FCC ID: PSMDATATAC001

Exhibit 11

RF Exposure Information
SAR Report

APREL Laboratories

Certification Report on

Specific Absorption Rate (SAR) Experimental Analysis

THALES e-TRANSACTIONS, Inc.

Artema DataTAC POS Terminal P4432-054 & -056

Test Date: July 2001

SAR Certified — Telecommunications Approval Board - Spectrum Sciences Institute - APREL Laboratories

THLB-Artema P4432-909-3764

51 Spectrum Way Nepean ON K2R 1E6
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INVESTIGATIVE SAR REPORT

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

Product: Artema DataTAC POS Terminal

Model: P4432-054 & -056

Client: THALES e-TRANSACTIONS, Inc.

Address: 53 Perimeter Center east, Suite 175
Atlanta, GA 30346 - USA

Project #: THLB-Artema P4432-909-3764

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

Approved by ______________ Date: 22 August 2001.
Stuart Nicol
Director Product Development, Dosimetric R&D

Submitted by ______________ Date: August 22, 2001
Jay Sarkar
Technical Director of Standards & Certification

Released by ______________ Date: Aug 22/01.
Dr. Jacek J. Wojcik, P. Eng.

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FCC ID: PSMDATATAC001
Applicant: THALES e-TRANSACTIONS, Inc.
Equipment: Artema DataTAC POS Terminal
Model: P4432-054 & -056
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 Artema POS terminal in support of an FCC grant application. The measurements were carried out in accordance with FCC 96-326. The Device Under Investigation (DUI) was evaluated for its maximum power level 1.919 W (ERP). The duty cycle of the device was set at 25% (appendix E).

The DUI was tested at low, middle and high channels for the Motient network 806 MHz to 821 MHz frequency range. The maximum 10g SAR (2.88 W/kg) was found to coincide with the peak performance RF output power of channel 24B0 high (821 MHz) for the right side of the device. (The hot spot is located on the antenna).

At a separation distance of 17.4 mm from the right side of the device, the 1g SAR is 1.19 W/Kg. The operational manual will contain a warning stating that bystanders and parts of the user's body other than extremities, must be at least 17.4 mm away from the right side of the device. Test data and graphs are presented in this report .

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 RF exposure environment.

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

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TABLES AND FIGURES

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1. INTRODUCTION

Tests were conducted to determine the Specific Absorption Rate (SAR) for a sample Artema POS terminal. 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 Figure 2. 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 Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields".

3. DEVICE UNDER INVESTIGATION

- Artema POS, s/n 4432050050153, received on July 19, 2001.

The Artema POS will be called DUI (Device Under Investigation) in the following test report.

The manufacturer's original submission documentation contains all the necessary drawings and applicable design details.

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4. TEST EQUIPMENT

- APREL Triangular Dosimetric Probe Model E-009, s/n 115, Asset # 301420
- CRS Robotics A255 articulated robot arm, s/n RA2750, Asset # 301335
- CRS Robotics C500 robotic system controller, s/n RC584, Asset # 301334
- HP 8920A RF Communications Test Set, Asset# 301290
- Wireless Test Tool software supplied by the modem manufacturer, Research In Motion Ltd.
- Tissue Recipe and Calibration Requirements, APREL procedure SSI/DRB-TP-D01-033
- APREL flat Phantom F1 (overall shell thickness 3mm)

5. TEST 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).
3. The probe is moved precisely from one point to the next using the robot (10 mm increments for wide area scanning, 5 mm increments for zoom scanning, and 2.5 mm increments for the final depth profile measurement).
4. The probe travels in the homogeneous liquid simulating human muscle tissue. Appendix A contains information about the properties of the simulated tissue used during the measurement process.
5. The liquid is contained in a manikin simulating a portion of the human body with an overall shell thickness of 3 mm.
6. The DUI is positioned with the surface under investigation against the phantom.

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

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

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. In the case of this DUI, the Tx power was sampled throughout the test process. The following table shows the RF power sampled before and after each of the seven sets of data used for the worst case SAR in this report.

