FCC ID: PQSWAVENET-DUAL-V
Class II Permissive Changes

Exhibit 4

RF Exposure Information
SAR Report

Certification Report on

Specific Absorption Rate (SAR)
Experimental Analysis

Wavenet Technologies Pty Ltd.

Wireless Modem
DUALWAVE V

Test Date: April 2002

WVTB-Dual Wave V Motient Cradle-3868

51 Spectrum Way Nepean ON K2R 1E6
Tel: (613) 820-2730 Fax: (613) 820-4161
email: info@aprel.com

• CONSULTING • RESEARCH • TRAINING • CERTIFICATION TESTING SINCE 1981

APREL Laboratories

Experimental Analysis SAR Report

Subject: **Specific Absorption Rate (SAR) Hand and Body Report**

FCC ID: PQSWAVENET-DUAL-V

Product: PDA Wireless Modem Attachment for a Palm M Series

Model: DWV 100 D

Client: Wavenet Technologies Pty Ltd.

Address: 140 Burswood Road
Burswood, Perth, WA 6100
Australia

Project #: WVTB-Dual Wave V Motient Cradle-3868

Telecommunications Approval Board - Spectrum Sciences Institute
SAR Certified
APREL Laboratories
Dualwave-V

Prepared by APREL Laboratories
51 Spectrum Way
Nepean, Ontario
K2R 1E6

Approved by ____________ Date: 3-June-2002.
Stuart Nicol
Director Product Development, Dosimetric R&D

Submitted by ____________ Date: June 3, 2002
Jay Sarkar
Technical Director of Standards & Certification

Released by ____________ Date: June 3/02.
Dr. Jacek J. Wojcik, P. Eng.

LICENSED PROFESSIONAL ENGINEER J.J. WOJCIK PROVINCE OF ONTARIO

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Applicant name and address	Date and Location of Testing
Wavenet Technologies Pty. Ltd. 140 Bursewood Road Bursewood, Perth ,WA 6100 Australia.	Date of Test: April 2002 Project No. :WVTB-DUALWAVE V Motient Cradle 3868 Test Location: APREL Laboratories, Nepean, ON CANADA

FCC ID: PQSWAVENET-DUAL-V

APPLICANT: Wavenet Technologies Pty. Ltd.

Product:	**PDA Wireless Modem attachment for Palm V/Vx**
Model:	**DWV 100D**
Serial No.:	**01450021**
EUT Type:	**Licensed Non-Broadcast Station transmitter (TNB)**
TX Frequency:	**806 - 821 MHz**
Max. Power Output:	**1.820W/32.6dBm ERP**
Max. SAR Value:	**0.33 W/kg Hand SAR**
	0.71 W/kg Body (Partial) SAR
FCC Rule Parts:	**2.1093, FCC/OET Bulletin 65 Supplement C(2001)**
Application Type:	**Certification**

This is a wireless Modem attachment for Palm V/ Vx, 800 MHz band transceiver system for wireless data communications on the DataTAC wireless system. Frequency band is limited to 806 MHz to 821 MHz.

This application has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-200X (May, 2002).

I attest to the accuracy of the data. All measurements reported were carried out under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the compliance of these measurements and vouch for the qualifications of the persons taking them. This relates only to the sample tested.

Jayanta (Jay) Sarkar
Technical Director , Standards & Certification

51 Spectrum Way
Nepean, Ontario
Canada K2R 1E6

visit our Web Pages: www.aprel.com

tel: (613) 820-2730
fax: (613) 820-4161
email: info@aprel.com

FCC ID: PQSWAVENET-DUAL-V
Applicant: Wavenet Technologies Pty Ltd
Equipment: PDA Wireless Modem Attachment for Palm-V/Vx
Model: DWV100 D
Standard: FCC 96 –326, Guidelines for Evaluating the Environmental Effects of Radio-Frequency Radiation

ENGINEERING SUMMARY

This report contains the results of the engineering evaluation performed on the DUALWAVE-V (Motient Network) Attachment for the Palm-V series PDA that can also be attached to a laptop via a communications cable. The measurements were carried out in accordance with FCC 96-326. The DUALWAVE-V was evaluated for its maximum power level 32.6 dBm / 1.820 W (ERP) with a 7 % duty cycle.

The DUALWAVE-V was tested at low, middle and high channels for the keyboard up, keyboard down, and right sides for body, and hand, exposure while attached to the PDA. The device was also tested for bystander exposure while attached to a laptop. The maximum 10g SAR (0.33 W/kg) was found to coincide with the peak performance RF output power of channel 2000 (806 MHz) for the Keyboard Down of the device. (The hot spot is located near the base of the antenna). The maximum 1g SAR (0.71 W/kg) was found to coincide with the peak performance RF output power of channel 2000 (806 MHz) for the Keyboard Down of the device. (The hot spot is located near the base of the antenna). The conservative SAR was measured **with no separation distance (zero mm)** from the device to the phantom. Test data and graphs are presented in this report. The 10g average result for hand exposure was assessed while the device was placed fully under the phantom with no separation distance.

The DUALWAVE-V was tested for bystander exposure while attached to a laptop PC with and without the PDA. It was found from the assessed data that the DUI produced a lower SAR value while it was attached to the laptop. All tests conducted and documented in this report were performed while the DUT was used in wireless (portable) mode as the results provide a more conservative SAR assessment.

Based on the test results and on how the device will be marketed and used, it is certified that the product meets the requirements as set forth in the above specifications, for the RF exposure environment.

The results presented in this report relate only to the sample tested.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

TABLE OF CONTENTS

51 Spectrum Way Tel. (613) 820-2730
Nepean, Ontario, K2R 1E6 Fax (613) 820 4161
e-mail: info@aprel.com

1. INTRODUCTION

Tests were conducted to determine the Specific Absorption Rate (SAR) for a sample PDA Wireless Modem attachment for Palm V/Vx. These tests were conducted at APREL Laboratories' facility located at 51 Spectrum Way, Nepean, Ontario, Canada. A view of the SAR measurement setup can be seen in Appendix A. This report describes the results obtained.

2. APPLICABLE DOCUMENTS

The following documents are applicable to the work performed:

1) FCC 96-326, Guidelines for Evaluating the Environmental Effects of Radio-Frequency Radiation

2) ANSI/IEEE C95.1-1999, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

3) ANSI/IEEE C95.3-1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

4) OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields".

5) IEEE P-1528 Draft "Recommended Practice for Determining the Peak Spatial Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communication Devices: Experimental Techniques."

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

3. DEVICE UNDER INVESTIGATION

- DUALWAVE-V, PDA Wireless Modem-Attachment for a Palm V/Vx, s/n 01450021, received on March 14th, 2002.

The WaveNet DUALWAVE-V PDA Wireless Modem attachment for Palm V/Vx shall be called DUI (**D**evice **U**nder **I**nvestigation) in the following test report.

Table 1: Measured Transmitted Power

Frequency	Channel	Power
815 MHz	Mid	1.820 W

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

4. TEST EQUIPMENT

- APREL Triangular Dosimetric Probe Model E-010, s/n 154, Asset # 301485
- ALIDX-500 Dosimetric SAR Measurement System
- APREL flat Phantom F1, Part # P-V-G8 (overall shell thickness 2mm)
- APREL 835 MHz Dipole Asset # 301459
- APREL RF Amplifier, AL-RF-A
- Hewlett Packard Signal Generator Asset
- R&S Power Meter
- Hewlett Packard Dual Directional Coupler
- APREL Universal Phantom P-UP-1

Table 2: Instrumentation

Instrument	Calibration Due	Asset Number/Serial Number
E-010 Probe	28 November 2002	154
ALIDX-500	August 2001	NA
APREL Flat Phantom	NA	APL-001
APREL UniPhantom	NA	APL-085
APREL 835 MHz Dipole	12 December 2003	301463
APREL RF Amplifier	NA	301467
HP-Signal Generator	12 November 2002	301463
R&S Power Meter	September 2002	301451
R&S Power Sensor	September 2002	301461
HP Directional Coupler	10 October 2002	100251

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

5. SET UP

5.1 ALIDX-500 Measurement System

The image below shows the laboratory along with the ALIDX-500 Measurement system.

