-RP000 8344	012	20 Oct 97
	Mon, Field, W&G 100 KHz to 3 GHz	EMR-20C	B-0074	08 Dec 97
	Mon, Field, W&G 5 Hz to 30 KHz	EFA-1	B-0057	09 Dec 97
✓	Receiver, EMI, 9 KHz to 1 GHz	EMC-25 MK-III	351	02 Aug 96
✓	Spectrum Analyzer, 100 Hz 8.4 GHz	ATFST R3465	35060162	18 Dec 97
✓	Spectrum Analyzer, TEK, 22 GHz	492BP	B010153	21 Nov 97
	Spectrum Analyzer, 5 Hz to 50 KHz	HP 358CA-02	A06305	07 Oct 97
	Spectrum Analyzer, QP detector, 9 KHz-1.8G	TEK 2712-12	B011218	05 Jan 98
	Mixer, HP, 11517A, 12 - 40 GHz, w/accys.	11517A	2325A00175	19 Sep 97
	Mixer, HP, 26 - 40 GHz, w/accys.	11974A	1315A00105	18 Sep 97
	Mixer, PMP, 60 - 90 GHz	FM	073	20 Oct 97
	Mixer, PMP, 90 140 GHz	FM	068	20 Oct 97
✓	Counter, Frequency, EIP, 110 GHz	548A-590	01783	16 Dec 97
✓	Oscillator, Disciplined (2)	2010B	01724	12 Mar 98
✓	Receiver, WWVB, 60 KHz	8163	0725	09 Mar 98
✓	Power Meter, 0.1 to 60 GHz (2)	436A	1719A01744	05 May 97
✓	Power Sensor, -70 to -20 dBm, 0.01 to 18 GHz (2)	8481D	3643A15709	23 May 97
✓	Power Splitter, Resistive, DC to 18 GHz	121667A	12011	05 May 97
	Wave Analyzer, 5HZ to 50 KHz	HP 3581A	A03063	08 Oct 97
✓	Preselector, 9 KHz-1800 MHz	TEK 2706	B010106	07 Mar 97
✓	Preamplifier, 100 KHz - 1300 MHz (3)	HP 8447D	A01897	07 Mar 97
✓	Preamplifier, 100 MHz - 20 GHz	MITEQ 0.1-20 GHz	LM021195A	05 Apr 98
✓	Attenuator, 50 Ohm, HP, 6 dB, (2)	8491B	-	17 Nov 97
	Attenuator, Kit, HP, Reference	11582A	-	15 Nov 97
	Attenuator, 50 Ohm, 50 dB, 4 GHz	WIE-10350N	521	26 Nov 96
✓	Filter, HPF, 1.5 GHz, SMA	SMT 41241	306A	05 Apr 98
✓	Filter, HPF, 3.0 GHz, N	u-Phase H3000N	153	05 Apr 98
	Coupler, Directional, 1-4 GHz	Narda 3022-20	70741	15 Dec 97
	Coupler, Directional, 2-4 GHz	Narda 3003-30	1639	15 Dec, 97
	Coupler, Directional, 4-8 GHz	Narda 22014-30	06	15 Dec, 97
	Coupler, Directional, 8-12 GHz	Narda 22046-20	21	15 Dec 97
	Coupler, Directional, 2-18 GHz	Krytar 1818 16dB	2597	15 Dec 97
	Directional Coupler / Wattmeter	44AP	26067P	26 Nov 96
	Generator, Signal, HP, 10 MHz 40 GHz	8350B	1435A00817	16 Dec 97
✓	Generator, Signal, HP, 2 26.5 GHz	8673B	1546A00308	15 Dec 97
	Generator, Signal, HP, 0.99 GHz	8656A	2341A05572	03 Sep 97
✓	Generator, Signal, HP 2.6 GHz	8660D	2741A0209	11 Nov 97
	Oscilloscope, Tektronix, 100 MHz	THS720P	B010609	22 Oct 97
✓	Oscilloscope, Tektronix, 1 GHz / 5 GHz	TDS680B	B030137	08 Aug 97

Table 2-2: Test Equipment List

 PO Box 1029 Cedar Park, Texas 78630-1029, USA (512) 219-8218

3. TEST PROCEDURES AND RESULTS

3.1 Emission Testing

3.1.1 Test Description

ANSI C63.4-1992, *Methods of Measurement of Radio Noise Emissions, 9 KHz to 40 GHz,* **CISPR 16-1 : 1993-08**, *Specifications For Radio Disturbance and Immunity Measuring Apparatus and Methods*, and **CISPR Publications 22 : 1993-12**, *Limits and methods of measurement of radio interference of information technology equipment*, were the guiding documents for equipment, test set-ups, and procedures used during these tests. Radiated emissions from 9 KHz to 10 GHz were measured.

3.1.2 Test Configuration, Radiated

The radiated emission pre-scan for each sample transceiver was conducted on the diagonal centerline of the M/S chamber, 1 meter from all chamber walls. For final radiated emissions testing on the OATS, each transceiver was placed in the center of the non-conductive test table 80 cm above the turntable and ground plane.

The maximum emission obtained in either antenna polarity and maximized for azimuth is reported. Each **EUT** was placed in a diagnostic mode that provided continuous hopping - no listen time. During testing, the Concentrator AC power was varied from 90 VAC to 140 VAC.

3.1.3 Test Procedure, Radiated

General emission measurements were made using procedures and equipment outlined in ANSI C63.4-1992, and CISPR 22 to determine compliance with **47 CFR 15.205** and **15.209.** Antenna conducted emission measurements were made for each **EUT** and those values were used to gain perspective into the possible radiated values while evaluating the OATS emissions. Signal detection below 1,000 MHz was quasi-peak. Emissions measured above 1,000 MHz were peak detected in a 100 KHz RBW and in a 1 MHz RBW and converted to average values. Emissions in-band (902 - 928 MHz) were measured as outlined in ANSI C63.4-1992 using peak and average detection IAW **47 CFR 15.35(b)**. Peak detected plots are presented here for clarity.

Harmonic emission measurements above 1 GHz were conducted on the OATS with the ridge-guide horn antenna, microwave cable, appropriate filter, and pre-amplifier using procedures outlined in ANSI C63.4 for intentional radiators. Height and azimuth scans were performed to obtain maximum emissions on all measurements. Each harmonic of the transmitter and LO was investigated through 9,280 GHz (10^{th} harmonic of 928 MHz) with particular emphasis placed on measuring the energy transmitted in the restricted bands listed in **47 CFR 15.205.**

For demonstrating compliance with **15.205** which provides an average detected limit, first each harmonic band was evaluated in the peak detected mode in both 100 KHz and 1 MHz RBW. Then the average power function of the ADVANTEST R3265A was adjusted as follows: Option 76 ON, (measurement of average power density ON), RBW = 3 MHz, VBW = 3 MHz, Sweep Width = 10 MHz, Measurement Window Width = 1 MHz, Sweep Time = 1 sec, and average time set to 130 sec. (The cycle time of the PR code is 13 seconds.) The same results were obtained with M/W width = 100 KHz and window sweep = 0.1 second. The window was placed in the center and to each side of center and the average run. The average detected power on each harmonic measured 25 dB or more below the peak power.

?
NOT ACCEPTABLE

For verification of compliance with **47 CFR 15.205**, a peak to average conversion factor of 22.4 dB is used in this report. The derivation of this factor is shown below.

3.1.4 Test Results, Radiated Emissions

The **EUT**s measured acceptably below the limits currently established in **47 CFR 15** for intentional radiators when measured IAW the procedures of **47 CFR 15.**

In-band emissions (902 - 928 MHz) from the transmitters were measured at 3m using a log periodic antenna on the OATS to determine the general characteristics of the hopping scheme and RF timing. This data also provides an indication of spectrum shape and possible LO emissions. Oscilloscope plots and spectrum analyzer plots of this data are included herein.

At 3.0 meters, the highest signal level **radiated** from either of the vertical or horizontal transmitters was at 910 MHz, 124.5 dBuV/m (Peak) VERTICAL. This emission is 0.5 dB below the maximum emission (125 dBuV/m at 3 m) allowed by **47 CFR 15.247.** The highest spurious emission was the third harmonic of the **PROX-100,** in a restricted band, at 75.2 dBuV/m (Peak) VERTICAL and HORIZONTAL, 1.2 dB below the limits prescribed by **15.209** and **15.205.** All significant OATS measured radiated emissions are presented in the table below. Signals between 9 KHz and 900 MHz were more than 20 dB below the limits of **15.205** and **15.209.**

As evaluated, this system has adequate design, shielding, and RF decoupling characteristics to meet the emission limits established by the FCC for intentional radiators. The **EUT**s that were tested are identified in the enclosed photographs. Each **EUT** provided identical antenna conducted spurious emission levels when measured in a 50 Ohm system.

Compliance may be attained as indicated in this report with the specified product design and configuration that is described herein. Any changes to the design or implementation must be evaluated for any possible impact on the emission characteristics of the product. See **47 CFR 15.21.**

ProNet, Inc. PROX-V (Vertical) measured at 3.0 m on OATS, 15 May, 1998 (Peak Detected in 1 MHz RBW)

Freq. MHz	Ant Fact	Cable loss	Atten.	Amp Gain	Measured	Pk. Field	Avg. Field	LIMIT	Lim. Margin
910	23.2	0.6	6	0	-12.30	F	124.50	125	0.50
1820	26.5	0.85	6	31.7	-60.72	47.93	25.53	54	28.47
2730	30.4	0.98	6	29.6	**-39.56**	**75.22**	**52.82**	**54**	**1.18**
3640	31.7	1.1	6	30.6	-57.72	57.48	35.08	54	18.92
4550	33.6	1.3	6	31.6	-56.50	59.80	37.40	54	16.60
5460	34.5	1.7	6	32.4	-56.22	60.58	38.18	54	15.82
6370	34.9	2.2	6	30.4	-67.38	52.32	29.92	54	24.08
7280	36.3	2.7	6	30.6	-78.06	43.34	20.94	54	33.06
8190	37.3	3.8	6	32.4	-82.32	39.38	16.98	54	37.02
9100	37.9	4.1	6	31.6	-82.15	41.25	18.85	54	35.15

Table 3-1: 3 meter OATS Radiated Emissions Data, Transceiver, PROX-Vertical

NOTE:

Measurements have been made using peak detection in a 1 MHz resolution bandwidth using max hold. Measurements were made over a long enough period to allow the hop set (13,000 ms) to repeat several times. Usually each measurement was integrated five minutes or more. Peak to average conversion was accomplished by applying the following formula to the measured peak value.

$$10 * \log10 (75 \text{ ms} / 13,000 \text{ ms}) = -22.4 \text{ dB}$$

The 2,370 MHz measurement was made using a direct substitution method, the measurement uncertainty is that of the antenna factor and the power meter/sensor.

