Certificate Number: 1449-02

ELECTROMAGNETIC EXPOSURE (EME) TESTING LABORATORY

8000 West Sunrise Blvd.
Fort-Lauderdale, Florida

S.A.R. TEST REPORT

FCC ID: K7GT5X00
T5200– P14TAD03P2AA

February 16, 2001 Rev A

Tested By:	Stephen C. Whalen EME Engineer
Prepared By:	Stephen C. Whalen EME Engineer
Reviewed and Approved By:	Ken Enger Sr. Resource Manager Product Safety and EME Lab Director

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

REVISION HISTORY

Date	Revision	Comments
02/16/01	O	Original
04/11/01	A	Corrected date on cover page

1.0 Introduction

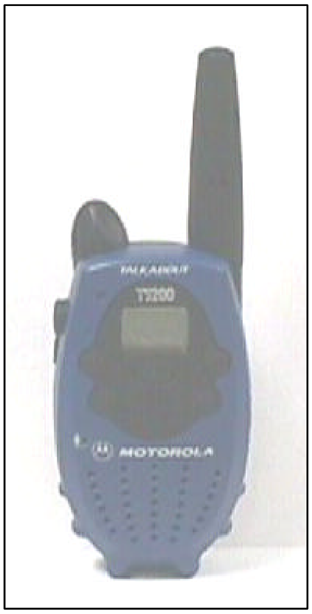
This report details the test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurement performed at CGISS EME laboratory for the T5200 Portable Radio Product, model number P14TAD03P2AA (FCC ID: K7GT5X00).

2.0 Reference Standards and Guidelines

This product is designed to comply with the following national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- National Council on Radiation Protection and Measurements (NCRP) of the United States, Report 86, 1986
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 1999 (applicable to wireless phones only)

3.0 Description of Test Sample



The Portable Device, Model number P14TAD03P2AA operates in 462.5625 – 467.7125 MHz band at a rated ERP (Effected Radiated Power) of 0.5W as a 2-way PTT (Push-To-Talk) with 14 channels and is marketed for FRS (Family Radio Services).

The following antenna, battery, and accessories/options were tested: (Refer to appendix B for illustrations of Body-worn Accessories.)

Item	**Kit Number**	**Description**
Antenna	NA	¼ wave, Helical, Fixed Non-removable
Battery	AA	COTS (Commercial Off The Shelf) Alkaline
Carry case	NTN9399A NTN9392A	Arm Pack/Belt Carry Case Swivel Belt Clip
Audio	NTN8867A NTN8870A	Remote Speaker Microphone Earbud W/PTT Microphone

3.1 Antenna Description:

3.1.1 Antenna Location on Device

Left [ ] Right [X] Top [X] Bottom [ ] Front [ ] Back [ ]

3.1.2 Antenna Dimensions

Length - cm	6.5
Diameter - cm (at tip of antenna)	1.1
Diameter - cm (at middle of antenna)	1.4
Diameter - cm (at base of antenna)	1.6

3.1.3 Antenna Configuration

Fixed [X] Retractable [ ] External [X] Internal [ ] Other [ ]

3.1.4 Antenna Gain:

Extended [-2.0 dBi] Retracted [NA]

3.2 Test Signal

Test Signal Source:

Test Mode [ ] Base Station [ ] Simulator [ ] Native Transmission Mode [X]

Signal Modulation:

CW	**X**
TDMA	
Other	

3.3 Test Frequency and Output Power

Output power measurement conditions:

Free Space Radiated		SAR test configuration		Conducted	X	Other	

Output Power measured with:

Power meter		RF Communications test set HP8920B	X	Spectrum Analyzer		Other	

Test Frequency (MHz)	Initial Measured Power before SAR (W)	dB loss from Initial Power after SAR (dB)
467.6875	0.452	-1.0

