



M. Flom Associates, Inc. - Global Compliance Center

3356 North San Marcos Place, Suite 107, Chandler, Arizona 85225-7176

www.mflom.com general@mflom.com (480) 926-3100, FAX: 926-3598

Environmental Assessment

for

Mobiles/Fixed Base Station

for

FCC ID: FCC ID: FRW2000-UHF1

Model:P2000-UHF1

to

Federal Communications Commission

47 CFR 1.1310 (MPE)

Radiofrequency Radiation Exposure Limits

Date Of Report: September 30, 2003

On the Behalf of the Applicant:

Wulfsberg Electronics Division

At the Request of:

P.O. 13187

Wulfsberg Electronics Division
6400 Wilkinson Drive
Prescott, AZ 86301-6164

Attention of:

Main: (928) 708-1550; Fax: (928) 541-7627
Scott Hovelsrud, Tactical Communications Product Line Mgr.
Direct (928) 708-1505
Email: scott.hovelsrud@wulfsberg.com
Mary Beaumont, Principal RF Engineer
Direct (928) 708-1543
Email: mary.beaumont@wulfsberg.com

Supervised By:

A handwritten signature in black ink, reading 'M. Flom P. Eng.' with a stylized flourish at the end.

Morton Flom, P. Eng.

Table of Contents

Rule	Description	Page
	Test Report	1
	Identification of the Equipment Under Test	2
	Standard Test Conditions and Engineering Practices	4
1.1310	Environmental Assessment	5

Page Number 1 of 13.

Required information per ISO/IEC Guide 25-1990, paragraph 13.2:

a) **Test Report (Supplemental)**

b) Laboratory: M. Flom Associates, Inc.
(FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107
(Canada: IC 2044) Chandler, AZ 85225

c) Report Number: d0390093

d) Client: Wulfsberg Electronics Division
6400 Wilkinson Drive
Prescott, AZ 86301-6164

e) Identification: P2000-UHF1
FCC ID: FRW2000-UHF1
Description: UHF 403-470MHz Transceiver

f) EUT Condition: Not required unless specified in individual tests.

g) Report Date: September 30, 2003
EUT Received: August 11, 2003

h, j, k): As indicated in individual tests.

i) Sampling method: No sampling procedure used.

l) Uncertainty: In accordance with MFA internal quality manual.

m) Supervised by:



Morton Flom, P. Eng.

n) Results: The results presented in this report relate only to the item tested.

o) Reproduction: This report must not be reproduced, except in full, without written permission from this laboratory.

Page Number

2 of 13.

Identification of the Equipment Under Test (EUT)**Name and Address of Applicant:**

Wulfsberg Electronics Division
 6400 Wilkinson Drive
 Prescott, AZ 86301-6164

Manufacturer:

Wulfsberg Electronics Division
 6400 Wilkinson Drive
 Prescott, AZ 86301-6164

FCC ID: FRW2000-UHF1

Model Number: P2000-UHF1

Description: UHF 403-470MHz Transceiver

Type of Emission: 16K0F3E, 11K0F3E, 8K10F1E,
8K10F1D

Frequency Range, MHz: 403 to 470

Power Rating, Watts: 1 to 10
☒ Switchable ☐ Variable ☐ N/A

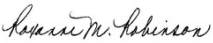
Modulation:
☐ AMPS
☐ TDMA
☐ CDMA
☒ OTHER

Antenna:
☐ Helical
☐ Monopole
☐ Whip
☒ Other

Note: For RF Safety test antenna gain taken at the upper range of expected gain (i.e. 0 dBd) and RF Power set to highest nominal power across all channels.

Page Number 3 of 13.

M. Flom Associates, Inc. is accredited by the American Association for Laboratory Association (A2LA) as shown in the scope below.

 THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION ACCREDITED LABORATORY A2LA has accredited M. FLOM ASSOCIATES, INC. Chandler, AZ for technical competence in the field of Electrical (EMC) Testing The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002. Presented this 2nd day of March, 2001.  Peter M. Robinson President For the Accreditation Council Certificate Number 1008.01 Valid to December 31, 2002 For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation	 American Association for Laboratory Accreditation <u>SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999</u> M. FLOM ASSOCIATES, INC. Electronic Testing Laboratory 3356 North San Marcos Place, Suite 107 Chandler, AZ 85225 Morton Flom Phone: 480 926 3100 ELECTRICAL (EMC) Valid to: December 31, 2002 Certificate Number: 1008-01 In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following <u>electromagnetic compatibility tests</u>: <table><thead><tr><th>Tests</th><th>Standard(s)</th></tr></thead><tbody><tr><td>RF Emissions</td><td>FCC Part 15 (Subparts B and C) using ANSI C63.4-1992, CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438</td></tr><tr><td>Harmonic Currents</td><td>EN 61000-3-2</td></tr><tr><td>Fluctuation and Flicker</td><td>EN 61000-3-3</td></tr><tr><td>RF Immunity</td><td>EN: 50082-1, 50082-2 (both excluding "Power Frequency Magnetic Field Immunity"), 55024 (excluding Power Frequency Magnetic Field and Conducted Immunity); AS/NZS 4251.1</td></tr><tr><td>Electrostatic Discharge (ESD)</td><td>EN 61000-4-2</td></tr><tr><td>Radiated Susceptibility</td><td>EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3</td></tr><tr><td>EFT</td><td>EN 61000-4-4; IEC 1000-4-4; IEC 801-4</td></tr><tr><td>Surge</td><td>EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5</td></tr><tr><td>Voltage Dips, Short Interruptions, and Line Voltage Variations</td><td>EN 61000-4-11</td></tr><tr><td>47 CFR (FCC)</td><td>Part: 2, 18, 21, 22, 23, 24, 25, 26, 27, 74, 80, 87, 90, 95, 97, 101 (excluding SAR Testing)</td></tr></tbody></table>  Peter M. Robinson (A2LA Cert. No. 1008.01) 05/10/02 Page 1 of 1 5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974	Tests	Standard(s)	RF Emissions	FCC Part 15 (Subparts B and C) using ANSI C63.4-1992, CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438	Harmonic Currents	EN 61000-3-2	Fluctuation and Flicker	EN 61000-3-3	RF Immunity	EN: 50082-1, 50082-2 (both excluding "Power Frequency Magnetic Field Immunity"), 55024 (excluding Power Frequency Magnetic Field and Conducted Immunity); AS/NZS 4251.1	Electrostatic Discharge (ESD)	EN 61000-4-2	Radiated Susceptibility	EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3	EFT	EN 61000-4-4; IEC 1000-4-4; IEC 801-4	Surge	EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5	Voltage Dips, Short Interruptions, and Line Voltage Variations	EN 61000-4-11	47 CFR (FCC)	Part: 2, 18, 21, 22, 23, 24, 25, 26, 27, 74, 80, 87, 90, 95, 97, 101 (excluding SAR Testing)
Tests	Standard(s)																						
RF Emissions	FCC Part 15 (Subparts B and C) using ANSI C63.4-1992, CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438																						
Harmonic Currents	EN 61000-3-2																						
Fluctuation and Flicker	EN 61000-3-3																						
RF Immunity	EN: 50082-1, 50082-2 (both excluding "Power Frequency Magnetic Field Immunity"), 55024 (excluding Power Frequency Magnetic Field and Conducted Immunity); AS/NZS 4251.1																						
Electrostatic Discharge (ESD)	EN 61000-4-2																						
Radiated Susceptibility	EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3																						
EFT	EN 61000-4-4; IEC 1000-4-4; IEC 801-4																						
Surge	EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5																						
Voltage Dips, Short Interruptions, and Line Voltage Variations	EN 61000-4-11																						
47 CFR (FCC)	Part: 2, 18, 21, 22, 23, 24, 25, 26, 27, 74, 80, 87, 90, 95, 97, 101 (excluding SAR Testing)																						

"This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this report have been determined in accordance with the laboratory's terms of accreditation unless stated otherwise in the report."