Note

The power measurement is not conducted and only relative to a true pin on pin conducted measurement.

Scan		**Power Readings (dBm)**		**D**	**Battery #**
Type	**Height (mm)**	**Before**	**After**	**(dB)**	
Area	2.5	25.2	24.8	0.4	3
Zoom	2.5	25.2	24.8	0.4	2
Zoom	7.5	25.2	25.0	0.4	2
Zoom	12.5	25.5	25.0	0.5	6
Zoom	17.5	25.5	25.0	0.5	6
Zoom	22.5	25.5	25.0	0.5	6
Depth	2.5 – 22.5	25.3	25.0	0.3	7

Table 1. Sampled RF Power

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6.2. SAR MEASUREMENTS

1) RF exposure is expressed as 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.

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

3) Figure 3 in Appendix A shows a contour plot of the SAR measurements for the DUI (channel 24B0, 821 MHz). It also shows an overlay of the DUI's outlines, superimposed onto the contour plot

   A different presentation of the same data is shown in Appendix A Figure 4. This is a surface plot, where the measured SAR values provide the vertical dimension, which is useful as a visualization aid.

4) Wide area scans were performed for the low, middle and high channels of the DUI. The DUI was operating at maximum output power 1.919 W (ERP) with the duty factor set at 25%. The DUI was placed in close proximity to the phantom for the keyboard up, keyboard down, left, and right sides. The phantom shell thickness is 3 mm overall.

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DUI Side	In Craddle	Antenna Distance to Phantom (mm)	L/M/H	Channel #	Freq (MHz)	Peak Local SAR (W/Kg
Right side	No	0	Middle	22D0	815	3.92
Right side	No	0	Low	2000	806	4.03
Right side	No	0	High	24B0	821	4.12
Right side	Yes	30	High	24B0	821	0.31
Keyboard down side	No	35	High	24B0	821	2.66
Keyboard up side	No	35	High	24B0	821	1.16
Left side	No	90	High	24B0	821	0.50

Table 2. SAR Measurements

7. USER'S HAND EXPOSURE

All subsequent testing for user's hand exposure was performed on channel 24B0 (821 MHz), with the right of the DUI facing up against the bottom of the phantom. This relates to the position and frequency found to provide the maximum measured SAR value.

1) Channel 24B0 (821 MHz) was then explored on a refined 5 mm grid in three dimensions. The SAR value averaged over 10 grams was determined from these measurements by averaging the 125 points (5x5x5) comprising a 2 cm cube. The maximum SAR value measured averaged over 10 grams was determined from these measurements to be 1.87 W/kg.

2) To extrapolate the maximum SAR value averaged over 10 grams to the inner surface of the phantom a series of measurements were made at five (x,y) co-ordinates within the refined grid as a function of depth, with 2.5 mm spacing. The average exponential coefficient was determined to be (-0.090 ± 0.004) mm.

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3) The distance from the probe tip to the inner surface of the phantom for the lowest point is 2.5 mm. The distance from the probe tip to the tip of the measuring dipole within the APREL Triangular Dosimetric Probe Model E-009 is 2.3 mm. The total extrapolation distance is 4.8 mm, the sum of these two.

Applying the exponential coefficient over the 4.8 mm to the maximum SAR value averaged over 10 grams that was determined previously, we obtain the **maximum SAR value at the surface averaged over 10 grams, 2.88 W/kg.**

8. BYSTANDER EXPOSURE

All subsequent testing for bystander exposure was performed on channel 24B0 (821 MHz), with the right side of the DUI facing up against the bottom of the phantom. This relates to the position and frequency found to provide the maximum measured SAR value.

1) Channel 24B0 (821 MHz) was also explored on a refined 5 mm grid in three dimensions. The SAR value averaged over 1 gram was determined from these measurements by averaging the 27 points (3x3x3) comprising a 1 cm cube. The maximum SAR value measured averaged over 1 gram was determined from these measurements to be 2.96 W/kg.

