REPORT OF

TEST DATA FOR

FOR PNI

Prepared by
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June 5, 2004

PNI Wireless Temperature Transmitter
PN 12173

GEL File PNI 03-2004

GLEN ELLEN LABORATORIES
1876 London Ranch Road
Glen Ellen, CA 95442

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This report contains 10 pages

1. Test Methodology

The radiated tests were performed in accordance with the procedures specified by ANSI C63.4-2001. Compliance with applicable standards was determined by comparing the measured results with respect to the limits specified in 47CFR Part 15.249 and Part 15.209. These measurements were made on June 3, 2004, by Dan Swann, Tony de Rijk and Anders Boeen, at a distance of 3 meters.

Initially, the transmitter was tested at a 1 meter measurement distance on all three axis with 360 degrees of rotation on each axis to determine the direction of maximum emissions. The highest radiation level was obtained when the antenna end of the EUT was directly facing the receive antenna. Therefore, the unit was tested on the open area test site turntable as shown in the photographs of the radiated test setup.

Limits were converted from mV/m and uV/m using:

Limit in dBuV/meter = 20 * Log (limit in mV/meter * 1000)) = 20 * Log (limit in uV/meter)

The limits used were as follows, for a Part 15.249 transmitter in the 902-928 MHz band:

Intentional radiator limit, fundamental frequency

quasi-peak limit = 50 mV/m at 3 meters = 94 dBuV/m

peak limit = 94 dBuV/m + 20 dB = 114 dBuV/m

Intentional radiator limit, harmonics of the fundamental frequency

average limit = 500 uV/m at 3 meters = 54 dBuV/m

peak limit = 54 dBuV/m + 20 dB = 74 dBuV/m

Unintentional radiation limits

30 to 88 MHz quasi-peak limit = 100 uV/m = 40 dBuV/m

88 to 216 MHz quasi-peak limit = 150 uV/m = 43.5 dBuV/m

216 to 960 MHz quasi-peak limit = 200 uV/m = 46 dBuV/m

above 960 MHz, below 1000 MHz, quasi-peak limit = 500 uV/m = 54 dBuV/m,

above 1000 MHz, average limit = 500 uV/m = 54 dBuV/m,

2. Description of Test Facility

2.1 Site Description

The Glen Ellen Laboratories open field test site complies with the requirements specified by VDE 0876/9.78, VDE 0877 Part 1/11.81, VDE 0877 Part 2/2.85, CISPR 16, CISPR 22, and ANSI C63.4-1992. The test site closely follows the theoretical normalized site attenuation specifications for both horizontal and vertical polarizations. The site has been fully described in a report dated November 3, 2002, submitted to the FCC, and accepted in a letter dated November 8, 2002 (Registration Number 90613.)

The facility is located near the town of Glen Ellen, California, at the street address of 1876 London Ranch Road. The site is at approximately 175 meters altitude on the East side of Sonoma Mountain, at the coordinates of 38 degrees 22 minutes North Latitude and 122 degrees 32 minutes West Longitude. The site sits north of a ridge approximately 100 meters higher in elevation and 1000 meters to the South, which attenuates VHF and above frequencies from the San Francisco Bay area 60 kilometers to the South. The open field test site consists of a 10 by 20 meter area of galvanized hardware cloth placed on top of a flat asphalt surface located in an open meadow. All seams of adjacent widths of hardware cloth are soldered together. The metal turntable top surface is flush with the ground plane. All metal objects other than the groundscreen/flush turntable are located a considerable distance further than the standard 10-meter CISPR measurement ellipse.

2.2 Test Equipment List

Test equipment used included:

1. Hewlett Packard 8591EM spectrum analyzer, cal due 04-10-05.
2. Sonoma Instruments 317 preamplifier, 10 kHz to 2.5 GHz, cal due 04-14-05.
3. GEL BIC9414 biconical antenna, 30 MHz to 300 MHz, cal due 06-12-04.
4. GEL LPA-3 log periodic antenna, 275 MHz to 2 GHz, cal due 06-12-04.