ProNet, Inc. PROX-H (Horizontal) measured at 3.0 m on OATS, 15 May, 1998 (Peak Detected in 1 MHz RBW)

Freq. MHz	Ant Fact	Cable loss	Atten.	Amp Gain	Measured	Pk. Field	Avg. Field	LIMIT	Lim. Margin
910	23.2	0.60	6	0	-13.70		123.10	125	1.90
1820	26.5	0.85	6	31.7	-56.78	51.87	29.47	54	24.53
2730	30.4	0.98	6	29.6	**-49.16**	**65.62**	**43.22**	**54**	**10.78**
3640	31.7	1.10	6	30.6	-58.88	56.32	33.92	54	20.08
4550	33.6	1.30	6	31.6	-53.56	62.74	40.34	54	13.66
5460	34.5	1.70	6	32.4	-58.31	58.49	36.09	54	17.91
6370	34.9	2.20	6	30.4	-64.50	55.20	32.80	54	21.20
7280	36.3	2.70	6	30.6	-76.43	44.97	22.57	54	31.43
8190	37.3	3.80	6	32.4	-70.91	50.79	28.39	54	25.61
9100	37.9	4.10	6	31.6	-73.22	50.18	27.78	54	26.22

Table 3-1: 3 meter OATS Radiated Emissions Data, Transceiver, PROX-Horizontal

NOTE:

Measurements have been made using peak detection in a 1 MHz resolution bandwidth using max hold. Measurements were made over a long enough period to allow the hop set (13,000 ms) to repeat several times. Usually each measurement was integrated five minutes or more. Peak to average conversion was accomplished by applying the following formula to the measured peak value.

$$10 * \log 10\ (75\ \text{ms} / 13{,}000\ \text{ms}) = -22.4\ \text{dB}$$

3.1.5 Test Results, §15.207 - 15.209 Emissions

Emission measurements in the M/S chamber and on the 3 meter OATS show that the concentrator and **PROX-100** combination meet the emission requirements of CLASS B equipment, Home or Office use. Conducted emission measurements made on the **PROX-100** power/data cable show about 40 uV of broadband noise when QP detected. The concentrator produces broadband emission around 72 MHz which, when QP detected, is 15 dB below the limit. A narrowband signal on 170.57 MHz that is apparent when quantifying power in the M/S chamber is not detectable on the OATS at 3 meters.

Concentrator pre-scan test data is presented herein for reference, a verification report is on file for this product.

4. CONCLUSIONS

The **ProNet, Inc. Model PROX-100, Proximity Transceiver,** consisting of a 1 Watt horizontal or vertical polarized unlicensed Part 15 transceiver using frequency hopping spread spectrum is compliant with the requirements of 47 CFR 15 Subpart C based on the results contained in this report.

It is important that the two **PROX-100** versions use identical PC boards and that each respective antenna configuration remains as reported herein. Changes to the RF circuitry, antenna or layout will require re-evaluation for compliance with the Commission's rules.

It is the responsibility of the manufacturer under US law to submit this test report along with FCC Form 731 and await a Grant of Equipment Authorization from the FCC. Equipment meeting the technical requirements and requiring FCC approval, but not approved by the FCC may not be marketed until such FCC approval is granted. It is also the manufacturer's responsibility to ensure the continued compliance of future production units with the essential protection requirements.

4.1 Labeling Requirements

A notice to the purchaser of the **PROX-100** must be placed within the products documentation indicating that the transceiver has been CERTIFIED TO COMPLY with the current Federal Communications Commission rules, Part 15 Subpart C and explaining the conditions of allowed operation. The transceiver must display the appropriate FCC ID code as shown, on the right side, in Table 2.1 of this Test Report. This requirement is outlined in **47 CFR 15.19(3)**. Additional information on identification requirements for Certified equipment may be found in **2.925.**

4.2 RFR Safety (Radiofrequency radiation)

Current guidelines for radio frequency exposure limits are contained in OET-65. That bulletin requires that manufacturer's calculate or measure the possible human exposure hazard from intentional radiators such as the **PROX-100.** The maximum permissible exposure level for the general population in the **PROX-100** band (915 MHz) is; f/1,500 = 0.61 mW/cm^2 (37 V/m). This level is theoretically reached at a distance of approximately 15 cm (5.9 inches) from the **PROX-100** antenna.

If the above separation cannot be guaranteed by the installation then a warning statement must be included in the installation data and a label should be placed on each antenna. The label should state that there is a RF Radiation hazard exceeding the OET-65 limits for human exposure at distances closer than 15 cm (5.9 inches) to an operating **PROX-100** antenna.

$$\text{Power Density} = \frac{\text{EIRP}}{4\pi R^2}$$

However, direct measurement of the power density with the W&G EMR-20 field probe shows that the 30-minute averaged field at 10 cm is 20 Volts/meter and is 5 V/m at 50 cm. This is a reasonable 1/d fall off considering that the 10 cm measurement was made in the laboratory and that the 50 cm measurement was made outside, in the clear. See photographs 23 and 24.

At 10 cm the measured RFR is less than 1/2 the exposure limit. It is reasonable to keep humans at least 10 cm from the **PROX-100** antenna.

