Project Number: 00128-10

Prepared for:

PRONET, INC.
6340 LBJ Freeway
Dallas Texas 75240

By

Professional Testing (EMI), Inc.
1601 FM 1460, Suite B
Round Rock, Texas 78664

October 1999

CERTIFICATION
Electromagnetic Interference
Test Report

PRONET, INC.
Tracker-1000 Transceiver
(Intentional Radiator Portion)

Table of Contents

Title Page 1
Table of Contents 2
Certificate of Compliance 3

1.0 EUT Description 4
1.1 EUT Operation 4
2.0 Electromagnetic Emissions Testing 4
2.1 Test Procedure 5
2.2 Test Criteria 5
2.3 Test Results 5
3.0 Occupied Bandwidth Measurements 6
3.1 Test Procedure 6
3.2 Test Criteria 6
3.3 Test Results 6
4.0 Antenna Requirement 6
4.1 Evaluation Procedure 7
4.2 Evaluation Criteria 7
4.3 Evaluation Results 7
5.0 Modifications to Equipment 7
6.0 List of Test Equipment 7

Figures

Figure 1: Radiated Emissions Test Setup 8

Appendices

Appendix A: Fundamental Emissions Test Data 9
Appendix B: Spurious Emissions Test Data 11
Appendix C: Occupied Bandwidth Test Data 14

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF PROFESSIONAL TESTING (EMI), INC.

Certificate of Compliance

Applicant:	ProNet, Inc.
Applicant's Address:	6340 LBJ Freeway Dallas Texas 75240
Model:	Tracker-1000 Transceiver
Serial Number:	N/A
Project Number:	00128-10
Test Dates:	October 15, 1999

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

The **ProNet, Inc. Tracker-1000 Transceiver** was tested to and found to be in compliance with FCC Part 15 Subpart C for an Intentional Radiator.

The highest emissions generated by the above equipment are listed below:

	Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Fundamental	904.8	99.5	125.0	-25.5
Spurious	1809.6	60.2	63.5	-3.3

Occupied Bandwidth

Record Only Per 47 CFR 15 - Widest OCBW: 16.4 kHz

_____

Jeffrey A. Lenk
President

This report has been reviewed and accepted by ProNet, Inc.. The undersigned is responsible for ensuring that the **Tracker-1000 Transceiver** will continue to comply with the FCC rules.

_____

1.0 EUT Description

The Equipment Under Test (EUT) is the **ProNet, Inc. Tracker-1000 Transceiver**. The **Tracker-1000 Transceiver** is one of the component **of ProNet Tracking Systems' Campus-911 System**. The **Tracker-1000 Transceiver** is a fast scanning receiver to locate a transmitting Personal Alarm Device (PAD) based on the received signal strength. The EUT operates in the 902 to 928 MHz frequency band and employs frequency-hopping to obtain diversity. The EUT is designed for compliance with 47 CFR 15.247 of the FCC rules. Specific test requirements for this device include the following:

47 CFR 15.247	Fundamental Transmit Power
47 CFR 15.247 & 15.205	Spurious Radiated Power
47 CFR 15.247 & 2.1049	Occupied Bandwidth (2.989 used as Procedural Reference)
47 CFR 15.203	Antenna Requirement

The system tested consisted of the following:

Manufacturer & Model	**Serial #**	**FCC ID #**	**Description**
ProNet, Inc. Tracker-1000 Transceiver	N/A	NBI-TRKR1000	Frequency Hopping Transceiver

A separate report pursuant to Part 15, Subpart B has been prepared for the **ProNet, Inc., Tracker-1000 Transceiver** as a Digital Device.

1.1 EUT Operation

The **Tracker-1000 Transceiver** was tested with the wireless link active and fully modulated. Setup and operational modes cover worst case configuration and operational modes for the device. The frequencies of the transmitting signal are: 904.8 MHz (lowest channel), 909.7 MHz (middle channel), and 914.6 MHz (highest channel).

2.0 Electromagnetic Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing.

Radiated emission measurements were made of the Fundamental and Spurious Emission levels for the **Tracker-1000 Transceiver**. Measurements of the occupied bandwidth were also made for the equipment.

Measurements of the maximum emission levels for the fundamental and the spurious/harmon ic emissions of the **Tracker-1000 Transceiver** were made at the Professional Testing "Open Field" Site 1, located in Marble Falls, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental for the device were performed to determine the worst case polarization of the devices. The fundamental emissions of the device were measured with the antennas of the devices vertical and horizontal to the ground plane. The emissions tests for both fundamental and spurious were performed at the following channels: 904.8 MHz (lowest channel), 909.7 MHz (middle channel), and 914.6 MHz (highest channel).