The ALIDX-500 Dosimetric SAR Measurement System was developed jointly with APREL Laboratories and IDX Robotics for use within wireless development and the compliance environment. The system consists of a six axis articulated arm, and controller for precise probe positioning (0.05mm repeatability). Custom software has been developed to enable communications between the robot controller software and the host operating system.

An amplifier is located on the articulated arm, which is isolated from the custom designed end effector and robot arm. The end effector provides the mechanical touch detection functionality and probe connection interface. The amplifier is functionally validated within the manufacturers site and calibrated at NCL Calibration Laboratories. A Data Acquisition Card (DAC) is used to collect the signal as detected by the isotropic e-field probe. The DAC manufacturer calibrates the DAC to NIST standards. A formal validation is executed using all mechanical and electronic components to prove conformity of the measurement platform as a whole.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

The ALIDX-500 has been designed to measure devices within the compliance environment to meet all recognized standards. The system also conforms to standards, which are currently being developed by the scientific and manufacturing community.

The course scan resolution is defined by the operator and reflects the requirements of the standard to which the device is being tested. Precise measurements are made within the predefined course scan area and the values are logged. The user predefines the sample rate for which the measurements are made where the sample rate is converted into the time domain which envelopes the whole cycle of the Tx function for the given device.

A complex algorithm is then used to calculate the values within the measured points down to a resolution of 1mm. The data from this process is then used to provide the co-ordinates from which the cube scan is created for the determination of the one and ten gram averages.

51 Spectrum Way Tel. (613) 820-2730
Nepean, Ontario, K2R 1E6 Fax (613) 820 4161
e-mail: info@aprel.com

Cube scan averaging consists of a number of complex algorithms, which are used to calculate the one, and ten gram averages. The basis for the cube scan process is centered on the location where the maximum measured SAR value was found. When a secondary peak value is found which is within 60% of the initial peak value, the system will report this back to the operator who can then asses the need for further analysis of both the peak values prior to the one and ten-gram cube scan averaging process. The algorithm consists of 3D cubic Spline, and Lagrange extrapolation to the surface, which form the matrix for calculating the measurement output for the one and ten gram average values. The resolution for the physical scan integral is user defined with a final calculated resolution down to 1mm.

In-depth analysis for the differential of the physical scanning resolution for the cube scan analysis has been carried out, to identify the optimum setting for the probe positioning steps, and this has been determined at 8mm increments on the X, & Y planes. The reduction of the physical step increment increased the time taken for analysis but did not provide a better uncertainty or return on measured values.

Prior to the measurement process the operator can insert the parameters for which the physical measurements are made, defining the X, Y, and Z probe movement integrals. For the FCC compliance process both OET 65 “Supplement C” and the IEEE draft standard “P-1528” were used to define the measurement parameters used during the assessment of the device.

The final output from the system provides data for the area scan measurements, physical and splined (1mm resolution) cube scan with physical and calculated values (1mm resolution).

The overall uncertainty for the methodology and algorithms the ALIDX500 used during the SAR calculation was evaluated using the data from IEEE P-1528 f3 algorithm.

$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\cdot\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

The probe used during the measurement process has been assessed to provide values for diode compression. These values are calculated during the probe calibration exercise and are used in the mathematical calculations for the assessment of SAR.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

5.2 Validation

A full system validation was run prior to the SAR testing. The methodology used for the system validation was taken from IEEE P-1528 section 7 (where applicable). Further details of the tissue used during system the validation is provided in section 6.3 Simulated Tissue. The results from the system validation are provided in Annex A Measurement Results.

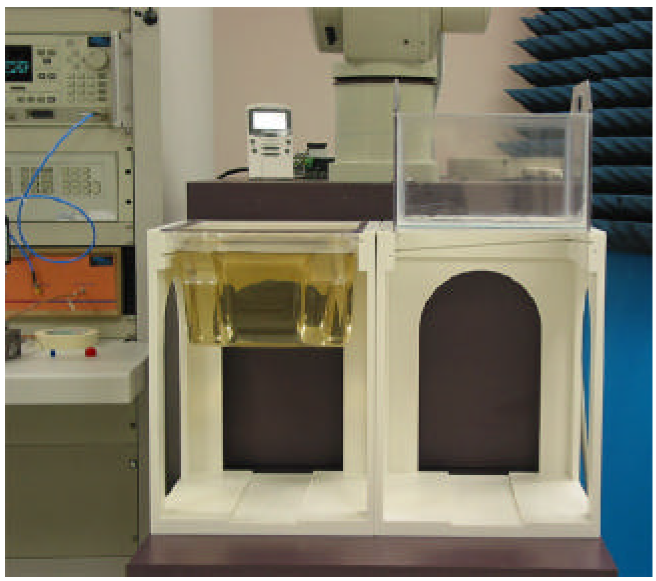
The image below shows the setup used for the system validation.

51 Spectrum Way Tel. (613) 820-2730
Nepean, Ontario, K2R 1E6 Fax (613) 820 4161
e-mail: info@aprel.com

5.3 Body & Bystander Analysis

Measurements were made on the device using the APREL Universal Phantom, on the low, mid, and high channel of the device. The device was assed for the right side, left side, keyboard up and keyboard down permutations. The separation distance used was 0 mm for the conservative SAR assessment. The results from this exercise are presented in section 6 test results.

The image below shows part of the setup used for body measurements.



51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

5.4 Simulated Tissue

The recipe used to make the simulated tissue was similar to those presented in "OET 65 Supplement C" for body and consisted of the following ingredients:

BODY	Water	52.4%
	Salt	1.38%
	Sugar	45.0%
	HEC	1.0%
	PD7	0.02%

The density used to determine SAR from the measurements was the recommended 1.0 kg/m^3 found in Appendix C of "Supplement C OET Bulletin 65, Edition 01-01".

Dielectric parameters of the simulated tissue material were determined using an Anritsu 37347A Vector Network Analyzer, a Hewlett Packard 809B Slotted Line Carriage, and an APREL SLP-001 Slotted Line Probe.

Table 3: Properties of the Tissue measured at 835 MHz

BODY Tissue	APREL	Target Value	Δ (%)
Dielectric constant, ε_r	52.9	55.2	- 4.16
Conductivity, σ [S/m]	1.02	0.97	+ 5.15
Tissue Conversion Factor	7.26	-	-

Table 4: Tissue Calibration Instrumentation

Instrument	Calibration Due	Asset Number/Serial Number
Anritsu VNA	7 August 2002	Z0107643 TEMP
HP Slotted Line	NA	100195
APREL Slotted Line Probe	December 2002	APL-SLP-001

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

5.5 Methodology

1. The test methodology utilized in the certification of the DUI complies with the requirements of FCC 96-326 and ANSI/IEEE C95.3-1992.

2. The E-field is measured with a small isotropic probe (output voltage proportional to E^2).

$$SAR = \frac{\sigma\,|\mathbf{E}|^2}{\rho}$$

3. The probe is moved precisely from one point to the next using the robot (10 mm increments for wide area scanning and 8 mm increments for zoom scanning in the X, Y directions) and (5.0 mm increments for the final depth profile measurement in the Z direction).

4. The probe travels in the homogeneous liquid simulating human tissue (body).

   Section 5.4 contains information about the properties of the simulated tissue used for these measurements.

5. The liquid is contained in a manikin simulating a portion of the human body with an overall shell thickness of 2 mm.

6. The DUI is positioned with the surface under investigation against the phantom with no separation distance for conservative analysis.