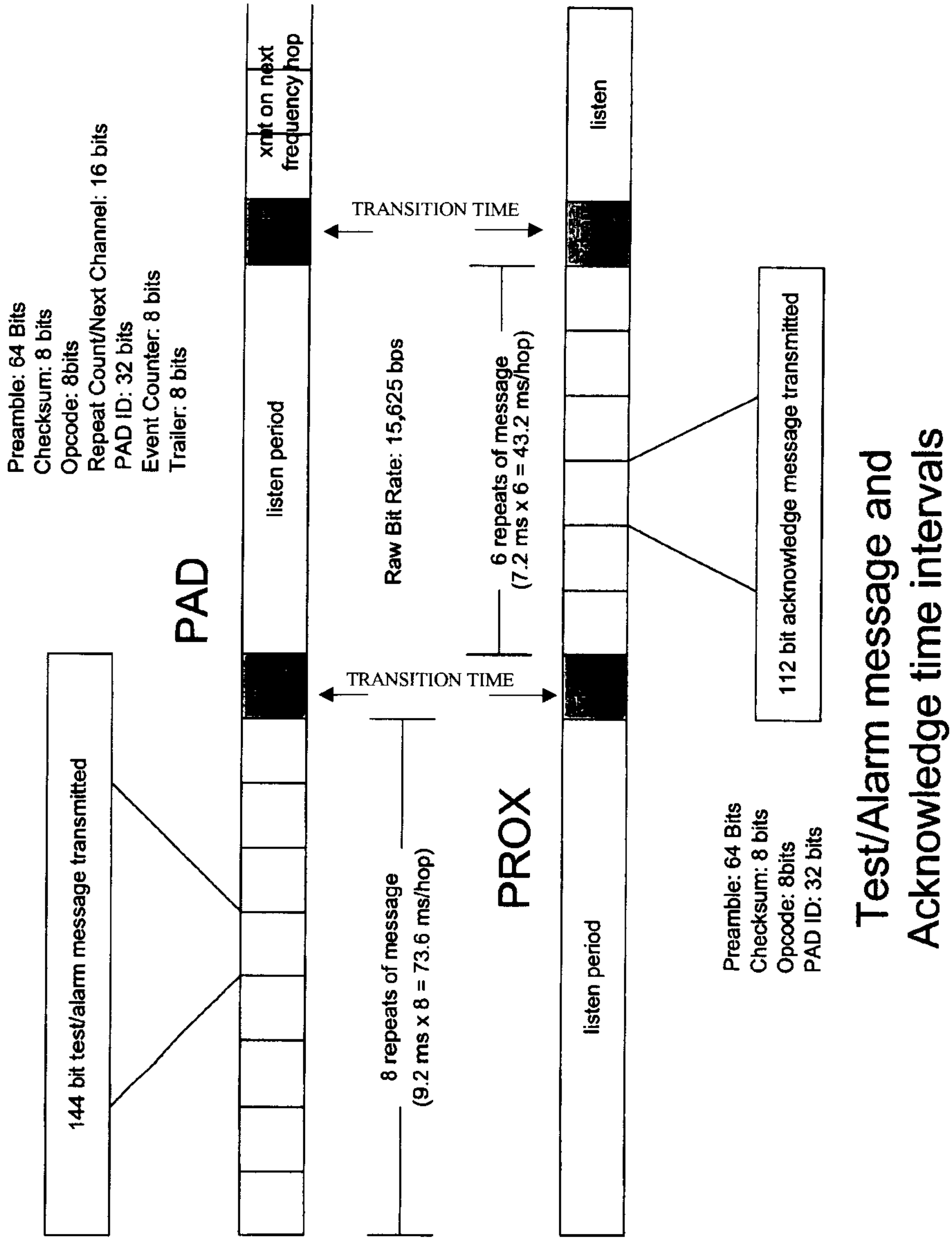


Figure 1: General *Campus-Trac*™ System Timing

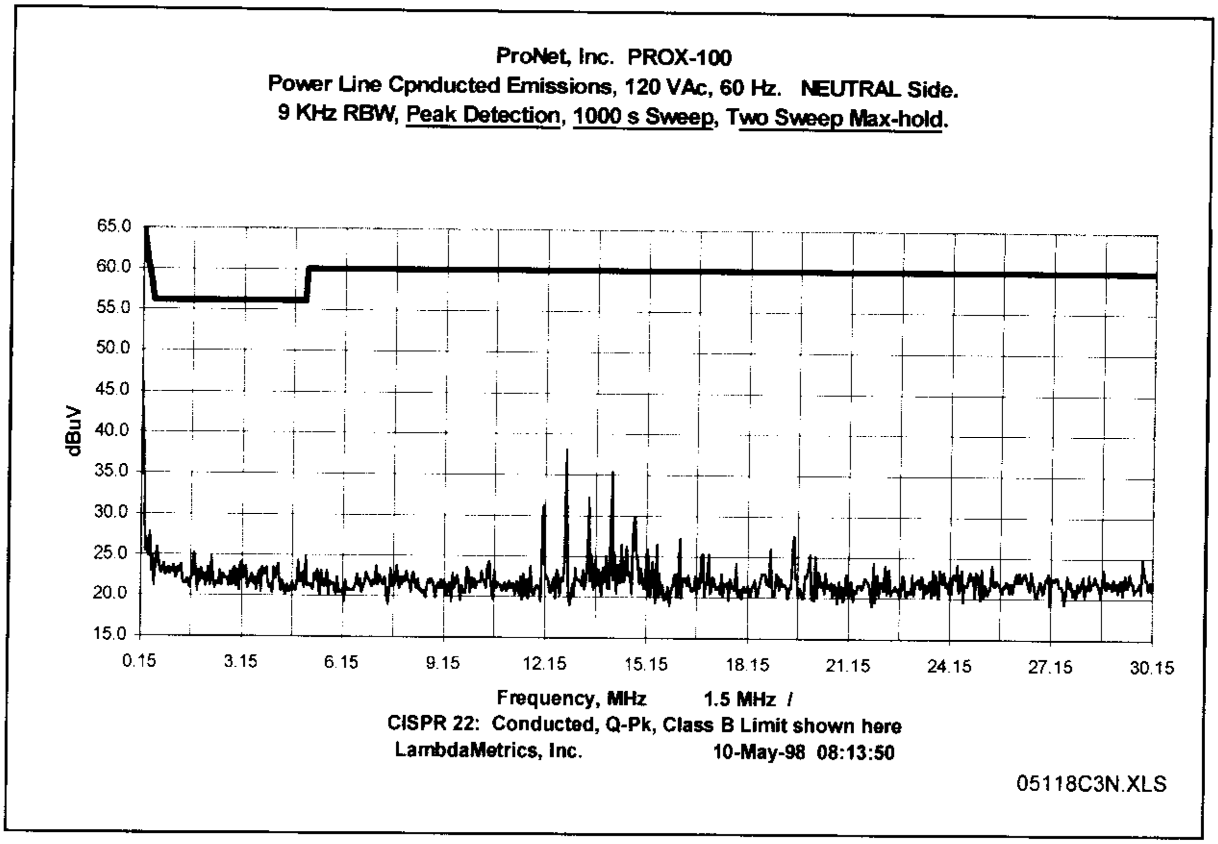


Figure 2: Power Line Conducted Emissions, Worst Case

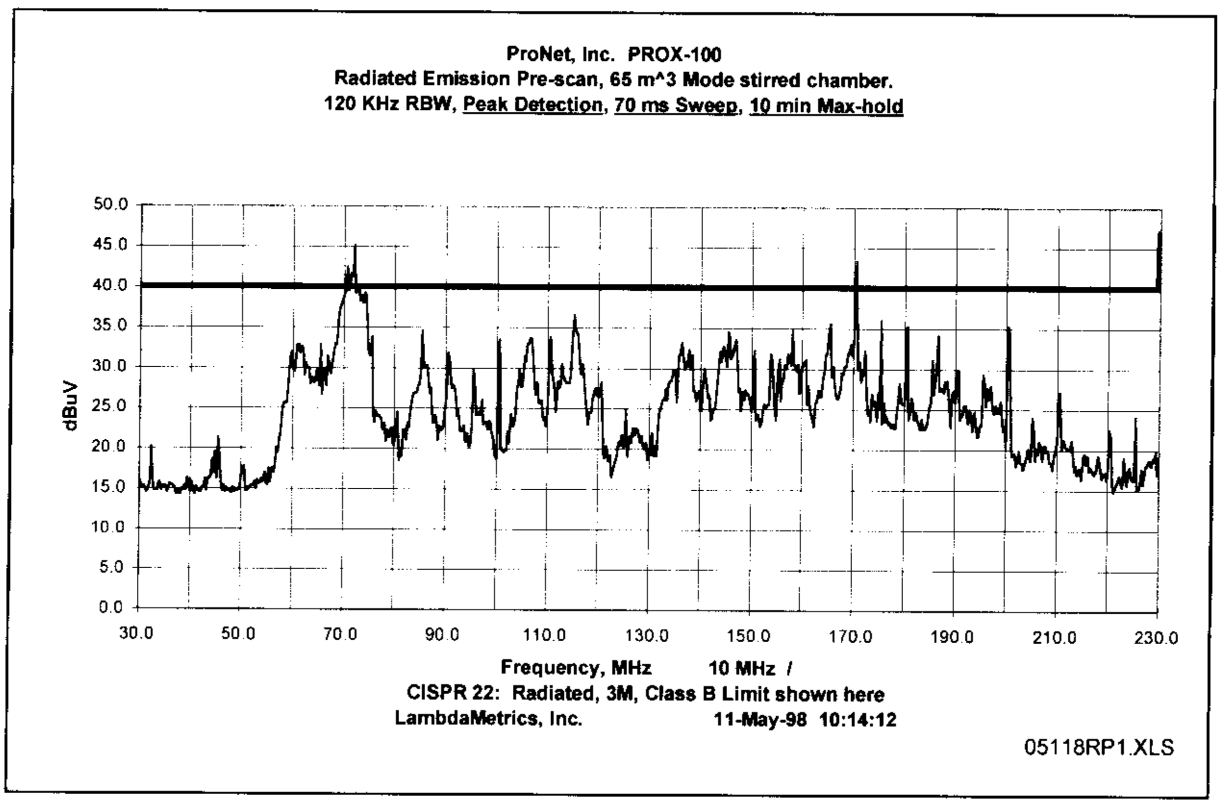


Figure 3: Radiated Emissions, Concentrator and PROX, 30 to 200 MHz

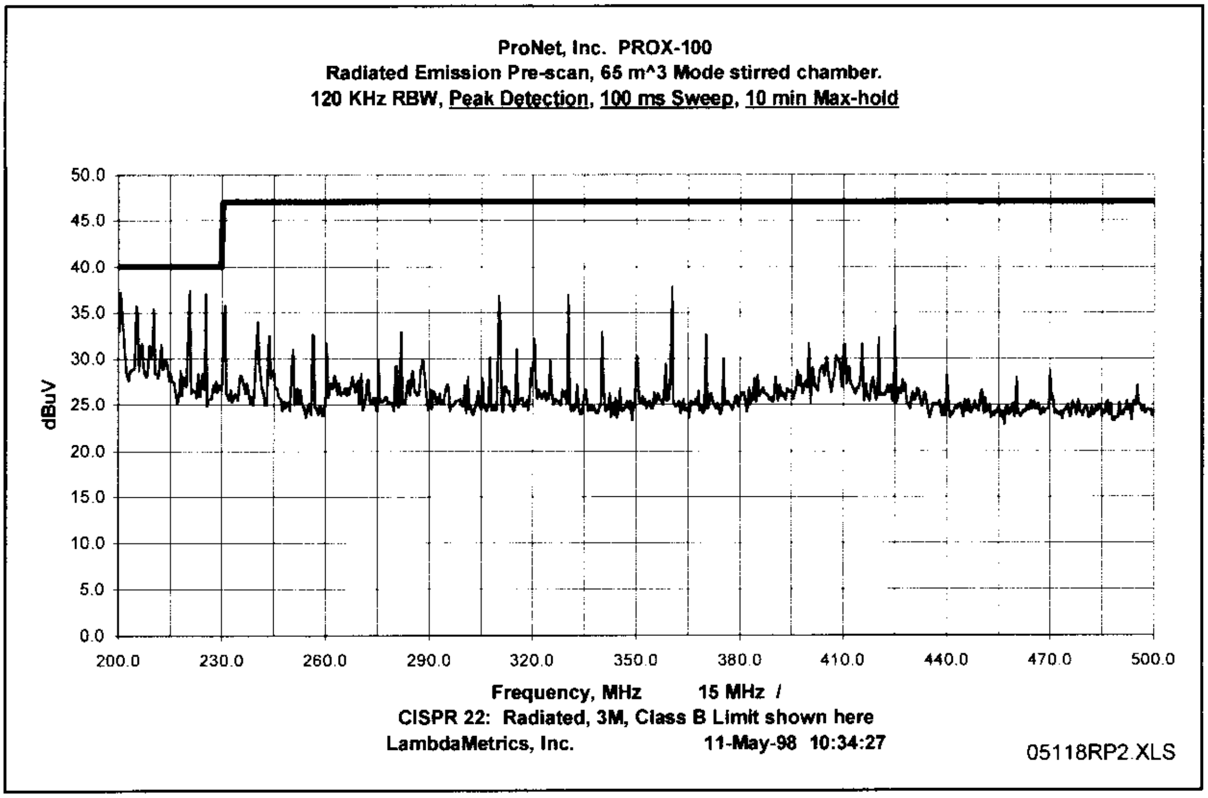


Figure 4: Radiated Emissions, Concentrator and PROX, 200 to 500 MHz

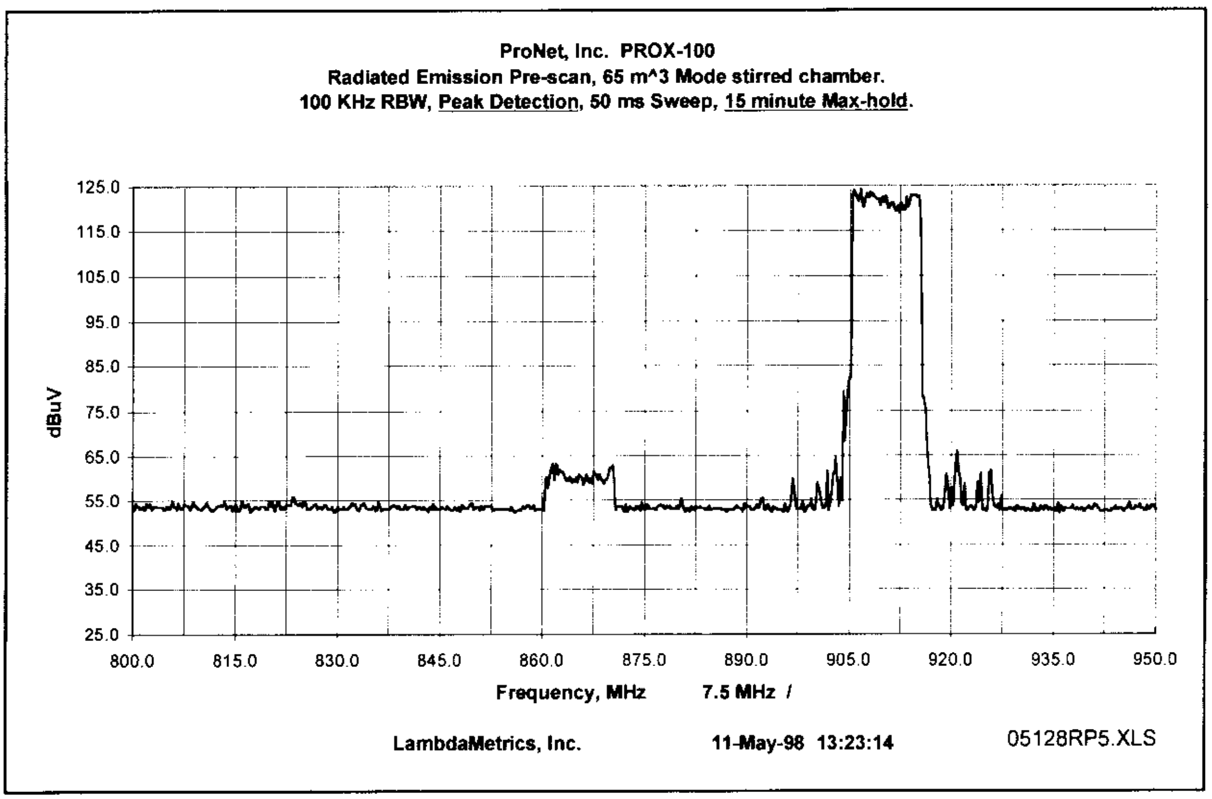


Figure 5: Radiated Emissions, PROX, in-band
Long term maximum hold.

