DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

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FCC IDENTIFIER:	**AL8CS50XXXX**
IC IDENTIFIER:	**457A-CS50XXXX**
Model(s):	**CS50-USB**
Rule Part(s):	**FCC 47 CFR §2.1093; IC RSS-102 Issue 1 (Provisional)**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (01-01)**
Device Classification:	**Digital Transmission System (DTS)**
Device Type:	**Wireless USB Headset System (Base Unit)**
Mode of Operation:	**TDMA (Time Division Multiple Access)**
Tx Frequency Range(s):	**902 - 928 MHz (ISM Band)**
RF Output Power Tested:	**15.5 dBm Peak Conducted (Antenna 1)** **14.7 dBm Peak Conducted (Antenna 0)**
Max. Duty Cycle Tested:	**3.8 % (Crest Factor: 1:25.6)**
Antenna Type(s) Tested:	**Internal Diversity (0-Left/1-Right)**
Power Source(s) Tested:	**Laptop PC (USB)** **Plantronics AC Adapter (P/N: 45561-02)**
Max. SAR Level(s) Evaluated:	**0.0118 W/kg (1g average)**
Class II Permissive Change(s):	**Add USB Adapter Unit (Base)**

Celltech Labs Inc. declares under its sole responsibility that this wireless device is compliant with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), Industry Canada RSS-102 Issue 1 (Provisional) and IEEE Standard 1528-2003 for the General Population / Uncontrolled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Spencer Watson
Compliance Technologist
Celltech Labs Inc.

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1.0 INTRODUCTION

This measurement report demonstrates that the PLANTRONICS CS50-USB Wireless USB Headset System (Base Unit) FCC ID: AL8CS50XXXX complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), IC RSS-102 Issue 1 (Provisional) (see reference [4]), and IEEE Standard 1528-2003 (see reference [5]) were employed. A description of the product, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION of Device Under Test (DUT)

FCC Rule Part(s)	47 CFR §2.1093		
IC Rule Part(s)	RSS-102 Issue 1 (Provisional)		
FCC Device Classification	Digital Transmission System (DTS)		
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01) to OET Bulletin 65 (97-01)		
Device Type	Wireless USB Headset System (Base Unit)		
FCC IDENTIFIER	AL8CS50XXXX		
IC IDENTIFIER	457A-CS50XXXX		
Model(s)	CS50-USB		
Serial No.(s)	441	Antenna 0 (Left)	Identical Prototype
	445	Antenna 1 (Right)	Identical Prototype
Tx Frequency Range(s)	902 - 928 MHz	ISM Band	
Mode(s) of Operation	TDMA (Time Division Multiple Access)		
Maximum Duty Cycle Tested	3.8 % (Crest Factor: 1:25.6)		
RF Output Power Tested	15.5 dBm	Peak Conducted	Antenna 1
	14.7 dBm	Peak Conducted	Antenna 0
Power Source(s) Tested	Laptop PC (USB)		
	Plantronics AC Adapter (P/N: 45561-02)		
Antenna Type(s) Tested	Internal Diversity (0-Left / 1-Right)		
Class II Permissive Change(s)	Add USB Adapter Unit (Base)		

3.0 SAR MEASUREMENT SYSTEM

Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

DASY4 Measurement System with SAM Phantom

DASY4 Measurement System with SAM Phantom

4.0 MEASUREMENT SUMMARY

BODY SAR MEASUREMENT RESULTS

Freq. (MHz)	Chan.	Base Unit S/N	Test Mode	Power Supply	Antenna Tested		DUT Position to Planar Phantom	Separation Distance to Planar Phantom (cm)	Cond. Power Before Test (dBm)	Measured SAR 1g (W/kg)	SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) with drift
915.264	5	441	Modulated	USB Laptop	0	Left	Left Side	0.0	14.7	0.0111	0.129	0.0111
915.264	5	445	Modulated	USB Laptop	1	Right	Right Side	0.0	15.5	0.00969	0.0571	0.00969
915.264	5	445	Modulated	USB Laptop	1	Right	Back Side	0.0	15.5	0.00507	-0.142	0.00524
915.264	5	441	Modulated	USB Laptop	0	Left	Back Side	0.0	14.7	0.00182	-0.0519	0.00184
915.264	5	441	Modulated	USB Laptop	0	Left	Front Side Left Tilted	0.0	14.7	0.00942	-0.0263	0.00948
915.264	5	445	Modulated	USB Laptop	1	Right	Front Side Right Tilted	0.0	15.5	0.00675	-0.0166	0.00678
915.264	5	441	Modulated	AC Adapter	0	Left	Left Side	0.0	14.7	0.0118	0.0808	0.0118

ANSI / IEEE C95.1 1999 - SAFETY LIMIT
BODY: 1.6 W/kg (averaged over 1 gram)
Spatial Peak - Uncontrolled Exposure / General Population

Test Date(s)	September 3, 2004			Relative Humidity	41	%
Measured Fluid Type	915 MHz Body			Atmospheric Pressure	102.5	kPa
Dielectric Constant ε_r	IEEE Target		Measured	Ambient Temperature	23.7	°C
	55.0	± 5%	52.9	Fluid Temperature	21.3	°C
Conductivity σ (mho/m)	IEEE Target		Measured	Fluid Depth	≥ 15	cm
	1.06	± 5%	1.07	ρ (Kg/m^3)	1000	

Note(s):

1. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. The SAR evaluations were performed with power from Laptop PC connected to the DUT via USB cable. The maximum SAR level configuration was subsequently retested with AC power adapter to report a power source comparison as shown in the above table.
3. The SAR levels measured for mid channel were ≥ 3 dB below the SAR limit; therefore mid channel data only was reported (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
4. The power drifts measured by the DASY4 system were within 5% of the start power. Negative drifts were subsequently added to the corresponding measured SAR levels to report scaled SAR results as shown in the above table.
5. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures reported were consistent for all measurement periods.
6. The dielectric parameters of the simulated tissue mixture were measured prior to the SAR evaluation using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
7. The SAR measurements were performed within 24 hours of the system performance check.

5.0 DETAILS OF SAR EVALUATION

The PLANTRONICS CS50-USB Wireless USB Headset System (Base Unit) FCC ID: AL8CS50XXXX was compliant for localized Specific Absorption Rate (SAR) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

1) The base unit was tested for body SAR with the left side of the DUT (Antenna 0) facing parallel to, and touching, the outer surface of the SAM phantom (planar section).
2) The base unit was tested for body SAR with the right side of the DUT (Antenna 1) facing parallel to, and touching, the outer surface of the SAM phantom (planar section).
3) The base unit was tested for body SAR with the back side of the DUT facing parallel to, and touching, the outer surface of the SAM phantom (planar section). Both left and right side antennas were evaluated separately (Antenna 0, Antenna 1).
4) The base unit was tested for body SAR with the front left side of the DUT (Antenna 0) tilted, facing parallel to, and touching, the outer surface of the SAM phantom (planar section).
5) The base unit was tested for body SAR with the front right side of the DUT (Antenna 1) tilted, facing parallel to, and touching, the outer surface of the SAM phantom (planar section).
6) The body SAR evaluations were performed with power from Laptop PC connected to the DUT via USB cable. The maximum SAR level configuration was subsequently retested with AC power adapter to report a power source comparison.
7) The base unit and headset unit were separated by a 1-meter distance and the base unit transmitted automatically within 10 seconds of the separation. The green LED indicator on the front face of the base unit clicked as the relay closed, and the green LED on the exterior of the headset unit flashed to indicate the device was in test mode.
8) SAR measurements were performed with the DUT transmitting at maximum power on a fixed frequency using random modulation and a source-based time-averaged duty cycle of 3.8% (crest factor = 25.6).
9) The conducted power levels of the DUT were measured prior to the SAR evaluation according to the procedures described in FCC 47 CFR §2.1046.
10) The power drifts measured by the DASY4 system were within 5% of the start power. Negative drifts were subsequently added to the corresponding measured SAR levels to report scaled SAR results (see data table).
11) The SAR measurements were performed within 24 hours of the system performance check.

6.0 EVALUATION PROCEDURES

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.

(ii) For body-worn and face-held devices a planar phantom was used.

b. The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

An area scan was determined as follows:

c. Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.
d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

e. Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away form the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix D). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.
f. Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).
g. A zoom scan volume of 32 mm x 32 mm x 30 mm (5x5x7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7x7x7 points) to ensure complete capture of the peak spatial-average SAR.

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed at the planar section of the SAM phantom with a 900MHz dipole (see Appendix C for system validation procedures). The fluid dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters). A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system performance check test plot).

SYSTEM PERFORMANCE CHECK

Test Date	900MHz Equiv. Tissue	SAR 1g (W/kg)		Dielectric Constant ε_r		Conductivity σ (mho/m)		ρ (Kg/m^3)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured						
09/03/04	**Brain**	**2.70 ±10%**	2.63 (-2.6%)	**41.5 ±5%**	39.9	**0.97 ±5%**	0.96	1000	22.5	21.7	≥ 15	41	102.6

Note(s):
1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

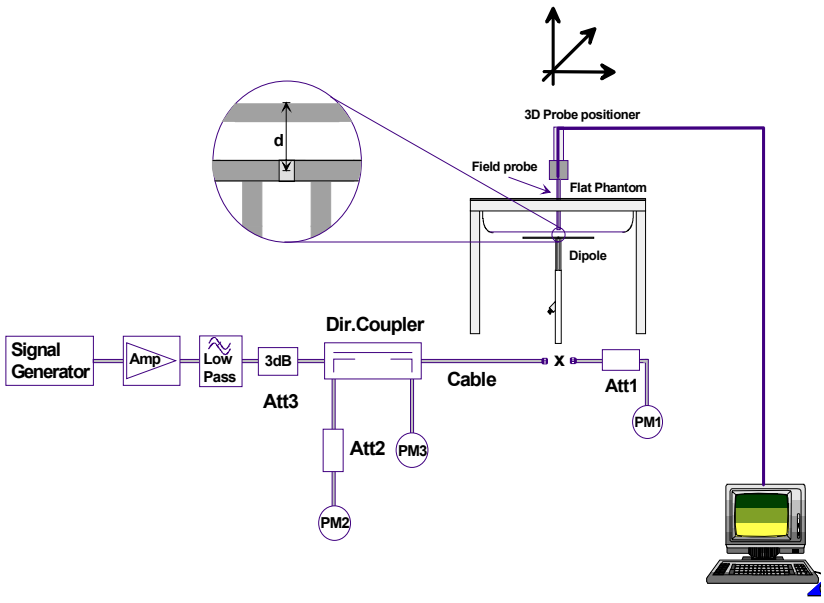


Figure 1. System Performance Check Setup

900MHz Dipole Setup

8.0 SIMULATED EQUIVALENT TISSUES

The 900MHz simulated tissue mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide was added and visual inspection was made to ensure air bubbles were not trapped during the mixing process. The fluids were prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

900/915MHz SIMULATED TISSUE MIXTURES		
INGREDIENT	**900MHz Brain**	**915MHz Body**
	System Performance Check	DUT Evaluation
Water	40.71 %	53.79 %
Sugar	56.63 %	45.13 %
Salt	1.48 %	0.98 %
HEC	0.99 %	--
Bactericide	0.19 %	0.10 %

9.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Notes:
1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER:	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor:	AMD Athlon XP 2400+
Clock Speed:	2.0 GHz
Operating System:	Windows XP Professional

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY4 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

DASY4 Measurement Server

Function:	Real-time data evaluation for field measurements and surface detection
Hardware:	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections:	COM1, COM2, DAE, Robot, Ethernet, Service Interface

E-Field Probe

Model:	ET3DV6
Serial No.:	1590
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	±0.2 dB (30 MHz to 3 GHz)

Phantom(s)

Type:	SAM V4.0C
Shell Material:	Fiberglass
Thickness:	2.0 ±0.1 mm
Volume:	Approx. 20 liters

11.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity:	±0.2 dB in brain tissue (rotation around probe axis) ±0.4 dB in brain tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to >100 mW/g; Linearity: ±0.2 dB
Surface Detection:	±0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of mobile phone

ET3DV6 E-Field Probe

12.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm (+/-0.2 mm) shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections (see Appendix F for specifications of the SAM phantom V4.0C).

SAM Phantom V4.0C

13.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

Device Holder

14.0 TEST EQUIPMENT LIST

TEST EQUIPMENT	SERIAL NO.	CALIBRATION DATE
Schmid & Partner DASY4 System	-	-
-DASY4 Measurement Server	1078	N/A
-Robot	599396-01	N/A
-DAE3	353	Dec 2003
-DAE3	370	May 2004
-ET3DV6 E-Field Probe	1387	Mar 2004
-ET3DV6 E-Field Probe	1590	May 2004
-300MHz Validation Dipole	135	Oct 2003
-450MHz Validation Dipole	136	Nov 2003
-835MHz Validation Dipole	411	Mar 2004
-900MHz Validation Dipole	054	June 2004
-1800MHz Validation Dipole	247	June 2004
-1900MHz Validation Dipole	151	June 2004
-2450MHz Validation Dipole	150	Sept 2004
-SAM Phantom V4.0C	1033	N/A
-Barski Planar Phantom	03-01	N/A
-Plexiglas Planar Phantom	161	N/A
-Validation Planar Phantom	137	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2004
Gigatronics 8652A Power Meter	1835267	April 2004
Gigatronics 80701A Power Sensor	1833535	April 2004
Gigatronics 80701A Power Sensor	1833542	April 2004
Gigatronics 80701A Power Sensor	1834350	April 2004
HP E4408B Spectrum Analyzer	US39240170	Dec 2003
HP 8594E Spectrum Analyzer	3543A02721	April 2004
HP 8753E Network Analyzer	US38433013	April 2004
HP 8648D Signal Generator	3847A00611	April 2004
Amplifier Research 5S1G4 Power Amplifier	26235	N/A
Itronix IX260+ Laptop PC	ZZGEG4112ZZ9777	N/A

15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**c_i 1g**	**Standard Uncertainty ±% (1g)**	**v_i or v_{eff}**
Measurement System						
Probe calibration	± 5.95	Normal	1	1	± 5.95	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 6.0	Normal	√3	1	± 6.7	12
Device holder uncertainty	± 5.0	Normal	√3	1	± 5.9	8
Power drift	± 5.0	Rectangular	√3		± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 13.76**	
Expanded Uncertainty (k=2)					**± 27.51**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])

MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**c_i 1g**	**Standard Uncertainty ±% (1g)**	**v_i or v_{eff}**
Measurement System						
Probe calibration	± 5.95	Normal	1	1	± 5.95	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Dipole						
Dipole Axis to Liquid Distance	± 2.0	Rectangular	√3	1	± 1.2	∞
Input Power	± 4.7	Rectangular	√3	1	± 2.7	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 10.54**	
Expanded Uncertainty (k=2)					**± 21.09**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])

16.0 REFERENCES

1] Federal Communications Commission, “Radiofrequency radiation exposure evaluation: portable devices”, Rule Part 47 CFR §2.1093: 1999.