2) To extrapolate the maximum SAR value averaged over 1 gram to the inner surface of the phantom a series of measurements were made at a five (x,y) co-ordinates within the refined grid as a function of depth, with 2.5 mm spacing. The average exponential coefficient was determined to be (-0.090 ± 0.004) mm.

3) The distance from the probe tip to the inner surface of the phantom for the lowest point is 2.5 mm. The distance from the probe tip to the tip of the measuring dipole within the APREL Triangular Dosimetric Probe Model E-009 is 2.3 mm. The total extrapolation distance is 4.8 mm, the sum of these two.

Applying the exponential coefficient over the 4.8 mm to the maximum SAR value averaged over 1 gram that was determined previously, we obtain the **maximum SAR value at the surface averaged over 1 gram, 4.55 W/kg**.

4) Wide area scans were then performed for channel 24B0 (821 MHz) versus DUI separation from the bottom of the phantom. The peak single point SAR for the scans were:

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DUI to phantom separation (mm)	Highest Local SAR (W/kg)
10	1.36
20	0.60
30	0.28

Table 3. SAR versus DUI-Phantom Separation

The measurements of highest local SAR versus separation of the DUI from the bottom of the phantom can be used to determine the SAR exposure of the bystander during operation of the DUI.

If the data for Figure 4 is fitted to an exponential equation we get:

$$\text{Peak Local SAR} = 5.7519\, e^{*-0.0932\,(\text{separation})}$$

A similar equation will exist for the maximum 1g SAR versus separation:

$$\text{Maximum 1g SAR} = k\, e^{*\,-0.0932\,(\text{separation})}$$

Using this equation with the previous data:

Maximum 1g SAR at the surface	=	4.55 W/kg
Tissue to DUI separation	=	3 mm,

Results in k = 6.02 which corresponds to the maximum 1g SAR when the separation is 0 mm. A conservative maximum 1g SAR of 1.19 W/kg (1.6 W/kg reduced by our measurement uncertainty, 25.1 % K^2) would occur for a separation of 17.4 mm from the antenna of the DUI.

At a standard separation distance of 4 cm, the maximum 1g SAR would be 0.14 W/kg.

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9. CONCLUSIONS

The maximum Specific Absorption Rate (SAR) for the hand averaged over 10 grams, determined at 821 MHz (channel 24B0) of the Artema POS, is **<u>2.88 W/kg</u>**. The overall margin of uncertainty for this measurement is 25.1 % K^2 (Appendix B). The SAR limit given in the FCC 96-326 Safety Guideline is 4 W/kg for hand exposure for the general population.

For a user exposing a part of the body other than the extremities, at a separation distance of 4 cm from the device, **<u>the maximum Specific Absorption Rate (SAR) averaged over 1g is 0.14 W/kg.</u>** The SAR limit given in the FCC 96-326 Safety Guideline is 1.6 W/kg for uncontrolled partial body exposure of the general population. The minimum separation distance that will ensure that the limit is not exceeded is 17.4 mm.

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 requirement.

Tested by ____________ Date JULY 20, 2001

Figure 1. DUI

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APPENDIX A.

