PCTEST ENGINEERING LABORATORY, INC.
6660-B Dobbin Road, Columbia, MD 21045 USA
Tel. 410.290.6652 / Fax 410.290.6554
http://www.pctestlab.com

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)
Class II Permissive Change

Applicant Name:
Novatel Wireless, Inc.
9645 Scrantpn Road, Suite 205
San Diego, CA 92121
United States

Date of Testing:
12/26/06 - 12/28/06
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0612271151

FCC ID: PKRNVWMX720

APPLICANT: NOVATEL WIRELESS, INC.

EUT Type:	Dual-Band CDMA/ EVDO Card (Rev. 0 & Rev. A)
Application Type:	Class II Permissive Change
FCC Rule Part(s):	§2.1093; FCC/OET Bulletin 65 Supplement C [July 2001]
FCC Classification:	Licensed Portable Transmitter (PCB)
Model(s):	MX720
Tx Frequency:	824.70 - 848.31 MHz (Cellular CDMA)/ 1851.25 - 1908.75 MHz (PCS CDMA)
Conducted Power:	0.270 W (24.31dBm) CDMA/ EVDO/ 0.284 W (24.52dBm) PCS CDMA/ EVDO
Max. SAR Measurement:	0.581 W/kg CDMA850 Body SAR/ 0.872 W/kg CDMA1900 Body SAR
Test Device Serial No.:	*Pre-Production* [S/N: 5B101CEC]
Class II Permissive Change(s):	Added USB Express Card Adapter Model: XUA-1
Date of Original Grant:	12/22/2006

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-2005 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-2003. Since there is no official procedure, the same procedures were followed for a similar device that was granted by the FCC (FCC ID: PKRNVWMCD3000).

I attest to the accuracy of data. All measurements reported herein 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.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

ACCREDITED
CERTIFICATE #2041.01

TABLE OF CONTENTS

1 INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.[1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-2005 *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz* ©2005 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [3] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

1.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 1-1).

Equation 1-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho\, dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

2 TEST SITE LOCATION

2.1 INTRODUCTION

The map at the right shows the location of the PCTEST LABORATORY in Columbia, Maryland. It is in proximity to the FCC Laboratory, the Baltimore-Washington International (BWI) airport, the city of Baltimore and Washington, DC (See Figure 2-1).

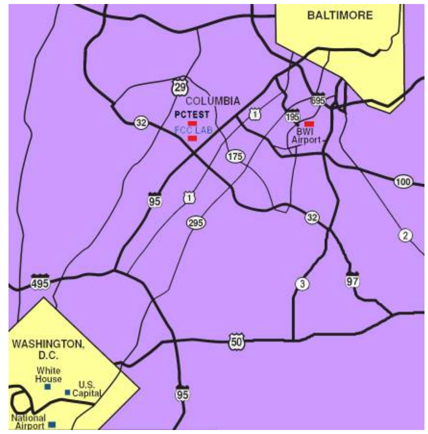
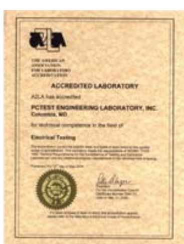


Figure 2-1
Map of the Greater Baltimore and Metropolitan Washington, D.C. area

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49' 38" W longitude. The facility is 1.5 miles north of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on January 27, 2006 and Industry Canada.

2.2 Test Facility / Accreditations:

Measurements were performed at an independent accredited PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



ACCREDITED LABORATORY

United States Department of Commerce
National Institute of Standards and Technology
NVLAP
Certificate of Accreditation to ISO/IEC 17025:2005
PCTEST Engineering Laboratory, Inc.
ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

3 SAR MEASUREMENT SETUP

3.1 Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. The DASY4 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Pentium 4 computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure 3-1).

3.2 System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the Gateway Pentium 4 2.53 GHz computer with Windows XP system and SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that 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 PC plug-in card.

3.3 System Electronics

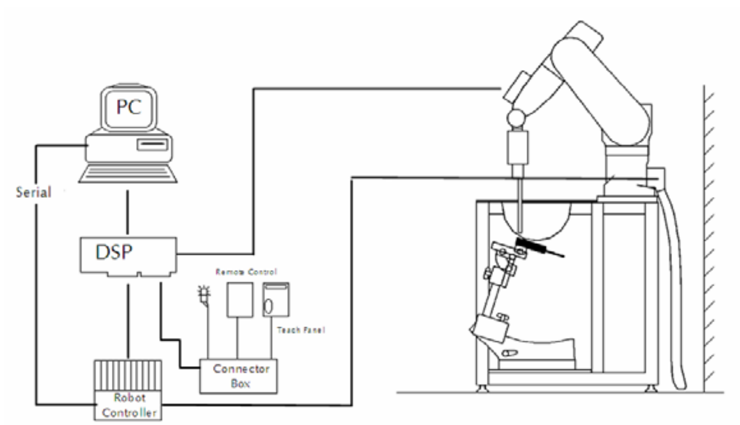


Figure 3-1
SAR Measurement System Setup

The DAE4 consists of 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 PC-card 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. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [7].

3.4 Automated Test System Specifications

<u>Positioner</u>

Robot:	Stäubli Unimation Corp. Robot RX60L
Repeatability:	0.02 mm
No. of Axes:	6

<u>Data Acquisition Electronic System (DAE)</u>

Cell Controller

Processor:	Pentium 4
Clock Speed:	2.53 GHz
Operating System:	Windows XP Professional

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter & control logic
Software:	DASY4, SEMCAD software
Connecting Lines:	Optical Downlink for data and status info Optical upload for commands and clock

<u>PC Interface Card</u>

Function:	166MHz low power Pentium MMX 32MB chipdisk Link to DAE 16-bit A/D converter for surface detection system Two Serial & Ethernet link to robotics Direct emergency stop output for robot

<u>Phantom</u>

Type:	SAM Twin Phantom (V4.0)
Shell Material:	Composite
Thickness:	2.0 ± 0.2 mm

Figure 3-2
DASY4 SAR Measurement System

4 DASY E-FIELD PROBE SYSTEM

4.1 Probe Measurement System

Figure 4-1
SAR System

The SAR measurements were conducted with the dosimetric probe ES3DV2, designed in the classical triangular configuration [7] (see Figure 4-1) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip (see Figure 4-2). It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Figure 5-1). The approach is stopped at reaching the maximum.

4.2 Probe Specifications

Model:	ES3DV2
Frequency Range:	10 MHz – 6.0 GHz
Calibration:	In brain and muscle simulating tissue at Frequencies from 835 up to 5800MHz
Linearity:	± 0.2 dB (30 MHz to 6 GHz)
Dynamic Range:	10 mW/kg – 100 W/kg
Probe Length:	330 mm
Probe Tip Length:	20 mm
Body Diameter:	12 mm
Tip Diameter:	2.5 mm
Tip-Center:	1 mm
Application:	SAR Dosimetry Testing Compliance tests of mobile phones

Figure 4-2
Near-Field Probe

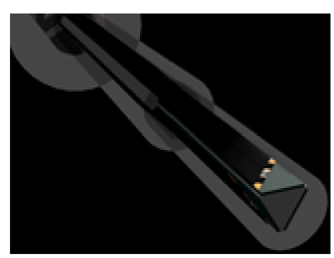


Figure 4-3
Triangular Probe Configuration

5 PROBE CALIBRATION PROCESS

5.1 Dosimetric Assessment Procedure

Each E-Probe/Probe amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

5.2 Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

5.3 Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

SAR = $C\dfrac{\Delta T}{\Delta t}$

where:

Δt = exposure time (30 seconds),
C = heat capacity of tissue (brain or muscle),
ΔT = temperature increase due to RF exposure.

SAR = $\dfrac{|E|^2 \cdot \sigma}{\rho}$

where:

σ = simulated tissue conductivity,
ρ = Tissue density

SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

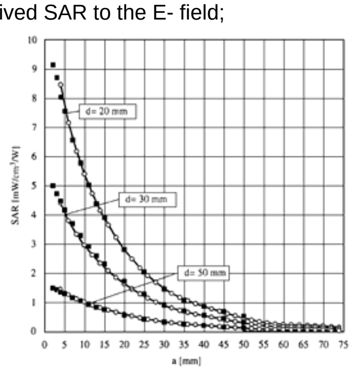


Figure 5-1 E-Field and Temperature measurements at 900MHz [7]

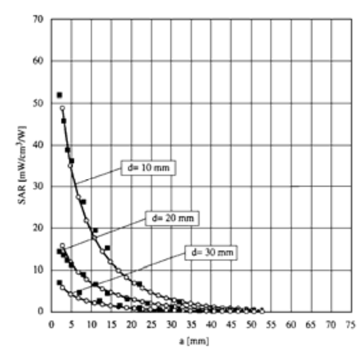


Figure 5-2 E-Field and temperature measurements at 1.9GHz [7]

6 PHANTOM AND EQUIVALENT TISSUES

6.1 SAM Phantoms

Figure 6-1
SAM Phantoms

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [11][12]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

6.2 Brain & Muscle Simulating Mixture Characterization

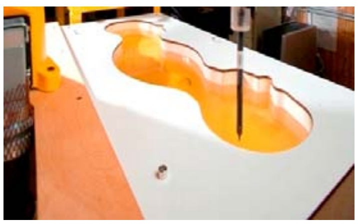


Figure 6-2
Head Simulated

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution (see Table 6-1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in the following table. Other head and body tissue parameters that have not been specified in IEEE-1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove [13].(See Table 6-1)