2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. For spurious/harmonic measurements above 1 GHz, the measurement antenna was placed 1 meter from the EUT. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 1.

2.2 Test Criteria

The table below shows FCC Part 15.247 radiated limits for an intentional radiator operating at 902-928 MHz band. In addition to these requirements, the EUT must meet the restricted emission band requirements of §15.205.The spurious measurements of the harmonic were performed to the 10th harmonic of the fundamental. The reference distance for each limit is also shown in this table.

Signal Type	Test Distance (Meters)	ERP watt	Field Strength (dBμV/m)
Fundamental (904.8 to 914.6 MHz)	3	1	125.0
Harmonics (2nd and above)	1	-	63.5

2.3 Test Results

The radiated test data for the fundamental is included in Appendix A. Quasi-Peak detector has been used during the test. The radiated emission test data for the harmonics is included in Appendix B. The emissions were maximized at each frequency and the highest emissions identified were measured using peak detection. The radiated emissions generated by the **Tracker-1000 Transceiver** are below the FCC Part 15.247 and FCC Part 15.205 maximum emission criteria.

3.0 Occupied Bandwidth Measurements

Measurements of the occupied bandwidth for the fundamental signals of the of the FCC Part 15.247 were made at the Professional Testing's Round Rock, Texas laboratory. All measurements were made in a controlled indoor environment in a configuration which did not present measurement distortion or ambient interference.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle which presented the highest signal level. The occupied bandwidth was also measured at the 904.8 MHz (lowest channel), 909.7 MHz (middle channel), 914.6 MHz (highest channel) on the device. Peak detection was used for all tests. The occupied bandwidth was based on a 20 dB criteria (20 dB down either side of the emission from the nominal center of the emission). A drawing showing the test setup is given as Figure 1.

3.2 Test Criteria

According to FCC Part 15.247, for frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 second.

Measurement of the occupied bandwidth was performed to verify that the emission bandwidth of each channel from the EUT did not exceed 250 kHz. The typical occupied bandwidth of each channel for the module is 25 kHz.

3.3 Test Results

The occupied bandwidth test data is included in Appendix C. The occupied bandwidth of each channel is less than 250kHz. The figures is typical for the **Tracker-1000 Transceiver**.

The total channels for the EUT is 50. For the **Tracker-1000 Transceiver**, each channel won't be activate twice before all the other channels have been activated. In a 20 second period, the average time of occupancy for each frequency is less than 20/50 = 0.4 second. Therefore, the **Tracker-1000 Transceiver** is within the band allowed under FCC Part 15.247 emission band criteria.

4.0 Antenna Requirement

An analysis of the **Tracker-1000 Transceiver** was performed to determine compliance with Section 15.203 of the Rules. This section requires specific handling and control of antennas used for devices subject to regulations under the Intentional Radiator portions of Part 15.

4.1 Evaluation Procedure

The structure and application of the **Tracker-1000 Transceiver** were analyzed with respect to the rules. The antenna for this unit is a small "rubber-duck" vertical antenna that protrudes from the end of the hand-held unit and is not accessible by the user. An auxiliary antenna port is not present.

4.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

(a) Antenna be permanently attached to the unit.

(b) Antenna must use a unique type of connector to attach to the EUT.

(c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

4.3 Evaluation Results

The **Tracker-1000 Transceiver** meets the criteria of this rule by virtue of having an external antenna permanently attached to the unit. The EUT is therefore compliant with §15.203.

5.0 Modifications to Equipment

There were no modifications made on the **Tracker-1000 Transceiver** during the performance of the test program in order to meet the FCC criteria.