7. All tests were performed with the highest power available from the sample DUI under transmit conditions.

More detailed descriptions of the test method are given in Section 6 where appropriate.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

6. TEST RESULTS

6.1. TRANSMITTER CHARACTERISTICS

The battery-powered DUI will consume energy from its batteries, which may affect the DUI's transmission power characteristics. In order to gage this effect the output of the transmitter is sampled before and after each SAR test. The following table shows the RF power sampled before and after each scan.

Note

This power measurement is not conducted and it is only relative to a true pin-on-pin conducted measurement. The spectrum analyzer provides the technician with the functionality of viewing the actual received TX-signal from the DUI. This allows the technician to monitor any drift in power during the test process, and as a result assess the delta if any.

Table 5: Relative power measurement before and after the scanning

Type of Exposure	**Scan Type**	**Power Readings (dBm)**		**ΔP_{TX} (dB)**	**Battery #**
		Before scanning	**After scanning**		
Hand Exposure	Coarse	-30.18	-30.45	-0.27	1
	Fine	-30.18	-30.45	-0.27	1
Body Exposure	Coarse	-30.18	-30.45	-0.27	1
	Fine - body	-30.18	-30.45	-0.27	1

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

6.2. SAR MEASUREMENTS

1) RF exposure is expressed as a Specific Absorption Rate (SAR). SAR is calculated from the E-field, measured in a grid of test points. SAR is expressed as RF power per kilogram of mass, averaged in 10 grams of tissue for the extremities and 1 gram of tissue elsewhere. The equation below is a representation of how SAR can theoretically equate.

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dV}\right)$$

2) The DUI was put into test mode for the SAR measurements via communications software supplied by the manufacturer running on the DUI to control the channel and operating TX-power.

3) **Table 6** provides the details in tabular form of the full measurement analysis that was performed on the DUI. **Appendix A** provides contour plots of the SAR measurements on the DUI. **Graph 1** provides the worst-case conservative SAR plot for channel 2000-low (806 MHz) with keyboard down that is presented as an overlay superimposed onto the contour plot of the DUI.

4) Wide area scans were performed for the low, middle and high channels of the DUI. The DUI was operating at maximum output power (32.6 dBm ERP) with the duty cycle set at 7 %. The DUI was placed up against the phantom during the test process. The phantom shell thickness is 2 mm overall.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

6.3. DIRECT CONTACT SAR

All subsequent testing for the direct contact SAR (user's hand exposure) was performed on three channels (low: 806 MHz, middle: 815 MHz, high: 821 MHz) in all four positions - with the keyboard and the bottom side as well as left and right side of the DUI facing up against the phantom. The highest 10 g averaged SAR was measured on low channel with the keyboard facing down. The results are presented in Table 6 below.

1) The device had an initial course scan executed to establish the location of the maximum peak SAR. A calculated resolution of 1 mm was used to determine the location for the peak SAR.
2) The device was then explored on a refined 32 mm grid (Cube, Fine Scan) in three dimensions (X, Y & Z) measuring at 8 mm integrals X & Y and 5 mm integrals in the Z plane so as to create a physical measured point matrix. The system then runs a series of complex algorithms, which completes the matrix of calculated and measured values equivalent to a 1 mm resolution in the X & Y planes.
3) The software runs a series of computations using Lagrange functions to provide the data for the Z plane, which is inserted into the matrix.
4) To complete the calculated matrix (1 mm resolution) a fourth-order polynomial extrapolation is used to compute the surface values and the 1 and 10-gram averages are then calculated.
5) Where two (or more) peaks with similar values are measured the location of the peaks is recorded. A refined grid is then created to asses each peak location individually, and the maximum value from the assesment is used to record conservative SAR for this report.

   The highest conservative SAR value averaged over 10 grams for the direct contact exposure analysis (user's hand exposure) was found to be 0.33 W/kg (presented in Table 6). With 21.6 % uncertainty (given in Appendix D) the worst case direct contact (hand) SAR value cannot get higher than 0.40 W/kg which leaves a large margin from the given limit (4.0 W/kg).

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

6.4. BODY EXPOSURE

All subsequent testing for the direct contact SAR (user's hand exposure) was performed on three channels (low: 806 MHz, middle: 815 MHz, high: 821 MHz) in all four positions - with the keyboard and the bottom side as well as left and right side of the DUI facing up against the phantom. The highest 1 g averaged SAR was measured on low channel with the keyboard facing down. The results are presented in **Table 6** below.

1) The device had an initial course scan executed to establish the location of the maximum peak SAR. A calculated resolution of 1mm was used to determine the location for the peak SAR.
2) The device was then explored on a refined 32 mm grid (Cube, Fine Scan) in three dimensions (X, Y & Z) measuring at 8 mm integrals X & Y and 5 mm integrals in the Z plane so as to create a physical measured point matrix. The system then runs a series of complex algorithms, which completes the matrix of calculated and measured values equivalent to a 1 mm resolution in the X, & Y planes.
3) The software runs a series of computations using Lagrange functions to provide the data for the Z plane, which is inserted into the matrix.
4) To complete the calculated matrix (1 mm resolution) a fourth order polynomial is used to extrapolate the surface values and the 1 and 10-gram averages are then calculated.
5) Where two (or more) peaks with similar values were measured the location of the peaks was recorded. A refined grid is then created to asses each peak location individually, and the maximum value from the assesment is used to record conservative SAR for this report.

   Maximum conservative SAR value averaged over 1 gram for the body analysis was found to be 0.71 W/kg (as presented in Table 6). With 21.6 % uncertainty (given in Appendix D) the worst case body SAR value cannot get higher than 0.90 W/kg which leaves a large margin from the given limit (1.6 W/kg).

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Table 6: Test results - 1 g and 10 g SAR values for DUALWAVE-M PDA Wireless Modem measured at the highest power (1.820 W ERP)

DUI		Channel			Measured SAR (W/kg)	
Position	**Separation distance (from the phantom)**	**L/M/H**	**Ch #**	**Freq. (MHz)**	**1 g SAR** Partial Body Exposure Limit: 1.6 W/kg	**10 g SAR** Hand Exposure Limit: 4.0 W/kg
Keyboard Down	0 mm	Low	2000	806	0.71	0.33
Keyboard Down	0 mm	Middle	22D0	815	0.48	0.21
Keyboard Down	0 mm	High	24B0	821	0.53	0.28
Keyboard Up	0 mm	Middle	22D0	0.47	0.47	0.20

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

7. CONCLUSIONS

The maximum Specific Absorption Rate (SAR) averaged over **10 grams**, determined at low channel (Ch: 2000, f_{TX}=806 MHz) for the DUALWAVE-V PDA Wireless Modem Atachment for Palm V/Vx, is **0.33 W/kg** (direct contact SAR for the exposed extremities – hands, wrists, feet and ankles). The overall margin of uncertainty for this measurement is ±21.6 % (Appendix D). With given uncertainty SAR will not exceed the limit specified in the FCC 96-326 Safety Guideline (**4.0 W/kg** for hand exposure for the general population).

The maximum Specific Absorption Rate (SAR) averaged over **1 gram**, determined at low channel (Ch: 2000, f_{TX}=806 MHz) for the DUALWAVE-V PDA Wireless Modem Atachment for Palm V/Vx is **0.71 W/kg** (partial body SAR). The overall margin of uncertainty for this measurement is ±21.6 % (Appendix D). With given uncertainty SAR will not exceed the limit specified in the FCC 96-326 Safety Guideline (**1.6 W/kg** for body exposure for the general population).