Table 6-1
Composition of the Brain & Muscle Tissue Equivalent Matter

Frequency (MHz)	300	450		835	900			1450	1800				1900		1950	2000	2100		2450		3000
Recipe #	1	1	3	1	1	2	3	1	1	2	2	3	1	2	4	1	1	2	2	3	2
Ingredients (% by weight)																					
1,2-Pro-panediol						64.81															
Bactericide	0.19	0.19	0.50	0.10	0.10		0.50					0.50								0.50	
Diacetin			48.90				49.20					49.43								49.75	
DGBE								45.41	47.00	13.84	44.92		44.94	13.84	45.00	50.00	50.00	7.99	7.99		7.99
HEC	0.98	0.98		1.00	1.00																
NaCl	5.95	3.95	1.70	1.45	1.48	0.79	1.10	0.67	0.36	0.35	0.18	0.64	0.18	0.35				0.16	0.16		0.16
Sucrose	55.32	56.32		57.00	56.50																
Triton X-100										30.45				30.45				19.97	19.97		19.97
Water	37.56	38.56	48.90	40.45	40.92	34.40	49.20	53.80	52.64	55.36	54.90	49.43	54.90	55.36	55.00	50.00	50.00	71.88	71.88	49.75	71.88
Measured dielectric parameters																					
ϵ_r'	46.00	43.4	44.3	41.6	41.2	41.8	42.7	40.9	39.3	41	40.4	39.2	39.9	41	40.1	37	36.8	41.1	40.3	39.2	37.9
σ(S/m)	0.86	0.85	0.9	0.9	0.98	0.97	0.99	1.21	1.39	1.38	1.4	1.4	1.42	1.38	1.41	1.4	1.51	1.55	1.88	1.82	2.46
Temp. (°C)	22	22	20	22	22	22	20	22	22	21	22	20	21	21	20	22	22	20	20	20	20
Target dielectric parameters (Table 2)																					
ϵ_r'	45.30	43.50		41.5	41.50			40.5	40.0								39.80		39.2		38.5
σ(S/m)	0.87	0.87		0.9	0.97			1.2	1.4								1.49		1.8		2.4
NOTE—Multiple columns for any single frequency are optional recipes. Recipe #, reference: 1 (Kanda et al. [B85]), 2 (Vigneras [B143]), 3 (Peyman and Gabriel [B119]), 4 (Fukunaga et al. [B50]).																					

*The formulas containing Triton X-100 and corresponding measured parameters are under review and verification.

7 DOSIMETRIC ASSESSMENT & PHANTOM SPECS

7.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed point was measured and used as a reference value.
2. The SAR distribution at the exposed side of the phantom was measured at a distance of 3.0mm from the inner surface of the shell. The horizontal grid spacing was 15mm x 15mm.
3. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see Figure 7-1):
    a. The data at the surface was extrapolated since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm [15]. A polynomial of the fourth order was calculated through the points in the z-axis. This polynomial was then used to evaluate the points between the surface and the probe tip.
    b. The maximum interpolated value was found with a software algorithm. Around this maximum, the SAR values averaged over the spatial volumes (1g or 10g) were computed using 3D-Spline interpolation. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions) [15][16]. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
    c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 1, was re-measured to measure drift. If the value drifted by more than 5%, the evaluation was repeated.

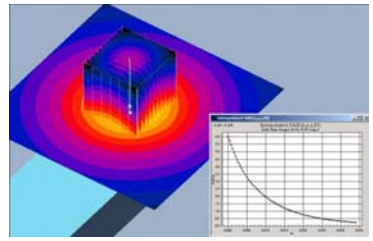


Figure 7-1
Sample SAR Area Scan

7.2 Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Figure 7-2). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimized reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15cm to minimize reflections from the upper surface.

Figure 7-2
SAM Twin Phantom Shell

8 TEST CONFIGURATION POSITIONS

8.1 SAR for Notebooks and Lap-touching Devices

Lap-touching devices that have transmitting antennas located less than 20 cm from the lap of the user require routine SAR evaluation. Such devices are considered portable and are capable of being held to the body. Devices are to be setup touching the phantom and are configured with maximum output power during SAR assessment for a worst-case SAR evaluation.

Figure 8-1
Notebook Setup for SAR

8.2 Integral Antenna PCMCIA and CompactFlash Cards

KDB 497522. Integral-antenna PCMCIA and CompactFlash radio cards are common module-like devices meant to be purchased and installed without tools or special skills by consumers. The common host configurations (platforms, categories) are notebook (laptop) computers with PCMCIA slot(s) in the keyboard section, and PDAs (personal digital assistants or palmtop computers). Integral-antenna radio cards installed in PDAs with body-worn and/or held-to-ear configurations, and in all notebook computers, must be evaluated under portable RF exposure conditions per 47 C.F.R. 2.1093(b). To better represent the range of near field topography and environment of various notebook and PDA hosts, SAR evaluation using a minimum of <u>three</u> hosts within each platform type (three PDAs, three notebooks, etc.) is recommended by FCC. Hosts shall be modern, current-market, and expected final installations for the PC Cards.

Figure 8-2
CompactFlash radio card in PDA host configuration

For notebook computers with multiple card slots (e.g., two stacked), RF exposure should be evaluated with the transmitter installed in the slot(s) producing the highest SAR (See Figure 8-3). The minimum number of positions that should be evaluated for notebook computers and body-worn PDAs are bottom-face in parallel and in contact (0 cm) with flat phantom, and device perpendicular to phantom with recommended spacing of 1.5 cm.

Figure 8-3
PCMCIA Radio Card in a notebook host configuration

8.3 Positioning for Convertible and Slate Tablet Computers

Figure 8-4
Tablet Computer Form Factors

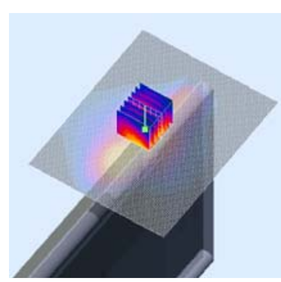


Figure 8-5
Tablet PC Body SAR

KDB 447498. Tablet (notepad) computers are tested in a lap-held position with the bottom of the computer in direct contact against a flat phantom for all user-enabled portrait and landscape positions.

8.4 SAR Testing with IEEE 802.11 a/b/g Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

8.4.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

8.4.2 Frequency Channel Configurations [22]

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz §15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11, 15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels. These are referred to as the “default test channels”. 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.

Table 8-1
802.11 Test Channels per FCC Requirements

Mode		GHz	Channel	Turbo Channel	“Default Test Channels”			
					§15.247		UNII	
					802.11b	802.11g		
802.11 b/g		2.412	1		√	∇		
		2.437	6	6	√	∇		
		2.462	11		√	∇		
802.11a	UNII	5.18	36				√	
		5.20	40	42 (5.21 GHz)				*
		5.22	44					*
		5.24	48	50 (5.25 GHz)			√	
		5.26	52				√	
		5.28	56	58 (5.29 GHz)				*
		5.30	60					*
		5.32	64				√	
		5.500	100	Unknown				*
		5.520	104				√	
		5.540	108					*
		5.560	112					*
		5.580	116				√	
		5.600	120					*
		5.620	124				√	
		5.640	128					*
		5.660	132					*
		5.680	136				√	
		5.700	140					*
	UNII or §15.247	5.745	149		√		√	
		5.765	153	152 (5.76 GHz)		*		*
		5.785	157		√			*
		5.805	161	160 (5.80 GHz)		*	√	
	§15.247	5.825	165		√			

9 FCC 3G MEASUREMENT PROCEDURES – JUNE 2006

Power measurements were performed using a base station simulator under digital average power [22].

9.1 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated call using a base station simulator in a shielded chamber. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR [4]. SAR measurements were taken with a fully charged battery. In order to verify that the device was tested and maintained at full power, it was configured with the base station simulator. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

9.2 SAR Measurement Conditions for CDMA2000

The following procedures were followed according to FCC "SAR Measurement Procedures for 3G Devices", June 2006.

9.2.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices", June 2006. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in "All Up" condition. .

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 13-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 13-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

Table 9-1
Parameters for Max. Power for RC1

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 9-2
Parameters for Max. Power for RC3

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

9.2.2 Body SAR Measurements

SAR for body exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts. Body SAR was measured using TDSO / SO32 with power control bits in the “All Up”

Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

9.2.3 Devices with EVDO

For device with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for EV-DO is not required.7 Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3.7 SAR for Rev. A is not required when the maximum average output of each channel is less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev. 0 and Rev. A.

9.3 Device Capabilities*:

Band	Channel	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]	1x EvDO Rev. A [dBm]
	F-RC	RC3	(FTAP)	(RTAP)	(FETAP)	(RETAP)
	Vocoder Rate	N/A	N/A	N/A	N/A	N/A
Cellular	1013	24.41	24.36	24.40	24.30	24.32
	384	24.35	24.31	24.36	24.26	24.30
	777	24.46	24.41	24.51	24.20	24.33
PCS	25	24.37	24.30	24.38	24.22	24.29
	600	24.32	24.33	24.36	24.31	24.33
	1175	24.44	24.40	24.43	24.30	24.38

Figure 9-1.1 Conducted Power for MX720

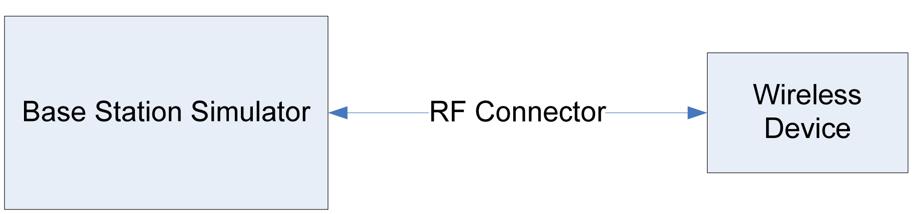


Figure 9-1.2
Power Measurement Setup

10 ANSI/IEEE C95.1-2005 RF EXPOSURE LIMITS

10.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

10.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 10-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-2005

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

1 The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2 The Spatial Average value of the SAR averaged over the whole body.
3 The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

11 MEASUREMENT UNCERTAINTIES

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.6	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