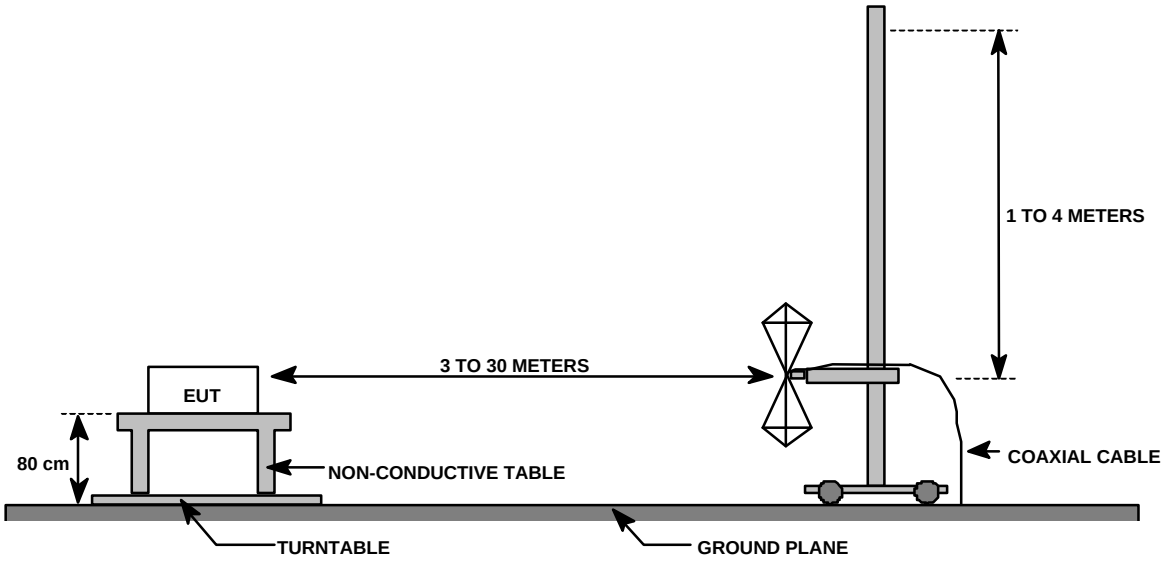
6.0 List of Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

Electromagnetic Emissions Test Equipment

Device	Description	Date Last Calibrated	Calibration Due
HP 8567A	Spectrum Analyzer	02/19/99	02/19/00
HP 85650A	Quasi Peak Adapter	02/19/99	02/19/00
HP 8566B	Spectrum Analyzer	10/30/98	10/30/99
HP 85650A	Quasi Peak Adapter	10/30/98	10/30/99
HP 8447F	Preamp	10/28/98	10/28/99
EMCO 3108	Biconical Antenna	07/10/99	07/10/00
EMCO 3146	Log Antenna	07/10/99	07/10/00
EMCO 3115	Microwave Antenna	05/21/99	05/21/00
MITEQ	Preamp	05/16/99	05/16/00

FIGURE 1: Radiated Emissions Test Setup



Appendix A

Radiated Emissions Data Sheets

Fundamental Radiated Data Sheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 3
DETECTOR FUNCTION: Quasi-Peak

Antenna Horizontal

Freq. (MHz)	EUT Dir. (Deg.)	Antenna Height (Meter)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
904.8	197.0	1.0	68.3	23.4	7.8	99.5	125.0	-25.5
909.7	190.0	1.0	67.7	23.4	7.8	98.9	125.0	-26.1
914.6	193.0	1.0	66.6	23.5	7.9	98.0	125.0	-27.0

Antenna Vertical

Freq. (MHz)	EUT Dir. (Deg.)	Antenna Height (Meter)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
904.8	145.0	2.0	64.6	23.4	7.8	95.8	125.0	-29.2
909.7	145.0	2.0	64.1	23.4	7.8	95.3	125.0	-29.7
914.6	145.0	2.0	62.9	23.5	7.9	94.3	125.0	-30.7

COMMENT #1: EUT Horizontal. In EUT Vertical condition, the emission is low than the EUT Horizontal condition.

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TEST ENGINEER:_____APPROVED BY:_____

Larry Zhou **Jeffrey Lenk**

Appendix B

Spurious Radiated Emissions Data Sheets

Spurious Radiated Data Sheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 1
ANTENNA POLARIZATION: Vertical
DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Dir. (Deg.)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1809.60	180	25.3	28.3	2.2	55.8	63.5	-7.7
2714.40	180	10.4	30.1	2.3	42.8	63.5	-20.7
3619.20	0	5.0	31.3	4.4	40.7	63.5	-22.8
4524.00	0	5.1	32.7	3.1	40.9	63.5	-22.6
5428.80	0	4.3	34.3	4.2	42.8	63.5	-20.7
6333.60	0	5.2	35.5	4.5	45.2	63.5	-18.3
7238.40	0	4.7	36.0	5.1	45.8	63.5	-17.7
8143.20	0	5.1	37.0	5.2	47.3	63.5	-16.2
9048.00	0	4.8	36.5	5.7	47.0	63.5	-16.5

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: EUT Horizontal.

COMMENT #2: Antenna Elevation optimized at 1 meter.

COMMENT #3: Lowest Channel.