[2] Health Canada, “Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz”, Safety Code 6.

[3] Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

[4] Industry Canada, “Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada’s Safety Code 6 for Exposure of Humans to Radio Frequency Fields”, Radio Standards Specification RSS-102 Issue 1 (Provisional): September 1999.

[5] IEEE Standard 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 09/03/04

Body SAR - Antenna 0 - Left Side of DUT (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 441

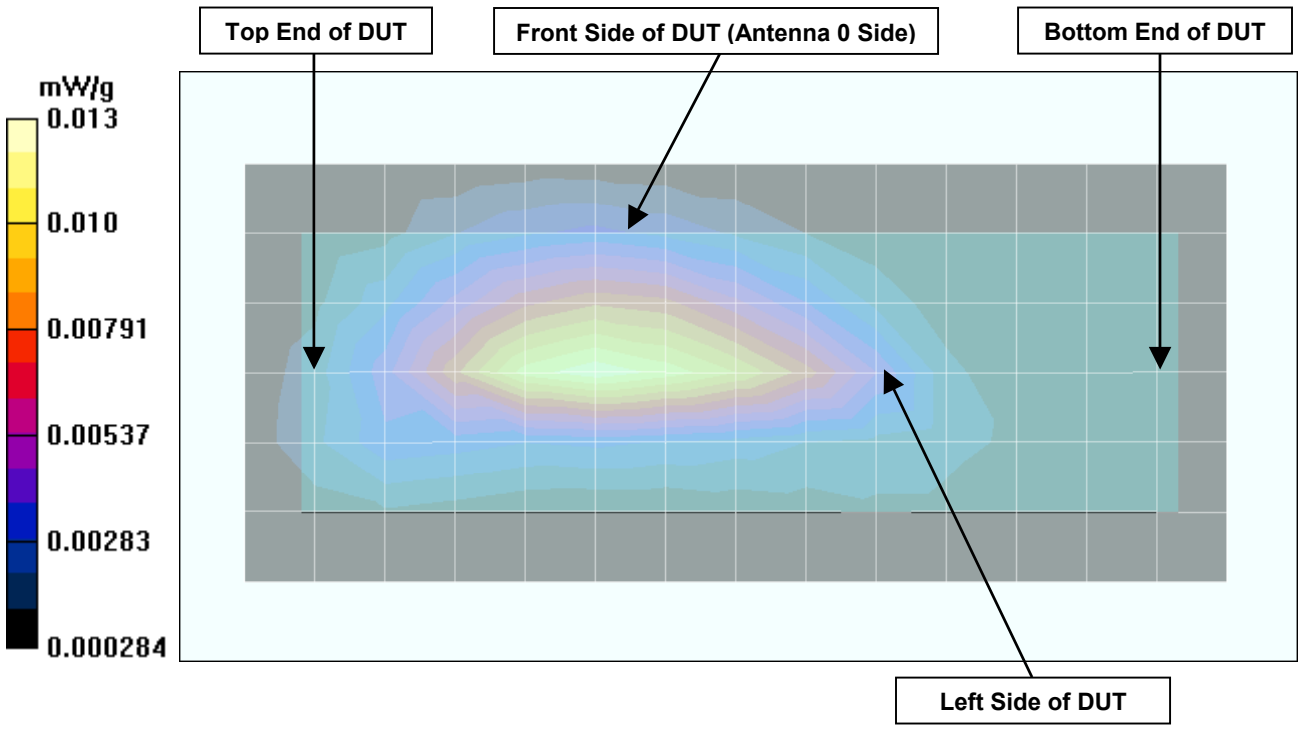
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: Laptop PC (USB)
Communication System: Modulated TDMA
RF Output Power: 14.7 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 0 - Left Side of DUT - 0.0 cm Separation Distance/Area Scan (7x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 0 - Left Side of DUT - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.55 V/m; Power Drift = 0.129 dB
Peak SAR (extrapolated) = 0.022 W/kg
SAR(1 g) = 0.0111 mW/g; SAR(10 g) = 0.00588 mW/g



Date Tested: 09/03/04

Body SAR - Antenna 1 - Right Side of DUT (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 445

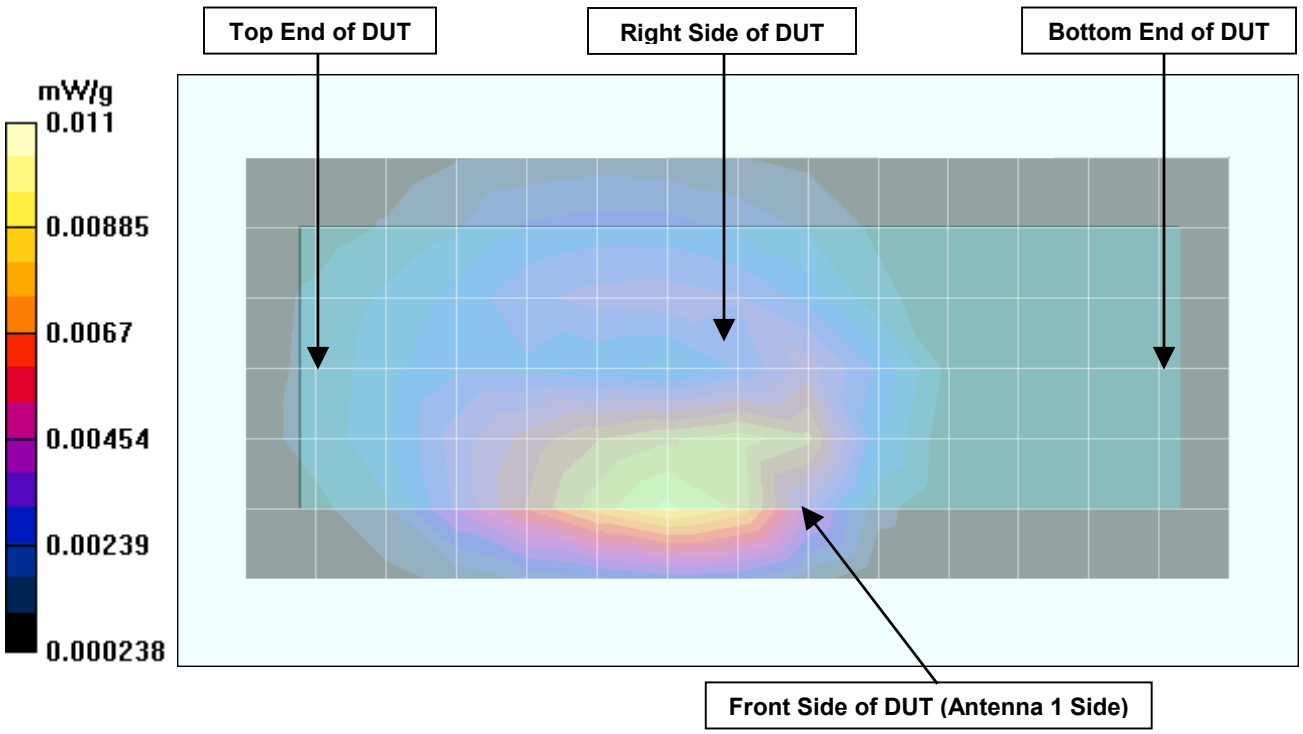
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: Laptop PC (USB)
Communication System: Modulated TDMA
RF Output Power: 15.5 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 1 - Right Side of DUT - 0.0 cm Separation Distance/Area Scan (7x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 1 - Right Side of DUT - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.68 V/m; Power Drift = 0.0571 dB
Peak SAR (extrapolated) = 0.019 W/kg
SAR(1 g) = 0.00969 mW/g; SAR(10 g) = 0.0049 mW/g



Date Tested: 09/03/04

Body SAR - Antenna 1 - Back Side of DUT (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 445

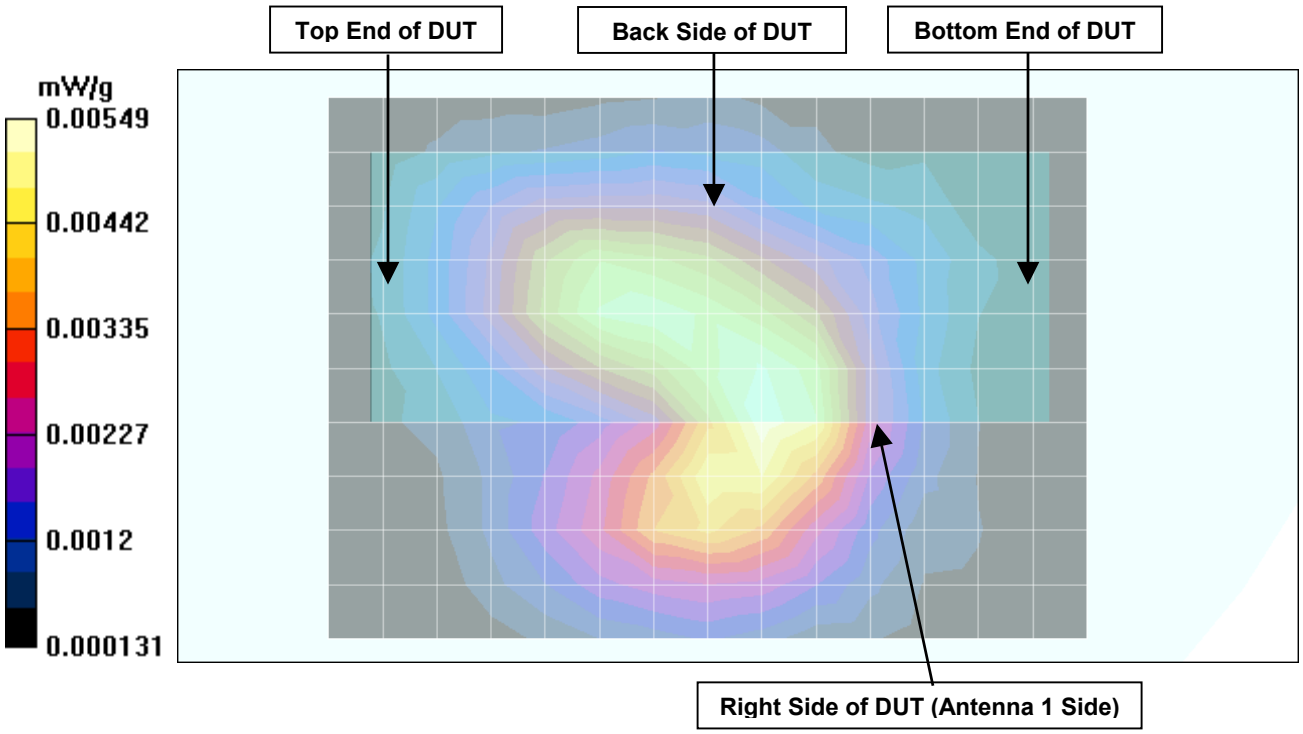
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: Laptop PC (USB)
Communication System: Modulated TDMA
RF Output Power: 15.5 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 1 - Back Side of DUT - 0.0 cm Separation Distance/Area Scan (11x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 1 - Back Side of DUT - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.28 V/m; Power Drift = -0.142 dB
Peak SAR (extrapolated) = 0.00771 W/kg
SAR(1 g) = 0.00507 mW/g; SAR(10 g) = 0.00331 mW/g



Date Tested: 09/03/04

Body SAR - Antenna 0 - Back Side of DUT (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 441