12 SYSTEM VERIFICATION

12.1 Tissue Verification

Table 12-1
Measured Tissue Properties

Calibrated Date:	12/28/06		12/28/06		12/26/06		12/26/06	
	835H		**835M**		**1900H**		**1900M**	
	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant	41.50	41.84	55.20	54.55	40.00	40.41	53.30	53.98
Conductivity	0.900	0.880	0.970	0.970	1.400	1.420	1.520	1.540

12.2 Test System Verification

Prior to assessment, the system is verified to ±10% of the specifications at 835 MHz and 1900 MHz by using the system validation kit(s). (Graphic Plots Attached)

Table 12-2
System Verification Results

System Verification TARGET & MEASURED							
Date:	**Amb. Temp (˚C)**	**Liquid Temp (˚C)**	**Input Power (W)**	**Tissue Frequency (Mhz)**	**Targeted SAR_{1g} (mW)**	**Measured SAR_{1g} (mW)**	**Deviation (%)**
12/28/06	22.9	20.5	0.100	835	2.38	2.26	-4.84%
12/26/06	23.3	21.8	0.100	1900	3.97	3.92	-1.26%

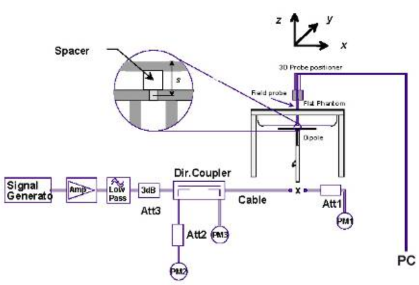


Figure 12-1
System Verification Setup Diagram

Figure 12-2
System Verification Setup Photo

13 SAR DATA SUMMARY

13.1 Body SAR Results

MEASUREMENT RESULTS								
FREQUENCY		Mode	Start/ End Average Power		Separation Distance (cm)	Antenna Type	Host Position	SAR
MHz	Ch.		Start	End				(W/kg)
836.52	384	CDMA	24.26	24.20	0.9 cm	Open	Bottom	0.413
848.31	777	CDMA	24.20	24.12	0.9 cm	Closed	Bottom	0.491
848.31	777	CDMA	24.20	24.09	0.9 cm	45 Degree	Bottom	0.453
824.04	1013	CDMA	24.30	24.31	0.9 cm	Closed	Bottom	0.330
848.31	777	CDMA	24.20	24.15	0.9 cm	Open	Bottom	**0.581**
1880.00	600	PCS	24.31	24.52	0.9 cm	Open	Bottom	0.806
1851.25	25	PCS	24.22	24.01	0.9 cm	Open	Bottom	**0.872**
1908.75	1175	PCS	24.30	24.26	0.9 cm	Open	Bottom	0.508
1851.25	25	PCS	24.22	24.25	0.9 cm	45 Degree	Bottom	0.862
1851.25	25	PCS	24.22	24.08	0.9 cm	Closed	Bottom	0.820
848.31	777	CDMA	24.20	24.16	0.9 cm	Open	Side 1	**0.442**
848.31	777	CDMA	24.20	24.27	0.9 cm	45 Degree	Side 1	0.387
848.31	777	CDMA	24.20	24.22	0.9 cm	Closed	Side 1	0.332
1908.75	1175	PCS	24.30	24.30	0.9 cm	Open	Side 1	**0.778**
1908.75	1175	PCS	24.30	24.21	0.9 cm	45 Degree	Side 1	0.370
1908.75	1175	PCS	24.30	24.32	0.9 cm	Closed	Side 1	0.374
848.31	777	CDMA	24.20	24.21	0.9 cm	Closed	Side 2	**0.187**
848.31	777	CDMA	24.20	24.21	0.9 cm	Open	Side 2	0.185
1908.75	1175	PCS	24.30	24.07	0.9 cm	Open	Side 2	**0.141**
1908.75	1175	PCS	24.30	24.69	0.9 cm	Closed	Side 2	0.077
ANSI / IEEE C95.1 2005 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					Muscle 1.6 W/kg (mW/g) averaged over 1 gram			

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001]. Procedures were followed from the previously-issued original grant (FCC ID: PKRNVWMCD3000) as discussed with Tim Harrington/ FCC.
2. All modes of operation were investigated, and worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. Liquid tissue depth is 15.1 cm. ± 0.1.
5. Body SAR was tested in EVDO RTAP Mode.
6. Separation distance from the bottom of the flat phantom to the dongle.

14 EQUIPMENT LIST

Manufacturer	Model / Equipment	Calibration Date	Cal Inerval	Calibration Due	Serial No.
Agilent	8753E (30kHz-6GHz) Network Analyzer	5/25/2006	Annual	5/25/2007	JP38020182
Agilent	N4010A Wireless Connectivity Test Set	6/11/2006	Annual	6/11/2007	GB46170464
Agilent	E5515C Wireless Communications Test Set	7/27/2006	Annual	7/27/2007	GB41450275
Agilent	E5515C Wireless Communications Test Set	10/6/2006	Annual	10/6/2007	GB43193972
Agilent	8648D (9kHz-4GHz) Signal Generator	10/1/2006	Annual	10/1/2007	3613A00315
Gigatronics	8657A Universal Power Meter	4/7/2006	Annual	4/7/2007	8650319
Gigatronics	80701A (0.05-18GHz) Power Sensor	4/11/2006	Annual	4/11/2007	1833460
Rohde & Schwarz	NRVS Power Meter	6/1/2005	Biennial	6/1/2007	835360/079
Rohde & Schwarz	NRV-Z53 Power Sensor	6/1/2005	Biennial	6/1/2007	846076/007
Rohde & Schwarz	CMU200 Base Station Simulator	11/8/2006	Annual	11/8/2007	107826
Rohde & Schwarz	CMU200 Base Station Simulator	7/26/2006	Annual	7/26/2007	833855/010
Rohde & Schwarz	CMU200 Base Station Simulator	4/20/2006	Annual	4/20/2007	836371/079
SPEAG	D1900V2 1900 MHz SAR Dipole	3/9/2005	Biennial	3/9/2007	502
SPEAG	D835V2 835MHz SAR Dipole	8/24/2005	Biennial	8/24/2007	4d026
SPEAG	D2450V2 2450 MHz SAR Dipole	9/25/2005	Biennial	9/25/2007	719
SPEAG	D5GHzV2 5 GHz SAR Dipole	10/5/2005	Biennial	10/5/2007	1007
SPEAG	EX3DV4 SAR Probe	1/18/2006	Annual	1/18/2007	3550
SPEAG	DAE4	6/1/2006	Annual	6/1/2007	704
SPEAG	EX3DV4 SAR Probe	7/14/2006	Annual	7/14/2007	3589
SPEAG	DAE4	9/4/2006	Annual	9/4/2007	665
SPEAG	EX3DV4 SAR Probe	11/23/2006	Annual	11/23/2007	3561
SPEAG	ES3DV2 SAR Probe	9/20/2006	Annual	9/20/2007	3022
SPEAG	DAE3	10/16/2006	Annual	10/16/2007	455
Agilent	E8257D (250kHz-20GHz) Signal Generator	2/11/2006	Annual	2/11/2007	MY45470194
Agilent	E8257D (250kHz-20GHz) Signal Generator	3/30/2006	Annual	3/30/2007	MY44320964
Extech	421305 Digital Thermometer	N/A	Annual	N/A	426966

Notes:

The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Validation measurement is performed by PCTEST prior to SAR evaluation. The brain simulating material is calibrated by PCTEST using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the body-equivalent material.

15 CONCLUSION

15.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

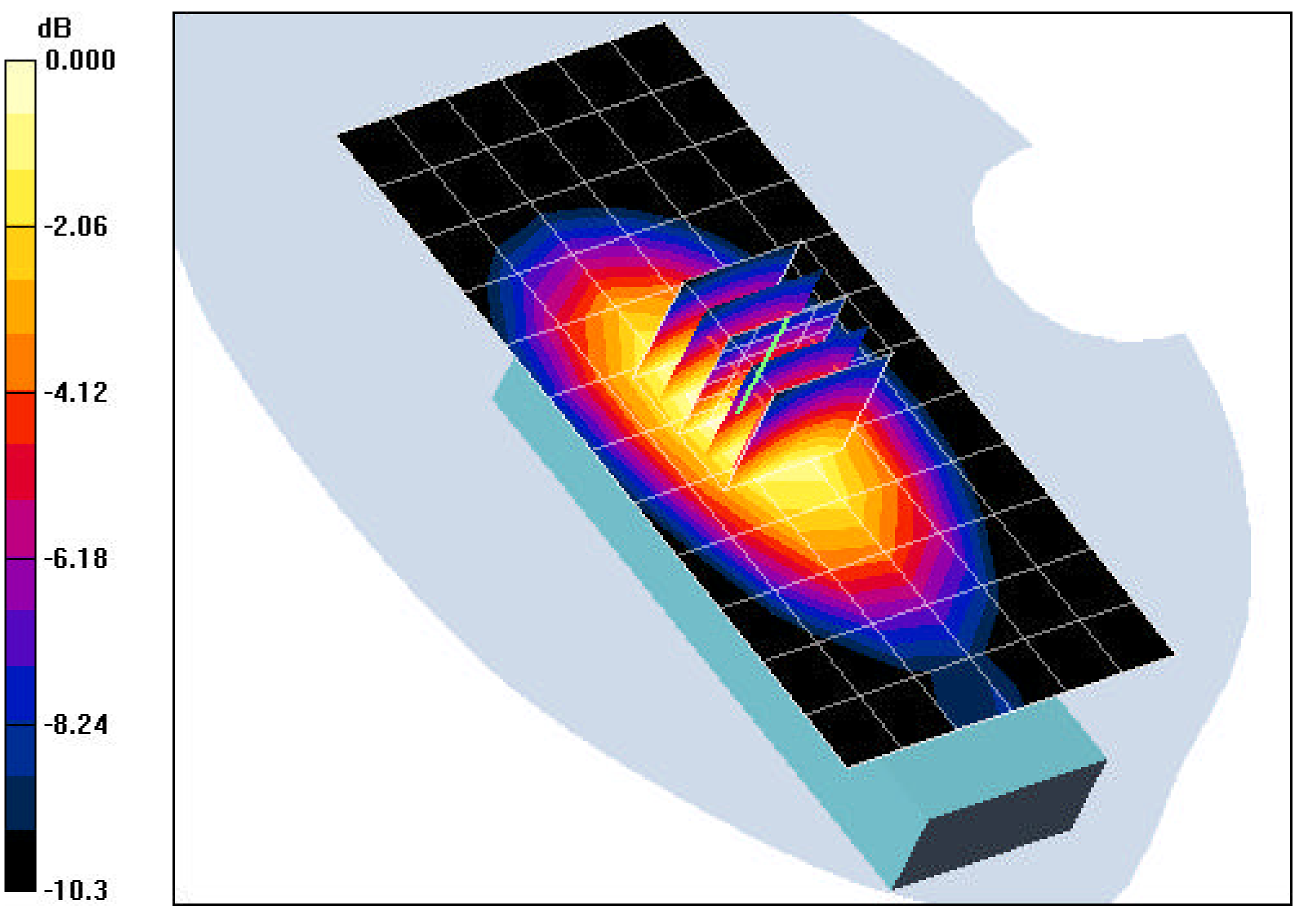
Communication System: Cellular CDMA; Frequency: 848.31 MHz; Duty Cycle: 1:1
Medium: 835 Muscle (σ= 0.97 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9cm from DUT to Flat Phantom