TEST ENGINEER:_____ **APPROVED BY:**_____

Larry Zhou **Jeffrey Lenk**

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 1
ANTENNA POLARIZATION: Vertical
DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Dir. (Deg.)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1819.40	180	21.4	28.3	2.2	51.9	63.5	-11.6
2729.10	0	10.5	30.1	2.3	42.9	63.5	-20.6
3638.80	0	5.2	31.3	4.4	40.9	63.5	-22.6
4548.50	0	4.1	32.7	3.1	39.9	63.5	-23.6
5458.20	0	4.2	34.3	4.2	42.7	63.5	-20.8
6367.90	0	4.7	35.5	4.5	44.7	63.5	-18.8
7277.60	0	4.9	36.0	5.1	46.0	63.5	-17.5
8187.30	0	4.7	37.0	5.2	46.9	63.5	-16.6
9097.00	0	5.2	36.5	5.7	47.4	63.5	-16.1

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: EUT Horizontal.

COMMENT #2: Antenna Elevation optimized at 1 meter.

COMMENT #3: Middle Channel.

TEST ENGINEER:_____**APPROVED BY:**_____

Larry Zhou **Jeffrey Lenk**

Spurious Radiated Data Sheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 1
ANTENNA POLARIZATION: Vertical
DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Dir. (Deg.)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1829.20	160	21.8	28.3	2.2	52.3	63.5	-11.2
2743.80	260	10.2	30.1	2.3	42.6	63.5	-20.9
3658.40	0	4.7	31.3	4.4	40.4	63.5	-23.1
4573.00	0	5.2	32.7	3.1	41.0	63.5	-22.5
5487.60	0	4.9	34.3	4.2	43.4	63.5	-20.1
6402.20	0	5.1	35.5	4.5	45.1	63.5	-18.4
7316.80	0	4.2	36.0	5.1	45.3	63.5	-18.2
8231.40	0	4.8	37.0	5.2	47.0	63.5	-16.5
9146.00	0	4.7	36.5	5.7	46.9	63.5	-16.6

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: EUT Horizontal.

COMMENT #2: Antenna Elevation optimized at 1 meter.

COMMENT #3: Highest Channel.

TEST ENGINEER:_____**APPROVED BY:**_____

Larry Zhou **Jeffrey Lenk**

Spurious Radiated Data Sheet

ProNet, Inc.

Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 1
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Dir. (Deg.)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1809.60	30	29.7	28.3	2.2	60.2	63.5	-3.3
2714.40	60	17.8	30.1	2.3	50.2	63.5	-13.3
3619.20	0	5.0	31.3	4.4	40.7	63.5	-22.8
4524.00	0	5.2	32.7	3.1	41.0	63.5	-22.5
5428.80	0	4.7	34.3	4.2	43.2	63.5	-20.3
6333.60	0	4.9	35.5	4.5	44.9	63.5	-18.6
7238.40	0	4.7	36.0	5.1	45.8	63.5	-17.7
8143.20	0	5.1	37.0	5.2	47.3	63.5	-16.2
9048.00	0	5.2	36.5	5.7	47.4	63.5	-16.1

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: EUT Horizontal.

COMMENT #2: Antenna Elevation optimized at 1 meter.

COMMENT #3: Lowest Channel.

TEST ENGINEER:_____**APPROVED BY:**_____

Larry Zhou **Jeffrey Lenk**

Spurious Radiated Data Sheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 1
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Dir. (Deg.)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1819.40	60	29.4	28.3	2.2	59.9	63.5	-3.6
2729.10	120	14.8	30.1	2.3	47.2	63.5	-16.3
3638.80	0	4.7	31.3	4.4	40.4	63.5	-23.1
4548.50	0	5.5	32.7	3.1	41.3	63.5	-22.2
5458.20	0	4.3	34.3	4.2	42.8	63.5	-20.7
6367.90	0	5.1	35.5	4.5	45.1	63.5	-18.4
7277.60	0	5.0	36.0	5.1	46.1	63.5	-17.4
8187.30	0	4.7	37.0	5.2	46.9	63.5	-16.6
9097.00	0	4.9	36.5	5.7	47.1	63.5	-16.4

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: EUT Horizontal.

COMMENT #2: Antenna Elevation optimized at 1 meter.

COMMENT #3: Middle Channel.