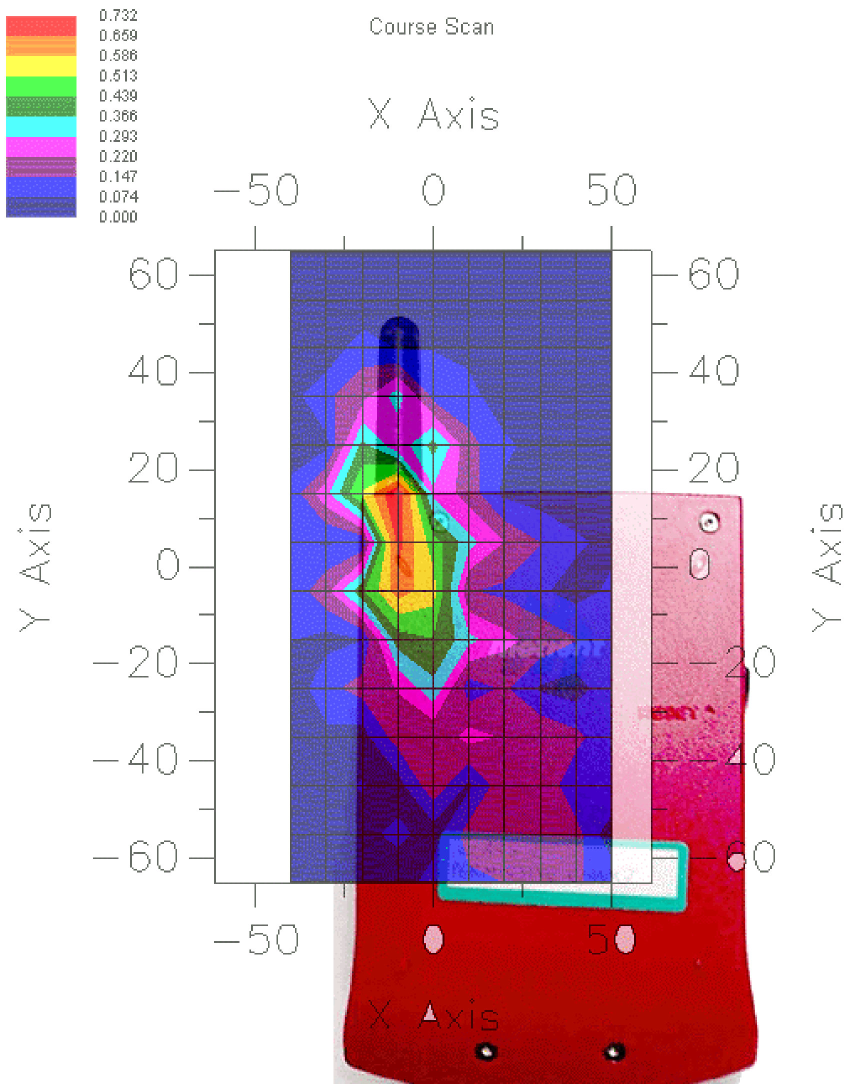
Considering the above, this unit as tested, and as it will be marketed and used, is found to be compliant with the FCC 96-326 requirements.

Tested by: Jingshi Chen Date: April, 2002

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Appendix A: GRAPHIC PLOTS FROM SAR MEASUREMENTS

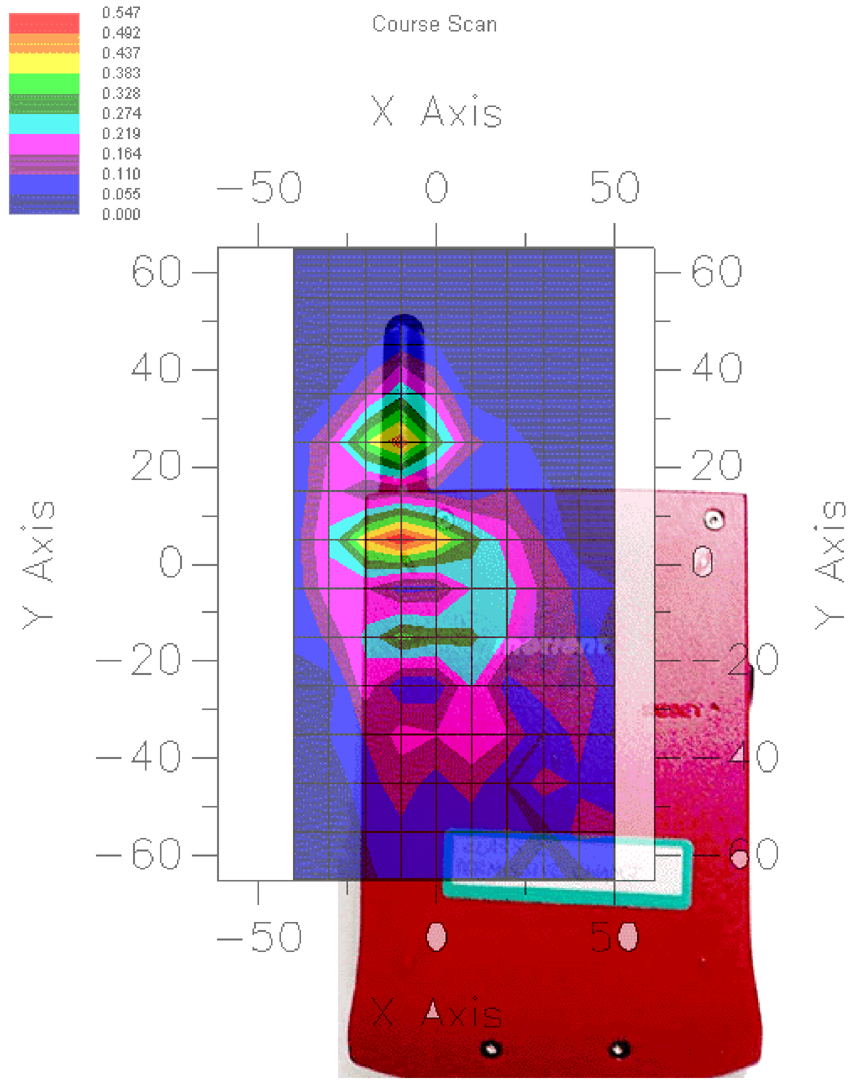
GRAPH 1
KEYBOARD DOWN
Distance: 0 mm
Low Channel – 806 MHz



SCAN 1
Area Scan-Max Peak SAR Value: 0.779 W/kg
Max 1g SAR: 0.71 W/kg
Max 10g SAR: 0.33 W/kg

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

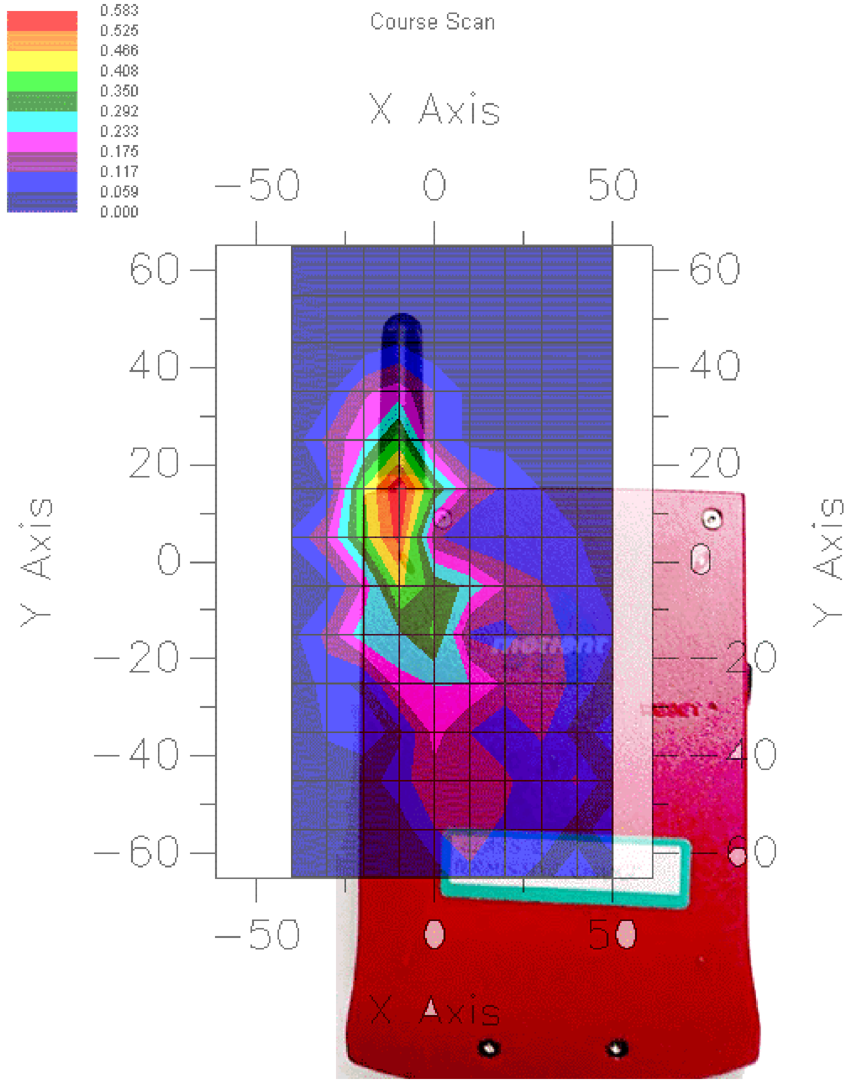
GRAPH 2
KEYBOARD DOWN
Distance: 0 mm
Middle Channel – 815 MHz