Test Date: 12-28-2006; Ambient Temp: 22.8°C; Tissue Temp: 20.2°C

Probe: ES3DV2 - SN3022; ConvF(5.95, 5.95, 5.95); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: CDMA EVDO RTAP, Bottom position, High ch, Ant. Open .9cm

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.4 V/m
Peak SAR (extrapolated) = 0.794 W/kg
SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.398 mW/g



0 dB = 0.662mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

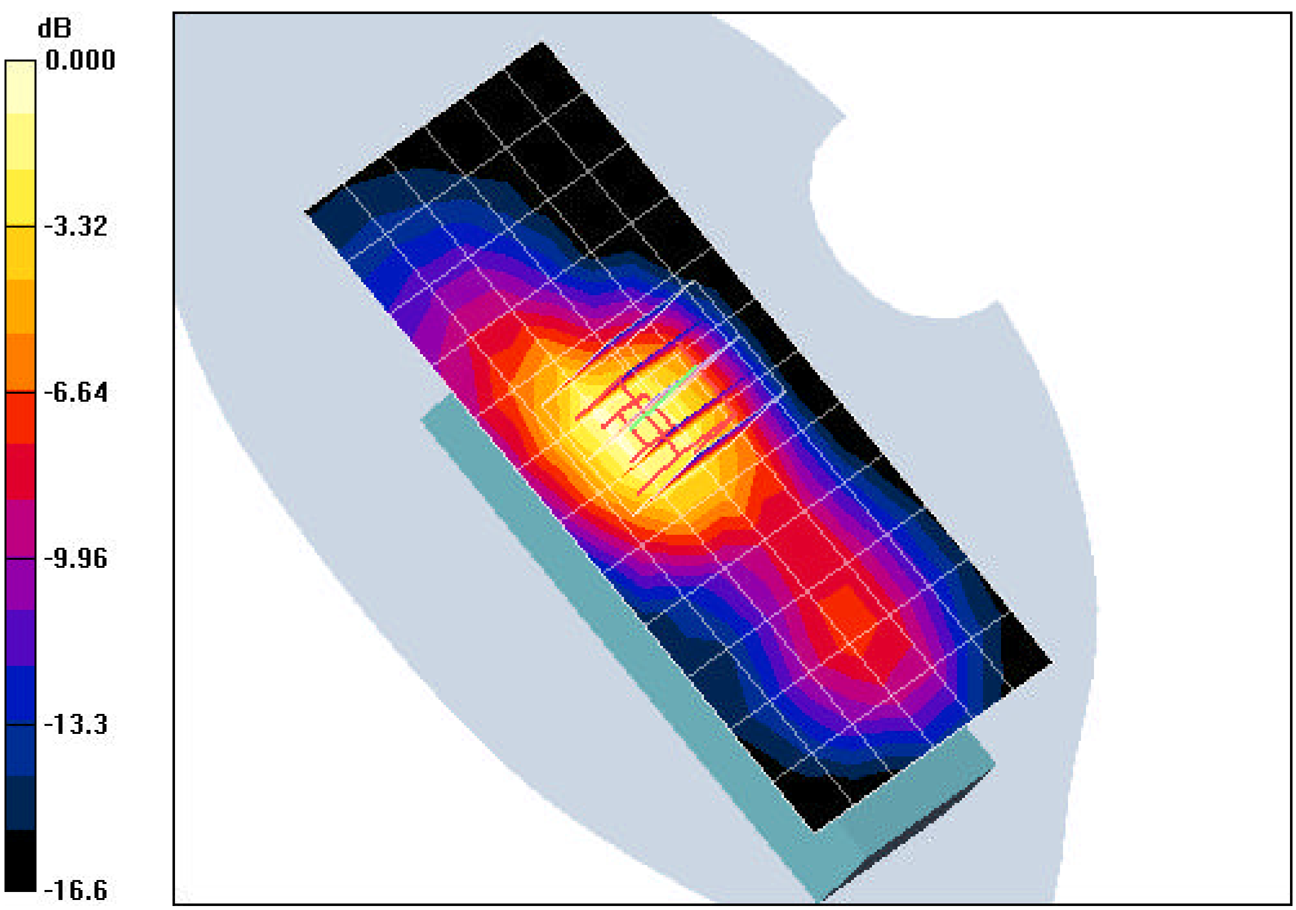
Communication System: PCS CDMA; Frequency: 1851.25 MHz; Duty Cycle: 1:1
Medium: 1900 Muscle (σ= 1.54 mho/m; ε_r = 54; ρ = 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9cm from DUT to Flat Phantom

Test Date: 12-26-2006; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: ES3DV2 - SN3022; ConvF(4.69, 4.69, 4.69); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: PCS EVDO RTAP Bottom position,Low ch, Ant. Open .9cm

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.1 V/m
Peak SAR (extrapolated) = 1.35 W/kg
SAR(1 g) = 0.872 mW/g; SAR(10 g) = 0.510 mW/g



0 dB = 1.04mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

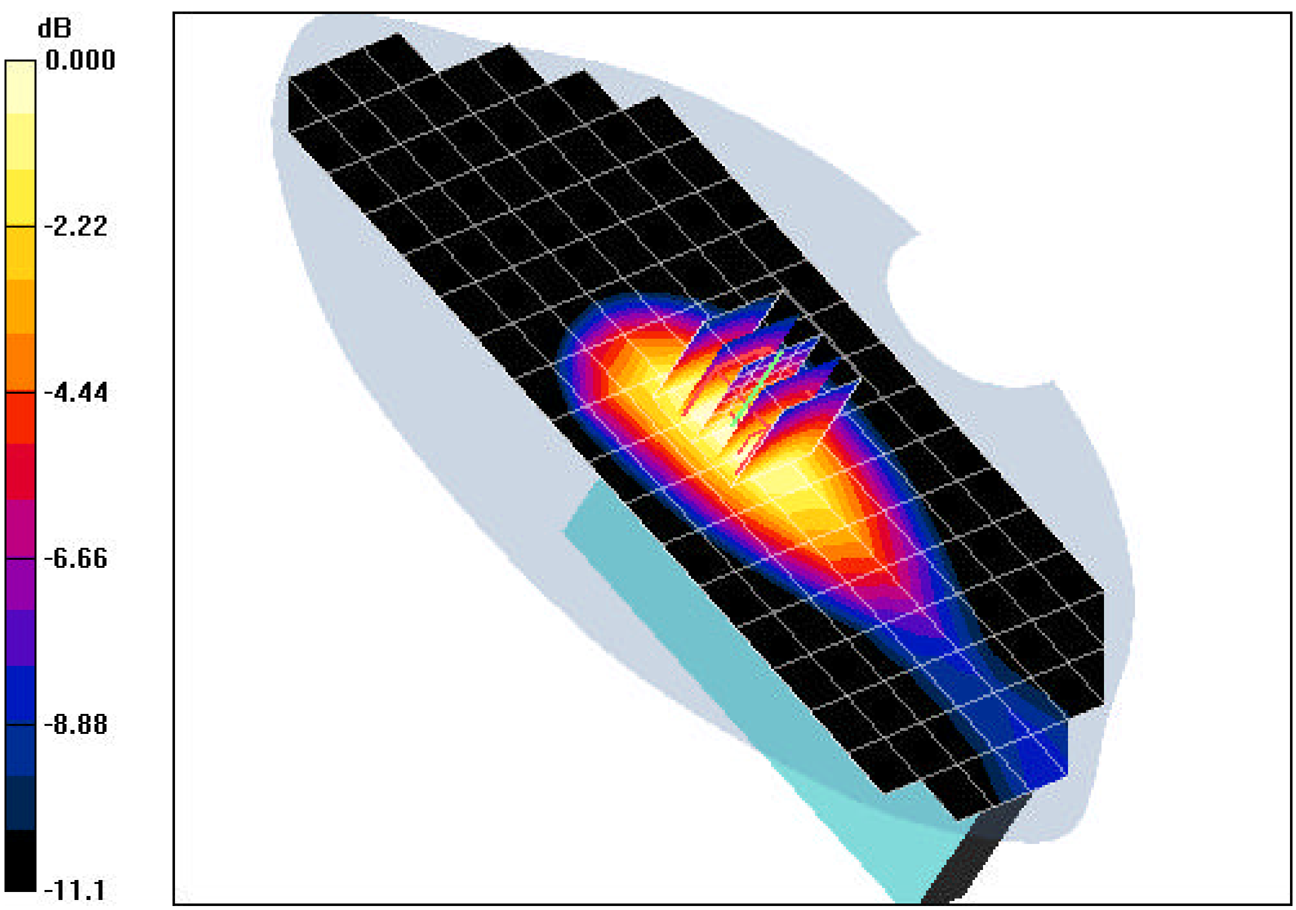
Communication System: Cellular CDMA; Frequency: 848.31 MHz; Duty Cycle: 1:1
Medium: 835 Muscle (σ= 0.97 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9cm from DUT to Flat Phantom