Measurement Setup, Tissue Properties and SAR Graphs

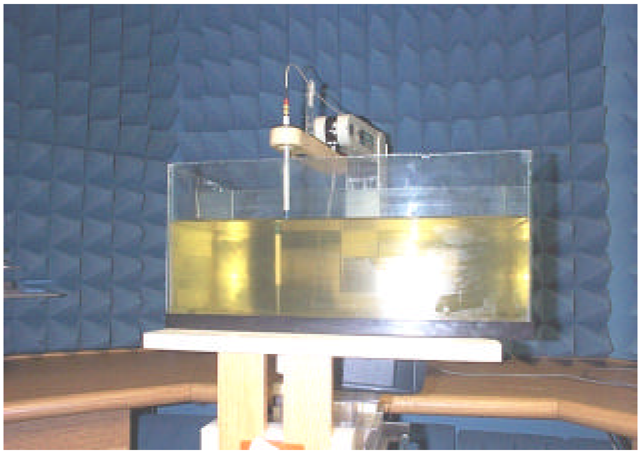

Figure 2. Setup

Simulated Tissue Material and Calibration Technique

The mixture used was based on that presented SSI/DRB-TP-D01-033, “Tissue Recipe and Calibration Requirements”. The density used to determine SAR from the measurements was the recommended 1000 kg/m^3 found in Appendix C of Supplement C to OET Bulletin 65, Edition 01-01).

Dielectric parameters of the simulated tissue material were determined using a Hewlett Packard 8510 Network Analyzer, a Hewlett Packard 809B Slotted Line Carriage, and an APREL SLP-001 Slotted Line Probe.

The recipe used for the Liquid Tissue was taken from OET Bulletin 65, Edition 01-01, presented on page 38 for body.

	APREL	Target values	Δ (%)
Dielectric constant, ε_r	54.8	55.2	0.4 %
Conductivity, σ [S/m]	1.04	0.97	7 %
Tissue Conversion Factor, γ	7.3	-	-

Table 4. Dielectric Properties of the Simulated Muscle Tissue at 815 MHz

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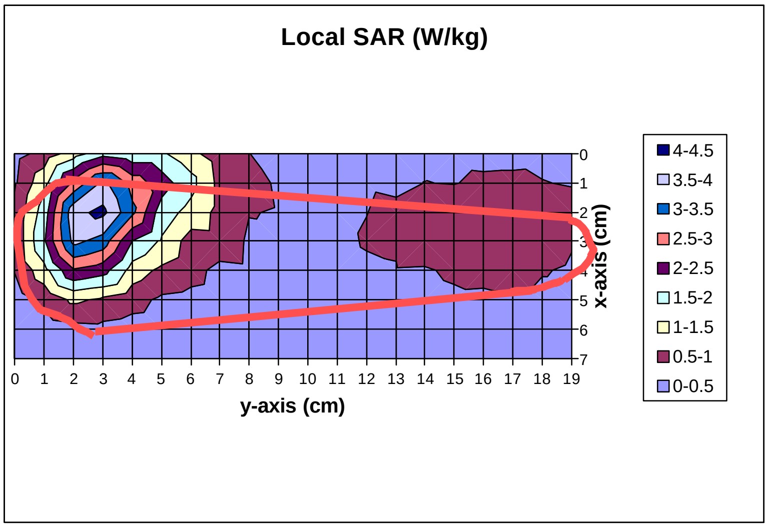

Figure 3. Contour Plot of Area Scan 2.5mm Above Phantom Surface

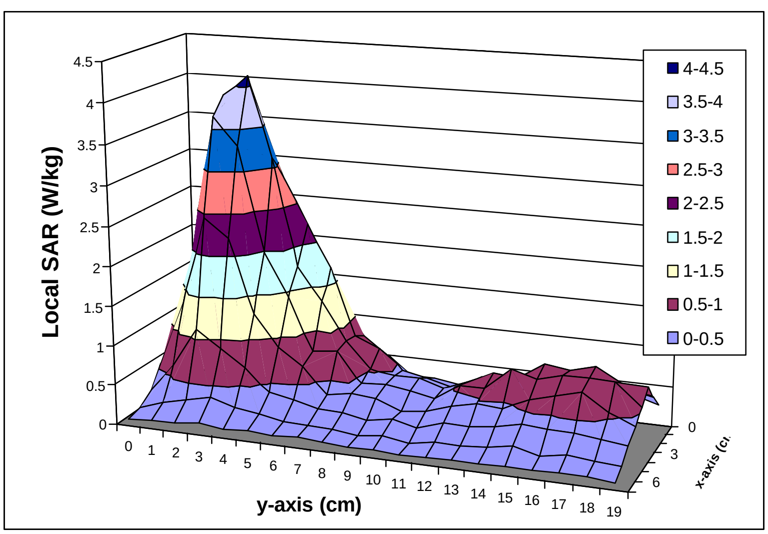

Figure 4. Surface Plot of Area Scan 2.5mm Above Phantom Surface

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APPENDIX B. Uncertainty Budget