TEST REPORT LM05158A AMENDMENT

Reference: ID 3129

Date: Mon 18 Jan, 1999

To: Rich Fabina, FCC lab.

Subject: Lab tests on modified NBI-PROX100

This Report supplements the original Certification filing for Electronic Tracking Systems, Inc., subsidiary of PRONET, Inc. and addresses the compliance issues raised by your correspondence 3129.

The client has reworked the transmitter section and provided two test units that comply with the requirement to test low, mid and high operating frequency and the mid frequency with the hopping stopped. The RF PC board is a different layout from the ones pictured in Photos 3-5 and 8-12 of the original test report. New photographs of the PCB and the modifications made to bring the NBI-PROX100 into compliance with the Commissions harmonic emission rules are provided herein.

I have included the spreadsheet that I used to calculate the 15.209 emission limit line for use in logging on the OATS. As you see the 2.4 dB pulse correction factor, antenna, and other conversions have been used to construct the three meter emission limit for this particular FHSS transmitter. This presentation shows radiated peak and average emissions for the fundamental as well as harmonics when measured at three meters for each of the four operating modes. Each of the two **EUT** versions now appear to meet the Commissions requirements for harmonic emissions, peak and average.

Also included are graphics showing peak and average OATS emissions using the calculated limits. The sa readings are raw (uncompensated for anything) which makes error analysis a bit easier for us. The antenna factors and amp gain were checked for minimum variation over each band. Low frequency emissions (10 KHz - 1GHz) were verified to be within the limits of 15.209 for these two **EUT**'s while operating on high, mid and low frequencies as well as during hopping on the mid frequency.

I believe that all other compliance issues have been satisfactorily answered in the original application or in this correspondence.

REPORT APPROVED 17 January, 1999 BY:

Ben Bibb

Ben Bibb, NARTE EMC-001970-NE,
President, **LambdaMetrics, Inc.**

MODIFICATIONS MADE TO THE PROX-100

December 30, 1998

Ben Bibb, President
LambdaMetrics, Inc.
P.O. Box 1029
Cedar Park, TX 78630

Dear Ben,

The changes we made to the original PROX to address the out-of-spec harmonic emissions include:

1) placed the power amp, power control network and both passive low-pass filters underneath a grounded metal shield can.

2) ran the power supply to the amp through a ferrite Pi filter to prevent rf energy from being coupled back into the power supply traces

3) replaced discrete low-pass filter at antenna port (after T/R switch) with a monolithic low-pass filter having lower radiation and better harmonic suppression characteristics

4) placed a monolithic low-pass filter at power amp output

5) adjusted power level ahead of power amp by means of a T-pad to ensure power amp and T/R switch are not in compression

6) poured ground plane on the top board layer under the power amp as much as possible

The two white wires on the pre-production units can be incorporated in the artwork for the production boards.

Please let me know if you need any additional information or any elaboration on any of the above. As always, thanks for all of your help.

Sincerely,

Tom Boren
Sr. Project Engineer
ProNet Tracking Systems
6340 LBJ Freeway
Dallas, TX 75240
(972) 687-2188
tboren@pronettracking.com

Correspondence ID 3129, Answers PROX-100

January 14, 1999

Ben Bibb, President
LambdaMetrics, Inc.
P.O. Box 1029
Cedar Park, TX 78630

Dear Ben,

Here are our responses to the FCC questions you forwarded to me via fax. As you can tell, they are the same as for the PAD for the most part. Also attached are the two installation/owner's manuals for the PROXs that contain the compliance statements. Let me know if you need anything else otherwise we can send this on to the FCC via e-mail or regular mail, whichever is the preferred method.

Responses to FCC questions

1. The channel carrier separation is 200 KHz when hopping in any given band. The 20 dB bandwidth of each channel is approximately 50 KHz (<250 KHz) and the units hop over 50 channels in the sequence given in paragraph 2 below. The dwell time on any given channel is a maximum of 262 ms and no channel is visited twice in any 20 second interval under normal operation. These parameters are all within the requirements specified under 15.247 (a) (1).

2. The hop channel sequence is derived from the following equation:

XmtChannel = BandNumber + (49 – ChannelTable(ChannelIndex)) * ChannelSpacing

Where:

BandNumber is the frequency band number (112,114,116, or 118)

ChannelTable = {0, 25, 8, 33, 5, 38, 4, 42, 23, 31, 11, 27, 17, 39, 1, 29, 20, 44, 10, 48, 15, 41, 14, 43, 2, 35, 3, 36, 12, 46, 6, 40, 19, 34, 9, 45, 7, 26, 24, 49, 18, 47, 22, 28, 16, 37, 13, 32, 21, 30} is the pseudo-random hop sequence

ChannelSpacing = 8 (200 KHz = 8 * 25 KHz) and

ChannelIndex is incremented by 1 every hop. The transmission then is on the frequency determined by:

Transmission Frequency = 902 + XmtChannel * 0.025 MHz

The frequency hop sequences for the four bands used are then (in MHz):

Channel Table	Band 112	Band 114	Band 116	Band 118
	112	114	116	118
0	904.800	904.850	904.900	904.950
25	909.800	909.850	909.900	909.950
8	906.400	906.450	906.500	906.550
33	911.400	911.450	911.500	911.550
5	905.800	905.850	905.900	905.950
38	912.400	912.450	912.500	912.550
4	905.600	905.650	905.700	905.750
42	913.200	913.250	913.300	913.350
23	909.400	909.450	909.500	909.550
31	911.000	911.050	911.100	911.150
11	907.000	907.050	907.100	907.150
27	910.200	910.250	910.300	910.350
17	908.200	908.250	908.300	908.350
39	912.600	912.650	912.700	912.750
1	905.000	905.050	905.100	905.150
29	910.600	910.650	910.700	910.750
20	908.800	908.850	908.900	908.950
44	913.600	913.650	913.700	913.750
10	906.800	906.850	906.900	906.950
48	914.400	914.450	914.500	914.550
15	907.800	907.850	907.900	907.950
41	913.000	913.050	913.100	913.150
14	907.600	907.650	907.700	907.750
43	913.400	913.450	913.500	913.550
2	905.200	905.250	905.300	905.350
35	911.800	911.850	911.900	911.950
3	905.400	905.450	905.500	905.550
36	912.000	912.050	912.100	912.150
12	907.200	907.250	907.300	907.350
46	914.000	914.050	914.100	914.150
6	906.000	906.050	906.100	906.150
40	912.800	912.850	912.900	912.950
19	908.600	908.650	908.700	908.750
34	911.600	911.650	911.700	911.750
9	906.600	906.650	906.700	906.750
45	913.800	913.850	913.900	913.950
7	906.200	906.250	906.300	906.350
26	910.000	910.050	910.100	910.150
24	909.600	909.650	909.700	909.750
49	914.600	914.650	914.700	914.750
18	908.400	908.450	908.500	908.550
47	914.200	914.250	914.300	914.350
22	909.200	909.250	909.300	909.350
28	910.400	910.450	910.500	910.550
16	908.000	908.050	908.100	908.150
37	912.200	912.250	912.300	912.350
13	907.400	907.450	907.500	907.550
32	911.200	911.250	911.300	911.350
21	909.000	909.050	909.100	909.150
30	910.800	910.850	910.900	910.950

The last ChannelIndex is saved and the next hop sequence begins with ChannelIndex + 1. This ensures that all frequencies are visited with equal probability even in the event that a hop sequence is not completed before terminating a transmission.

3. The transmitter cycles through the ChannelTable from beginning to end before repeating and all transmissions are of equal duration. This ensures that all frequencies are used equally.

4. The receivers have the same 25 KHz channel bandwidth as the transmitters. The receivers maintain sync with the transmitters by fast scanning to intercept the transmission on the next hop channel once it has received the information contained on the current channel.

5. The attached installation/owner's manuals contain the requisite compliance statement as called out in 15.19(a) (3).

Tom Boren
Sr. Project Engineer
ProNet Tracking Systems
6340 LBJ Freeway
Dallas, TX 75240
(972) 687-2188
tboren@pronettracking.com

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Monopole
- "LOW Frequency" EUT (904.8 MHz) Measured at 3.0 meters -

128.04

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
904.8	-14.16	-15.91	0.0	6.5	0.0	28.7	0.0	126.3	-	-
1809.6	-55.84	-62.25	32.6	6.6	0.8	27.6	2.4	44.7	54	9.3
2714.4	-64.13	-69.25	30.5	6.7	0.7	29.6	2.4	41.9	54	12.2
3619.2	-62.03	-66.59	29.9	6.8	0.7	31.9	2.4	47.5	54	6.5
4524.0	-58.72	-63.88	31.8	7.0	0.6	32.0	2.4	48.5	54	5.5
5428.8	-63.13	-71.44	32.3	7.1	0.6	34.6	2.4	43.2	54	10.8
6333.6	-68.69	-77.13	32.0	7.2	0.7	34.6	2.4	38.0	54	16.0
7238.4	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8143.2	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9048.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were vertical and slightly above the plane of the EUT with monopole vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Measurement noise Floor indicated by small itallic characters.

Video Averaging Results			
Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
904.8	-14.16	-15.91	-1.75
1809.6	-55.84	-62.25	-6.41
2714.4	-64.13	-69.25	-5.12
3619.2	-62.03	-66.59	-4.56
4524.0	-58.72	-63.88	-5.16
5428.8	-63.13	-71.44	-8.31
6333.6	-68.69	-77.13	-8.44

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Monopole
- "MID Frequency" EUT (909.7 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
909.7	-16.94	-18.18	0.0	6.5	0.0	28.6	0.0	123.9	-	-
1819.4	-59.72	-63.03	32.6	6.6	0.8	27.6	2.4	43.9	54	10.1
2729.1	-62.91	-66.97	30.5	6.7	0.7	29.6	2.4	44.1	54	9.9
3638.8	-61.34	-65.63	29.9	6.8	0.7	31.9	2.4	48.5	54	5.5
4548.5	-59.31	-63.38	31.8	7.0	0.6	32.0	2.4	49.0	54	5.0
5458.2	-65.19	-72.91	32.3	7.1	0.6	34.6	2.4	41.7	54	12.3
6367.9	-65.75	-79.25	32.0	7.2	0.7	34.6	2.4	35.9	54	18.2
7277.6	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8187.3	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9097.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were vertical and slightly above the plane of the EUT with monopole vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Video Averaging Results			
Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
909.7	-16.94	-18.18	-1.24
1819.4	-59.72	-63.03	-3.31
2729.1	-62.91	-66.97	-4.06
3638.8	-61.34	-65.63	-4.29
4548.5	-59.31	-63.38	-4.07
5458.2	-65.19	-72.91	-7.72
6367.9	-65.75	-79.25	-13.50

Measurement noise Floor indicated by small itallic characters.