4.0 Description of Test Equipment

4.1 Descriptions of SAR Measurement System

The laboratory utilizes a Dosimetric Assessment System (DASY™) SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The SAR measurements were conducted with the ET3DV6 (serial number 1383) probe. It was calibrated at SPEAG™, and has a calibration date August 30, 2000. A copy of the calibration certificate is included as appendix C. Dipole Validation Kit type 450MHz (serial number 450-002) was used to validate the system accuracy at 450MHz. The Dipole validation result is 4.91mW/g when normalized to 1W compared to the target of 5.16mW/g, which is within the required accuracy of ± 10% (Dipole SAR Validation Certificate for Dipole S/N 450-002), and thus the measured SAR values are considered correct. See appendix B for print out of the validation test results from the DASY™ measurement system.

The DASY™ system is operated per the instructions in the DASY™ Users Manual. The entire manual is available directly from SPEAG™.

4.2 Description of Phantom

Human shaped, solid shell device made of fiberglass and mounted on a nonmetallic base or stand.

4.2.1 Full Body Phantom

Abdomen Thickness (mm)	0.15

Face Thickness (mm)	0.15

4.3 Simulated Tissue Properties:

4.3.1 Type of Simulated Tissue

Tissue type	Full Body	Head
Muscle	X	
Brain		NA

4.3.2 Simulated Tissue Composition

	Frequency 450MHz	
	Muscle	**Brain**
Di-Water	52 %	NA
Sugar	44.9 %	NA
Salt	2 %	NA
HEC	1 %	NA
Dowicil75	0.1 %	NA

Note: HEC (HYDROXYETHYL CELLULOSE) is a gelling agent and Dowicil 75 is anti bacterial compound.

Characterization of Simulated tissue materials and ambient conditions:
Simulated tissue prepared for SAR measurements are measured at room temperature and verified to be in spec prior to actual SAR measurements. This measurement was done by filling a coaxial slotted line with the tissue and probing the amplitude and phase changes versus distance in the simulated tissue. A HP8753D Network Analyzer is used to perform the measurements. Measured simulated tissue dielectric constant and conductivity used in SAR runs as of January 25, 2001.

	450MHz	
	Muscle	**Brain**
Di-electric Constant	57.6	NA
Conductivity – S/m	0.95	NA

5.0 Description of Test Procedure

Several accessories are available which possible influence operating conditions of this portable radio. These accessories include carry cases, which are intended to be attached to the user, and various types of audio accessories. The combinations of carry case and audio accessory devices when worn on the body permits the portable radio to be operated in PTT (Push To Talk) mode.

All SAR measurements were performed with the radio positioned in the described test positions and in continuous transmit mode, enabled by artificial means.

5.1 Description of Test Positions

The following describes the test positions used to perform SAR measurements on the portable radio:

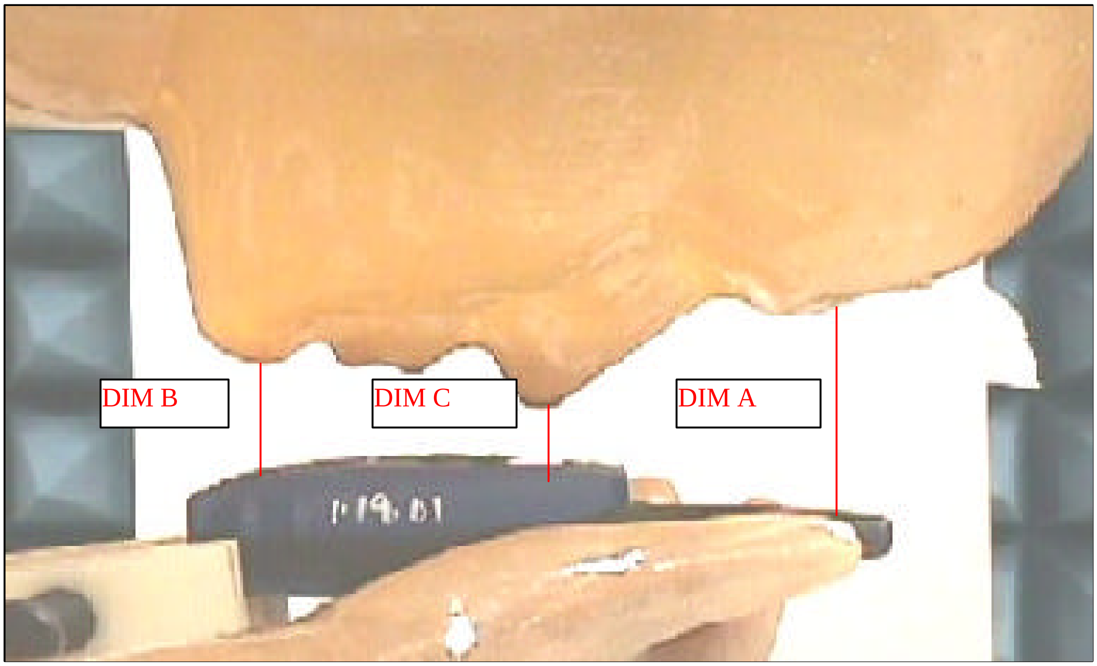
Face - The portable radio, without belt clip, is positioned in the right hand of a full body phantom in a normal two-way radio operating position and the radio's normal speaking area is aligned with the center of the phantom's mouth.

Abdomen - The portable radio is positioned in a belt clip attached beneath the abdomen of the full body phantom with the back of the radio facing the abdomen, the front of the radio facing the floor. An interface cable between the radio connector and an audio accessory is connected to the radio to allow two-way radio operation while carried on belt

The abdomen test configuration adequately covers a worst-case assessment for the (NTN9399A) Arm Pack. SAR measured in cylinders with a radius greater then 3 cm is negligible as compared to the SAR in a Flat /Abdomen phantoms

Reference figures: 1, 2, and 3 for portable radio antenna orientation and distances relative to phantoms

Figure 1: Facial Position



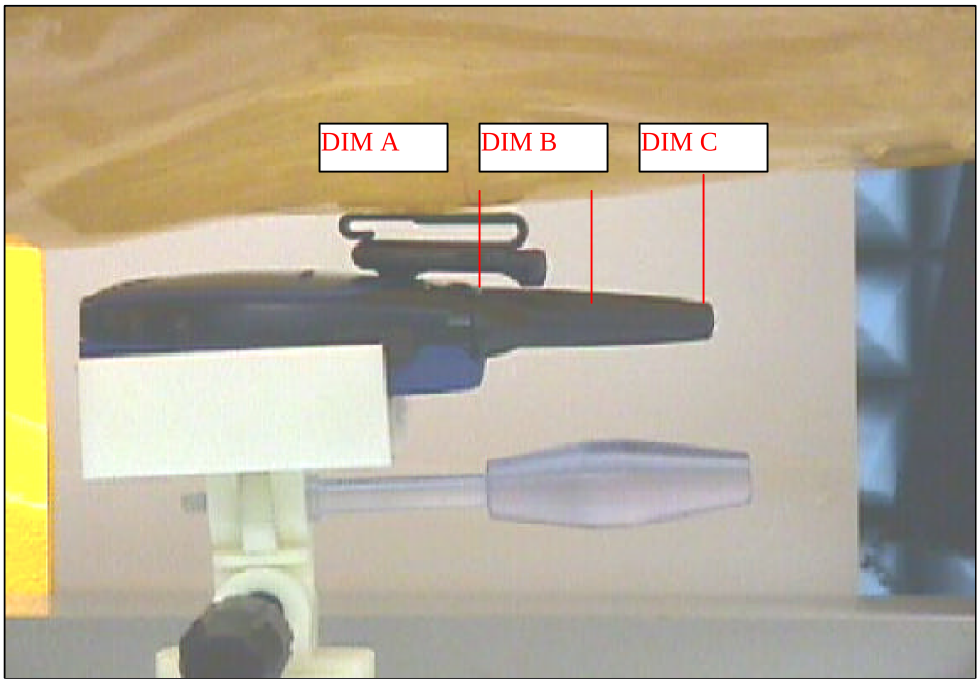
DIM A = Distance from center of phantom's forehead to radio surface = 53 mm