Should this report contain any data for tests for which we are not accredited, or which have been undertaken by a subcontractor that is not A2LA accredited, such data would not covered by this laboratory's A2LA accreditation.

**Standard Test Conditions
and
Engineering Practices**

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4-1992/2000, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst-case measurements.

Page Number	5 of 13.
Name of Test:	Environmental Assessment
Specification:	FCC: 47 CFR 1.1310
Measurement Guide:	ANSI/IEEE C95.1 1992
Test Equipment:	Maximum Permissible Exposure (MPE) measurement system, consisting of: Narda 8717-1174R, Radiation meter Narda 8761D, E-field probe (300 kHz – 3 GHz) (Calibrated Nov-98)
Measurement Procedure:	1. The following measurements were performed with a Narda probe using ANSI/IEEE C95.1 as a guide. 2. Prior to making any measurements, the measurements system was calibrated in accordance with the manufacturer's procedures. 3. The EUT's radiating element (antenna) was placed on a 1 m tall table for ease of testing. For equipment normally operated on a metal surface, a ground plane was used. 4. The remaining equipment necessary to operate the EUT was maintained at a distance from the measurement arrangement suitable to minimize interference with the measurements. 5. The minimum safe distance was calculated from the formula $\text{Power Density} = \text{EIRP} / 4\pi R^2$ (Peak Watts/m²). The calculation is shown with the measurement data. 6. With the EUT operating at maximum power, a search was initiated for worst case emissions with the probe raised and lowered over a range of 0.2 to 2 meters in height and over a horizontal plane of 0° to 360°. 7. Average values were calculated for the whole body (0.2-2.0m), lower body (0.2-0.8m) and upper body (1.0-2.0m).
Results:	Attached.

Page Number 6 of 13.

Name of Test: R.F. Radiation Exposure

FCC Rules: 1.1307, 1.1310, 1.1311, 2.1091
Description, EUT: See page 2 of Test Report

Equipment under test: P2000-UHF1
Frequencies tested, MHz 403.025 437.025 469.975
Antenna Gain = 3 dB nominal
Antenna Model AT-462 (Manufactured by Comant)

Instruments Narda 8717-1174R, Radiation Meter
Narda 8760B, E-field probe (300 kHz – 1 GHz)
Narda 8761D, E-field probe (300 kHz – 3 GHz)

Limits: Uncontrolled	0.3-1.234 MHz:	Limit [mW/cm ²] = 100
Exposure	1.34-30 MHz:	Limit [mW/cm ²] = (180/f ²)
47 CFR 1.1310	30-300 MHz:	Limit [mW/cm ²] = 0.2
Table 1, (B)	300-1500 MHz	Limit [mW/cm ²] = f/1500
	1500-100,000 MHz:	Limit [mW/cm ²] = 1.0

Power, Conducted, W = 10 W
Power + Ant. Gain, W = 10 W, 50% Duty Cycle
Limit: Uncontrolled Exposure = 0.269, 0.291, 0.313 mW/cm²

Results at tested distance	Power Density, mW/cm ²			
	Probe Height, m	Freq. 403 MHz Distance 30 cm	Freq. 437 MHz Distance 27cm	Freq. 470 MHz Distance 25 cm
	2.0	0.050	0.101	0.044
	1.8	0.049	0.068	0.037
	1.6	0.111	0.205	0.113
	1.4	0.150	0.139	0.086
	1.2	0.202	0.192	0.167
	1.0	0.177	0.118	0.115
	0.8	0.092	0.093	0.118
	0.6	0.090	0.0280	0.024
	0.4	0.085	0.043	0.016
	0.2	0.027	0.026	0.009

Power Density Calculations: The measured power density readings were summed and the results divided by the number of readings to calculate the average.

	403 MHz	437 MHz	470 MHz
Whole body average (0.2 – 2.0 m, mW/cm ²) =	0.1033	0.1013	0.0729
Lower body average (0.2 - 0.8 m, mW/cm ²) =	0.0735	0.0475	0.04175
Upper body average (1.0 - 2.0 m, mW/cm ²) =	0.1231667	0.1371667	0.093667



Performed by:

David Lee

Page Number

7 of 13.