Test Date: 12-28-2006; Ambient Temp: 22.8°C; Tissue Temp: 20.2°C

Probe: ES3DV2 - SN3022; ConvF(5.95, 5.95, 5.95); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: Cell EvDO RTAP, Side 1 position, High. ch, Ant. Open .9cm

Area Scan (9x21x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.5 V/m
Peak SAR (extrapolated) = 0.611 W/kg
SAR(1 g) = 0.442 mW/g; SAR(10 g) = 0.303 mW/g



0 dB = 0.502mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

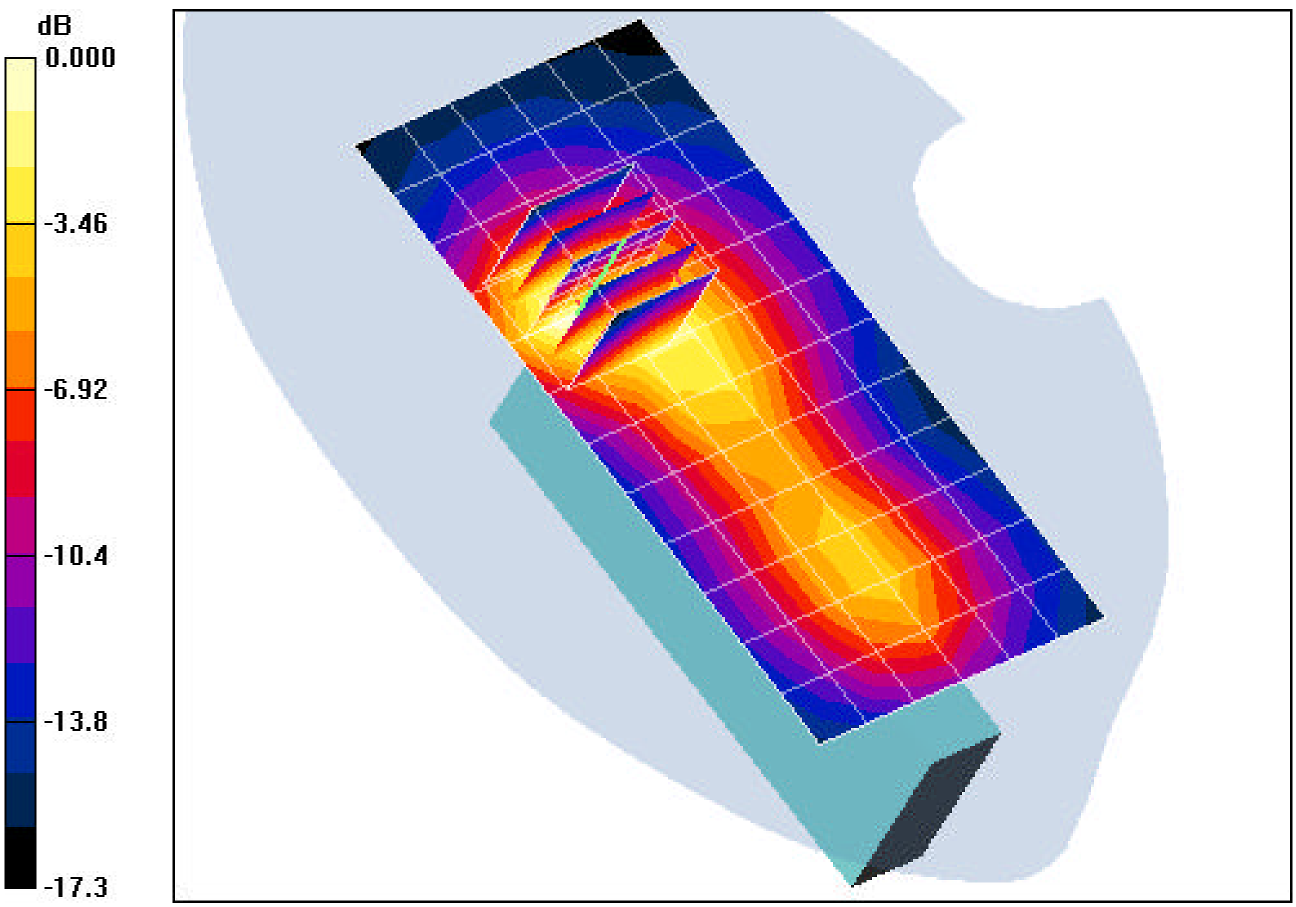
Communication System: PCS CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: 1900 Muscle (σ= 1.54 mho/m; ε_r = 54; ρ= 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9cm from DUT to Phantom

Test Date: 12-26-2006; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: ES3DV2 - SN3022; ConvF(4.69, 4.69, 4.69); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: PCS EVDO RTAP Side 1 position, High ch, Ant. Open .9cm

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.8 V/m
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.778 mW/g; SAR(10 g) = 0.446 mW/g



0 dB = 0.943mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

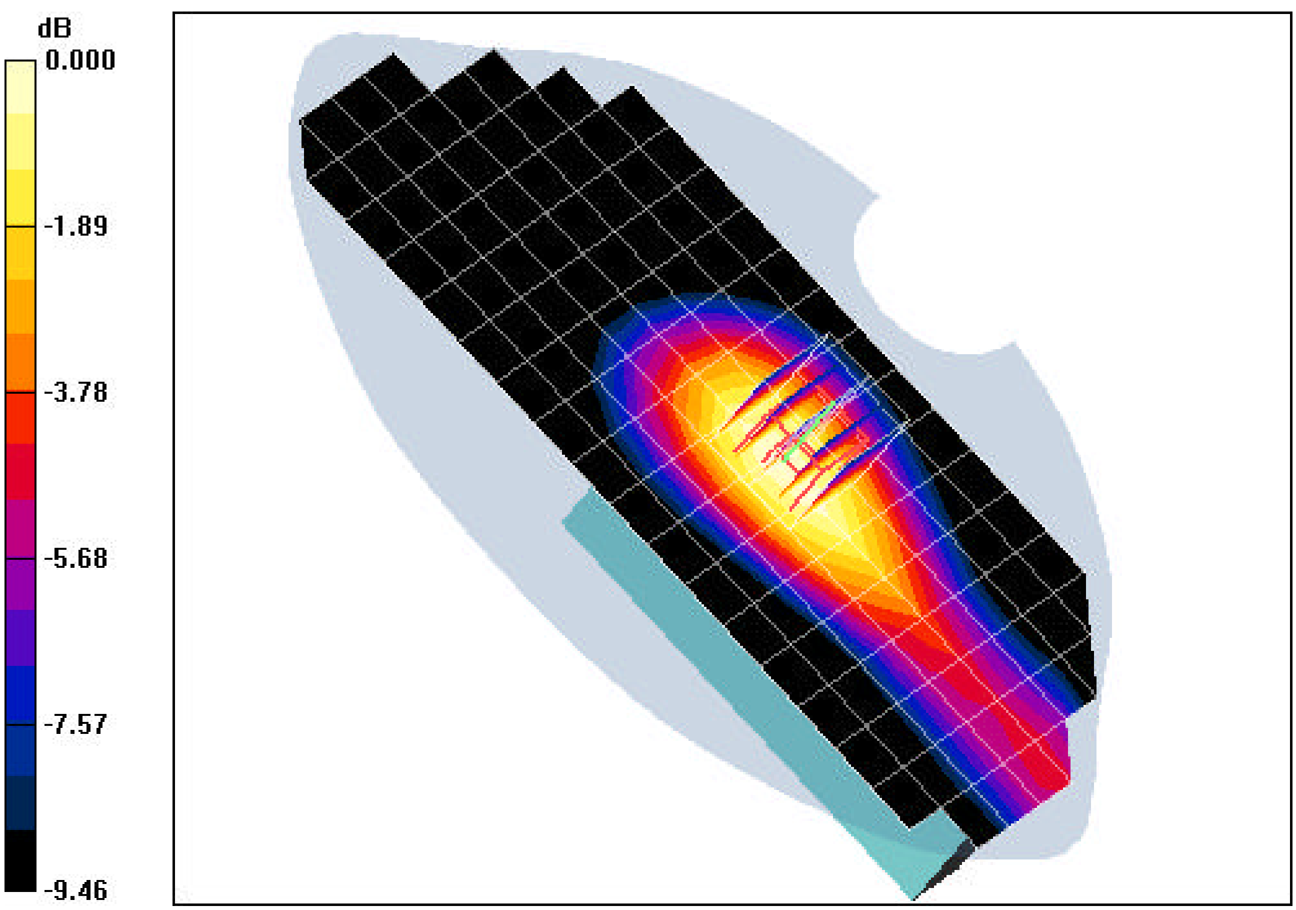
Communication System: Cellular CDMA; Frequency: 848.31 MHz; Duty Cycle: 1:1
Medium: 835 Muscle (σ= 0.97 mho/m; ε_r = 54.5; ρ= 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9cm from DUT to Flat Phantom