SCAN 2
Area Scan-Max Peak SAR Value: 0.547 W/kg
Max 1g SAR: 0.48 W/kg
Max 10g SAR: 0.21 W/kg

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

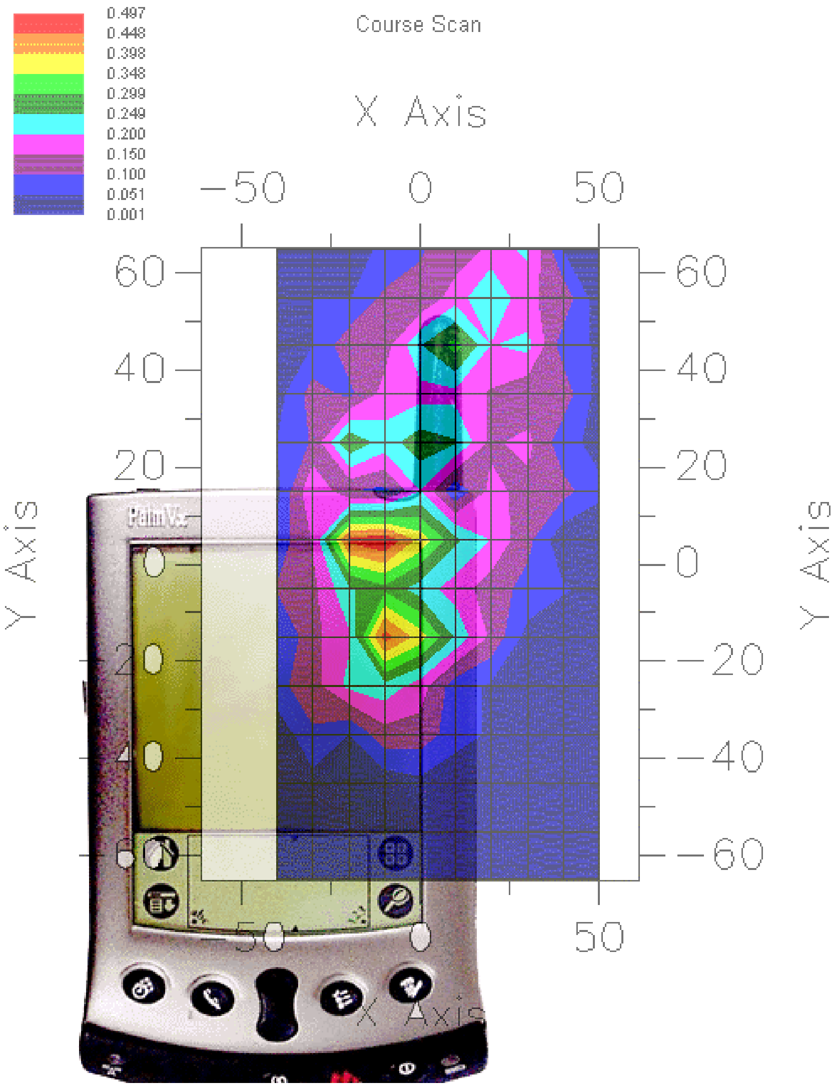
GRAPH 3
KEYBOARD DOWN
Distance: 0 mm
High Channel – 821 MHz



SCAN 3
Area Scan-Max Peak SAR Value: 0.605 W/kg
Max 1g SAR: 0.53 W/kg
Max 10g SAR: 0.28 W/kg

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

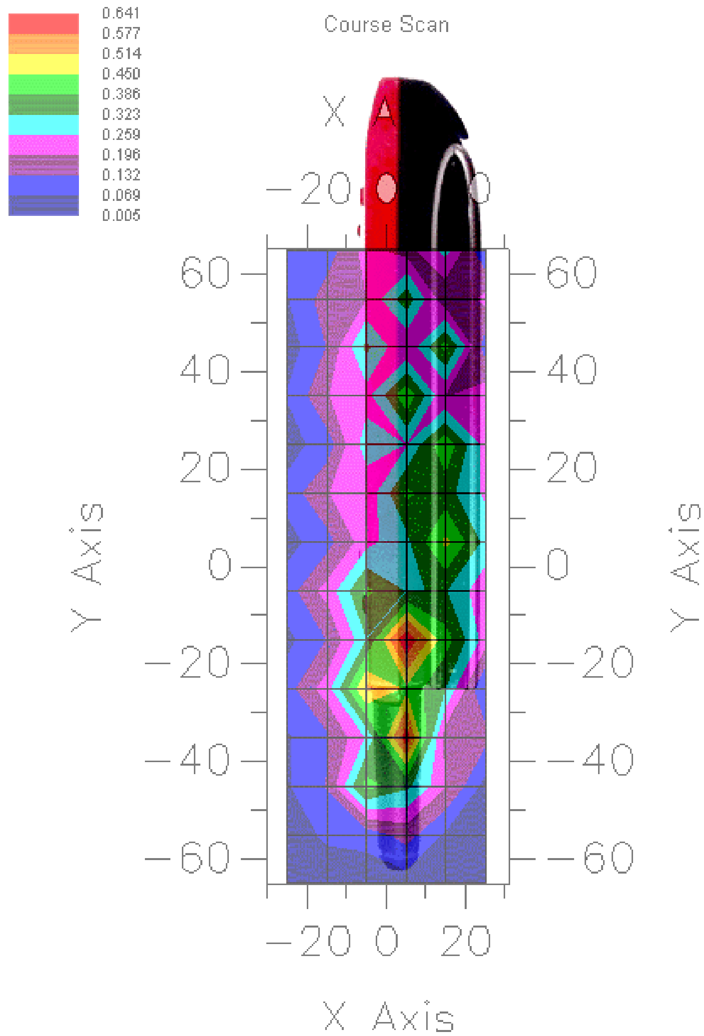
GRAPH 4
KEYBOARD UP
Distance: 0 mm
Middle Channel – 815 MHz



SCAN 4
Area Scan-Max Peak SAR Value: 0.526 W/kg
Max 1g SAR: 0.47 W/kg
Max 10g SAR: 0.20 W/kg