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Monopole
- "MID Freq. Hopper" EUT (909.7 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
909.7	-15.13	-16.91	0.0	6.5	0.0	28.6	0.0	125.2	-	-
1819.4	-59.00	-63.03	32.6	6.6	0.8	27.6	2.4	43.9	54	10.1
2729.1	-62.25	-67.73	30.5	6.7	0.7	29.6	2.4	43.4	54	10.6
3638.8	-60.88	-66.81	29.9	6.8	0.7	31.9	2.4	47.3	54	6.7
4548.5	-60.01	-67.00	31.8	7.0	0.6	32.0	2.4	45.4	54	8.6
5458.2	*-67*	*-79*	*32.3*	*7.1*	*0.6*	*34.6*	*2.4*	*35.6*	*54*	*18.4*
6367.9	*-67*	*-80*	*32.0*	*7.2*	*0.7*	*34.6*	*2.4*	*35.1*	*54*	*18.9*
7277.6	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8187.3	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9097.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were vertical and slightly above the plane of the EUT with monopole vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Measurement noise Floor indicated by small itallic characters.

Video Averaging Results			
Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
909.7	-15.13	-16.91	-1.78
1819.4	-59.00	-63.03	-4.03
2729.1	-62.25	-67.73	-5.48
3638.8	-60.88	-66.81	-5.93
4548.5	-60.01	-67.00	-6.99

MAXIMUM RADIATED EMISSIONS, NBI-PROX10 0, Monopole
- "HIGH Frequency" EUT (914.6 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
914.6	-15.59	-17.35	0.0	6.5	0.0	28.6	0.0	124.8	-	-
1829.2	-59.03	-63.25	32.6	6.6	0.8	27.6	2.4	43.7	54	10.3
2743.8	-62.72	-65.63	30.5	6.7	0.7	29.6	2.4	45.5	54	8.5
3658.4	-62.59	-66.41	29.9	6.8	0.7	31.9	2.4	47.7	54	6.3
4573.0	-61.03	-67.44	31.8	7.0	0.6	32.0	2.4	45.0	54	9.0
5487.6	-65.53	-76.41	32.3	7.1	0.6	34.6	2.4	38.2	54	15.8
6402.2	-66.59	-78.97	32.0	7.2	0.7	34.6	2.4	36.1	54	17.9
7316.8	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8231.4	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9146.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were vertical and slightly above the plane of the EUT with monopole vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Video Averaging Results

Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
914.6	-15.59	-17.35	-1.76
1829.2	-59.03	-63.25	-4.22
2743.8	-62.72	-65.63	-2.91
3658.4	-62.59	-66.41	-3.82
4573.0	-61.03	-67.44	-6.41
5487.6	-65.53	-76.41	-10.88
6402.2	-66.59	-78.97	-12.38

Measurement noise Floor indicated by small itallic characters.

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Patch
- "LOW Frequency" EUT (904.8 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
904.8	-19.19	-16.97	0.0	6.5	0.0	28.7	0.0	125.2	-	-
1809.6	-60.34	-62.38	32.6	6.6	0.8	27.6	2.4	44.6	54	9.4
2714.4	-62.13	-65.84	30.5	6.7	0.7	29.6	2.4	45.3	54	8.7
3619.2	-68.19	-79.69	29.9	6.8	0.7	31.9	2.4	34.4	54	19.6
4524.0	-63.84	-71.22	31.8	7.0	0.6	32.0	2.4	41.2	54	12.8
5428.8	-63.59	-72.94	32.3	7.1	0.6	34.6	2.4	41.7	54	12.3
6333.6	*-67*	*-80*	*32.0*	*7.2*	*0.7*	*34.6*	*2.4*	*35.1*	*54*	*18.9*
7238.4	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8143.2	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9048.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were always vertical and slightly below the plane of the EUT with patch plane vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Video Averaging Results			
Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
904.8	-19.19	-16.97	2.22
1809.6	-60.34	-62.38	-2.04
2714.4	-62.13	-65.84	-3.71
3619.2	-68.19	-79.69	-11.50
4524.0	-63.84	-71.22	-7.38
5428.8	-63.59	-72.94	-9.35

Measurement noise Floor indicated by small itallic characters.

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Patch
- "MID Frequency" EUT (909.7 MHz) Measured at 3.0 meters -

Meas.	Peak	"Avg."	Meas.	Meas.	Meas.	Meas.	Calc.	Calc. Avg.	Avg.	Limit
Freq	At s/a	At s/a	Amp K	Cab & Attn.	HPF	Ant. Fact.	Pulse Cor.	3 m Field	Limit	Margin
MHz	(1 MHz) dBm	(10 Hz) dBm	Gain dB	Loss dB	Loss, dB	dB 1/m	Fact. dB	dBuV/m	dBuV/m	dB
909.7	-17.13	-15.16	0.0	6.5	0.0	28.6	0.0	126.9	-	-
1819.4	-63.25	-65.44	32.6	6.6	0.8	27.6	2.4	41.5	54	12.5
2729.1	-60.53	-64.47	30.5	6.7	0.7	29.6	2.4	46.6	54	7.4
3638.8	-68.50	-78.16	29.9	6.8	0.7	31.9	2.4	35.9	54	18.1
4548.5	-64.25	-69.75	31.8	7.0	0.6	32.0	2.4	42.7	54	11.4
5458.2	-64.09	-70.00	32.3	7.1	0.6	34.6	2.4	44.6	54	9.4
6367.9	*-67*	*-80*	*32.0*	*7.2*	*0.7*	*34.6*	*2.4*	*35.1*	*54*	*18.9*
7277.6	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8187.3	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9097.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were always vertical and slightly below the plane of the EUT with patch plane vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Video Averaging Results			
Freq	At s/a	At s/a	1 MHz RBW
MHz	(1 MHz) dBm	(10 Hz) dBm	Pk::A
909.7	-17.13	-15.16	1.97
1819.4	-63.25	-65.44	-2.19
2729.1	-60.53	-64.47	-3.94
3638.8	-68.50	-78.16	-9.66
4548.5	-64.25	-69.75	-5.50
5458.2	-64.09	-70.00	-5.91

Measurement noise Floor indicated by small itallic characters.

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Patch
- "MID Freq. Hopper" EUT (909.7 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
909.7	-11.78	-15.19	0.0	6.5	0.0	28.6	0.0	126.9	-	-
1819.4	-59.91	-64.97	32.6	6.6	0.8	27.6	2.4	42.0	54	12.0
2729.1	-60.78	-64.28	30.5	6.7	0.7	29.6	2.4	46.8	54	7.2
3638.8	-73.00	-80.84	29.9	6.8	0.7	31.9	2.4	33.3	54	20.7
4548.5	-72.00	-76.41	31.8	7.0	0.6	32.0	2.4	36.0	54	18.0
5458.2	-65.71	-71.31	32.3	7.1	0.6	34.6	2.4	43.3	54	10.7
6367.9	*-67*	*-80*	32.0	7.2	0.7	34.6	2.4	35.1	54	18.9
7277.6	*-69*	*-83*	32.1	7.4	0.6	36.8	2.4	34.3	54	19.7
8187.3	*-73*	*-86*	32.4	7.5	0.7	36.8	2.4	31.2	54	22.8
9097.0	*-68*	*-84*	31.6	7.7	0.7	37.7	2.4	35.1	54	18.9

Maximum spurious emissions were always vertical and slightly below the plane of the EUT with patch plane vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
909.7	-11.78	-15.19	-3.41
1819.4	-59.91	-64.97	-5.06
2729.1	-60.78	-64.28	-3.50
3638.8	*-73*	-80.84	-7.84
4548.5	-72.00	-76.41	-4.41
5458.2	-65.71	-71.31	-5.60

Measurement noise Floor indicated by small italic characters.

MAXIMUM RADIATED EMISSIONS, NBI-PROX100, Patch
- "HIGH Frequency" EUT (914.6 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
914.6	-14.25	-15.65	0.0	6.5	0.0	28.6	0.0	126.5	-	-
1829.2	-59.81	-66.66	32.6	6.6	0.8	27.6	2.4	40.3	54	13.7
2743.8	-60.47	-65.00	30.5	6.7	0.7	29.6	2.4	46.1	54	7.9
3658.4	-67.47	-77.51	29.9	6.8	0.7	31.9	2.4	36.6	54	17.4
4573.0	-63.72	-71.80	31.8	7.0	0.6	32.0	2.4	40.6	54	13.4
5487.6	-64.41	-69.66	32.3	7.1	0.6	34.6	2.4	44.9	54	9.1
6402.2	*-67*	*-80*	*32.0*	*7.2*	*0.7*	*34.6*	*2.4*	*35.1*	*54*	*18.9*
7316.8	*-69*	*-83*	*32.1*	*7.4*	*0.6*	*36.8*	*2.4*	*34.3*	*54*	*19.7*
8231.4	*-73*	*-86*	*32.4*	*7.5*	*0.7*	*36.8*	*2.4*	*31.2*	*54*	*22.8*
9146.0	*-68*	*-84*	*31.6*	*7.7*	*0.7*	*37.7*	*2.4*	*35.1*	*54*	*18.9*

Maximum spurious emissions were always vertical and slightly below the plane of the EUT with patch plane vertical.
Fundamental, measured with tuned dipole, was maximum at boresight.

Measurement noise Floor indicated by small itallic characters.