Test Date: 12-28-2006; Ambient Temp: 22.8°C; Tissue Temp: 20.2°C

Probe: ES3DV2 - SN3022; ConvF(5.95, 5.95, 5.95); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: Cell EvDO RTAP, Side 2 position, High. ch, Ant. Closed .9cm

Area Scan (9x21x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.2 V/m
Peak SAR (extrapolated) = 0.254 W/kg
SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.132 mW/g



0 dB = 0.210mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

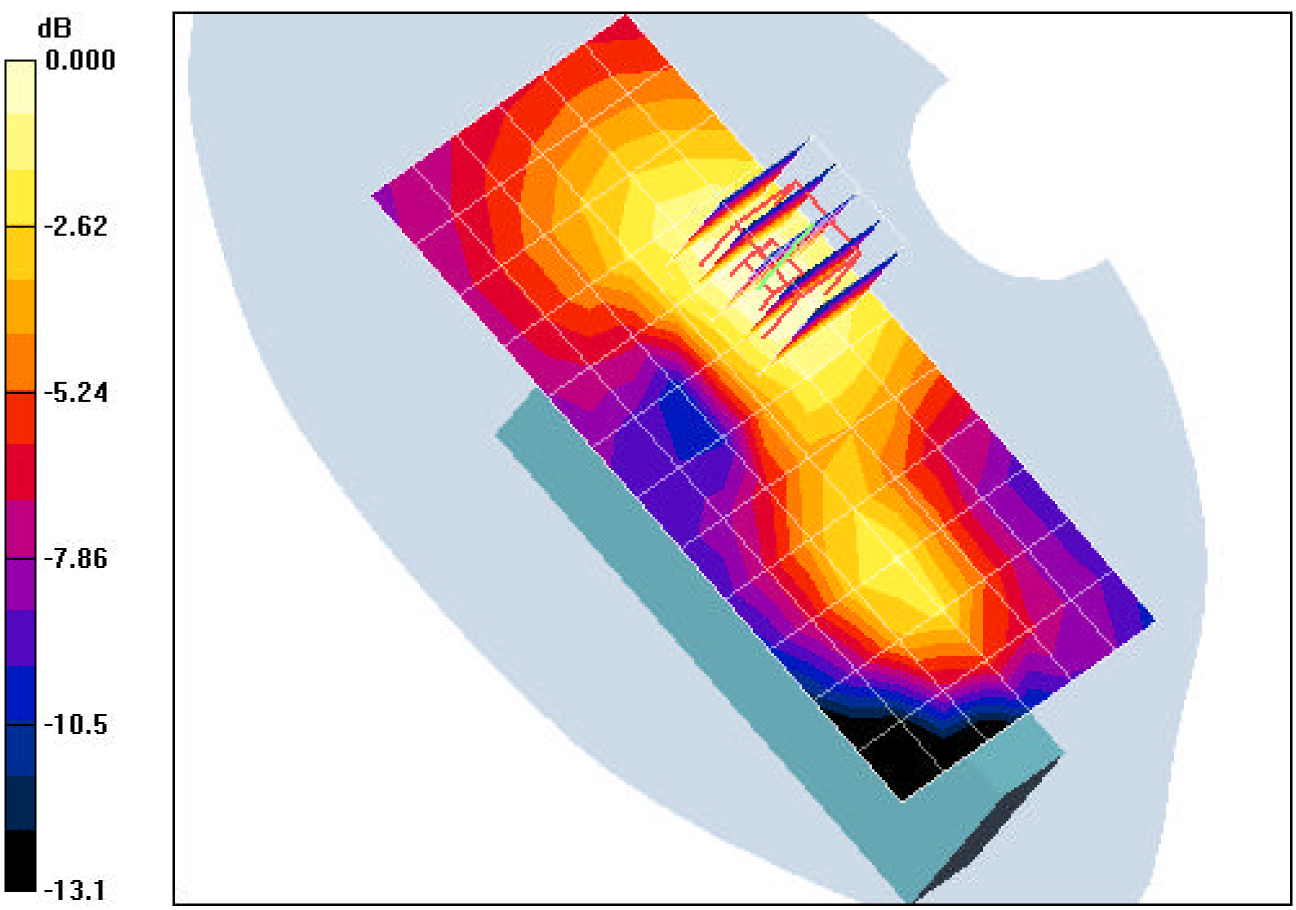
Communication System: PCS CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: 1900 Muscle (σ= 1.54 mho/m; ε_r = 54; ρ= 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9cm from the DUT to the Phantom

Test Date: 12-26-2006; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: ES3DV2 - SN3022; ConvF(4.69, 4.69, 4.69); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: PCS EVDO RTAP Side 2 position, High ch, Ant. Open .9cm

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.56 V/m
Peak SAR (extrapolated) = 0.205 W/kg
SAR(1 g) = 0.141 mW/g; SAR(10 g) = 0.092 mW/g



0 dB = 0.163mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

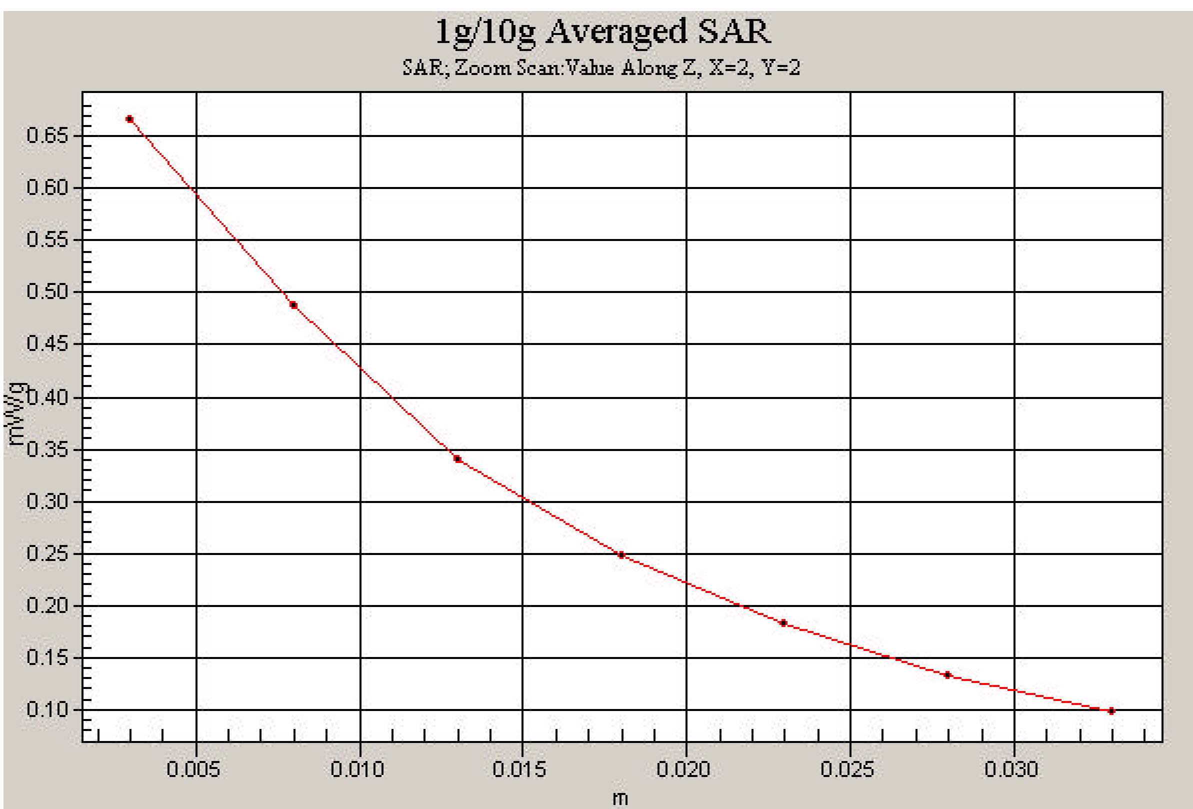
Communication System: Cellular CDMA; Frequency: 848.31 MHz; Duty Cycle: 1:1
Medium: 835 Muscle (σ = 0.97 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3)
Phantom section: Flat Section Space: 0.9cm from DUT to Flat Phantom

Test Date: 12-28-2006; Ambient Temp: 22.8°C; Tissue Temp: 20.2°C

Probe: ES3DV2 - SN3022; ConvF(5.95, 5.95, 5.95); Calibrated: 9/20/2006
Sensor -Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: CDMA EVDO RTAP, Bottom position, High ch, Ant. Open

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.4 V/m
Peak SAR (extrapolated) = 0.794 W/kg
SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.398 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: MX720 with Dongle USB; Type: Dual Band EVDO Modem Card; Serial: 5B101CEC