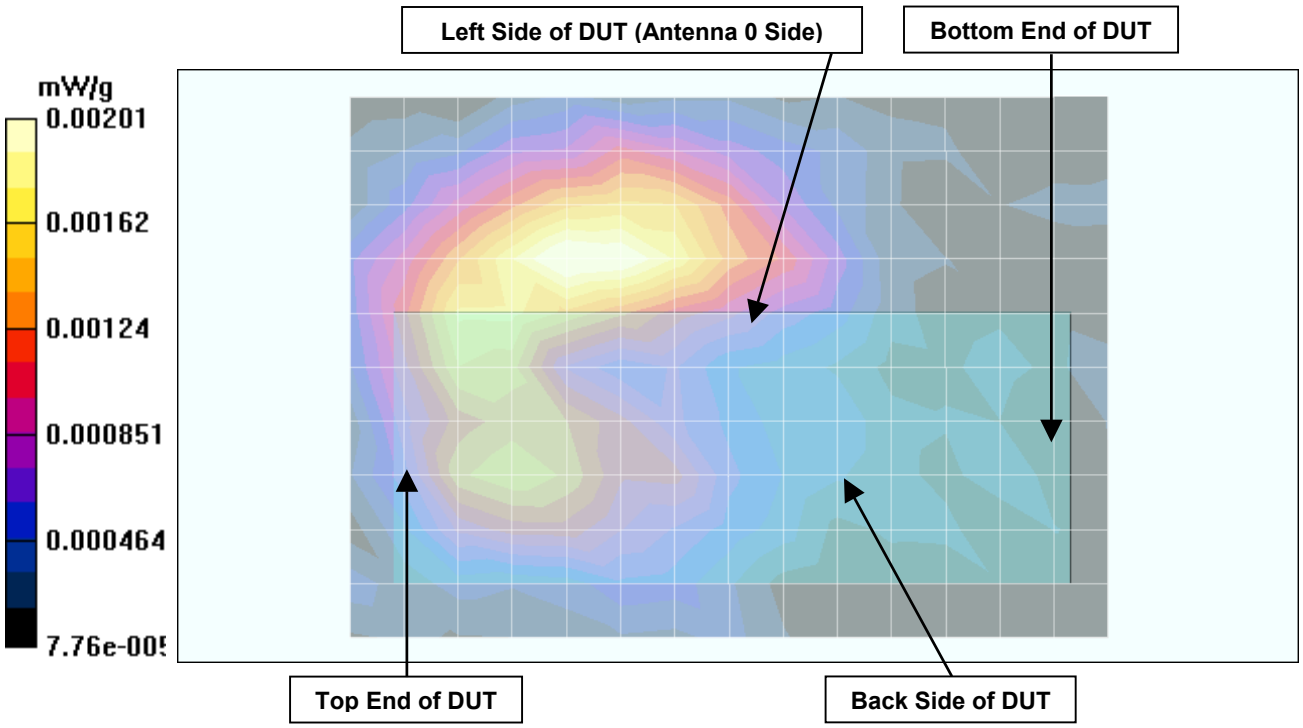
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: Laptop PC (USB)
Communication System: Modulated TDMA
RF Output Power: 14.7 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 0 - Back Side of DUT - 0.0 cm Separation Distance/Area Scan (11x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 0 - Back Side of DUT - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.886 V/m; Power Drift = -0.0519 dB
Peak SAR (extrapolated) = 0.00301 W/kg
SAR(1 g) = 0.00182 mW/g; SAR(10 g) = 0.00119 mW/g



Date Tested: 09/03/04

Body SAR - Antenna 0 - Front Side of DUT - Left Tilted (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 441

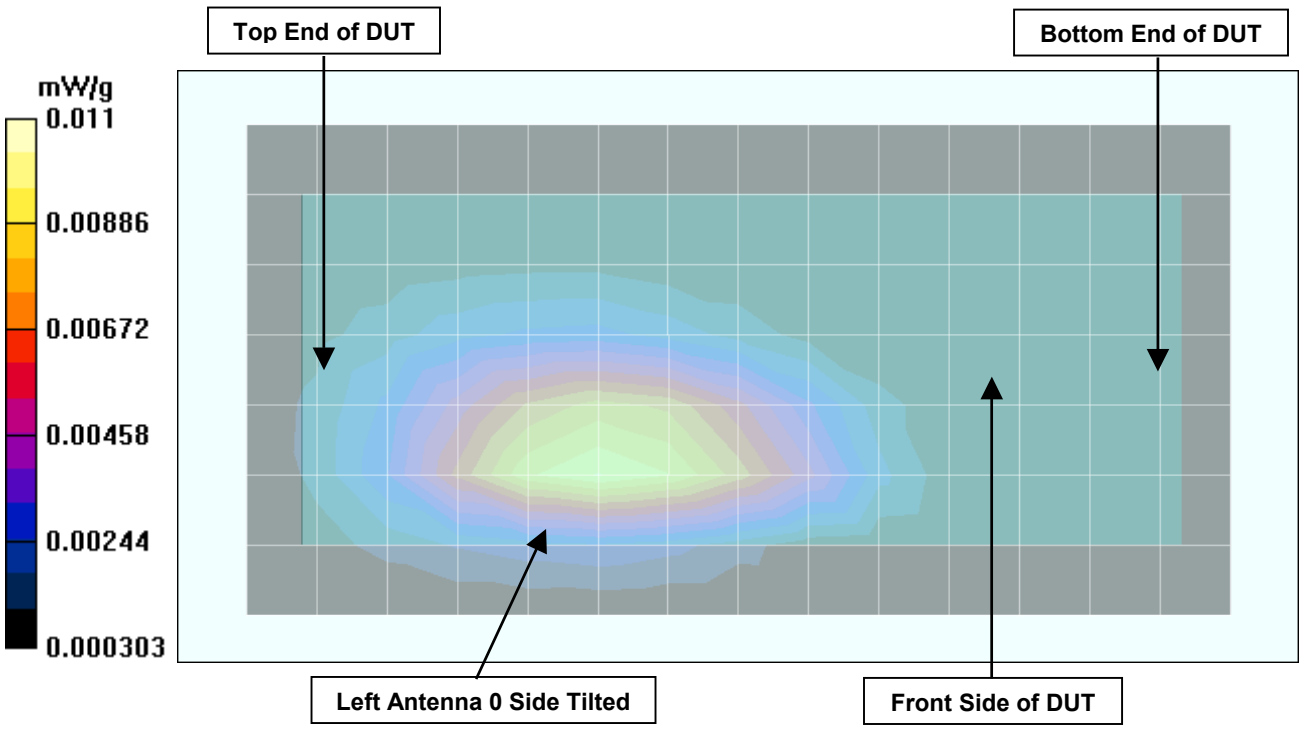
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: Laptop PC (USB)
Communication System Modulated TDMA
RF Output Power: 14.7 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 0 - Front Side of DUT - Left Tilted - 0.0 cm Separation Distance/Area Scan (8x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 0 - Front Side of DUT - Left Tilted - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.98 V/m; Power Drift = -0.0263 dB
Peak SAR (extrapolated) = 0.020 W/kg
SAR(1 g) = 0.00942 mW/g; SAR(10 g) = 0.00498 mW/g



Date Tested: 09/03/04

Body SAR - Antenna 1 - Front Side of DUT - Right Tilted (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 445

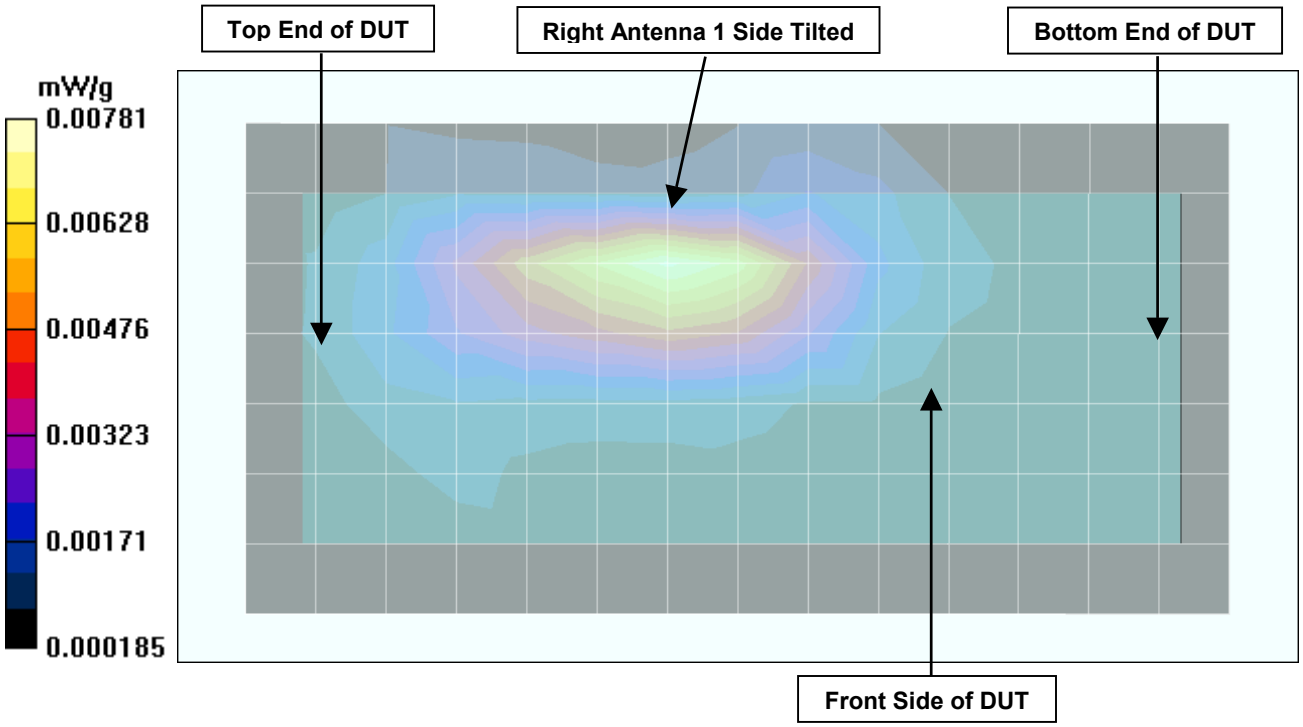
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: Laptop PC (USB)
Communication System: Modulated TDMA
RF Output Power: 15.5 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 1 - Front Side of DUT - Right Tilted - 0.0 cm Separation Distance/Area Scan (8x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 1 - Front Side of DUT - Right Tilted - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.46 V/m; Power Drift = -0.0166 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.00675 mW/g; SAR(10 g) = 0.00326 mW/g



Date Tested: 09/03/04

Body SAR - Antenna 0 - Left Side of DUT (Base Unit)

DUT: Plantronics Model: CS50-USB; Type: Wireless USB Base Unit for Headset System; Serial: 441

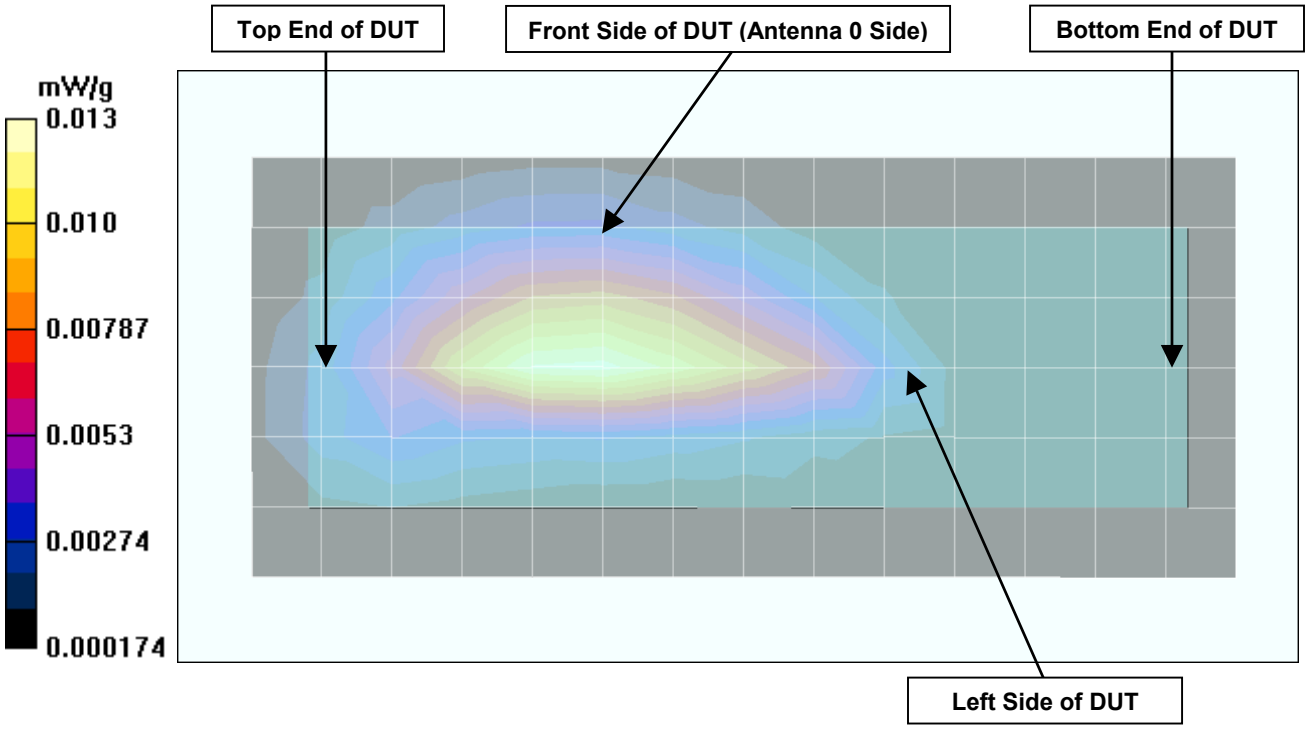
Ambient Temp: 23.7 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 102.5 kPa; Humidity: 41%

Power Source: AC Power Adapter
Communication System: Modulated TDMA
RF Output Power: 14.7 dBm (Peak Conducted)
Frequency: 915.264 MHz; Channel 5; Duty Cycle: 1:25.64
Medium: M915 (σ = 1.07 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3)