Test Setup:

Maximum Permissible Exposure (MPE)

State: UHF1



Page Number 8 of 13.

Name of Test: R.F. Radiation Exposure

FCC Rules: 1.1307, 1.1310, 1.1311, 2.1091
Description, EUT: See page 2 of Test Report

Equipment under test: P2000-UHF1 with P2000-UHF2
Frequencies tested, MHz: 155.025 485.025
Antenna Gain: = 3 dB + 3 dB nominal
Antenna Models: AT-462 (Manufactured by Comant)

Instruments: Narda 8717-1174R, Radiation Meter
Narda 8760B, E-field probe (300 kHz – 1 GHz)
Narda 8761D, E-field probe (300 kHz – 3 GHz)

Limits: Uncontrolled Exposure	0.3-1.234 MHz:	Limit [mW/cm ²] = 100
47 CFR 1.1310	1.34-30 MHz:	Limit [mW/cm ²] = (180/f ²)
Table 1, (B)	30-300 MHz:	Limit [mW/cm ²] = 0.2
	300-1500 MHz:	Limit [mW/cm ²] = f/1500
	1500-100,000 MHz:	Limit [mW/cm ²] = 1.0

Power, Conducted, W = 10 W + 10 W
Power + Ant. Gain, W = 10 W + 10 W, 50% Duty Cycle
Limit: Uncontrolled Exposure = 0.291 and 0.323 mW/cm²

Results at tested distance	Power Density, mW/cm ²			
	Probe Height, m	Freq. 437 MHz Distance 100 cm	Freq. 485 MHz Distance 100 cm	Both Frequencies Distance 100 cm
	2.0	0.165	0.113	0.236
	1.8	0.223	0.158	0.346
	1.6	0.242	0.158	0.359
	1.4	0.161	0.156	0.274
	1.2	0.164	0.193	0.314
	1.0	0.163	0.168	0.257
	0.8	0.082	0.119	0.153
	0.6	0.083	0.118	0.153
	0.4	0.151	0.128	0.223
	0.2	0.089	0.086	0.128

Power Density Calculations: The measured power density readings were summed and the results divided by the number of readings to calculate the average.

	437 MHz	485 MHz	Both
Whole body average (0.2 – 2.0 m, mW/cm ²) =	0.1523	0.1397	0.2443
Lower body average (0.2 – 0.8 m, mW/cm ²) =	0.10125	0.11275	0.16425
Upper body average (1.0 – 2.0 m, mW/cm ²) =	0.18633	0.15767	0.29767



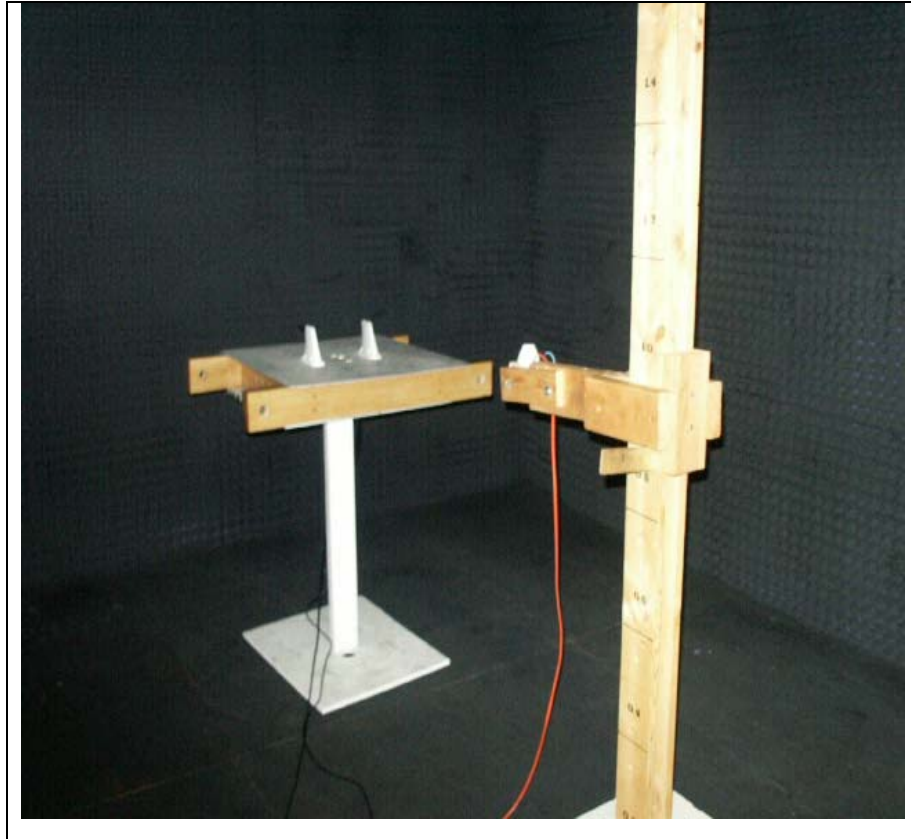
Performed by:

David Lee

Page Number 9 of 13.

Test Setup: Maximum Permissible Exposure (MPE)

State: UHF1 + UHF2



Page Number 10 of 13.

Name of Test: R.F. Radiation Exposure

FCC Rules: 1.1307, 1.1310, 1.1311, 2.1091
Description, EUT: See page 2 of Test Report

Equipment under test: P2000-UHF1 with P2000-VHF
Frequencies tested, MHz: 155.025 437.025
Antenna Gain: = 0 dB + 3 dB nominal
Antenna Models: AT-695 and AT-462 (Manufactured by Comant)

Instruments: Narda 8717-1174R, Radiation Meter
Narda 8760B, E-field probe (300 kHz – 1 GHz)
Narda 8761D, E-field probe (300 kHz – 3 GHz)

Limits: Uncontrolled Exposure	0.3-1.234 MHz:	Limit [mW/cm ²] = 100
47 CFR 1.1310	1.34-30 MHz:	Limit [mW/cm ²] = (180/f ²)
Table 1, (B)	30-300 MHz:	Limit [mW/cm ²] = 0.2
	300-1500 MHz:	Limit [mW/cm ²] = f/1500
	1500-100,000 MHz:	Limit [mW/cm ²] = 1.0

Power, Conducted, W = 10 W + 10 W
Power + Ant. Gain, W = 5 W + 10 W, 50% Duty Cycle
Limit: Uncontrolled Exposure = 0.200 and 0.291 mW/cm²

Results at tested distance	Power Density, mW/cm ²			
	Probe Height, m	Freq. 155 MHz Distance 80 cm	Freq. 437 MHz Distance 80 cm	Both Frequencies Distance 80 cm
	2.0	0.130	0.124	0.194
	1.8	0.115	0.211	0.269
	1.6	0.093	0.174	0.213
	1.4	0.070	0.145	0.169
	1.2	0.062	0.221	0.235
	1.0	0.086	0.203	0.236
	0.8	0.107	0.129	0.186
	0.6	0.117	0.112	0.180
	0.4	0.118	0.117	0.180
	0.2	0.115	0.047	0.133

Power Density Calculations: The measured power density readings were summed and the results divided by the number of readings to calculate the average.

	155 MHz	437 MHz	Both
Whole body average (0.2 – 2.0 m, mW/cm ²) =	0.1013	0.1483	0.1995
Lower body average (0.2 – 0.8 m, mW/cm ²) =	0.11425	0.10125	0.16975
Upper body average (1.0 – 2.0 m, mW/cm ²) =	0.09267	0.17967	0.21933