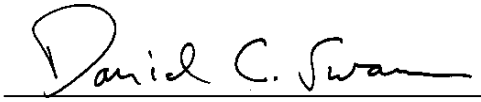
3. Radiated Emissions Data

3.1 Intentional Radiated Emissions

Transmitter Intentional Radiation, 3 meter test distance

Frequency MHz	Measured Amplitude dBuV	Antenna Factor dB/m	Cable Loss dB	Amplifier Gain dB	Field Strength dBuV/m	Part 15.249 Limit dBuV/m	Part 15.249 Margin dB
Vertical Polarization							
Peak Measurement							
914.975	83.6	23.9	7.5	18.4	96.5	114.0	-17.5
Quasi-Peak Measurement							
914.975	73.8	23.9	7.5	18.4	86.7	94.0	-7.3
Horizontal Polarization							
Peak Measurement							
914.975	85.5	23.9	7.5	18.4	98.5	114.0	-15.5
Quasi-Peak Measurement							
914.975	75.3	23.9	7.5	18.4	88.3	94.0	-5.7

Test Personnel:

Tester Signature  Date June 5, 2004

Tester Name Daniel C. Swann

3.2 Unintentional Radiated Emissions, Harmonics

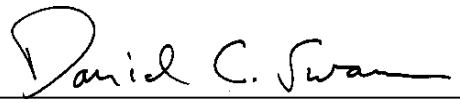
Transmitter Unintentional Radiation, 3 meter test distance

Frequency MHz	Measured Amplitude dBuV	Antenna Factor dB/m	Cable Loss dB	Amplifier Gain dB	Field Strength dBuV/m	Part 15.249 Limit dBuV/m	Part 15.249 Margin dB
Transmitter Harmonics							
Horizontal Polarization							
Peak Measurement							
1829.950	38.7	31.1	10.8	28.0	52.6	74	-21.4
Average Measurement							
1829.950	23.7	31.1	10.8	28.0	37.6	54	-16.4
Peak Measurement							
2744.925	37.3	33.1	12.3	26.8	55.9	74	-18.1
Average Measurement							
2744.925	23.0	33.1	12.3	26.8	41.6	54	-12.4

No signals found in Vertical Polarization

No signals found at other transmitter harmonics

Test Personnel:

Tester Signature  Date June 5, 2004

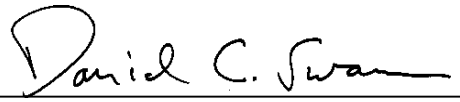
Tester Name Daniel C. Swann

3.3 Unintentional Radiated Emissions, Other Emissions

Transmitter Unintentional Radiation, 3 meter test distance

Frequency MHz	Measured Amplitude dBuV	Antenna Factor dB/m	Cable Loss dB	Amplifier Gain dB	Field Strength dBuV/m	Part 15.209 Quasi-Peak Limit dBuV/m	Part 15.209 Margin dB
Vertical Polarization							
44.508	44.5	13.2	1.9	38.5	21.1	40.0	-18.9
59.344	36.4	8.2	2.1	38.5	8.2	40.0	-31.8
74.180	36.8	6.4	2.3	38.6	7.0	40.0	-33.0
118.688	31.1	13.1	2.8	38.5	8.4	43.5	-35.1
133.524	28.8	14.4	2.9	38.5	7.5	43.5	-36.0
148.360	28.2	15.2	3.0	38.5	7.9	43.5	-35.6
Horizontal Polarization							
44.508	35.8	13.2	1.9	38.5	12.5	40.0	-27.5
59.344	36.4	8.2	2.1	38.5	8.2	40.0	-31.8
74.180	34.4	6.4	2.3	38.6	4.6	40.0	-35.4
118.688	32.2	13.1	2.8	38.5	9.5	43.5	-34.0
133.524	29.9	14.4	2.9	38.5	8.6	43.5	-34.9
148.360	31.5	15.2	3.0	38.5	11.1	43.5	-32.4

Test Personnel:

Tester Signature  Date June 5, 2004

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3.4 Field Strength Calculation for Radiated Emissions

The field strength was calculated from the following formula:

FS = MEASURED SIGNAL + AF + CF - GAIN

Where FS = field strength, in dBuV/m

MEASURED SIGNAL = Spectrum Analyzer signal amplitude

AF = antenna factor

CF = cable attenuation factor

GAIN = pre-amplifier gain (minus any external attenuators)

FS (uV/m) = antilog[10] FS (dBuV/m)

For example, for transmitter intentional radiation at 914.975 MHz in vertical polarization, a quasi-peak reading of 73.8 dBuV was measured. The antenna factor is 23.9 dB, the cable loss is 7.5 dB, and the pre-amplifier gain is 18.4 dB.

FS (dBuV/m) = 73.8 + 23.9 + 7.5 – 18.4

FS (dBuV/m) = 86.7 dBuV/m

Part 15.249 3 meter quasi-peak limit = 94.0 dBuV/m

Part 15.249 3 meter quasi-peak margin = -7.3 dB

4.0 Photographs

4.1 Front of Radiated Test Setup

4.0 Photographs (continued)

4.2 Rear View of Radiated Test Setup