DIM B = Distance between phantom's chin and radio surface = 27 mm

DIM C = Closest distance between phantom's nose tip and radio surface = 17 mm

Note: Radio is positioned with microphone 2.5cm from mouth.

Figure 2: Abdominal Position



Dim A = Distance from surface of antenna base to phantom surface = 20 mm

Dim B= Distance from surface of antenna center to phantom surface = 23 mm

Dim C= Distance from antenna surface tip to phantom = 28 mm

5.2 Probe Scan Procedures

The E-field probe is first scanned in a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position for reference for the cube evaluations.

6.0 Measurement Uncertainty:

The table below list an estimate of the possible errors that are associated with the measurement system.

Uncertainty Description	Standard Uncertainty
Probe Uncertainty	
- Axial Isotropy	± 2.4 %
- Spherical Isotropy	± 4.8 %
- Spatial Resolution	± 0.5 %
- Linearity Error	± 2.7 %
- Calibration Error	± 8 %
Evaluation Uncertainty	
- Data Acquisition Error	± 0.60 %
- ELF and RF Disturbances	± 0.25 %
- Conductivity Assessment	± 5 %
Spatial Peak SAR Evaluation Uncertainty	
- Extrapolation and boundary effects	± 3%
- Probe positioning	± 1 %
- Integration and cube orientation	± 3 %
- Cube shape inaccuracies	± 1.2 %
- Device positioning	± 1.0 %

The Total Measurement Uncertainty is ± 12.1 %. The Expanded Measurement Uncertainty is ± 24.2 % (k=2)

7.0 SAR Test Results

All possible combinations of battery, antenna and accessories/options (refer to section 3) were evaluated and then configured to obtain the highest measured SAR. The combination of swivel belt clip (NTN9392A) and Remote Speaker Microphone (NTN8867A) measured at the abdomen produced the highest measured SAR. The highest maximum calculated values for each body position are indicated in bold and summarized in the table below. The DASY™ measurement system's output files are provided in appendix A.

		Highest Measured SAR (CW)		Max Calculated SAR (PTT)	
Transmit Freq. (MHz)	Initial Cond. Power (W)	Face	Abdomen	Face	Abdomen
467.6875	0.452	0.30	0.68	**0.47**	**1.06**

The calculated maximum 1-gram averaged SAR value is determined by scaling up the SAR to adjust for any condition of permissible tuning, frequency, voltage and temperature; which is 0.62W in this case. For this reason, the radio Maximum Calculated 1-gram averaged peak SAR becomes: 1.06mW/g

Formula to calculate max SAR for Consumer radio

$$\text{Maximum Calculated 1-gram Average Peak SAR} = \frac{P_{max}}{P(0)} \times \frac{P(0)}{P_{end}} \times \frac{P(0)+P(30)}{2xP(0)} \times (D1xD2) \times SAR_{meas}.$$

P_{max} = Maximum power delivered to the antenna connector under any conditions of permissible tuning, frequency, voltage and temperature.

P(0) = Measured power before SAR testing.

P(30) = measured power at 30 minutes of continuous transmit.

P_{end} = Lowest measured power at end of SAR.

SAR_{meas}. = Measured 1 gram averaged peak SAR .

D1 = the transmission mode duty cycle, i.e., the ratio of the service mode and the tested mode.

D2 = the Push To Talk duty cycle.
For two-way radio (dispatch for controlled environment) = 0.5,
For two-way radio (dispatch for uncontrolled/ general population) = 1,

For data and telephony = 1.