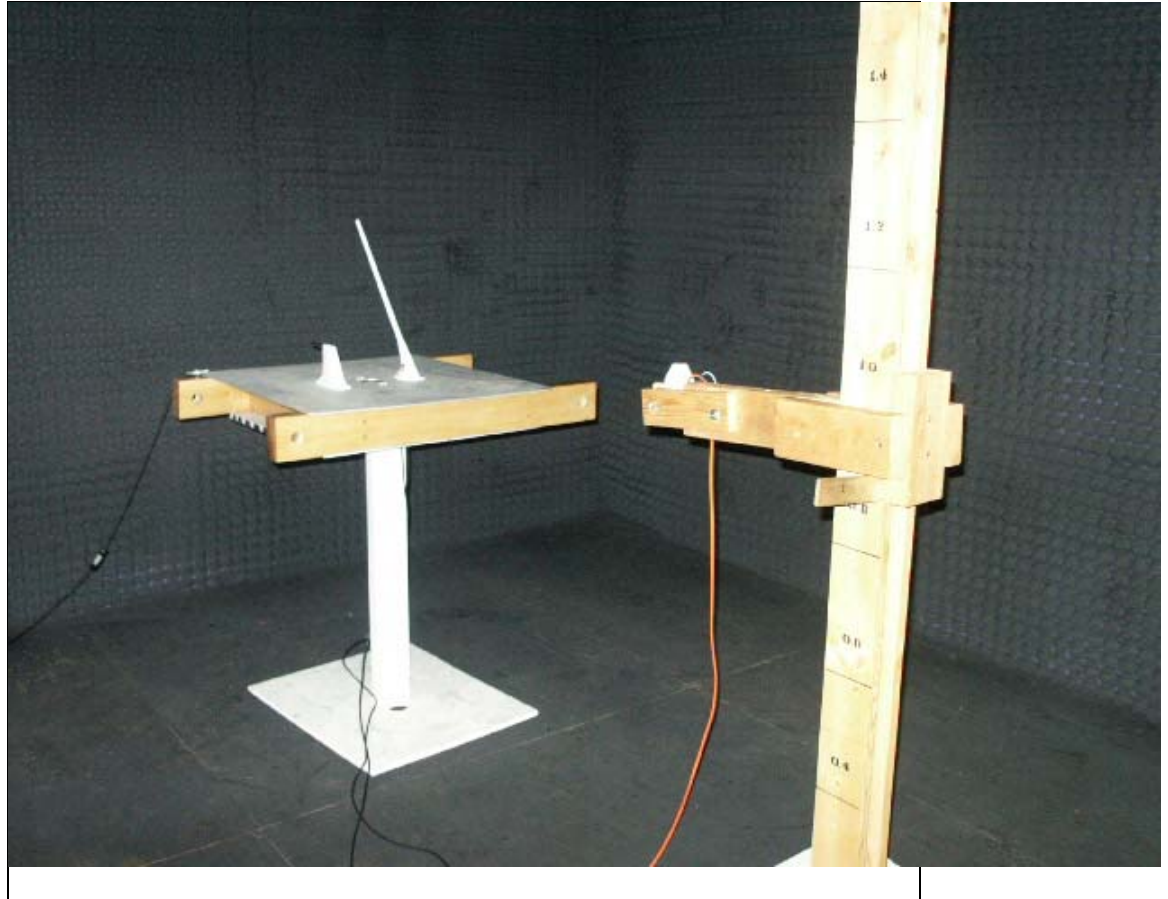
Performed by:

David Lee

Page Number 11 of 13.

Test Setup: Maximum Permissible Exposure (MPE)

State: VHF + UHF1



Page Number 12 of 13.

Name of Test: R.F. Radiation Exposure

FCC Rules: 1.1307, 1.1310, 1.1311, 2.1091
Description, EUT: See page 2 of Test Report

Equipment under test: P2000-UHF1 with P2000-800
Frequencies tested, MHz: 437.025 837.025
Antenna Gain: = 3 dB + 3 dB nominal
Antenna Model: AT-462 and CI 310 (Manufactured by Comant)

Instruments: Narda 8717-1174R, Radiation Meter
Narda 8760B, E-field probe (300 kHz – 1 GHz)
Narda 8761D, E-field probe (300 kHz – 3 GHz)