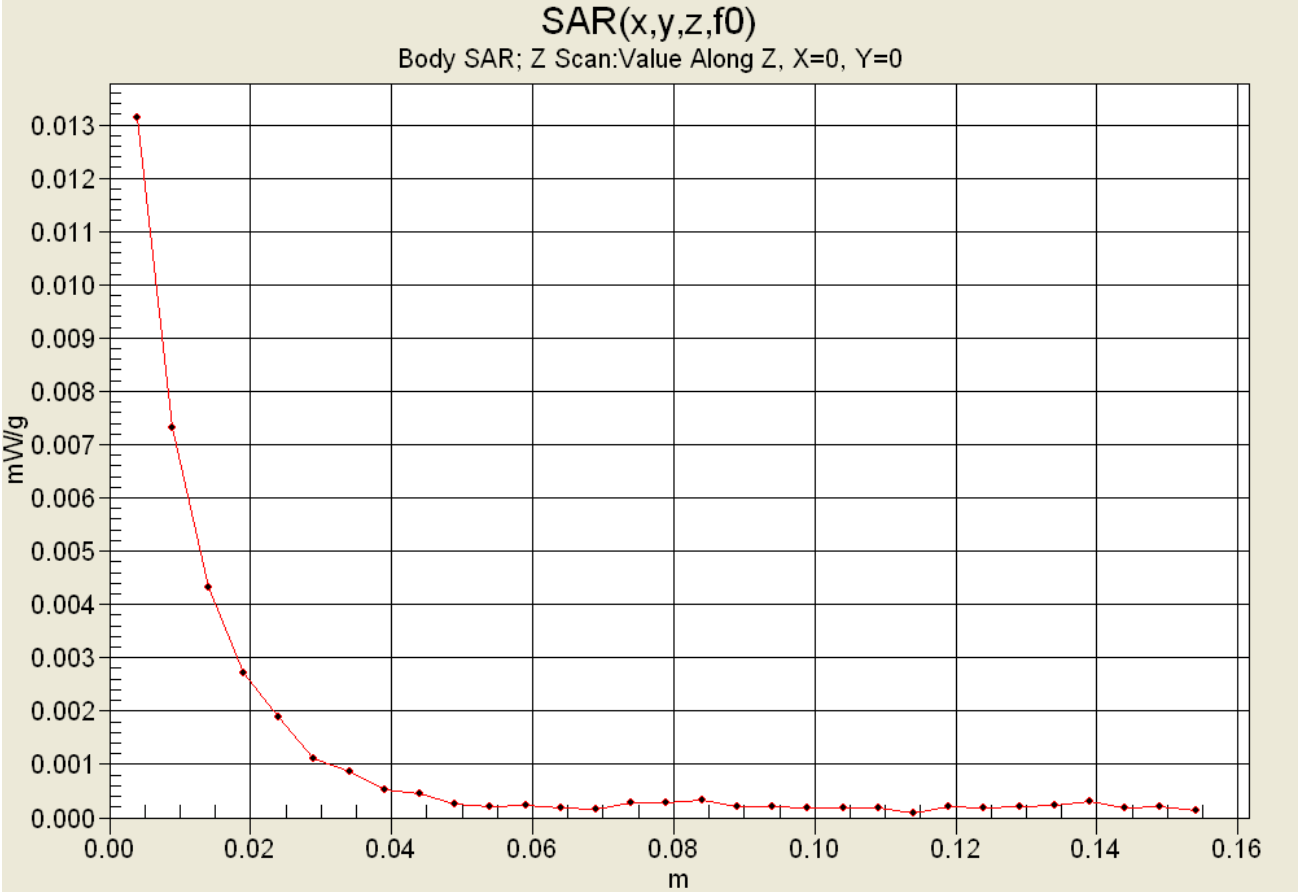
- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Body SAR - Antenna 0 - Left Side of DUT - 0.0 cm Separation Distance/Area Scan (7x15x1):
Measurement grid: dx=10mm, dy=10mm

Body SAR - Antenna 0 - Left Side of DUT - 0.0 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.35 V/m; Power Drift = 0.0808 dB
Peak SAR (extrapolated) = 0.024 W/kg
SAR(1 g) = 0.0118 mW/g; SAR(10 g) = 0.00611 mW/g

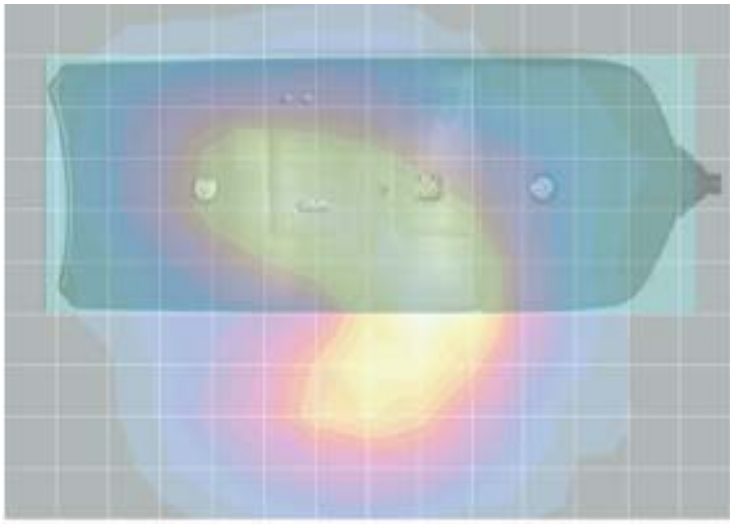


Z-Axis Scan

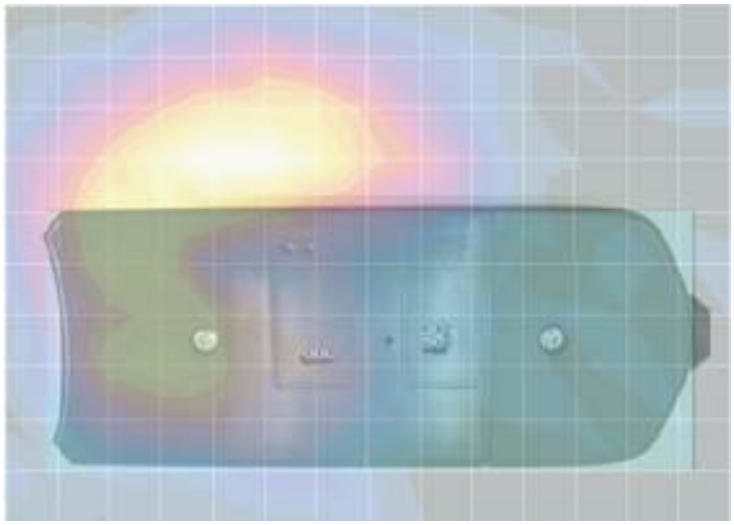

SAR(x,y,z,f0)
Body SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
0.013
0.012
0.011
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 09/03/04

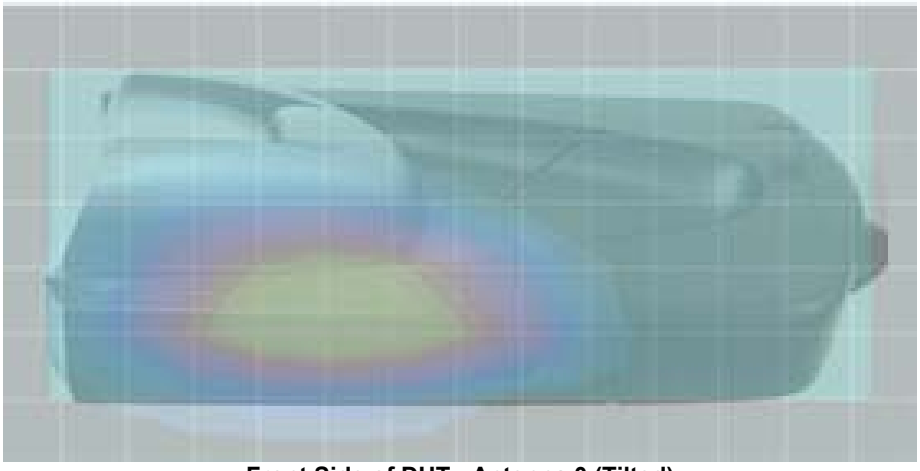
Transparent Overlays



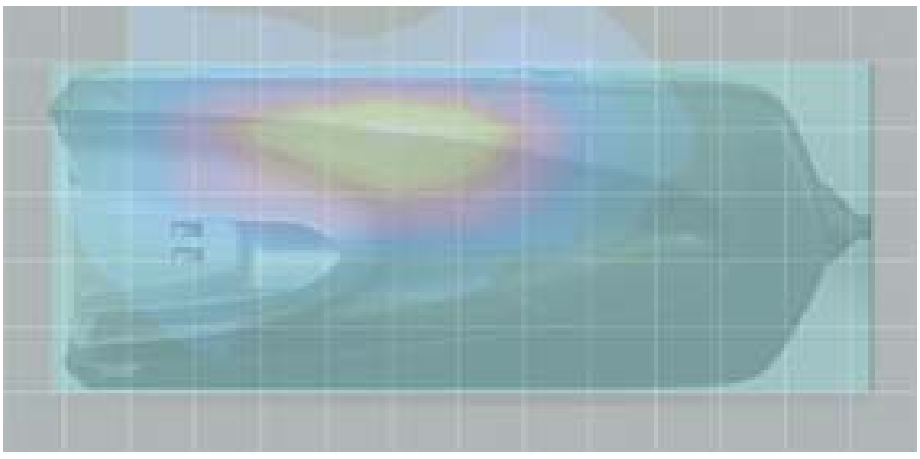
Back Side of DUT - Antenna 1



Back Side of DUT - Antenna 0



Front Side of DUT - Antenna 0 (Tilted)



Front Side of DUT - Antenna 1 (Tilted)

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 09/03/04

System Performance Check - 900 MHz Dipole

DUT: Dipole 900 MHz; Model: D900V2; Type: System Performance Check; Serial: 054; Calibrated: 06/10/2004

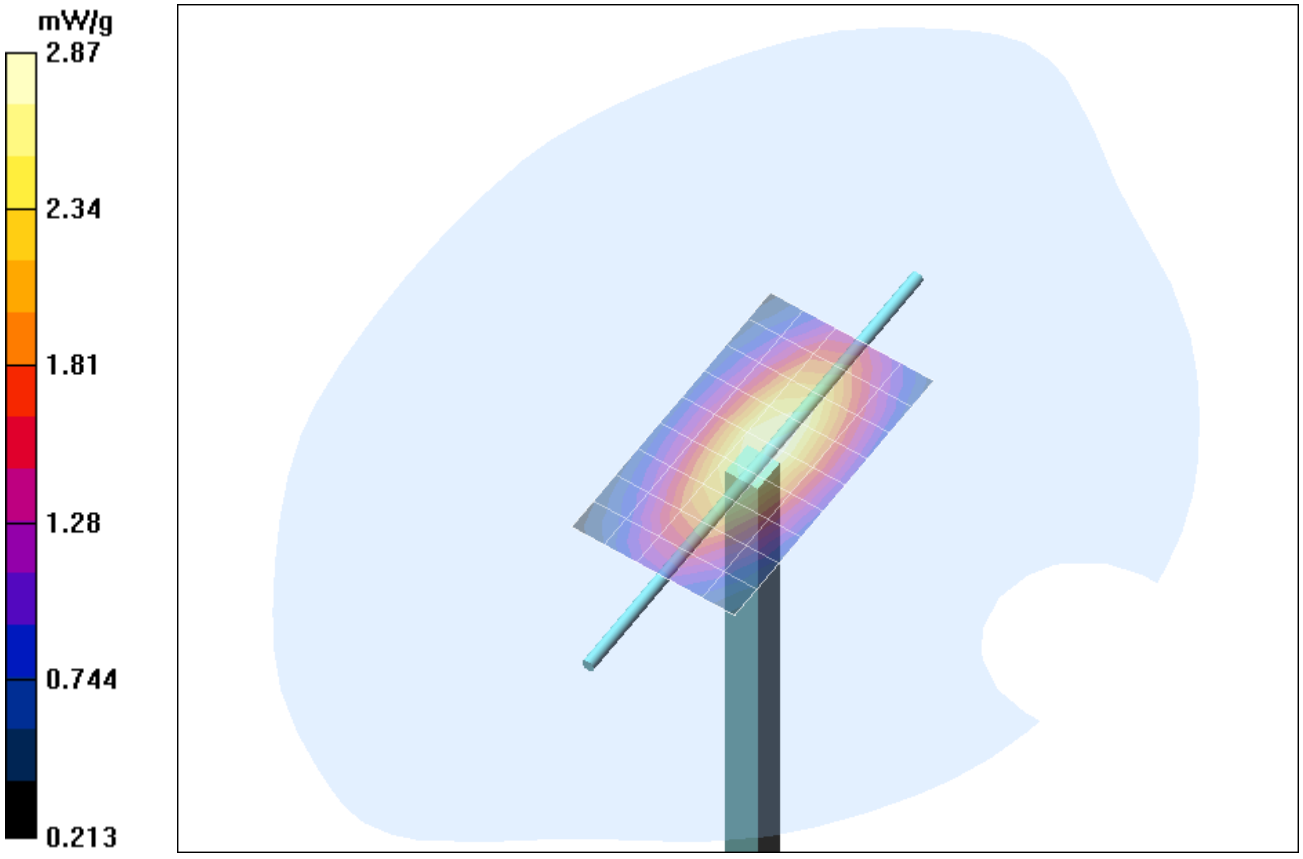
Ambient Temp: 22.5 °C; Fluid Temp: 21.7 °C; Barometric Pressure: 102.6 kPa; Humidity: 41%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900 (σ = 0.96 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3)