Calculated Uncertainties		
Type of Uncertainty	**Specific to**	**Uncertainty**
Power variation due to battery condition	DUI	3 %
Extrapolation due to curve fit of SAR vs depth	Setup	3 %
Extrapolation due to depth measurement	Setup	4.8 %
Conductivity	Setup	7 %
Permitivity	Setup	0.4 %
Probe Calibration	Setup	6.5 %
Probe Positioning	Setup	2 %
Probe Isotropicity	Setup	3.5 %
Other Setup Uncertainty (Ambient,,,)	Setup	3 %
	25.1% Expanded Uncertainty K^2	

Table 5. Uncertainty Budget (Hand & Bystander)

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APPENDIX C.

Dipole Validation Scan on a Flat Phantom

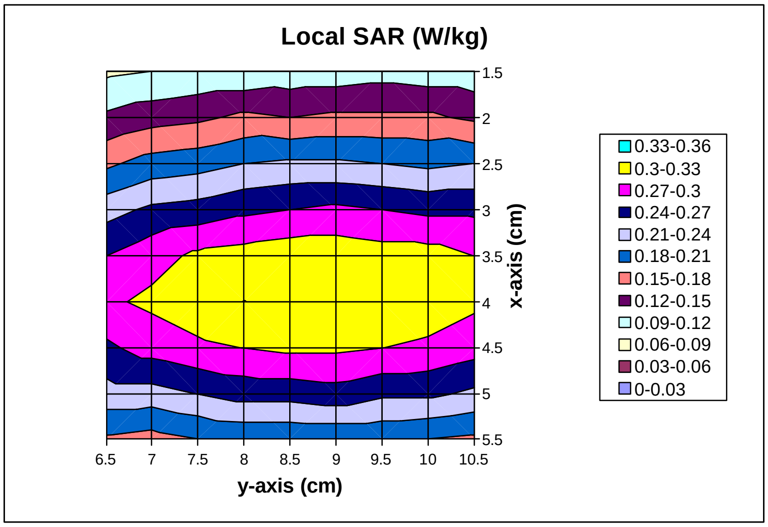

Figure 5. Surface Plot for Validation Dipole (Area Scan 2.5mm Above Phantom)

Frequency (MHz)	1 Gram SAR (W/Kg)	Target Value (W/Kg)	Delta (%)	Input Power to Dipole (dBm)	Distance from Dipole to Tissue (mm)
835	0.25	0.23	8%	13.7	15