Formula to calculate max SAR for Consumer radio

$$\text{Maximum Calculated 1-gram Average Peak SAR @ abdomen} = \frac{0.620W}{0.452W} \times \frac{0.452W}{0.356W} \times \frac{0.452W + 0.354W}{2 \times 0.452W} \times (1 \times 1) \times 0.68mW/g = 1.06mW/g$$

Formula to calculate max SAR for Consumer radio

$$\text{Maximum Calculated 1-gram Average Peak SAR @ face} = \frac{0.620W}{0.452W} \times \frac{0.452W}{0.356W} \times \frac{0.452W + 0.354W}{2 \times 0.452W} \times (1 \times 1) \times 0.30mW/g = 0.47mW/g$$

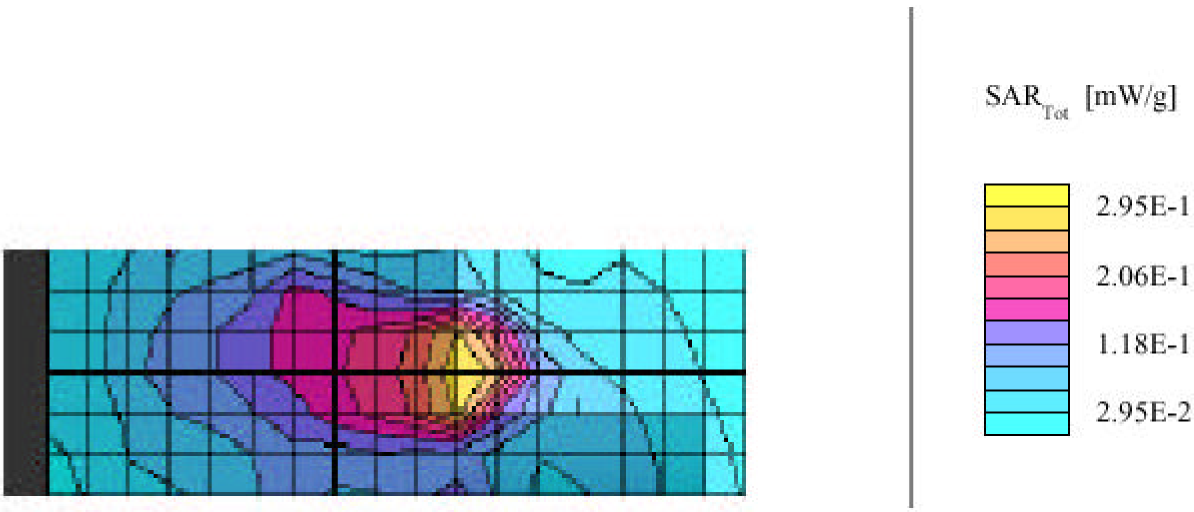
8.0 Conclusion

The highest Operational Maximum Calculated 1-gram average SAR values found for the portable radio model number P14TAD03P2AA was 1.06 mW/g. These results are fully compliant to the General Population/Uncontrolled Environment limit of 1.6mW/g / SAR.