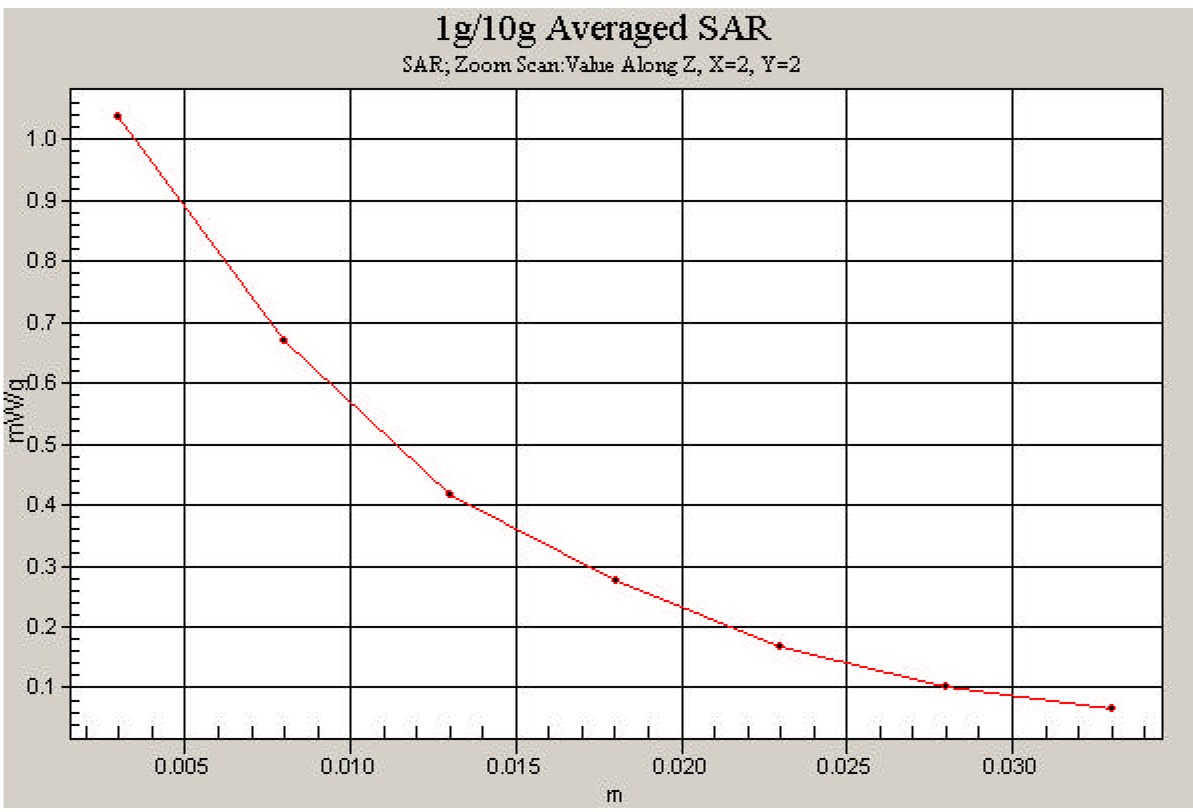
Communication System: PCS CDMA; Frequency: 1851.25 MHz; Duty Cycle: 1:1
Medium: 1900 Muscle (σ = 1.54 mho/m; ε_r = 54; ρ = 1000 kg/m^3)
Phantom section: Flat Section; Space: 0.9 cm from DUT to Flat Phantom

Test Date: 12-26-2006; Ambient Temp: 23.1°C; Tissue Temp: 21.4 °C

Probe: ES3DV2 - SN3022; ConvF(4.69, 4.69, 4.69); Calibrated: 9/20/2006
Sensor -Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Mode: PCS EVDO RTAP Bottom position,Low ch Ant. Open .9cm

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.1 V/m
Peak SAR (extrapolated) = 1.35 W/kg
SAR(1 g) = 0.872 mW/g; SAR(10 g) = 0.510 mW/g



APPENDIX B: DIPOLE VALIDATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d026

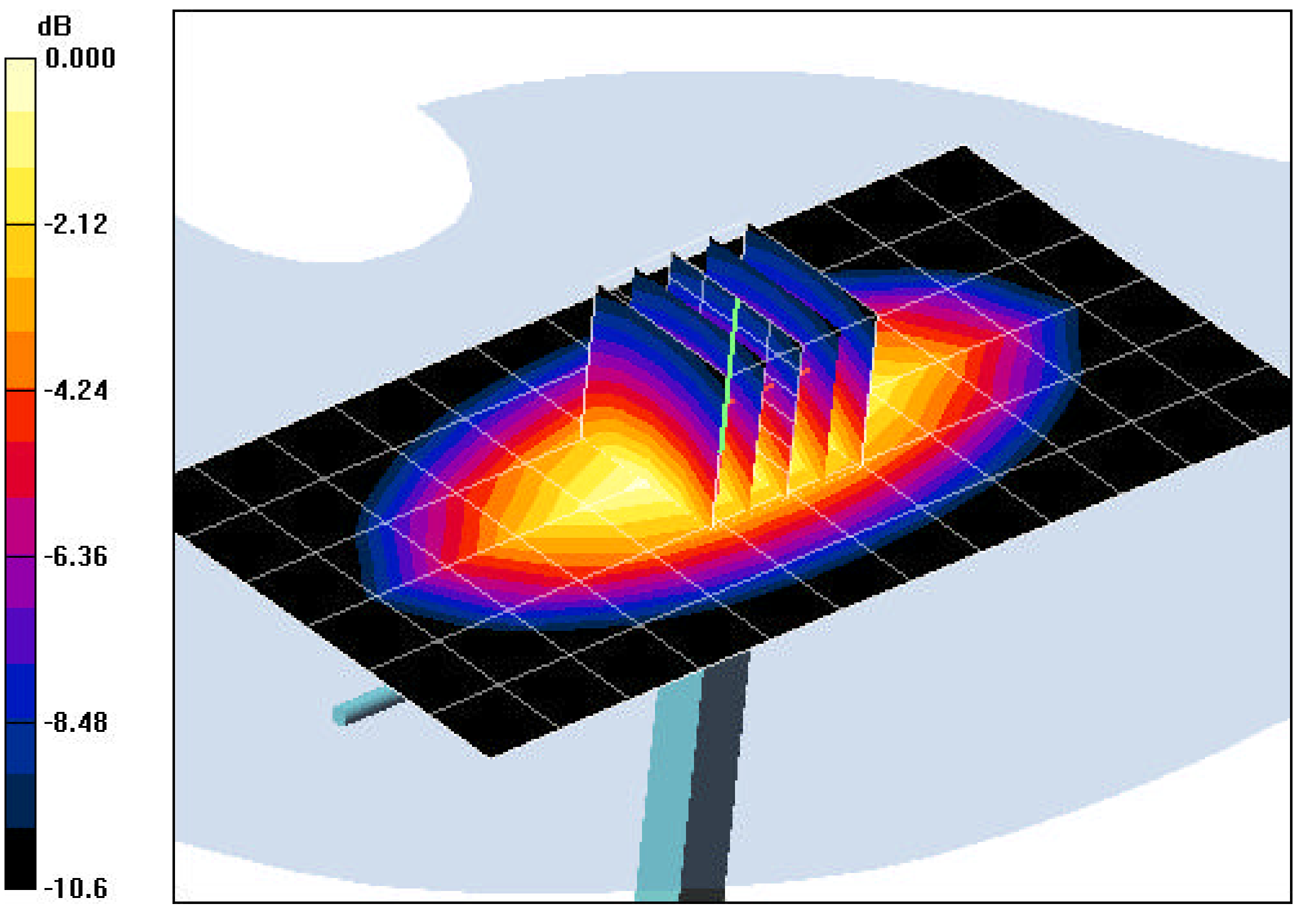
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Brain (σ = 0.88 mho/m, ε_r = 41.84, ρ = 1000 kg/m^3)
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12-28-2006; Ambient Temp: 22.9°C; Tissue Temp: 20.5°C

Probe: ES3DV2 - SN3022; ConvF(6.05, 6.05, 6.05); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

835MHz Dipole Validation

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 24.0 dBm (250 mW)
SAR(1 g) = 2.26 mW/g; SAR(10 g) = 1.47 mW/g
Target SAR(1g) = 2.375 mW/g; Deviation = -4.84 %



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 502

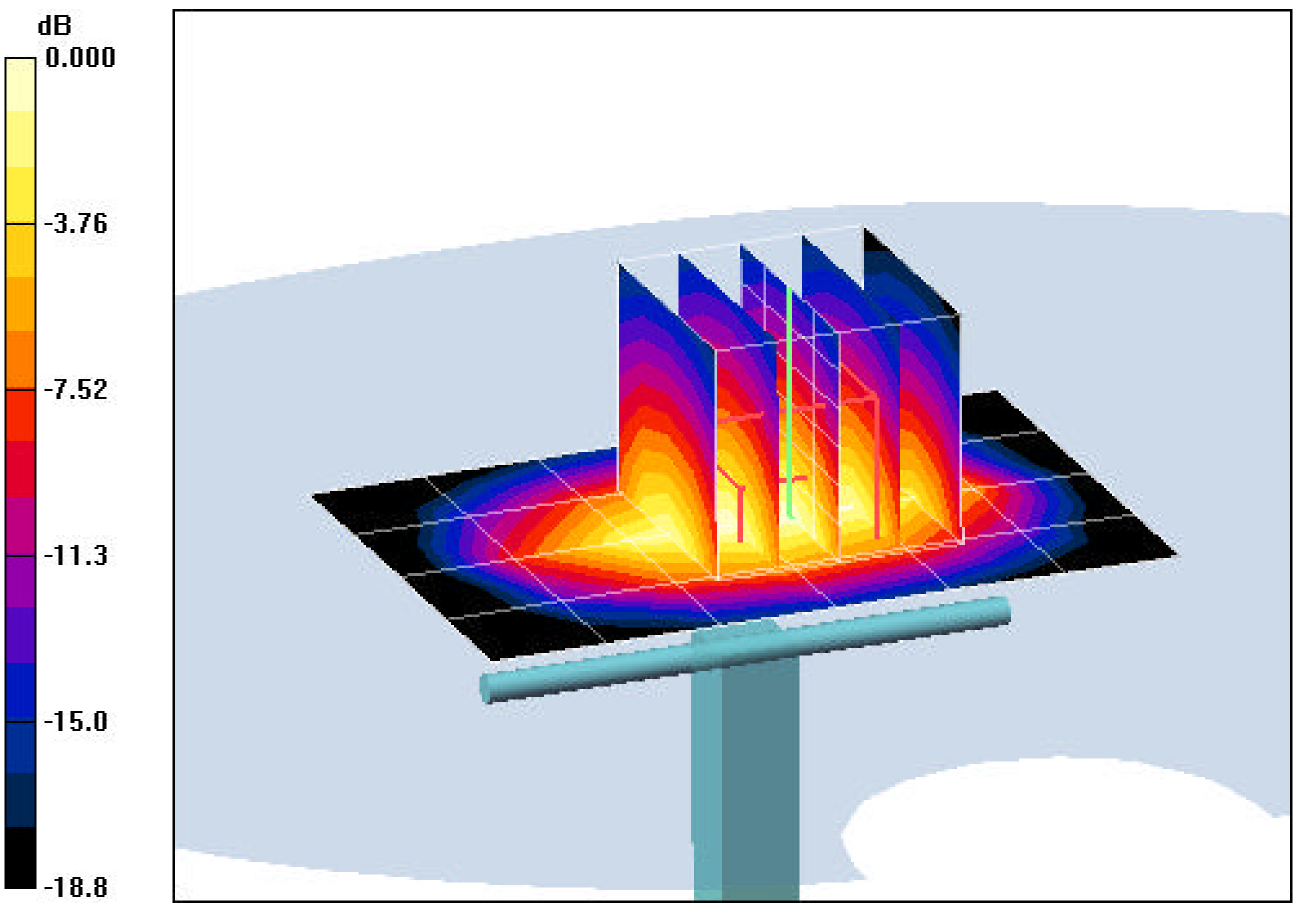
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Brain (σ = 1.42 mho/m, ε_r = 40.41, ρ = 1000 kg/m^3)
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-26-2006; Ambient Temp: 23.3°C; Tissue Temp: 21.8°C