Figure 6. Validation Dipole Under Phantom

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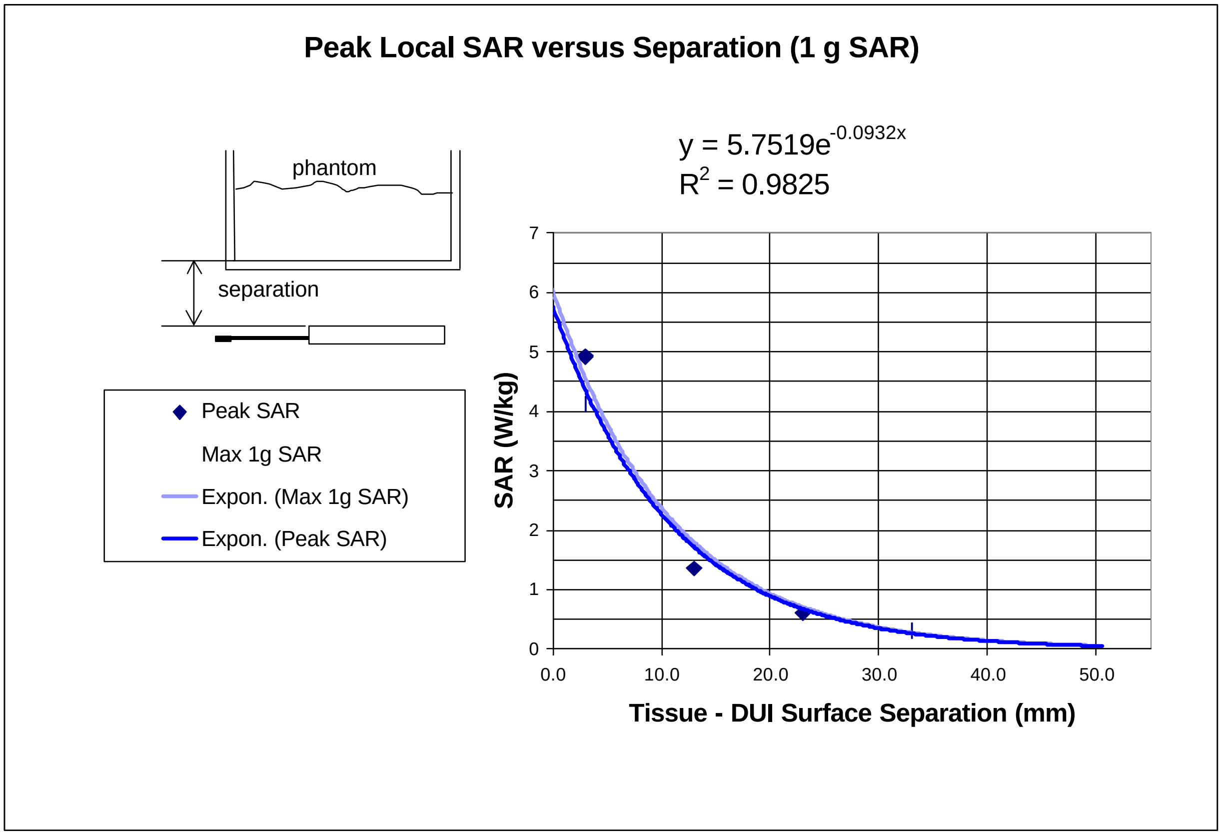

Figure 7. Peak Local SAR versus DUI Separation

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APPENDIX D. Probe Calibration

NCL CALIBRATION LABORATORIES

Calibration File No.: 301420

CERTIFICATE OF CALIBRATION

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/IDX Robotics Inc

Model No.: E-009

Serial No.: 115

Customer: APREL

Asset No.:301420

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

Cal. Date: 9 November, 2000 Cal. Due Date: 8 November, 2001

Remarks: None

Calibrated By: ______________________

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APPENDIX E.

Duty Factor Limiting Algorithm for the OEM Radio Module R802D-2-O

The duty factor limiting algorithm for the OEM radio module R802D-2-O is a firmware algorithm that directly inhibits the radio operational characteristics which generate the transmit pulses. This algorithm will be permanently imbeded within the radio firmware and installed at time of manufacture in the production facility. The algorithm cannot be modified or disabled by the user.

The radio module operates on a packet data network. The network controls the timing of most aspects of the radio signalling protocol. The shortest transmit event over which the mobile device has timing control is an entire uplink (transmit) transaction which is a series of transmit pulses. From the perspective of the mobile device this in an "atomic" event, i.e. the network controls the timing of the signalling within the transaction and the transaction can not be broken into smaller independent sub-parts.

Research in Motion Ltd. has implemented and tested a duty factor limiting algorithm for the radio module to comply with the requirement for limiting the duty factor at all times. To limit the duty factor at all times the algorithm controls the timing of when uplink (transmit) transactions are initiated. When an uplink (transmit) transaction occurs the algorithm accrues the actual transmit time. The algorithm ensures that the idle (transmitter off) time is sufficient to ensure the duty factor is less than the limit (25%) before the next uplink (transmit) transaction is initiated. This ensures that the duty factor is limited to the maximum allowable at all times.

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