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

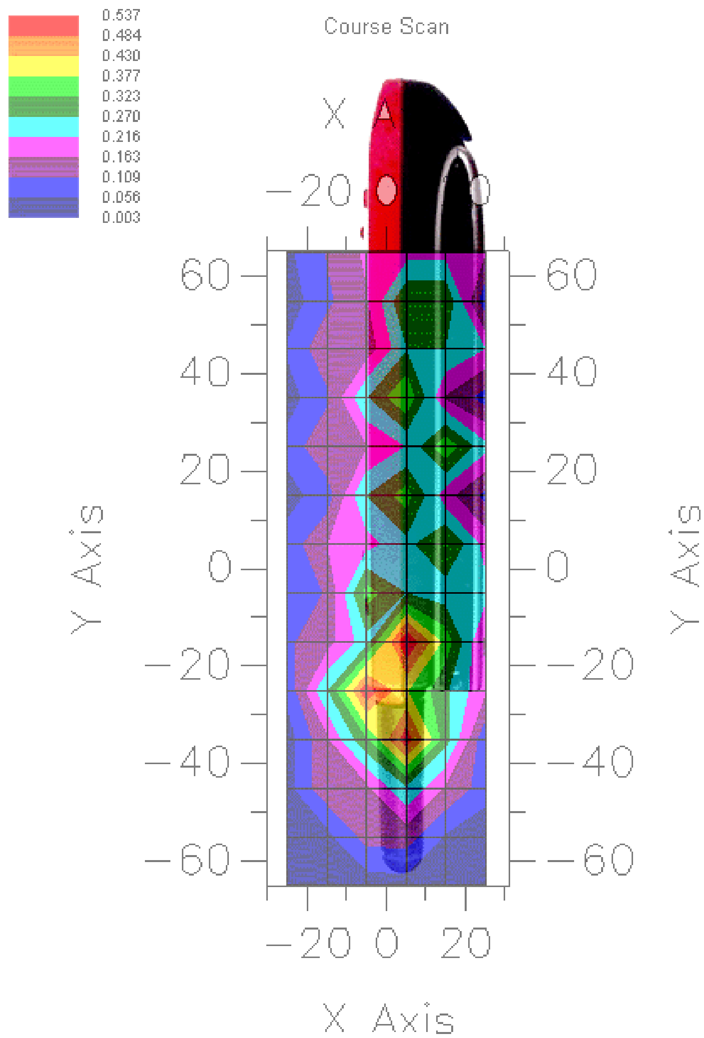
GRAPH 5
RIGHT SIDE
Distance: 0 mm
Low Channel – 806 MHz



SCAN 5
Area Scan-Max Peak SAR Value: 0.642 W/kg

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

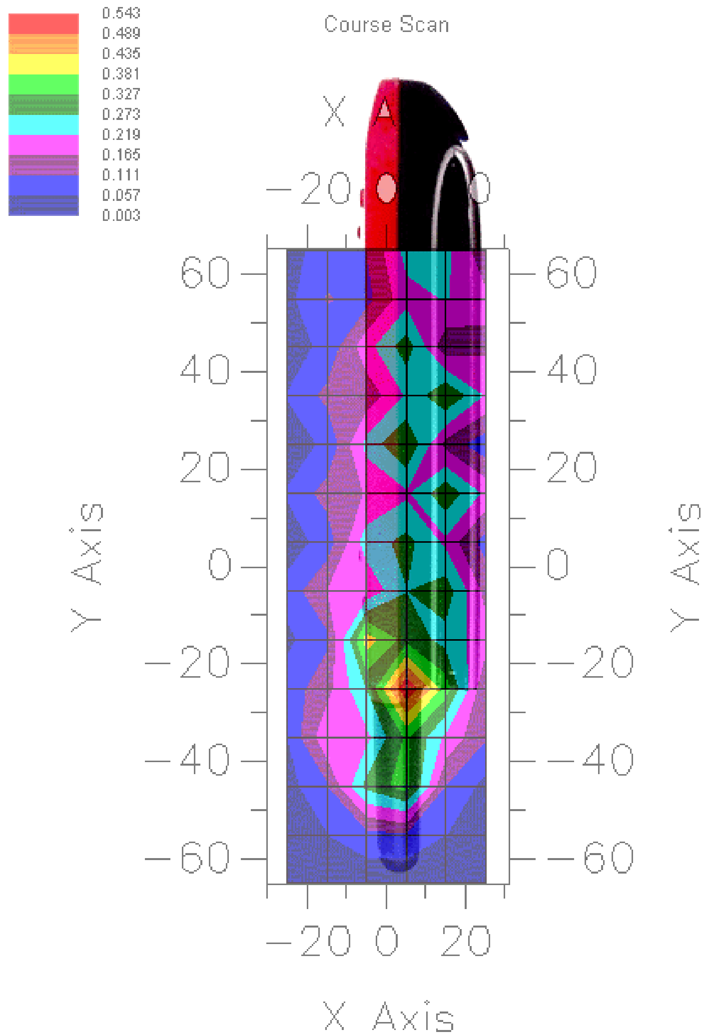
GRAPH 6
RIGHT SIDE
Distance: 0 mm
Middle Channel – 815 MHz



SCAN 6
Area Scan-Max Peak SAR Value: 0.541 W/kg

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

GRAPH 7
RIGHT SIDE
Distance: 0 mm
High Channel – 821 MHz



SCAN 7
Area Scan-Max Peak SAR Value: 0.546 W/kg

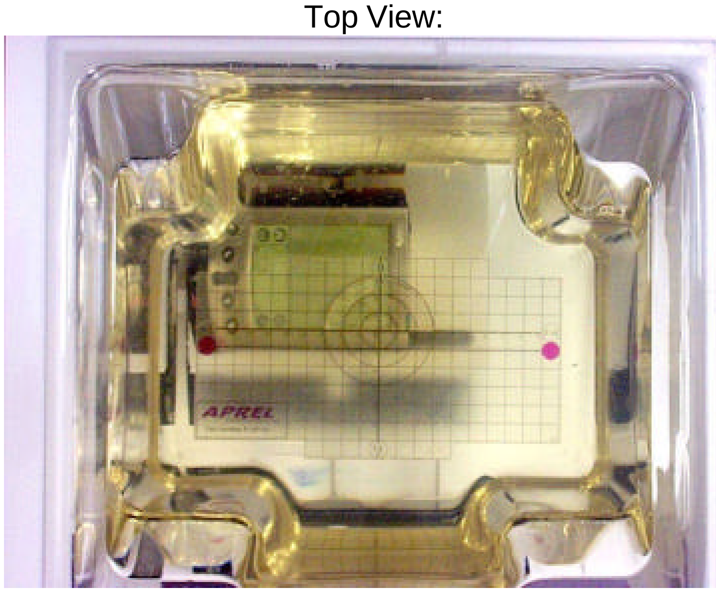
51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Appendix B: PICTURES OF THE EVALUATION SETUP

Picture 1: Tesing Setup
DUALWAVE-M PDA Wireless Modem
Keyboard Up
Separation Distance: 0 mm

Side View:

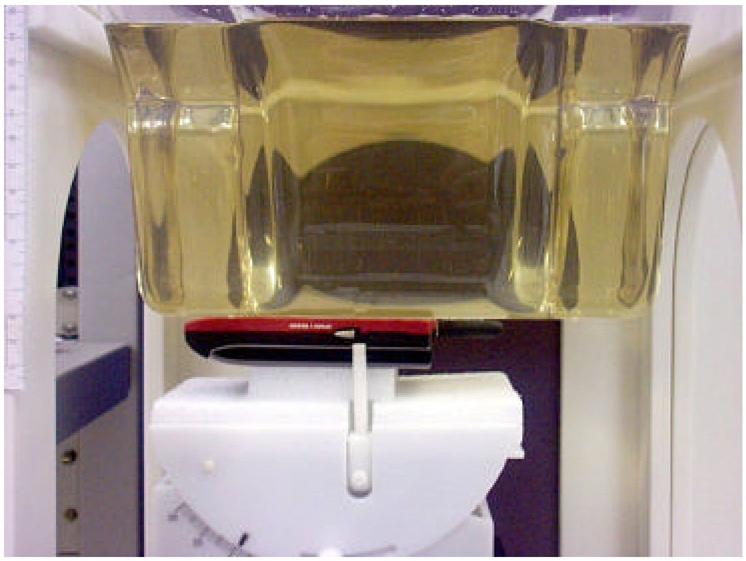
Top View:



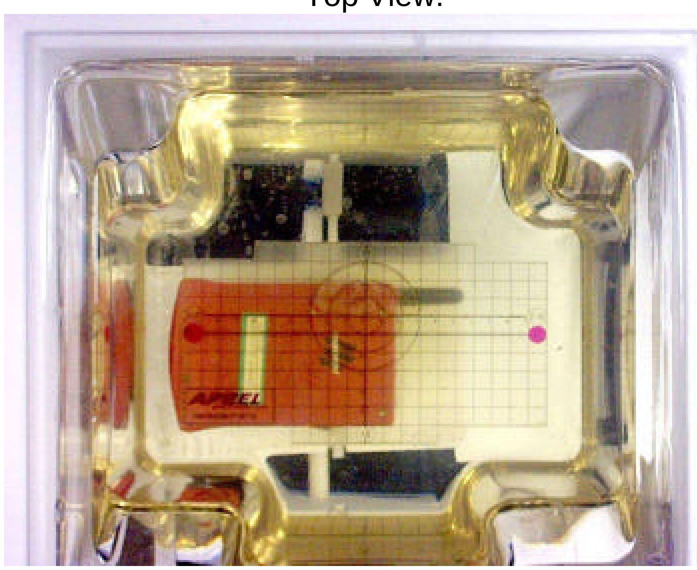
51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Picture 2: Tesing Setup
DUALWAVE-M PDA Wireless Modem
Keyboard Down
Separation Distance: 0 mm

Side View:



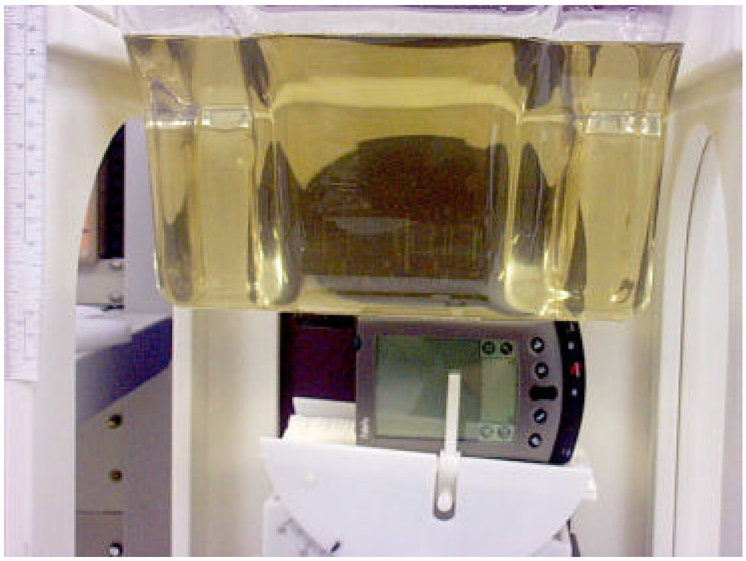
Top View:



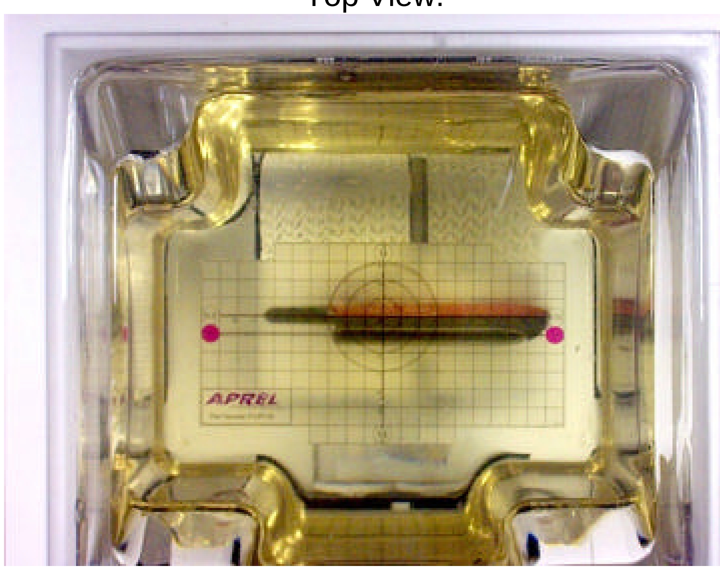
51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Picture 3: Tesing Setup
DUALWAVE-M PDA Wireless Modem
Right Side
Separation Distance: 0 mm

Side View:



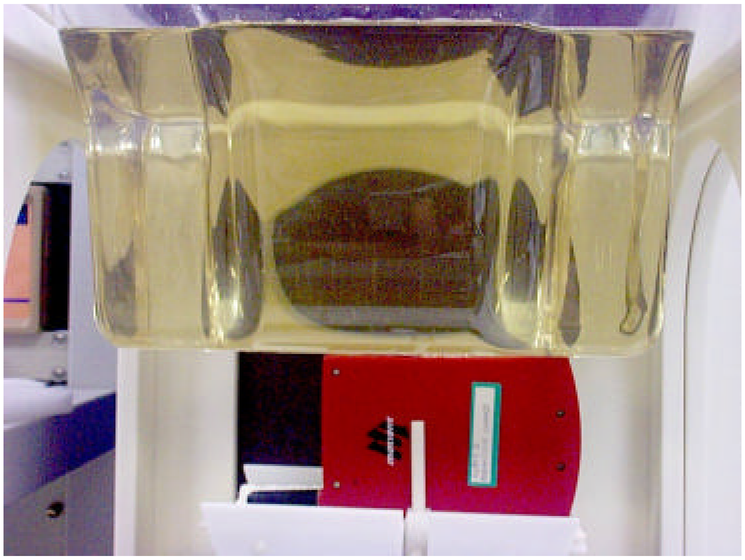
Top View:



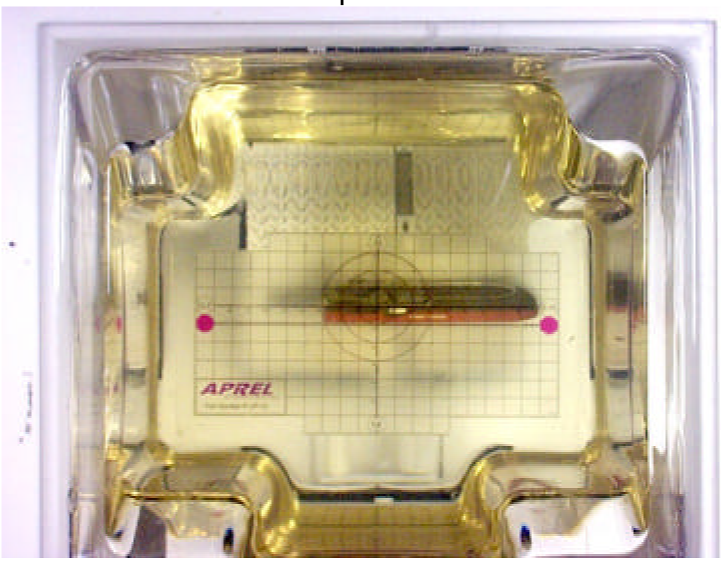
51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Picture 4: Tesing Setup
DUALWAVE-M PDA Wireless Modem
Left Side
Separation Distance: 0 mm

Side View:



Top View:



51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Appendix C: VALIDATION SCAN