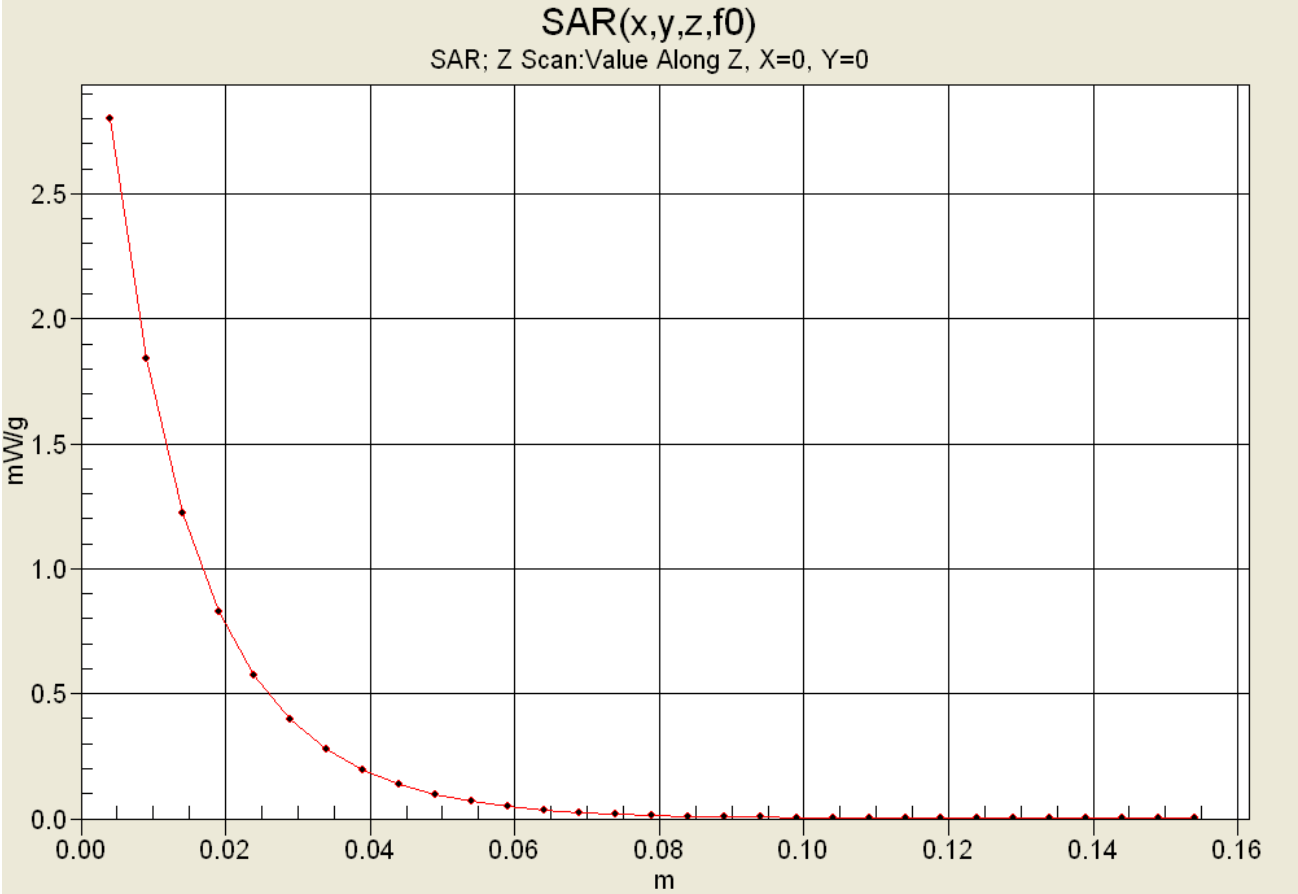
- Probe: ET3DV6 - SN1590; ConvF(6.71, 6.71, 6.71); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

900 MHz System Performance Check/Area Scan (6x10x1):
Measurement grid: dx=10mm, dy=10mm

900 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.8 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 4.01 W/kg
SAR(1 g) = 2.63 mW/g; SAR(10 g) = 1.68 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

APPENDIX C - SYSTEM VALIDATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client **Celltech Labs**

CALIBRATION CERTIFICATE

Object(s)	D900V2 - SN:054
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	June 10, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: June 14, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D900V2

Serial: 054

Manufactured: August 25, 1999
Calibrated: June 10, 2004

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters at 900 MHz:

Relative Dielectricity	**42.0**	± 5%
Conductivity	**1.00 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.18 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250 mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue: **11.0 mW/g** ± 16.8 % (k=2)[1]

averaged over 10 cm^3 (10 g) of tissue: **7.00 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.396 ns**	(one direction)
Transmission factor:	**0.992**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	Re{Z} = **49.5 Ω**
	Im {Z} = **-2.6 Ω**
Return Loss at 900 MHz	**-32.5 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

6. Power Test

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 06/10/04 11:48:00

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN054

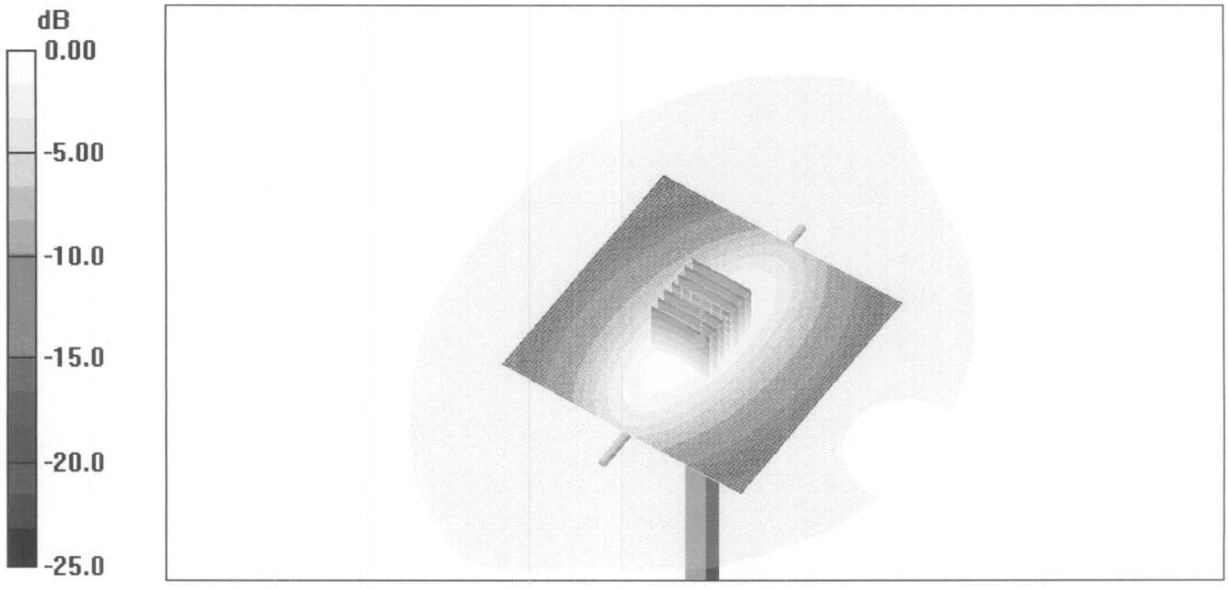
Communication System: CW-900; Frequency: 900 MHz;Duty Cycle: 1:1
Medium: HSL 900 MHz;
Medium parameters used: f = 900 MHz; σ = 1 mho/m; ε_r = 42; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.18, 6.18, 6.18); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn411; Calibrated: 11/6/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 56; Postprocessing SW: SEMCAD, V2.0 Build 34

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 56.4 V/m; Power Drift = 0.02 dB
Maximum value of SAR (interpolated) = 2.96 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.4 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 4.18 W/kg
SAR(1 g) = 2.75 mW/g; SAR(10 g) = 1.75 mW/g
Maximum value of SAR (measured) = 2.96 mW/g



0 dB = 2.96mW/g

054
Head

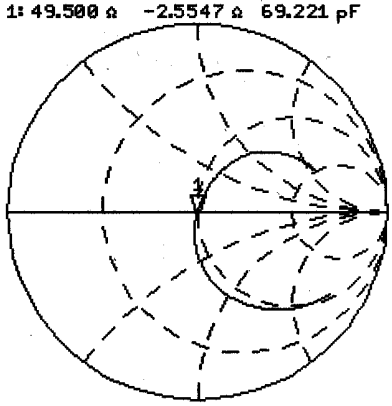
10 Jun 2004 10:08:29

CH1 S11 1 U FS 1: 49.500 Ω -2.5547 Ω 69.221 pF 900.000 000 MHz

Del

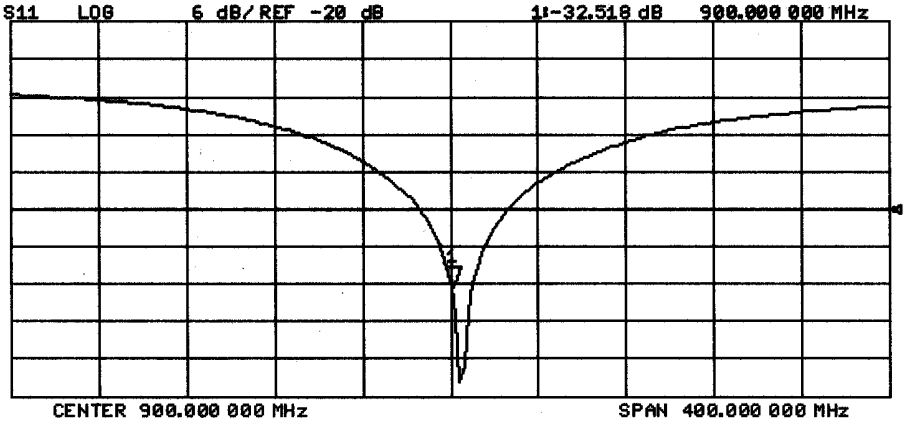
Cor

Avg
16



CH2 S11 LOG 6 dB/ REF -20 dB 1: -32.518 dB 900.000 000 MHz

Cor



CENTER 900.000 000 MHz SPAN 400.000 000 MHz

APPENDIX D - PROBE CALIBRATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client **Celltech Labs**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1590
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	May 24, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environ ment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	5-May-04 (METAS, No 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No 251-00388)	May-05
Reference 20 dB Attenuator	SN: 5086 (20b)	3-May-04 (METAS, No 251-00389)	May-05
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: May 24, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Probe ET3DV6

SN:1590

Manufactured:	March 19, 2001
Last calibrated:	May 15, 2003
Recalibrated:	May 24, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space

Diode Compression[A]

NormX	**1.85** $\mu V/(V/m)^2$	DCP X	**91**	mV
NormY	**2.01** $\mu V/(V/m)^2$	DCP Y	**91**	mV
NormZ	**1.73** $\mu V/(V/m)^2$	DCP Z	**91**	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	8.0	4.4
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	12.2	8.5
SAR_{be} [%]	With Correction Algorithm	0.2	0.1

Sensor Offset

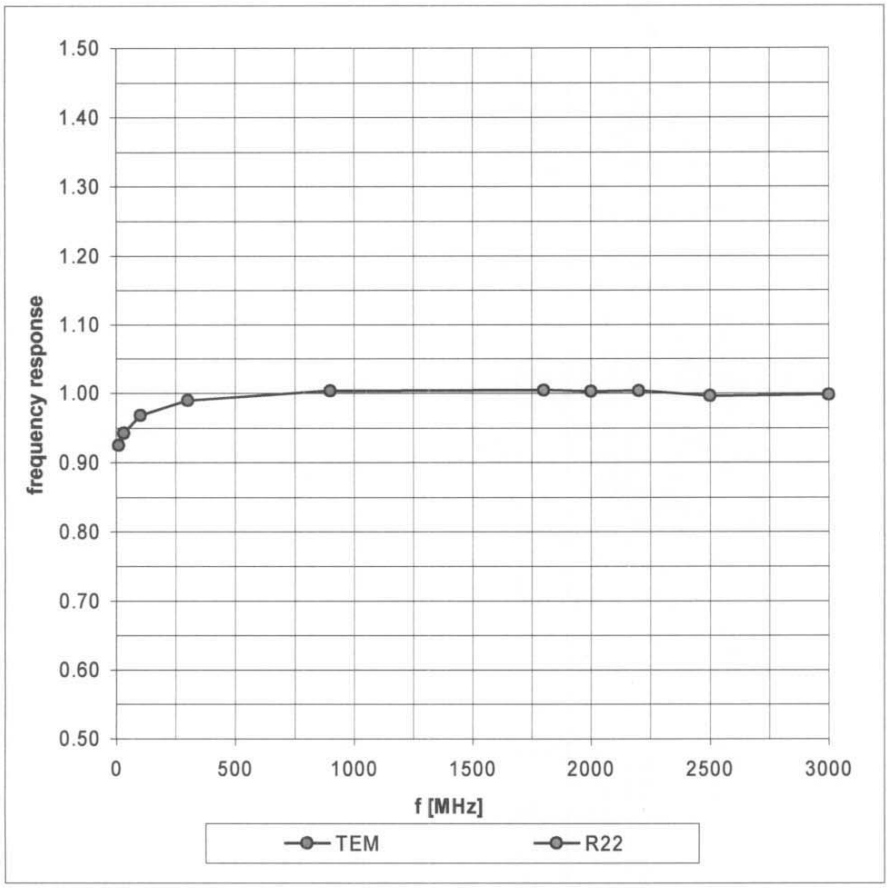
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

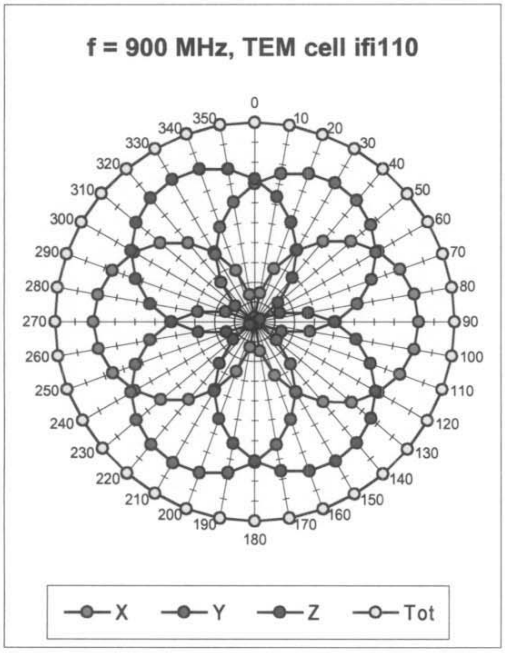
[A] numerical linearization parameter: uncertainty not required