Video Averaging Results

Freq MHz	At s/a (1 MHz) dBm	At s/a (10 Hz) dBm	1 MHz RBW Pk::A
914.6	-14.25	-15.65	-1.40
1829.2	-59.81	-66.66	-6.85
2743.8	-60.47	-65.00	-4.53
3658.4	-67.47	-77.51	-10.04
4573.0	-63.72	-71.80	-8.08
5487.6	-64.41	-69.66	-5.25

FCC limit translated to dBm on S/A (54 - 107 +2.4 + K - C&Att - HPF - af)

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
904.8		0.0	6.5	-	28.7	-			
1809.6	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2714.4	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3619.2	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4524.0	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5428.8	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6333.6	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7238.4	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8143.2	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9048.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

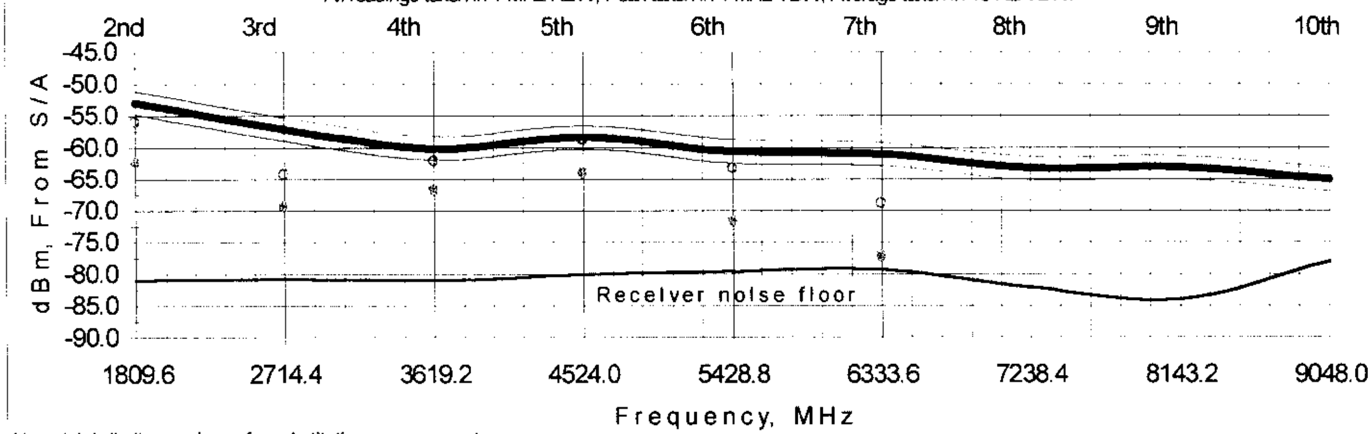
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Low Freq. Range (904.8 MHz) PROX, Monopole. 2.4 dB duty factor correction included in limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
909.7		0.0	6.5	-	28.6	-			
1819.4	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2729.1	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3638.8	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4548.5	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5458.2	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6367.9	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7277.6	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8187.3	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9097.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

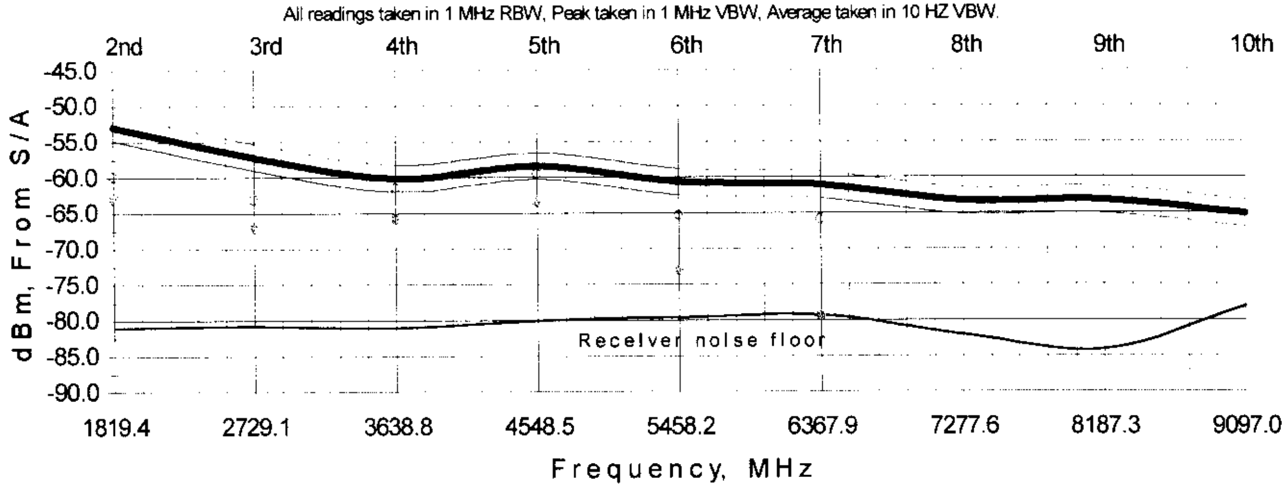
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Mid Freq. Range (909.7 MHz) PROX, Monopole. 2.4 dB duty factor correction included in limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

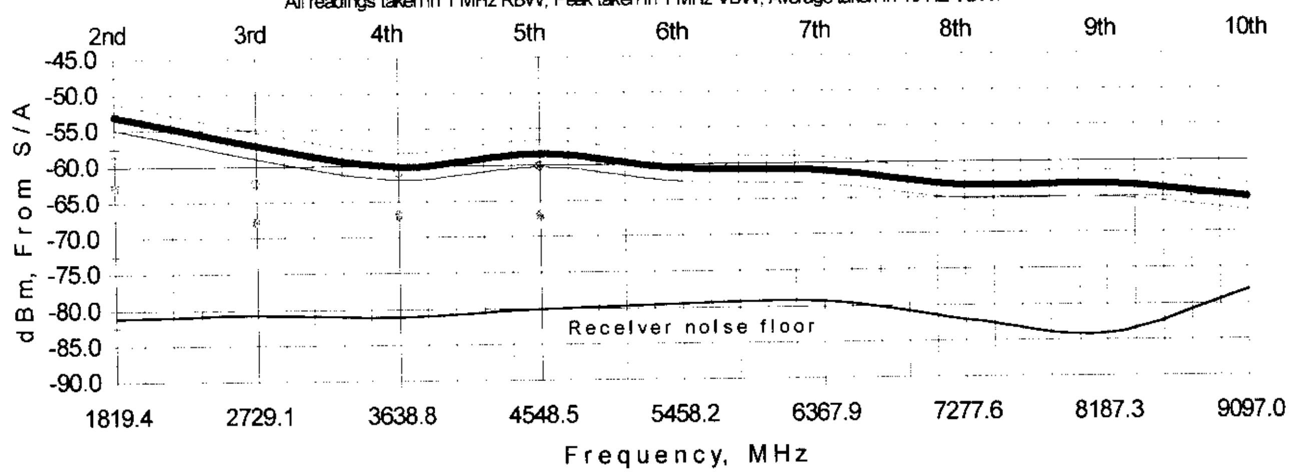
FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
909.7		0.0	6.5	-	28.6	-			
1819.4	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2729.1	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3638.8	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4548.5	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5458.2	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6367.9	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7277.6	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8187.3	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9097.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average
Mid Freq. Hopper (909.7 MHz) PROX, Monopole. 2.4 dB duty factor correction included in limit.
All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs
914.6		0.0	6.5	-	28.6	-	
1829.2	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m
2743.8	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m
3658.4	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m
4573.0	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m
5487.6	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m
6402.2	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m
7316.8	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m
8231.4	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m
9146.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m

Prob. of Low error	Prob. of Hi error
-54.8	-51.1
-59.0	-55.3
-62.0	-58.3
-60.3	-56.6
-62.5	-58.8
-63.0	-59.3
-65.2	-61.5
-65.1	-61.4
-67.0	-63.3

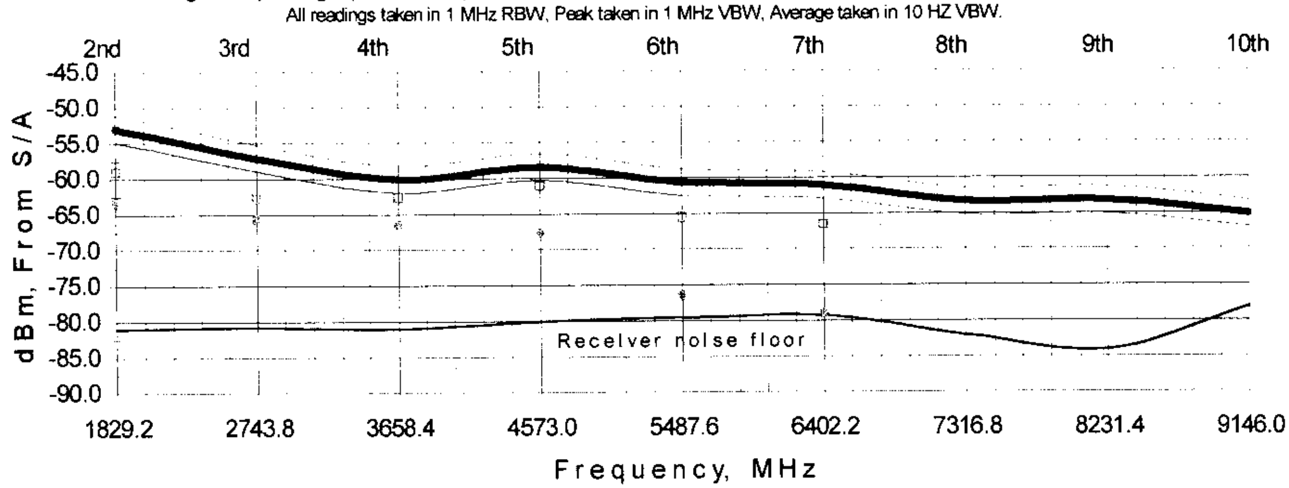
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

High Freq. Range (914.6 MHz) PROX, Monopole. 2.4 dB duty factor correction included in limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements. Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
904.8		0.0	6.5	-	28.7	-			
1809.6	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2714.4	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3619.2	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4524.0	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5428.8	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6333.6	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7238.4	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8143.2	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9048.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

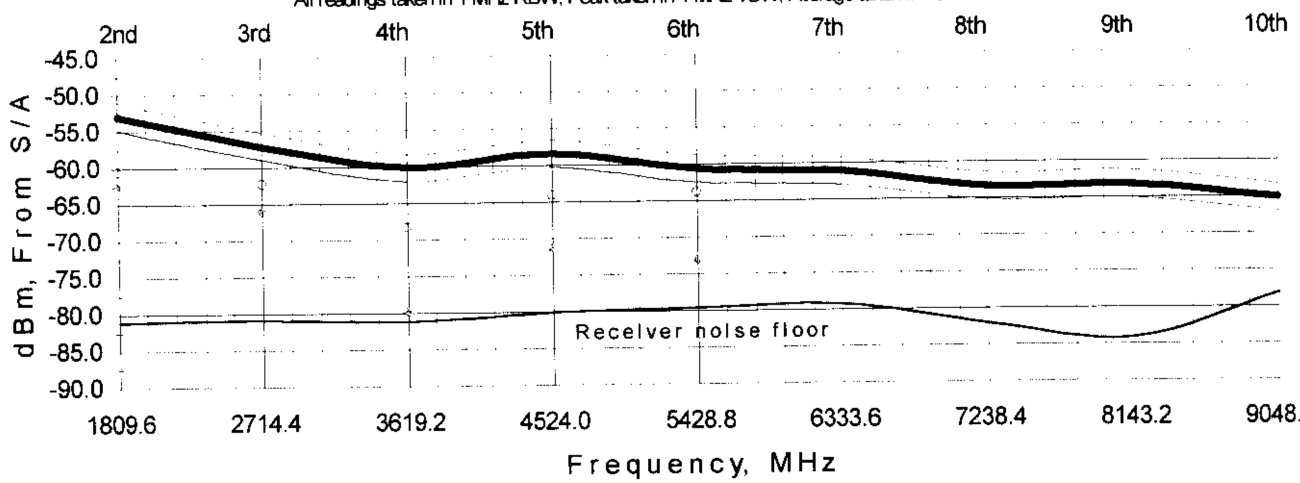
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Low Freq. Range (904.8 MHz) PROX, Patch. 2.4 dB duty factor correction included in limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
909.7		0.0	6.5	-	28.6	-			
1819.4	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2729.1	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3638.8	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4548.5	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5458.2	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6367.9	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7277.6	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8187.3	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9097.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