Appendix A: Data Results

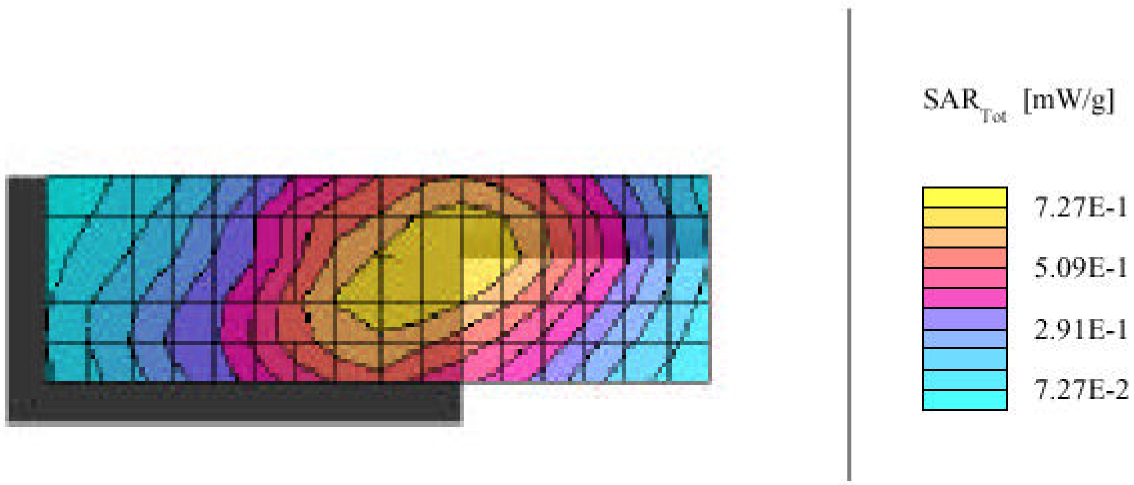
T5200 Face;Test Date:01/25/01

Run 01012505, Time: 24 min.
Model #: P14TAD03P2AA, S/N: 690WAY007K
Tx_Freq: 467.6875 MHz, 2.5cm from mic to mouth
Batt: Alkaline,
Full body Phantom; Abdomen section
Probe: ET3DV6 - SN1383; ConvF(7.12,7.12,7.12);
Crest factor: 1.0; Muscle_450 MHz: σ = 0.95 mho/m er = 57.6 ρ = 1.07 g/cm 3
Cube 5x5x7: SAR (1g): 0.297 mW/g, (Worst-case extrapolation)



T5200 Ab;Test Date:01/25/01

Run 01012501, Time: 20 min.
Model #: P14TAD03P2AA, S/N: 690WAY007K
Tx_Freq: 467.6875 MHz, SW. Belt Clip NTN9392A
Batt: Alkaline, RSM NTN8867A
Full body Phantom; Abdomen section
Probe: ET3DV6 - SN1383; ConvF(7.12,7.12,7.12);
Crest factor: 1.0; Muscle_450 MHz: σ = 0.95 mho/m er = 57.6 ρ = 1.07 g/cm 3
Cube 5x5x7: SAR (1g): 0.682 mW/g, (Worst-case extrapolation)



Appendix B: Illustrations of Body-worn Accessories

Illustrations of Body-worn Accessories

Photo 1
Front-view of T5200 and Arm Pack/Belt Carry Case (NTN9399A)

Photo 2
Side-view of T5200 and Arm Pack/Belt Carry Case (NTN9399A)

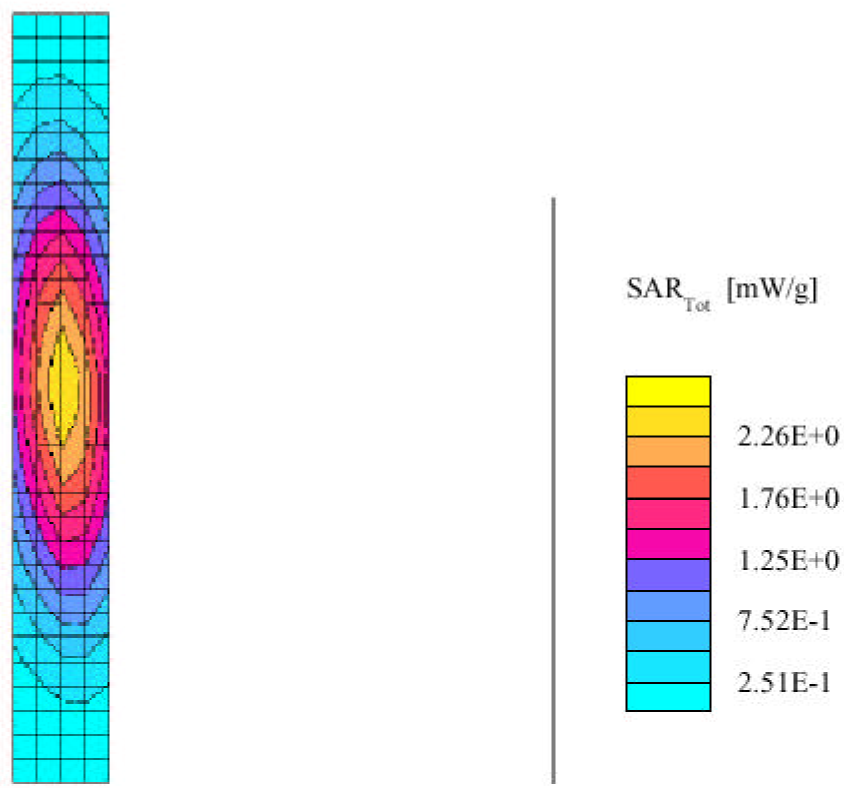
Photo 3
Side-view of T5200 and Swivel Belt Clip (NTN9392A)