TEST ENGINEER:_____**APPROVED BY:**_____

Larry Zhou **Jeffrey Lenk**

Spurious Radiated Data Sheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00128-10

MEASUREMENT DISTANCE (m): 1
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak

Freq. (MHz)	EUT Dir. (Deg.)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1829.20	270	29.3	28.3	2.2	59.8	63.5	-3.7
2743.80	150	13.4	30.1	2.3	45.8	63.5	-17.7
3658.40	0	4.8	31.3	4.4	40.5	63.5	-23.0
4573.00	0	5.1	32.7	3.1	40.9	63.5	-22.6
5487.60	0	5.7	34.3	4.2	44.2	63.5	-19.3
6402.20	0	4.3	35.5	4.5	44.3	63.5	-19.2
7316.80	0	4.7	36.0	5.1	45.8	63.5	-17.7
8231.40	0	4.9	37.0	5.2	47.1	63.5	-16.4
9146.00	0	4.9	36.5	5.7	47.1	63.5	-16.4

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: EUT Horizontal.

COMMENT #2: Antenna Elevation optimized at 1 meter.

COMMENT #3: Highest Channel.

TEST ENGINEER:_____**APPROVED BY:**_____

Larry Zhou **Jeffrey Lenk**

Appendix C

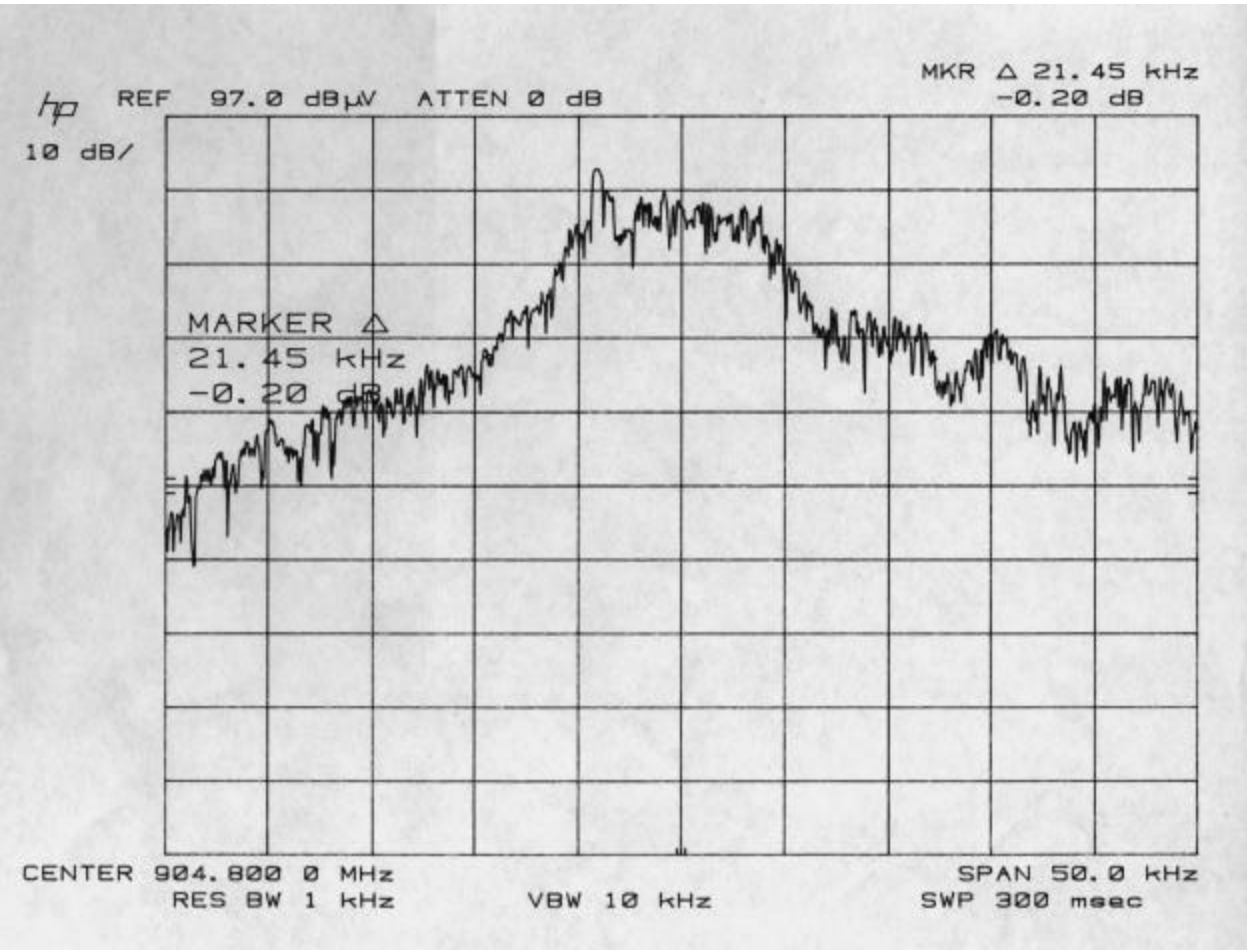
Occupied Bandwidth Data Sheets

Occupied Bandwidth Datasheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00218-10