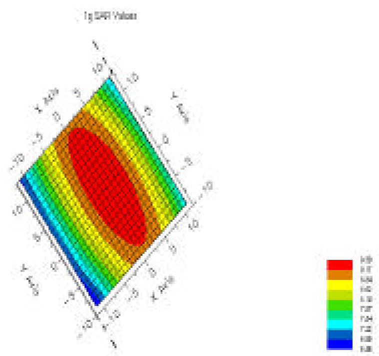


Figure 5. Contour Plot of 1 gram Validation Scan

Figure 6. Surface Plot of 1 gram Validation

Frequency: 835 MHz
Input Power to Dipole: 1 W
Distance from Dipole to Tissue: 15 mm
Tissue Deapth: 15 mm

Measured 1 Gram SAR (W/Kg)	Target 1 Gram SAR (W/Kg)	Delta (%)
9.1	9.5	3.0

Measured 10 Gram SAR (W/Kg)	Target 10 Gram SAR (W/Kg)	Delta (%)
5.8	6.20	6

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Appendix D: UNCERTAINTY BUDGET

Calculated Uncertainties		
Type of Uncertainty	**Specific to**	**Uncertainty**
Power variation due to battery condition	DUI	6.0%
Extrapolation due to depth measurement	Setup	3.8%
Conductivity	Setup	1.0%
Permitivity	Setup	2.0%
Probe Calibration	Setup	7.0%
Probe Positioning	Setup	1.0%
Probe Isotropicity	Setup	1.5%
Other Setup Uncertainty (Ambient,,,)	Setup	3.0%
Expanded Uncertainty: 21.6%	**Coverage Factor: K=2**	

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

Appendix E: PROBE CALIBRATION

NCL CALIBRATION LABORATORIES

Calibration File No.: 301485

C E R T I F I C A T E O F C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe

Manufacturer: APREL Laboratories
Model No.: E-010
Serial No.: 154

Customer: APREL
Asset No.: 301485

Calibration Procedure: SSI/DRB-TP-D01-032

Cal. Date: 29 Nov, 2001 Cal. Due Date: 28 Nov, 2002
Remarks: None

Calibrated By: ________________________________

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Abbreviated Record For Use in SAR Report

CALIBRATION RECORD

Customer:	APREL	
Asset No:	301485	
Equipment Type:	Miniature Isotropic RF Probe	
Manufacturer:	APREL Laboratories	
Model No:	E-010	
Serial No:	154	
Date:	29-Nov-01	Cal. Due: 28-Nov-02
Project No:	Internal	
Calibration Procedure:	SSI/DRB-TP-D01-032	
Environmental Conditions:	Temp: 22.7 C	Humidity: 30% - 55%

EQUIPMENT REFERENCES:

1. Directional Coupler, Hewlett Packard, model 767D, asset # 100251
2. RF Power Meter, Rohde & Schwarz, model NRVS, asset # 100851
3. RF Power Sensor, Rohde & Schwarz, model NRV-Z7, asset # 301461
4. Precision Guildline, Thermometer, asset # 301414
5. ALIDX-500 Near-Field Broadband Measurement System
6. APREL RF Power Amplifier, model M:AL-RFA-8
7. Signal Generator, Hewlett Packard, model 83640B
8. APREL Flat Phantom, model P-V-G2
9. APREL 835 MHz Dipole, asset#301463
10. APREL 1900 MHz Dipole, asset# 301459

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

CALIBRATION DATA

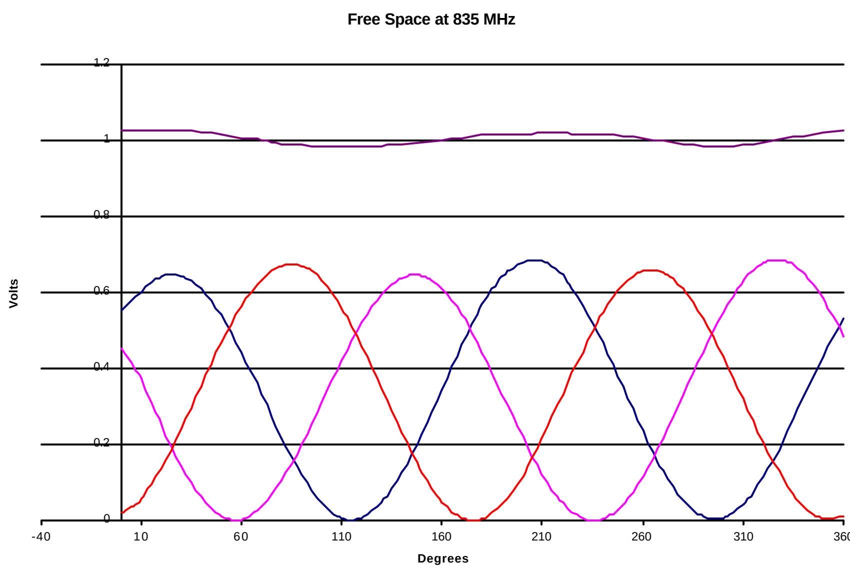
PHYSICAL PROBE DATA	
OFFSET [cm]	ANGLE [º]
0.25	54.73

TISSUE TYPE [MHz]	FREQUENCY	DIELECTRIC CONSTANT	CONDUCTIVITY [S/m]	CONVERSION FACTOR [W/kg]
Brain	835	41.4	0.88	4.4
Brain	1900	39.59	1.36	7.900
Muscle	1900	51.83	1.48	8.100
Muscle	835	54.7	0.97	4.5

Media Type	**Frequency [MHz]**	**Sensitivity One**	**Sensitivity Two**	**Sensitivity Three**
Air	835	1.378	1.439	1.250
Air	1900	2.886	2.954	2.651

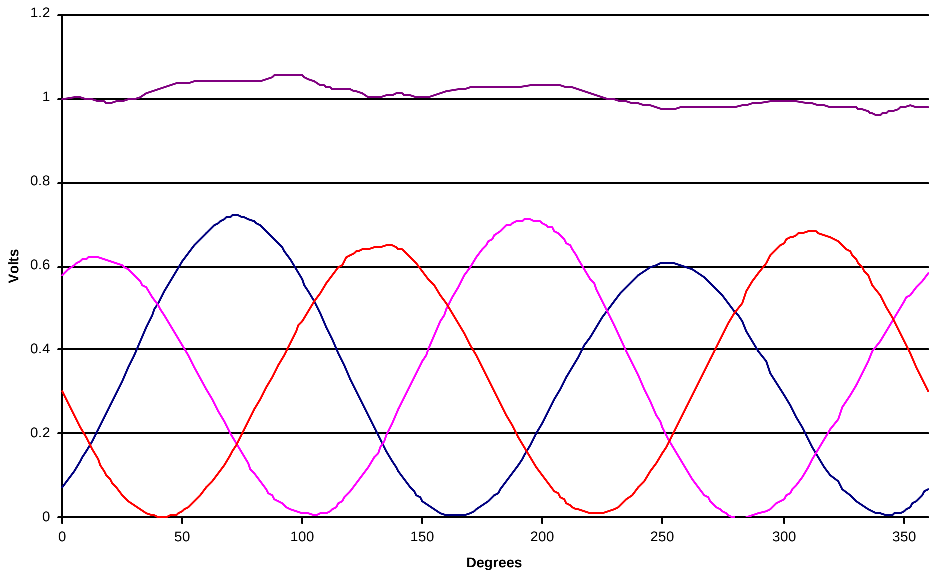
51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

FREQUENCY MHz	ISOTROPICITY [%]	[dB]
835	2.20	0.095
1900	4.71	0.20



51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Free Space at 1900 MHz



Validation Results:

Freq (MHz)	Power fed to dipole (W)	Distance from dipole to liquid (mm)	1 gram measured (W/Kg)	1 gram target (W/Kg)	Delta (%)	10 gram measured (W/Kg)	10 gram target (W/Kg)	Delta (%)
835	1	15	9.54	9.5	0.42	5.99	6.2	3.39
1900	1	10	38.32	39.7	-3.48	19.25	20.5	-6.1

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161