Photo 4
Side-view of T5200 and Arm Pack/Belt Carry Case (NTN9399A) with Velcro strap

Appendix C: Dipole Validation Data Results

450 CGISS Dipole 002;Test Date:01/25/01

450MHz Dipole Validation, Input Power 0.5W, Target SAR : 5.16mW/g @ 1W;sw
Flat Phantom
Probe: ET3DV6 - SN1383; ConvF(7.12,7.12,7.12);
Crest factor: 1.0; Muscle_450 MHz: σ = 0.95 mho/m er = 58.4 ρ = 1.07 g/cm 3
Cube 5x5x7: SAR (1g): 2.45 mW/g, (Worst-case extrapolation), Drift –0.01dB



Appendix D: Measurement Probe Calibration Certificate

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1383**
Place of Calibration:	**Zurich**
Date of Calibration:	**August 30, 2000**
Calibration Interval:	**12 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by: Nikolaos Neviana

Approved by: [signature]

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	ET3DV6
Serial Number:	1383
Place of Assessment:	Zurich
Date of Assessment:	September 20, 2000
Probe Calibration Due Date:	**August 30, 2001**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Approved by: Niels Kuster

Dosimetric E-Field Probe ET3DV6 SN:1383

Conversion factor (± standard deviation)

Frequency		Value	Tissue parameters
450 MHz	ConvF	7.14 ± 8%	ε_r = 47.0 σ = 0.63 mho/m (brain tissue)
835 MHz	ConvF	6.50 ± 8%	ε_r = 44.0 σ = 0.90 mho/m (brain tissue)
925 MHz	ConvF	6.33 ± 8%	ε_r = 44.0 σ = 0.93 mho/m (brain tissue)
1500 MHz	ConvF	5.89 ± 8%	ε_r = 41.1 σ = 1.00 mho/m (brain tissue)
1900 MHz	ConvF	5.36 ± 8%	ε_r = 39.9 σ = 1.42 mho/m (brain tissue)
150 MHz	ConvF	8.46 ± 8%	ε_r = 70.00 σ = 0.75 mho/m (muscle tissue)
450 MHz	ConvF	7.12 ± 8%	ε_r = 58.0 σ = 1.00 mho/m (muscle tissue)
835 MHz	ConvF	6.45 ± 8%	ε_r = 52.0 σ = 1.10 mho/m (muscle tissue)
925 MHz	ConvF	6.31 ± 8%	ε_r = 52.0 σ = 1.20 mho/m (muscle tissue)
1500 MHz	ConvF	6.07 ± 8%	ε_r = 41.2 σ = 1.48 mho/m (muscle tissue)
1920 MHz	ConvF	5.11 ± 8%	ε_r = 51.5 σ = 1.95 mho/m (muscle tissue)