Limits: Uncontrolled Exposure	0.3-1.234 MHz:	Limit [mW/cm ²] = 100
47 CFR 1.1310	1.34-30 MHz:	Limit [mW/cm ²] = (180/f ²)
Table 1, (B)	30-300 MHz:	Limit [mW/cm ²] = 0.2
	300-1500 MHz:	Limit [mW/cm ²] = f/1500
	1500-100,000 MHz:	Limit [mW/cm ²] = 1.0

Power, Conducted, W = 10 W + 5 W
Power + Ant. Gain, W = 10 W + 5 W, 50% Duty Cycle
Limit: Uncontrolled Exposure = 0.291 and 0.558 mW/cm²

Results at tested distance	Power Density, mW/cm ²			
	Probe Height, m	Freq. 437 MHz Distance 100 cm	Freq. 837 MHz Distance 100 cm	Both Frequencies Distance 100 cm
	2.0	0.134	0.151	0.215
	1.8	0.190	0.132	0.262
	1.6	0.224	0.120	0.287
	1.4	0.241	0.069	0.270
	1.2	0.252	0.119	0.299
	1.0	0.209	0.097	0.258
	0.8	0.132	0.076	0.178
	0.6	0.171	0.630	0.191
	0.4	0.216	0.058	0.233
	0.2	0.044	0.072	0.084

Power Density Calculations: The measured power density readings were summed and the results divided by the number of readings to calculate the average.

	155 MHz	837 MHz	Both
Whole body average (0.2 – 2.0 m, mW/cm ²) =	0.1813	0.1524	0.2277
Lower body average (0.2 – 0.8 m, mW/cm ²) =	0.14075	0.209	0.1715
Upper body average (1.0 – 2.0 m, mW/cm ²) =	0.20833	0.11467	0.265167



Performed by:

David Lee

Page Number 13 of 13.

Test Setup: Maximum Permissible Exposure (MPE)

State: UHF1 + 800



(The following will be placed in the Instruction Manual)

Mandatory Safety Instructions to Installers & Users

Use only manufacturer or dealer supplied antenna.

Antenna Minimum Safe Distance: ≥ 100 cm.

Antenna Gain: zero dBd referenced to a dipole.

The Federal Communications Commission has adopted a safety standard for human exposure to RF (Radio Frequency) energy which is below the OSHA (Occupational Safety and Health Act) limits.

Antenna Mounting: The antenna supplied by the manufacturer or radio dealer must not be mounted at a location such that during radio transmission, any person or persons can come closer than the above indicated minimum safe distance to the antenna i.e. ≥ 100 cm.

To comply with current FCC RF Exposure limits, the antenna must be installed at or exceeding the minimum safe distance shown above, and in accordance with the requirements of the antenna manufacturer or supplier.

Base Station Installation: The antenna should be fixed-mounted on an outdoor permanent structure. RF Exposure compliance must be addressed at the time of installation.

Antenna Substitution: Do not substitute any antenna for the one supplied or recommended by the manufacturer or radio dealer. You may be exposing person or persons to excess radio frequency radiation. You may contact your radio dealer or the manufacturer for further instructions.

Warning: Maintain a separation distance from the antenna to a person(s) of ≥ 100 cm.

You, as the qualified end-user of this radio device must control the exposure conditions of bystanders to ensure the minimum separation distance (above) is maintained between the antenna and nearby persons for satisfying RF Exposure compliance. The operation of this transmitter must satisfy the requirements of Occupational/Controlled Exposure Environment, for work-related use. Transmit only when person(s) are at least the minimum distance from the properly installed, externally mounted antenna.

**Testimonial
and
Statement of Certification**

This is to certify that:

1. **That** the application was prepared either by, or under the direct supervision of, the undersigned.
2. **That** the technical data supplied with the application was taken under my direction and supervision.
3. **That** the data was obtained on representative units, randomly selected.
4. **That**, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

Certifying Engineer:

A handwritten signature in black ink, appearing to read "M. Flom P. Eng.", with a horizontal line drawn underneath the signature.

Morton Flom, P. Eng.