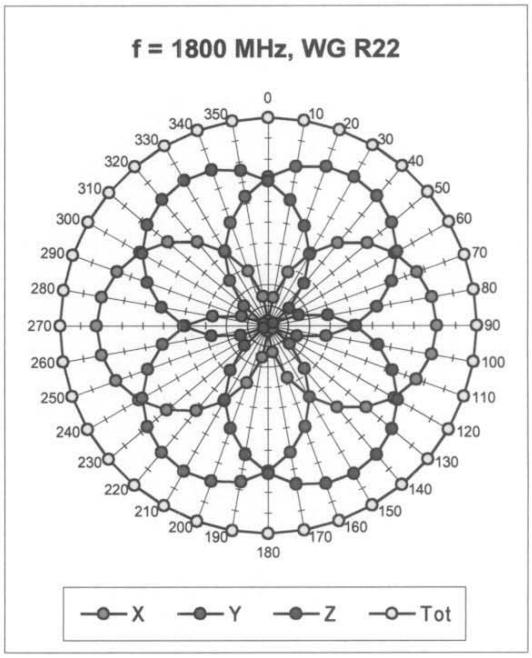
Frequency Response of E-Field

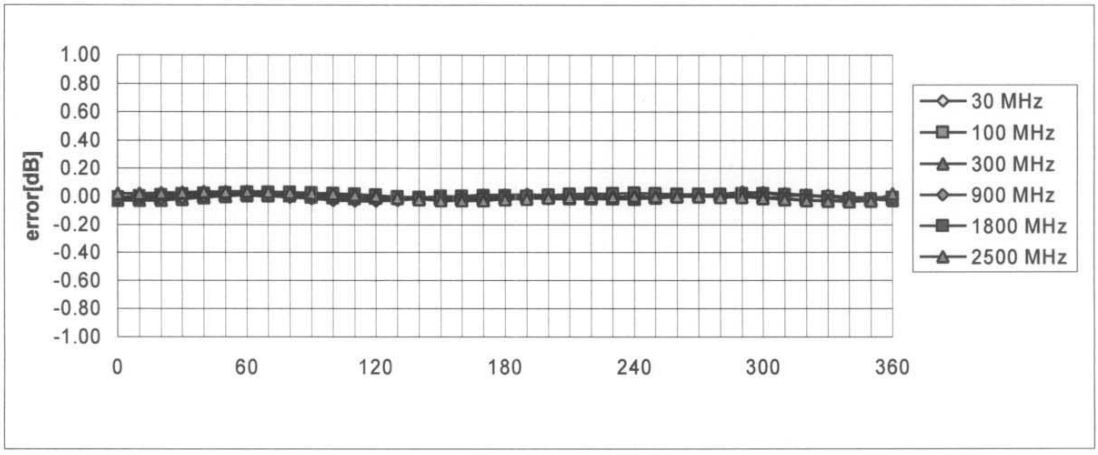
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ), θ = 0°



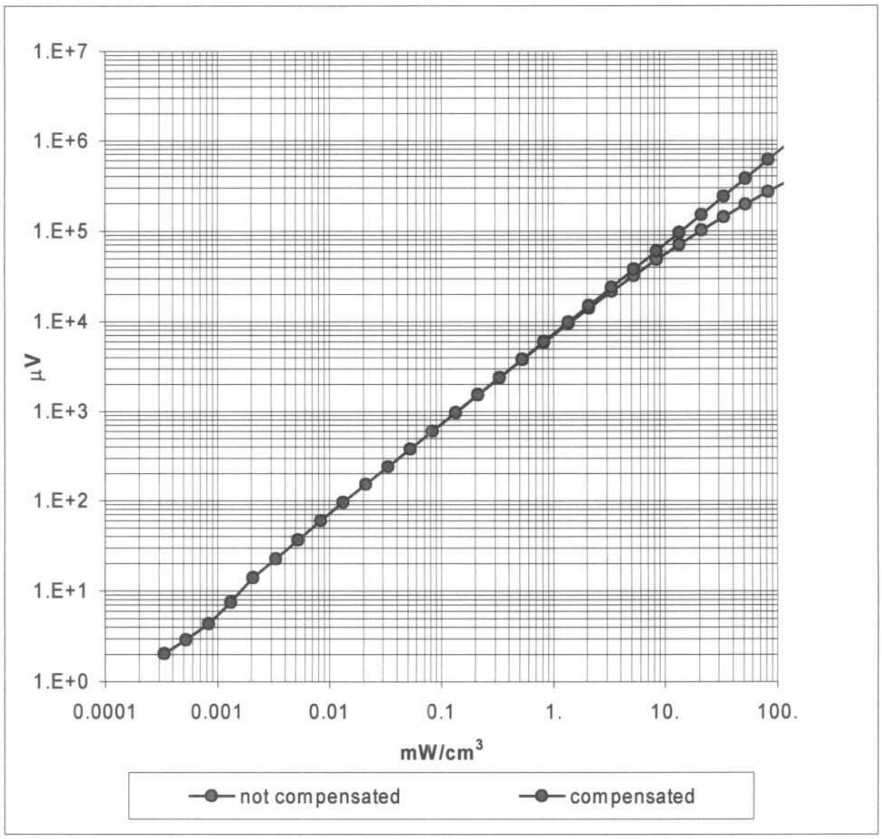


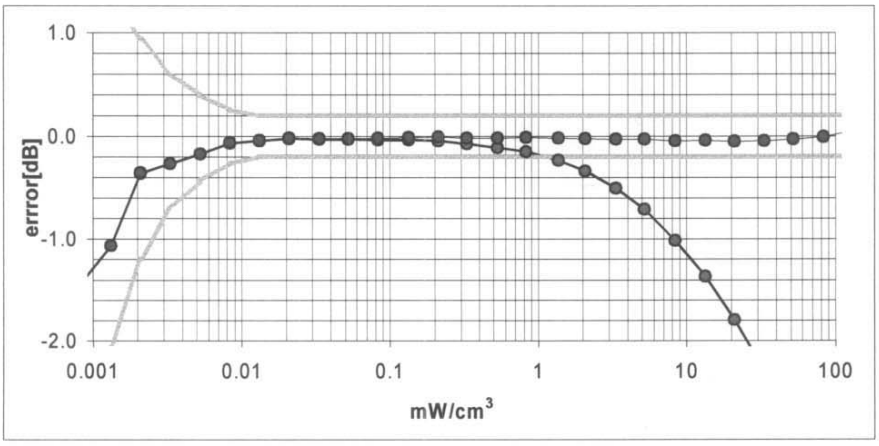


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

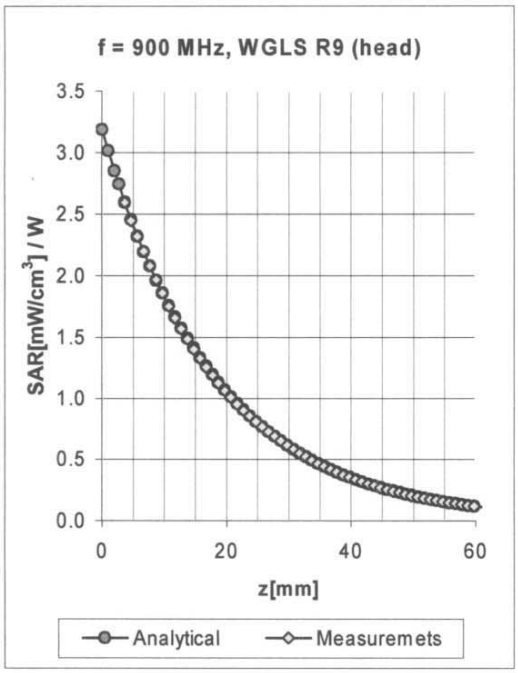
(Waveguide R22)

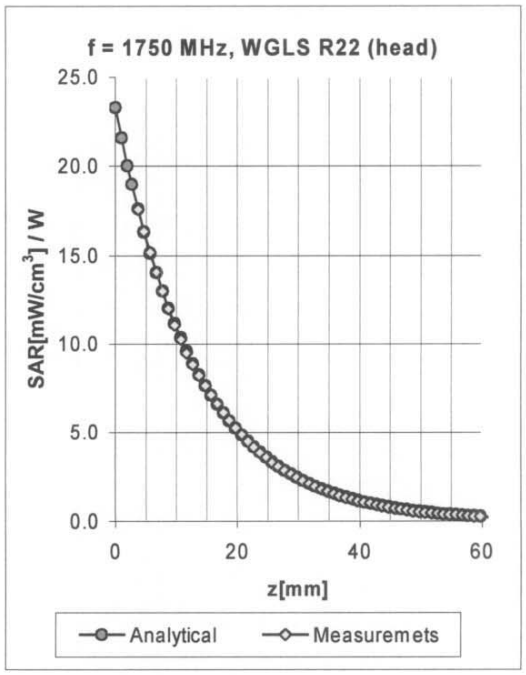




Probe Linearity Error < ± 0.2 dB

Conversion Factor Assessment



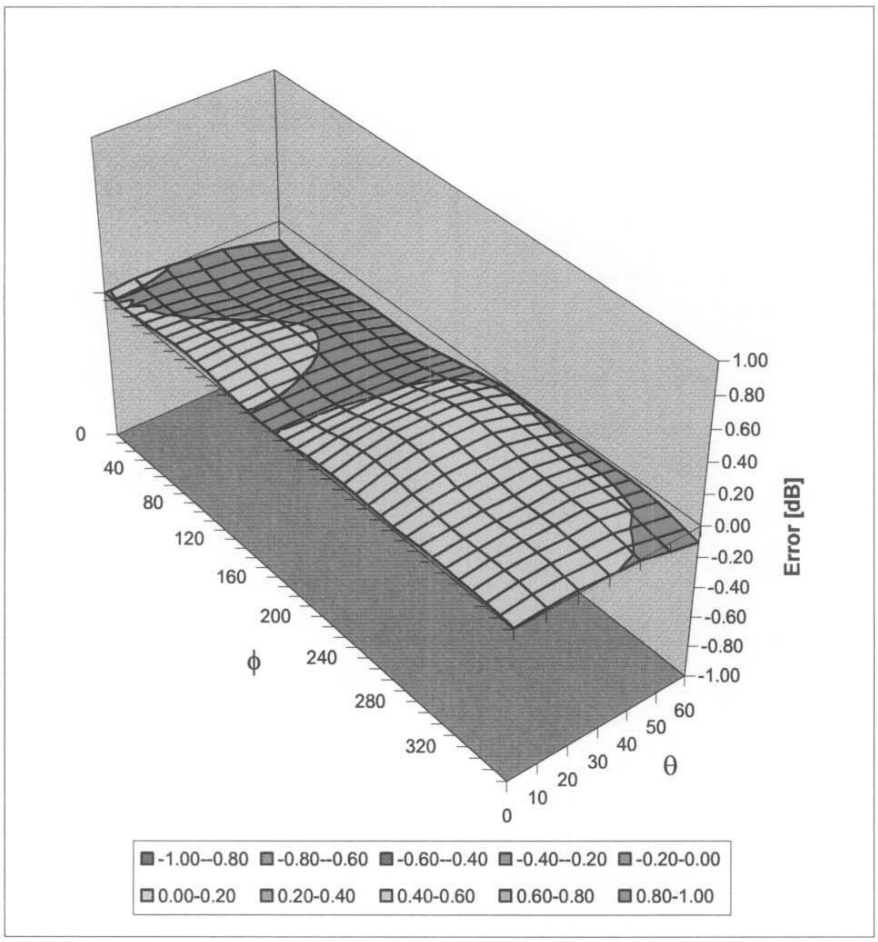


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	750-950	Head	41.5 ± 5%	0.90 ± 5%	0.68	1.64	6.71 ± 11.9% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.43	2.67	5.28 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.46	2.81	5.03 ± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.81	1.95	4.44 ± 9.7% (k=2)
835	750-950	Body	55.2 ± 5%	0.97 ± 5%	0.49	1.99	6.54 ± 11.9% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.50	2.87	4.68 ± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.52	2.93	4.58 ± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	0.91	1.78	4.22 ± 9.7% (k=2)

[B] The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (θ, φ), f = 900 MHz



Spherical Isotropy Error < ± 0.4 dB

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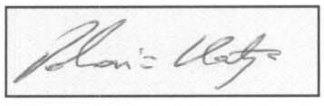
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1590**
Place of Assessment:	**Zurich**
Date of Assessment:	**May 25, 2004**
Probe Calibration Date:	**May 24, 2004**

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.