MEASUREMENT DISTANCE (m): 1.0
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak



COMMENT #1: 20dB Bandwidth = 21.45 kHz

COMMENT #2: Lowest Channel.

TEST ENGINEER:_____**APPROVED BY:**_____

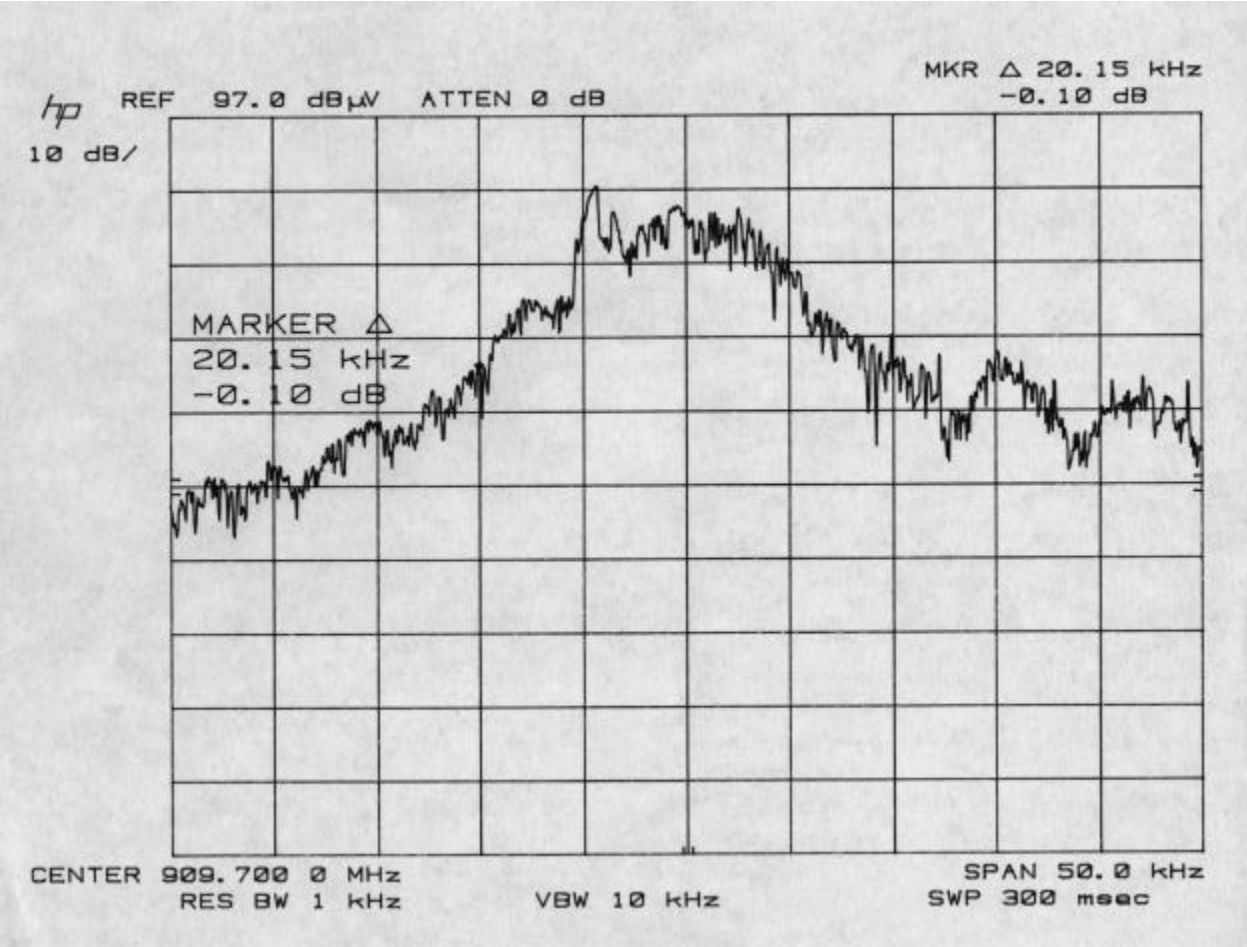
Larry Zhou **Jeffrey Lenk**

Occupied Bandwidth Datasheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00218-10

MEASUREMENT DISTANCE (m): 1.0
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak



COMMENT #1: 20dB Bandwidth = 20.15 kHz

COMMENT #2: Middle Channel.