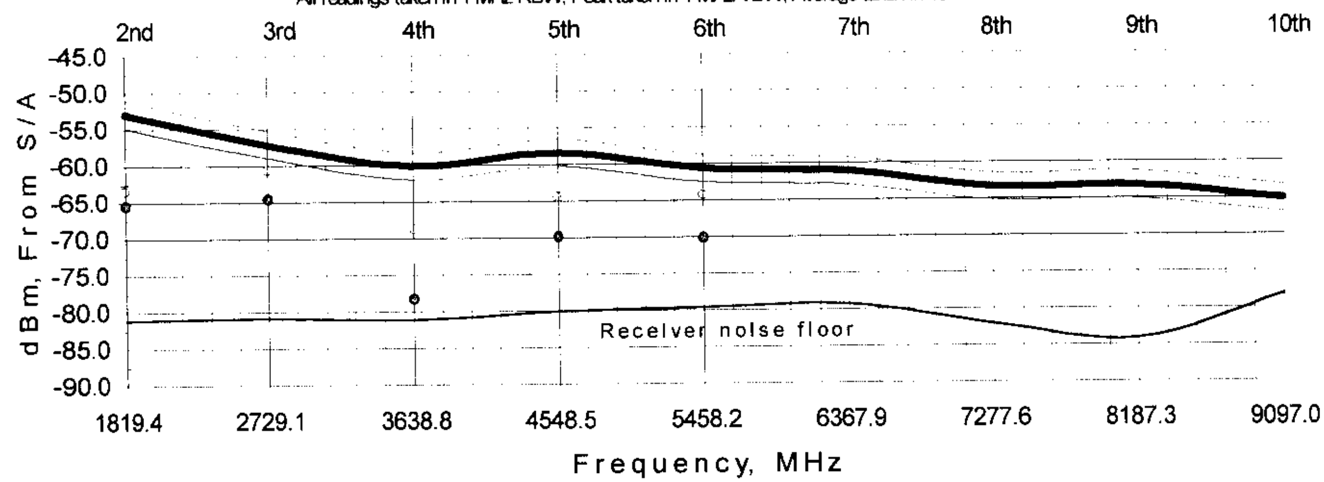
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Mid Freq. Range (909.7 MHz) PROX, Patch. 2.4 dB duty factor correction included in limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
909.7		0.0	6.5	-	28.6	-			
1819.4	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2729.1	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3638.8	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4548.5	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5458.2	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6367.9	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7277.6	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8187.3	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9097.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

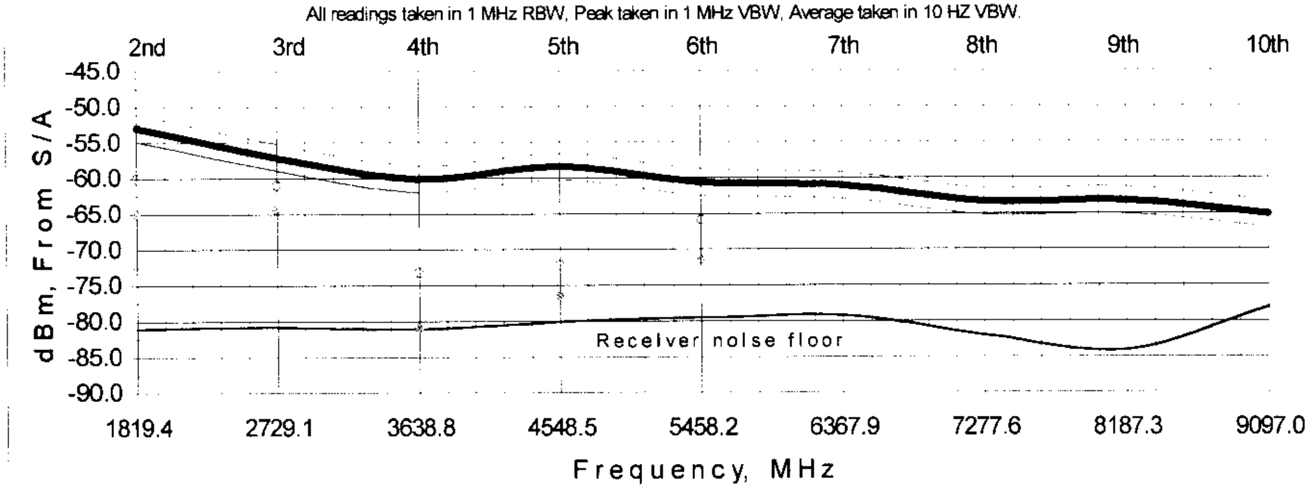
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Mid Freq. Hopper (909.7 MHz) PROX, Patch. 2.4 dB duty factor correction included in limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Meas. Freq MHz	FCC Limit At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error
914.6		0.0	6.5	-	28.6	-			
1829.2	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1
2743.8	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3
3658.4	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3
4573.0	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6
5487.6	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8
6402.2	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3
7316.8	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5
8231.4	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4
9146.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3

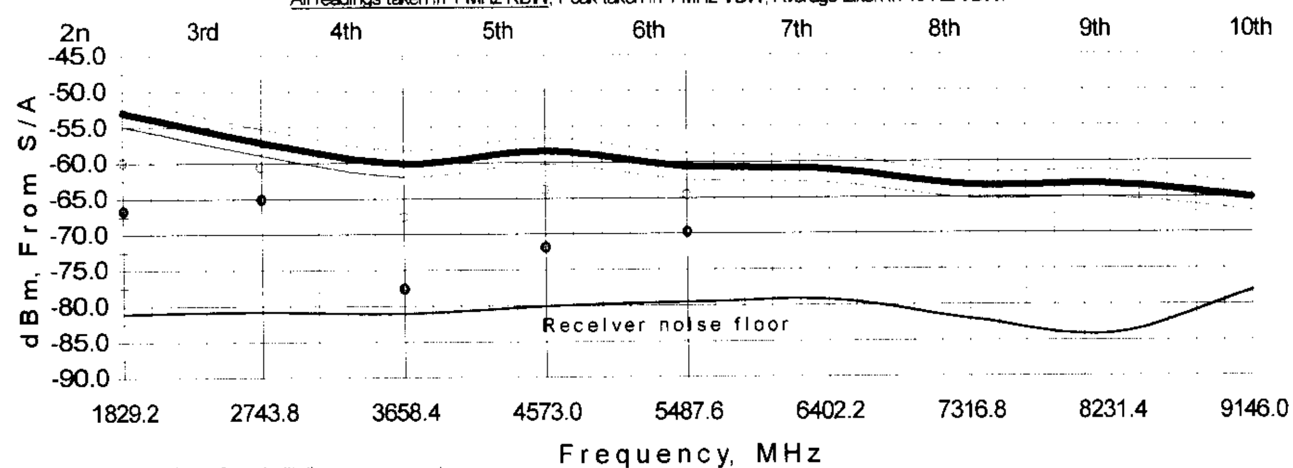
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

High Freq. Range (914.6 MHz) PROX, Patch. 2.4 dB duty factor correction included in limit.

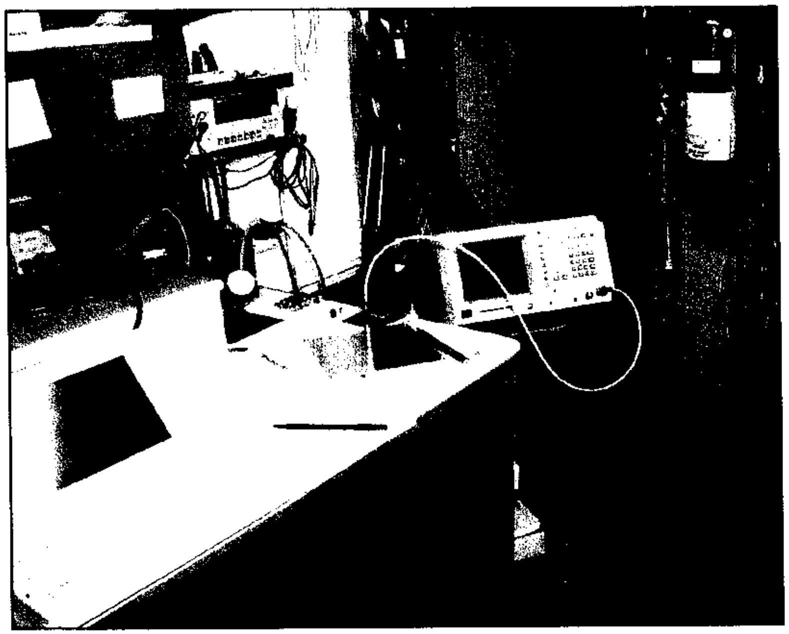
All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ VBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Antenna Conducted Emission Measurements



Antenna Conducted Emissions, Worst Case, Monopole PROX-100

Measured Transmitter Output Power	Freq, MHz	dBm	dist.(m)	Ant G(dBi)	dBuV/m	V/m
	904.8	28.90	3	2.2	126.3	2.072
	909.7	27.60	3	2.4	125.2	1.826
	914.6	29.00	3	0.6	124.8	1.744
Claculated Radiated Emissions and Calculated "Antenna Gains" to Match Measured.	1809.6	-40.00	3	-10.6	44.6	0.000170
	2714.4	-43.90	3	-6	45.3	0.000185
	3619.2	-44.76	3	-16.1	34.4	0.000052
	4524.0	-49.30	3	-4.7	41.2	0.000115
	5428.8	-58.44	3	4.9	41.7	0.000121
	6333.6	-60.00	3	0	35.2	0.000058
	7238.4	-69.50	3	0	25.7	0.000019
	8143.2	-63.14	3	0	32.1	0.000040
	9048.0	-67.85	3	0	27.4	0.000023

Fundamental measured into 10 dB, 2 Watt pad. Harmonics measured into 6 dB pad and 1.2 GHz High Pass Filter with spectrum analyzer. Field calculations are for reference only, antenna gains are calculated to match measured OATS fields.

= Entered (Measured Value)
= Calculated

Engage connector end of pig-tail to PROX-100W and secure to wall using listed hardware options. Connector will seat into channel when mounted to wall.