Assessed by:



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Dosimetric E-Field Probe ET3DV6 SN:1590

Conversion factor (± standard deviation)

150 MHz	ConvF	**9.1 ± 8%**	ε_r = **52.3 ± 5%** σ = **0.76 ± 5% mho/m** (head tissue)
300 MHz	ConvF	**7.9 ± 8%**	ε_r = **45.3 ± 5%** σ = **0.87 ± 5% mho/m** (head tissue)
450 MHz	ConvF	**7.5 ± 8%**	ε_r = **43.5 ± 5%** σ = **0.87 ± 5% mho/m** (head tissue)
150 MHz	ConvF	**8.8 ± 8%**	ε_r = **61.9 ± 5%** σ = **0.80 ± 5% mho/m** (body tissue)
450 MHz	ConvF	**7.7 ± 8%**	ε_r = **56.7 ± 5%** σ = **0.94 ± 5% mho/m** (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

900 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

September 03, 2004

Frequency	e'	e"
800.000000 MHz	41.1435	19.6542
810.000000 MHz	41.0578	19.6044
820.000000 MHz	40.9184	19.5811
830.000000 MHz	40.8012	19.5265
840.000000 MHz	40.6692	19.5196
850.000000 MHz	40.5052	19.4188
860.000000 MHz	40.3778	19.3622
870.000000 MHz	40.2177	19.3571
880.000000 MHz	40.0928	19.3534
890.000000 MHz	39.9822	19.3164
900.000000 MHz	39.8911	19.2503
910.000000 MHz	39.8179	19.2199
920.000000 MHz	39.6941	19.1905
930.000000 MHz	39.6100	19.1698
940.000000 MHz	39.5147	19.1342
950.000000 MHz	39.3928	19.1266
960.000000 MHz	39.2895	19.0767
970.000000 MHz	39.1696	19.0240
980.000000 MHz	39.0403	19.0219
990.000000 MHz	38.9511	18.9900
1.000000000 GHz	38.8469	18.9456

915 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

September 03, 2004

Frequency	e'	e"
815.000000 MHz	53.9837	21.4849
825.000000 MHz	53.8735	21.4109
835.000000 MHz	53.7503	21.4261
845.000000 MHz	53.6276	21.3540
855.000000 MHz	53.4745	21.3058
865.000000 MHz	53.3512	21.2376
875.000000 MHz	53.2403	21.2199
885.000000 MHz	53.1462	21.2072
895.000000 MHz	53.0848	21.1457
905.000000 MHz	53.0179	21.1029
915.000000 MHz	52.8981	21.0352
925.000000 MHz	52.8481	21.0182
935.000000 MHz	52.7168	20.9933
945.000000 MHz	52.6262	20.9836
955.000000 MHz	52.5492	20.9487
965.000000 MHz	52.4483	20.9444
975.000000 MHz	52.3291	20.9582
985.000000 MHz	52.2576	20.9232
995.000000 MHz	52.1583	20.8958
1.005000000 GHz	52.0412	20.8866
1.015000000 GHz	51.9741	20.8618

APPENDIX F - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

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

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp Schmid & Partner Engineering AG
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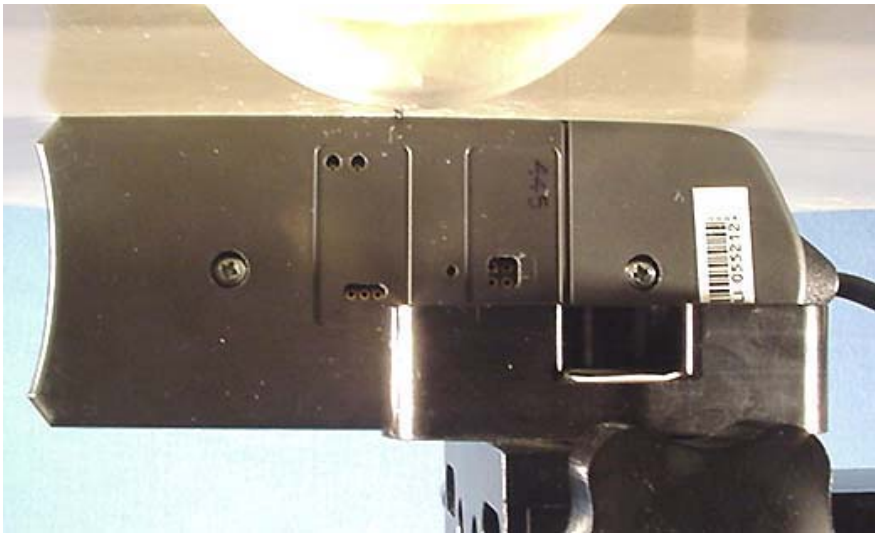
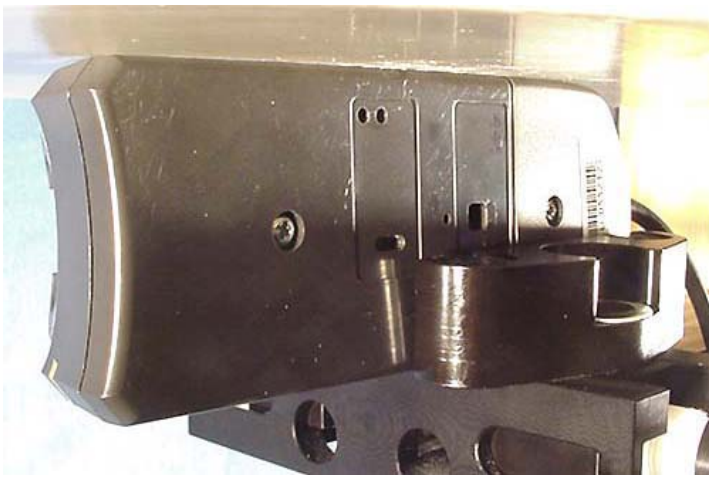
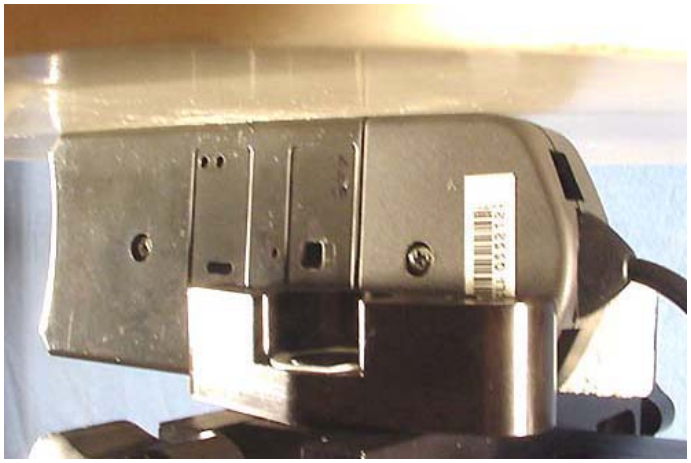
APPENDIX G - SAR TEST SETUP & DUT PHOTOGRAPHS

BODY SAR TEST SETUP PHOTOGRAPHS

Base Unit - Left Side of DUT (Antenna 0) Touching Planar Phantom
Laptop PC Power Source (USB)

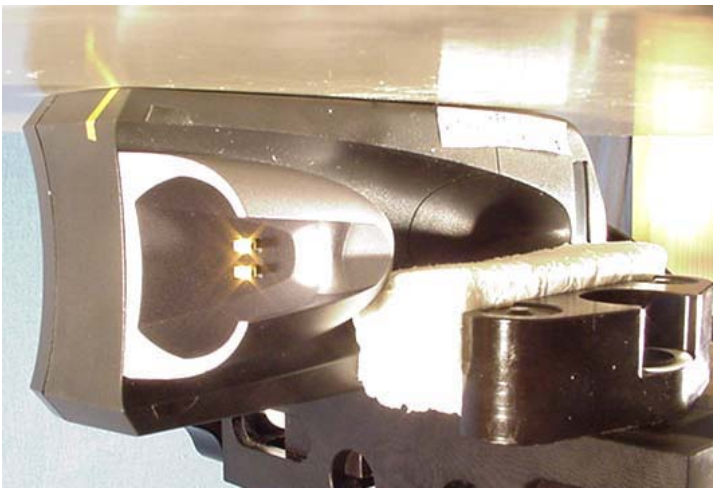






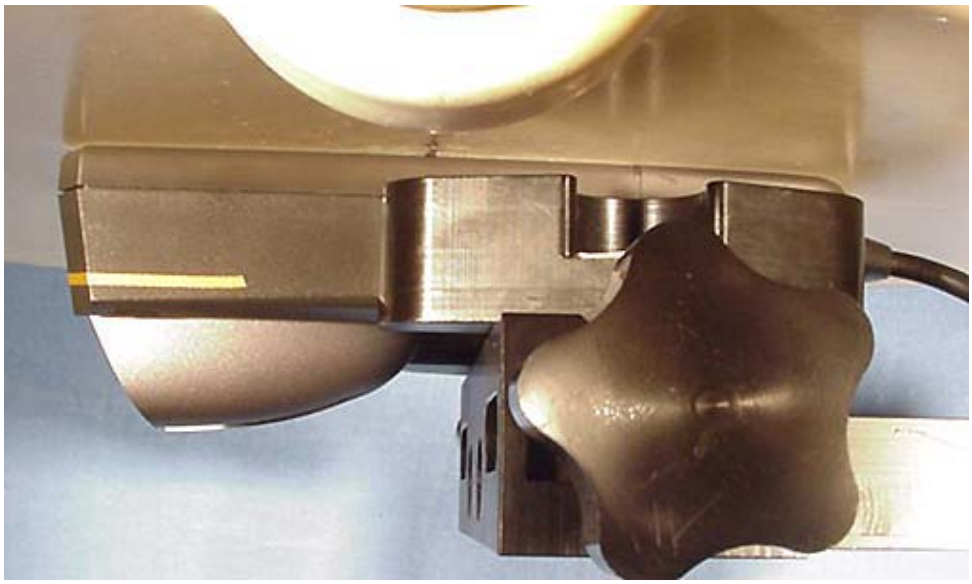
BODY SAR TEST SETUP PHOTOGRAPHS

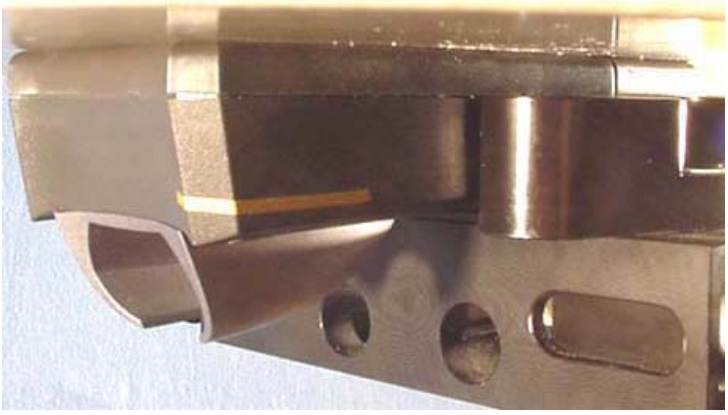
Base Unit - Right Side of DUT (Antenna 1) Touching Planar Phantom
Laptop PC Power Source (USB)

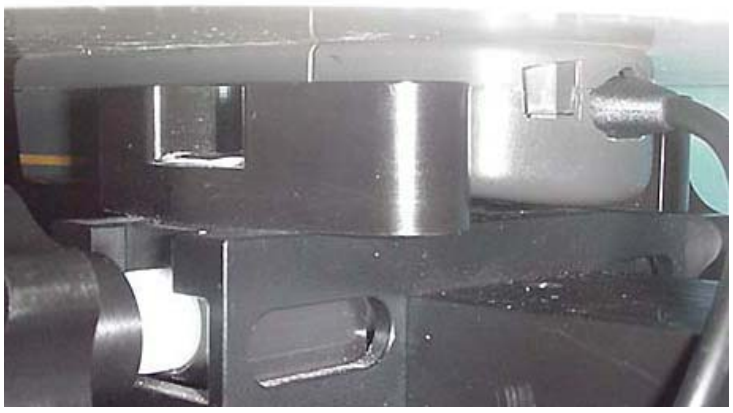


BODY SAR TEST SETUP PHOTOGRAPHS

Base Unit - Back Side of DUT Touching Planar Phantom
Laptop PC Power Source (USB)

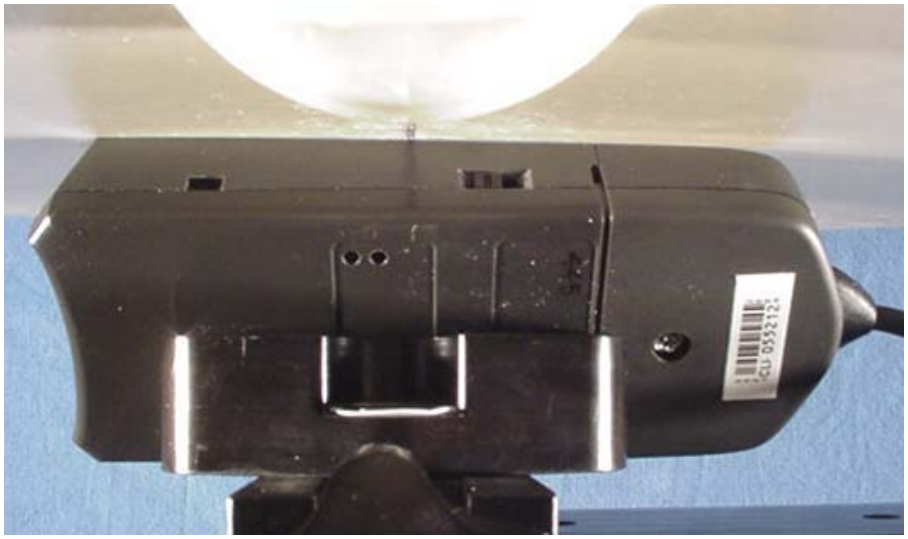


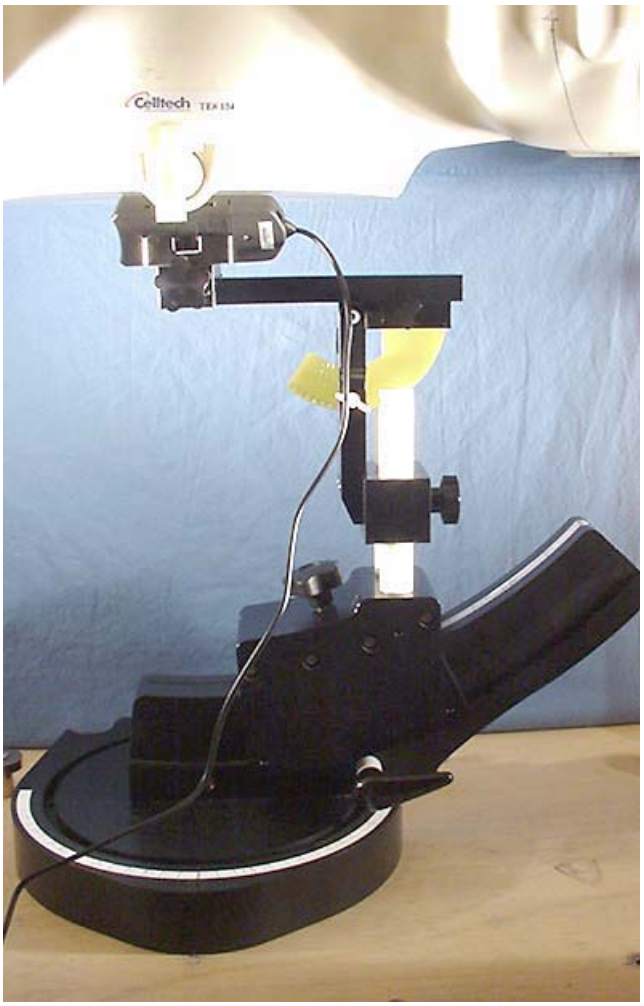


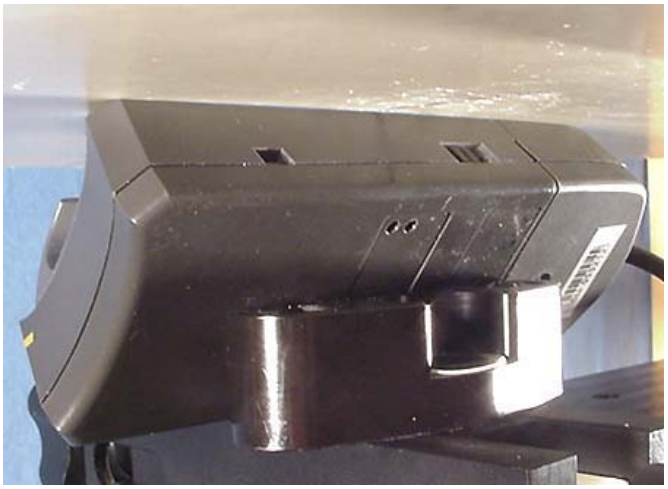


BODY SAR TEST SETUP PHOTOGRAPHS

Base Unit - Front Side of DUT (Left Tilted - Antenna 0) Touching Planar Phantom
Laptop PC Power Source (USB)