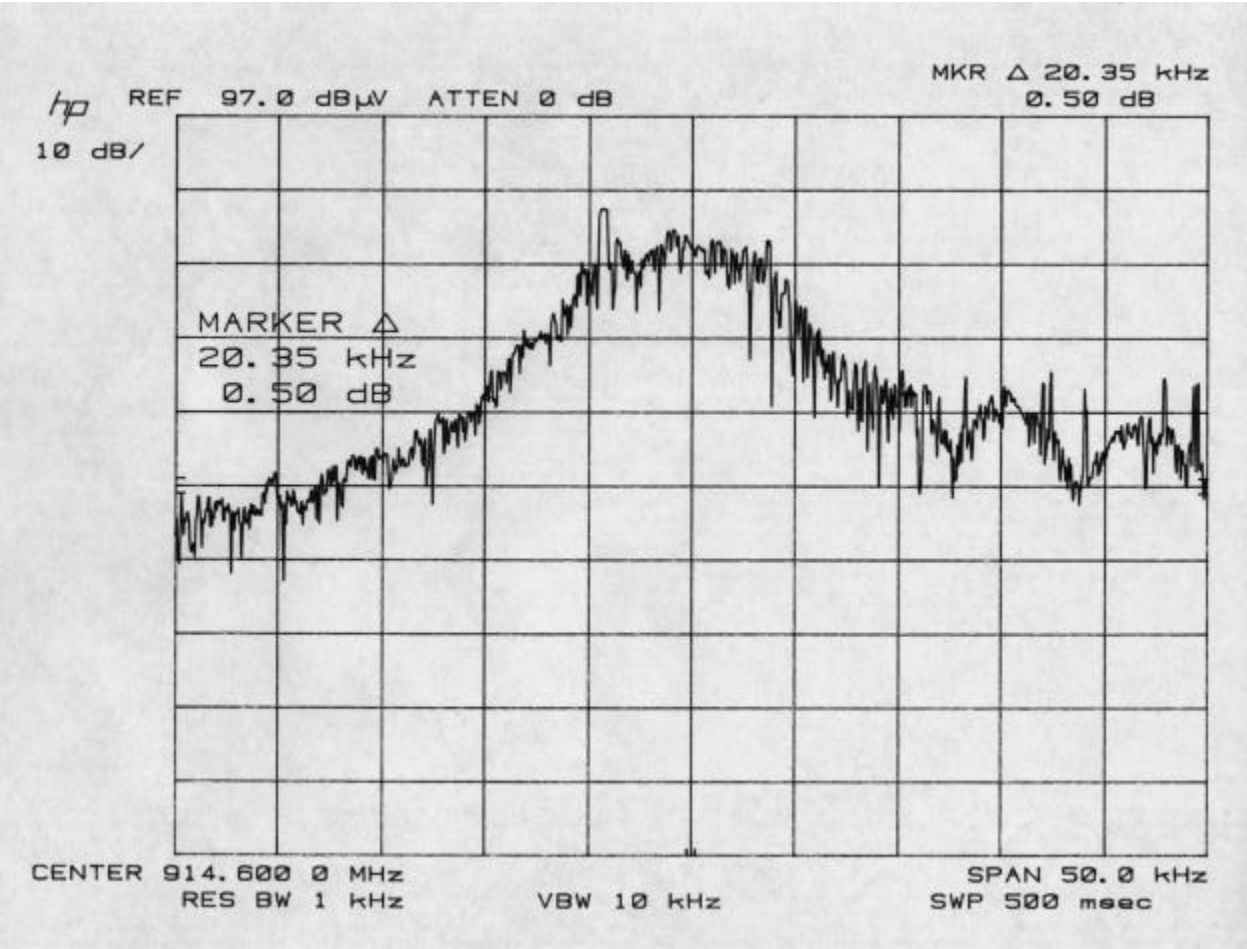
TEST ENGINEER:_____APPROVED BY:_____
Larry Zhou **Jeffrey Lenk**

Occupied Bandwidth Datasheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00218-10

MEASUREMENT DISTANCE (m): 1.0
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak



COMMENT #1: 20dB Bandwidth = 20.35 kHz

COMMENT #2: Highest Channel.