4.0 Hardware:

- Molex Connector: 39-00-0039
- Molex Pin: 39-01-2040
- Molex Hand Crimp Tool: 11-01-0197
- Beldin Wire: 9156
- Skotchlok™ 804 (Blue)
- Crimping/Striping Pliers
- #10 Plastic Anchors (Sheet-Rock Applications)
- #10 Lead Anchors (Concrete Applications)
- #10 PPH Tamperproof Driver
- No. 3 Drill Bit (Anchor Mount)
- No. 27 Drill Bit (Self Tapping Mount)
- WireMold™ V500 Metal Raceway, Ivory ScuffCoat™ Finish

5.0 FCC Compliance Statement:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation

PRONET Communications
6340 LBJ Freeway, Dallas, TX, USA, 75240
Phone: (972) 687-2000 (888) 226-7911 FAX: (972) 774-0640

EXHIBIT B

ProNet, Inc. Band Plan

Campus-Trac™ System

EXHIBIT B

Freq. (MHz)	Channel No.	CampusTrac™ Channel Identifier Set A	Set B	Set C	Set D	Notes
902.000	0					***Lower Edge of ISM Band***
▼						
904.800	112	A1				***First Set A Channel***
904.850	114		B1			***First Set B Channel***
904.900	116			C1		***First Set C Channel***
904.950	118				D1	***First Set D Channel***
905.000	120	A2				
905.050	122		B2			
905.100	124			C2		
905.150	126				D2	
905.200	128	A3				
905.250	130		B3			
905.300	132			C3		
905.350	134				D3	
905.400	136	A4				
905.450	138		B4			
905.500	140			C4		
905.550	142				D4	
905.600	144	A5				
905.650	146		B5			
905.700	148			C5		
905.750	150				D5	
905.800	152	A6				
905.850	154		B6			
905.900	156			C6		
905.950	158				D6	
906.000	160	A7				
906.050	162		B7			
906.100	164			C7		
906.150	166				D7	
906.200	168	A8				
906.250	170		B8			
906.300	172			C8		
906.350	174				D8	
906.400	176	A9				
906.450	178		B9			
906.500	180			C9		
906.550	182				D9	
906.600	184	A10				
906.650	186		B10			
906.700	188			C10		
906.750	190				D10	
906.800	192	A11				
906.850	194		B11			
906.900	196			C11		
906.950	198				D11	
907.000	200	A12				
907.050	202		B12			
907.100	204			C12		
907.150	206				D12	

EXHIBIT B

Freq.	Channel	Channel Identifier				
(MHz)	No.	Set A	Set B	Set C	Set D	Notes
907.200	208	A13				
907.250	210		B13			
907.300	212			C13		
907.350	214				D13	
907.400	216	A14				
907.450	218		B14			
907.500	220			C14		
907.550	222				D14	
907.600	224	A15				
907.650	226		B15			
907.700	228			C15		
907.750	230				D15	
907.800	232	A16				
907.850	234		B16			
907.900	236			C16		
907.950	238				D16	
908.000	240	A17				
908.050	242		B17			
908.100	244			C17		
908.150	246				D17	
908.200	248	A18				
908.250	250		B18			
908.300	252			C18		
908.350	254				D18	
908.400	256	A19				
908.450	258		B19			
908.500	260			C19		
908.550	262				D19	
908.600	264	A20				
908.650	266		B20			
908.700	268			C20		
908.750	270				D20	
908.800	272	A21				
908.850	274		B21			
908.900	276			C21		
908.950	278				D21	
909.000	280	A22				
909.050	282		B22			
909.100	284			C22		
909.150	286				D22	
909.200	288	A23				
909.250	290		B23			
909.300	292			C23		
909.350	294				D23	
909.400	296	A24				
909.450	298		B24			
909.500	300			C24		
909.550	302				D24	
909.600	304	A25				

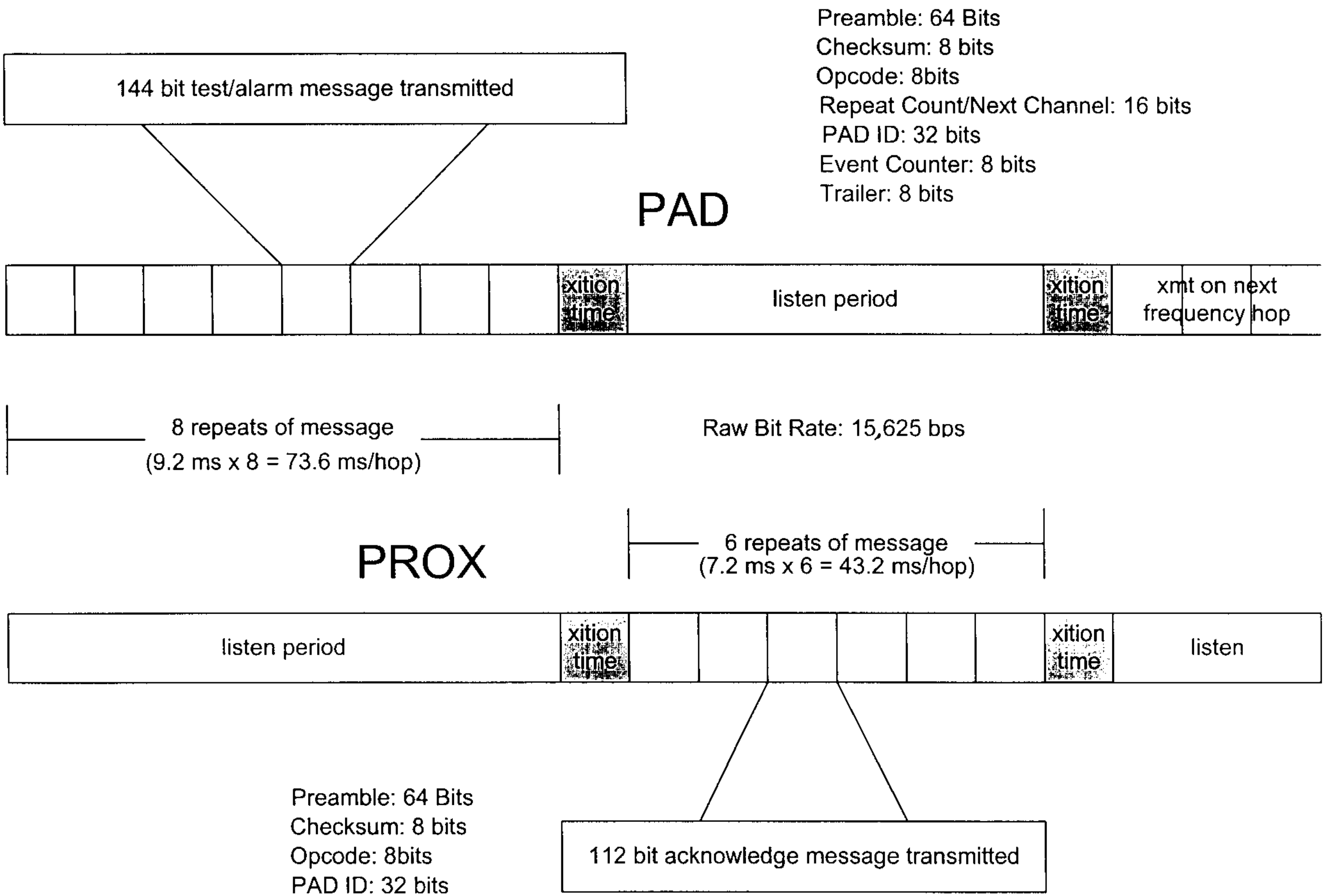
EXHIBIT B

Freq.	Channel	Channel Identifier				
(MHz)	No.	Set A	Set B	Set C	Set D	Notes
909.650	306		B25			
909.700	308			C25		
909.750	310				D25	***Upper Edge of Lower LMS Band***
909.800	312	A26				
909.850	314		B26			
909.900	316			C26		
909.950	318				D26	
910.000	320	A27				
910.050	322		B27			
910.100	324			C27		
910.150	326				D27	
910.200	328	A28				
910.250	330		B28			
910.300	332			C28		
910.350	334				D28	
910.400	336	A29				
910.450	338		B29			
910.500	340			C29		
910.550	342				D29	
910.600	344	A30				
910.650	346		B30			
910.700	348			C30		
910.750	350				D30	
910.800	352	A31				
910.850	354		B31			
910.900	356			C31		
910.950	358				D31	
911.000	360	A32				
911.050	362		B32			
911.100	364			C32		
911.150	366				D32	
911.200	368	A33				
911.250	370		B33			
911.300	372			C33		
911.350	374				D33	
911.400	376	A34				
911.450	378		B34			
911.500	380			C34		
911.550	382				D34	
911.600	384	A35				
911.650	386		B35			
911.700	388			C35		
911.750	390				D35	
911.800	392	A36				
911.850	394		B36			
911.900	396			C36		
911.950	398				D36	
912.000	400	A37				
912.050	402		B37			
912.100	404			C37		
912.150	406				D37	
912.200	408	A38				
912.250	410		B38			
912.300	412			C38		
912.350	414				D38	
912.400	416	A39				
912.450	418		B39			

EXHIBIT B

Freq. (MHz)	Channel No.	Channel Identifier Set A	Set B	Set C	Set D	Notes
912.500	420			C39		
912.550	422				D39	
912.600	424	A40				
912.650	426		B40			
912.700	428			C40		
912.750	430				D40	
912.800	432	A41				
912.850	434		B41			
912.900	436			C41		
912.950	438				D41	
913.000	440	A42				
913.050	442		B42			
913.100	444			C42		
913.150	446				D42	
913.200	448	A43				
913.250	450		B43			
913.300	452			C43		
913.350	454				D43	
913.400	456	A44				
913.450	458		B44			
913.500	460			C44		
913.550	462				D44	
913.600	464	A45				
913.650	466		B45			
913.700	468			C45		
913.750	470				D45	
913.800	472	A46				
913.850	474		B46			
913.900	476			C46		
913.950	478				D46	
914.000	480	A47				
914.050	482		B47			
914.100	484			C47		
914.150	486				D47	
914.200	488	A48				
914.250	490		B48			
914.300	492			C48		
914.350	494				D48	
914.400	496	A49				
914.450	498		B49			
914.500	500			C49		
914.550	502				D49	
914.600	504	A50				
914.650	506		B50			
914.700	508			C50		
914.750	510				D50	
▼						
915.000	(520)					**Midpoint of ISM Band**
▼						
928.000	(1040)					**Upper Edge of ISM Band**

An alarm event causes a PAD-1000 to transmit on the next five channels chosen from this PR table. it listens at the end of each transmission for a reply from a **PROX-100**, communication continues until help arrives or the PAD-1000 battery depletes. Channels are 25 KHz in bandwidth. All transmissions are hopped over 50 channels chosen from this pseudo-random table. with equal transmission time on each channel. Transmissions are typically of 40 to 90 ms duration on a given channel, and never exceed 400 ms duration. The radio is half-duplex; meaning it is either receiving or transmitting at any given time, 15.247(I).



Test/Alarm message and Acknowledge time intervals