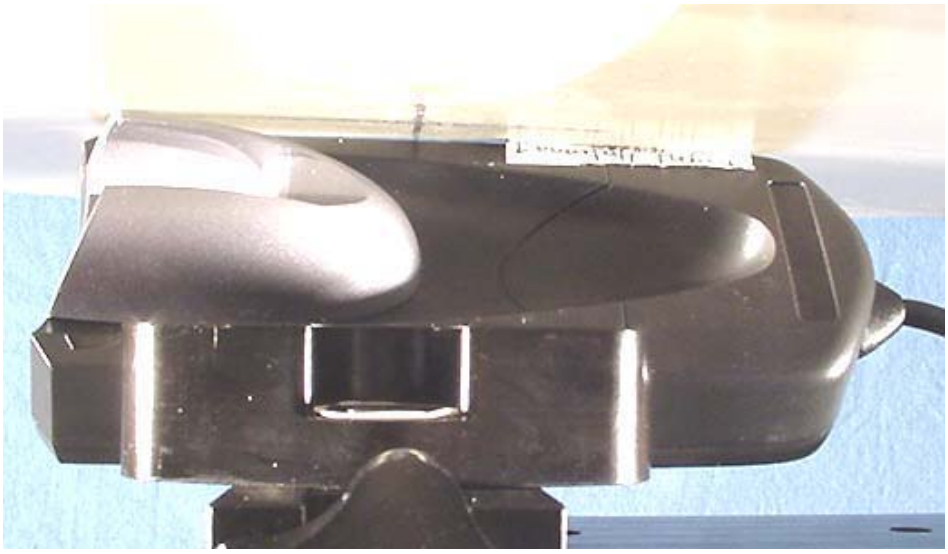


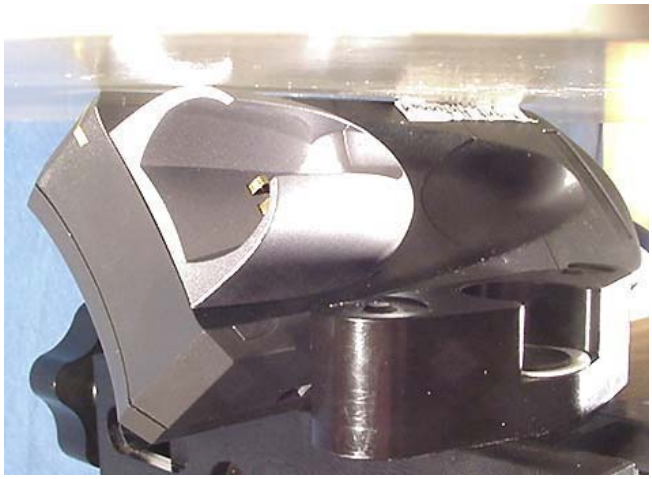




BODY SAR TEST SETUP PHOTOGRAPHS

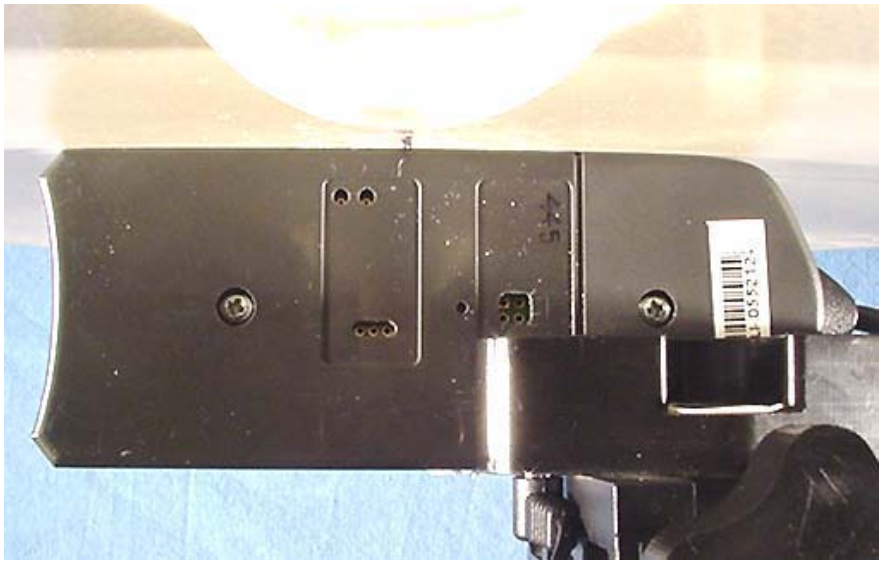
Base Unit - Front Side of DUT (Right Tilted - Antenna 1) Touching Planar Phantom
Laptop PC Power Source (USB)

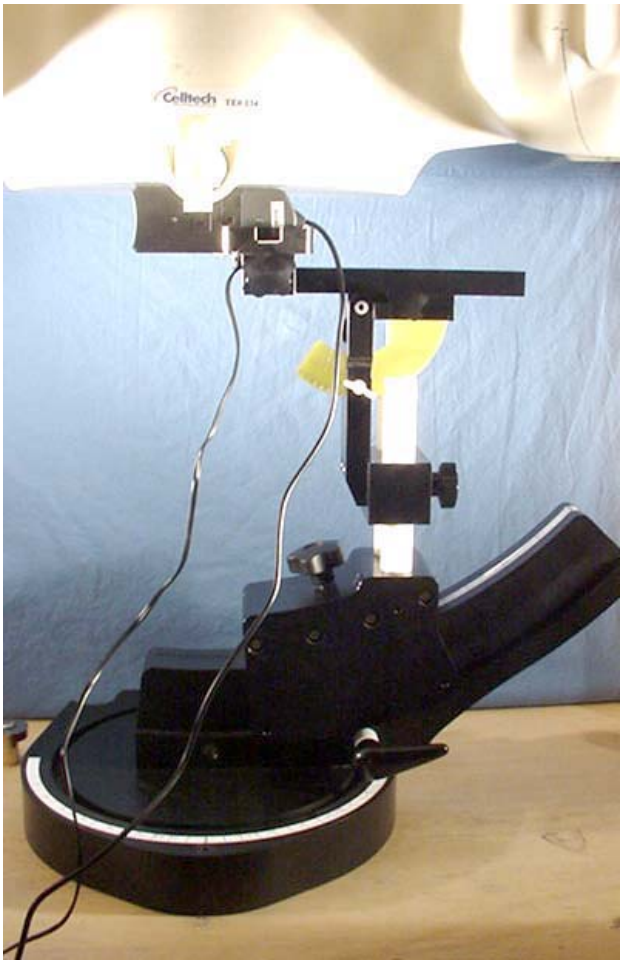


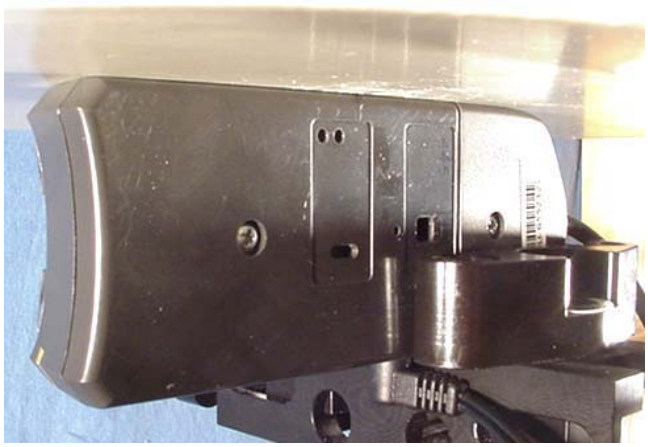


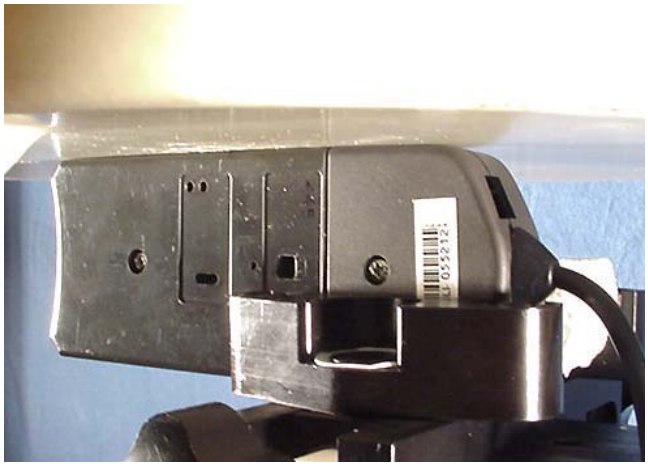
BODY SAR TEST SETUP PHOTOGRAPHS

Base Unit - Left Side of DUT (Antenna 0) Touching Planar Phantom
AC Adapter Power Source

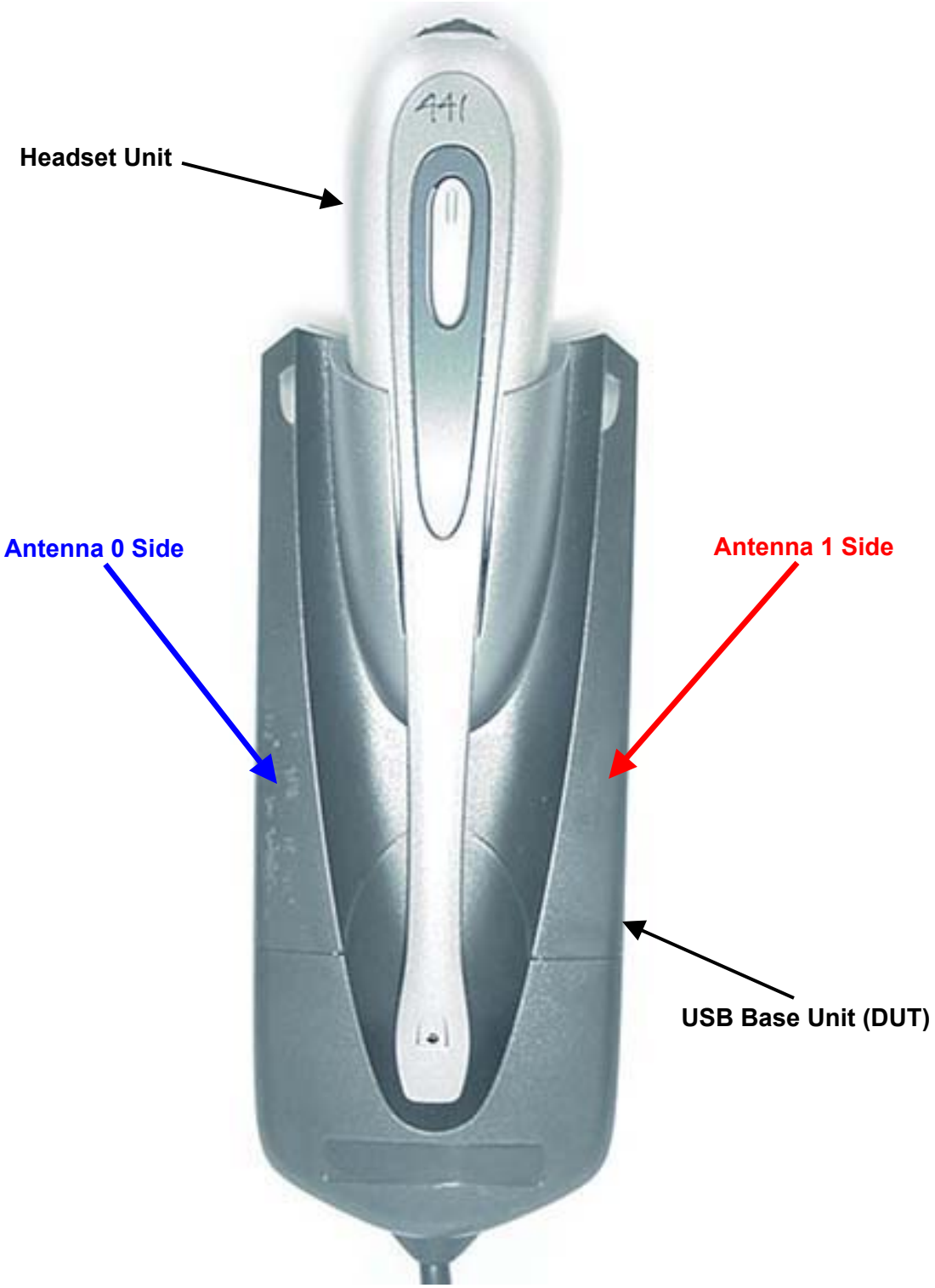








DUT PHOTOGRAPHS



DUT PHOTOGRAPHS

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