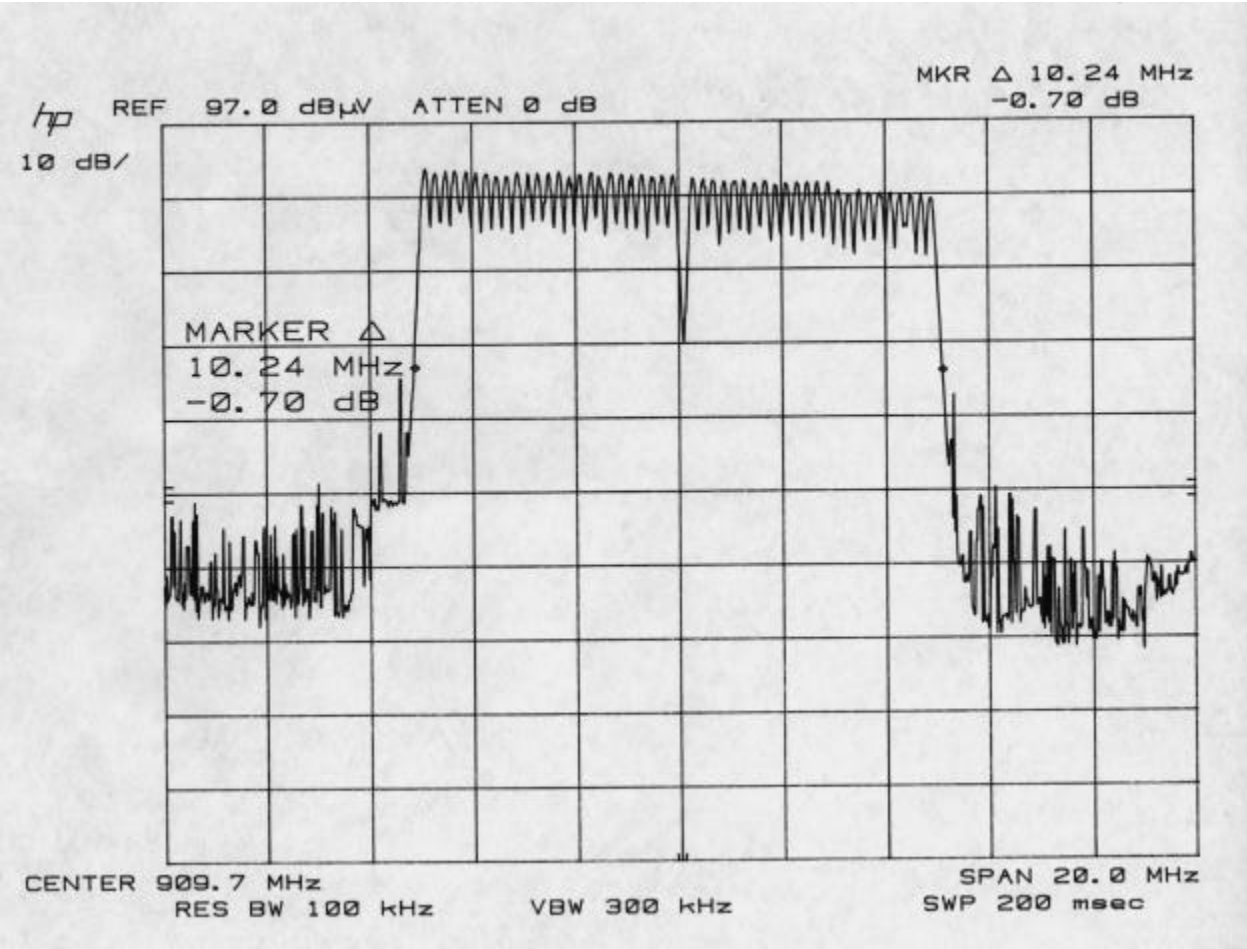
TEST ENGINEER:_____APPROVED BY:_____
Larry Zhou **Jeffrey Lenk**

Occupied Bandwidth Datasheet

ProNet, Inc.
Tracker-1000 Transceiver

SERIAL #: N/A
DATE: 10/15/99
PROJECT #: 00218-10

MEASUREMENT DISTANCE (m): 1.0
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak



COMMENT #1: The spectrum of all 50 channels (from 904.8 MHz to 914.6 MHz)

TEST ENGINEER:_____APPROVED BY:_____
Larry Zhou **Jeffrey Lenk**