Probe: ES3DV2 - SN3022; ConvF(5.03, 5.03, 5.03); Calibrated: 9/20/2006
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 9/4/2006
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

1900MHz Dipole Validation

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
SAR(1 g) = 3.92 mW/g; SAR(10 g) = 2.02 mW/g
Target SAR(1g) = 3.97 mW/g; Deviation = -1.26 %



0 dB = 4.89mW/g

APPENDIX C: PROBE CALIBRATION

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3022_Sep06

CALIBRATION CERTIFICATE

Object	ES3DV2 - SN:3022
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	September 20, 2006
Condition of the calibrated item	In Tolerance

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: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: September 20, 2006

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF.*
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV2

SN:3022

Manufactured:	April 15, 2003
Last calibrated:	July 21, 2005
Recalibrated:	September 20, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV2 SN:3022

Sensitivity in Free Space[A]

NormX	**1.00** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**93** mV
NormY	**1.03** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**93** mV
NormZ	**1.00** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**93** mV

(Diode Compression[B])

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	5.6	2.9
SAR_{be} [%]	With Correction Algorithm	0.0	0.0

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	4.7	2.0
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

Sensor Offset

Probe Tip to Sensor Center **2.0** mm

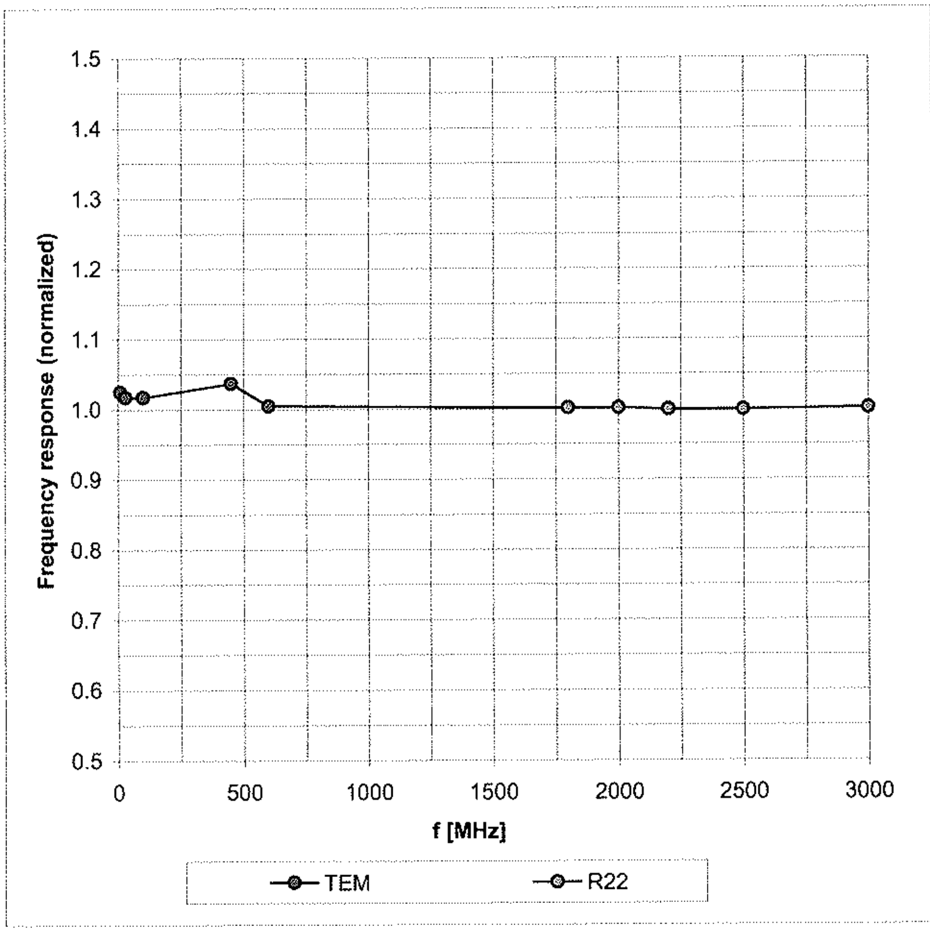
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

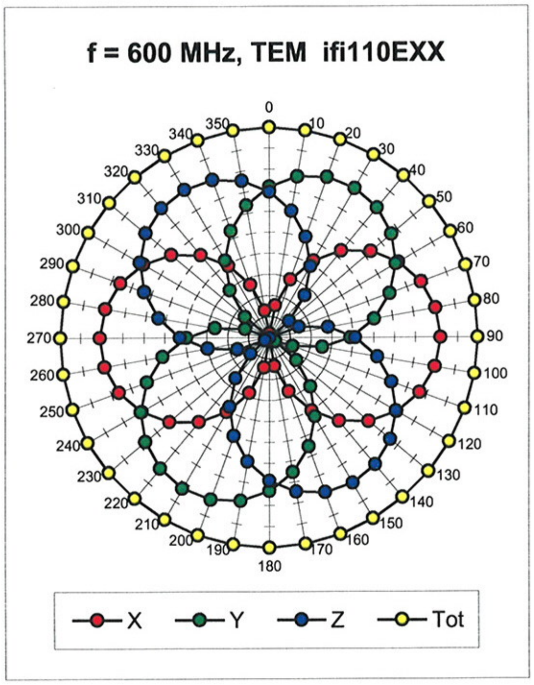
Frequency Response of E-Field

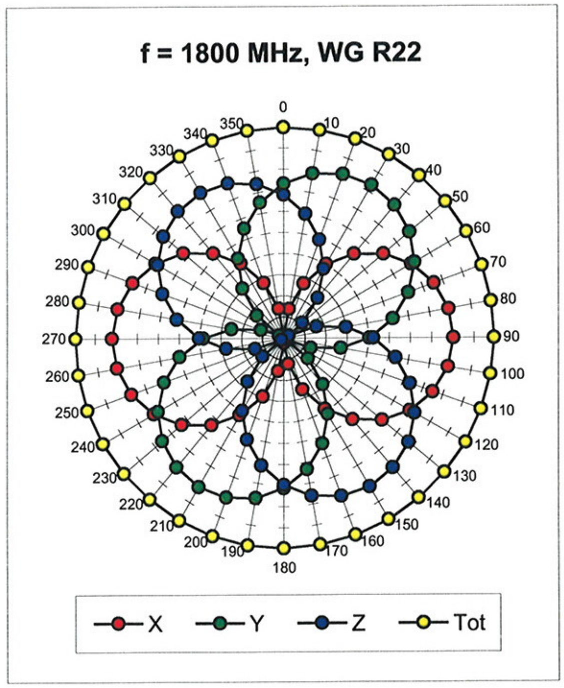
(TEM-Cell:ifi110 EXX, Waveguide: R22)

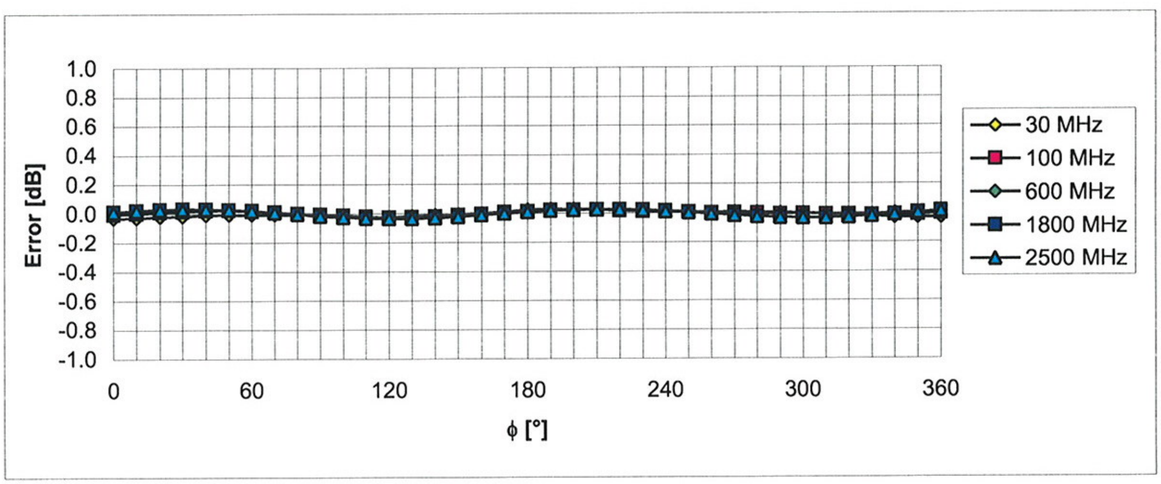


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



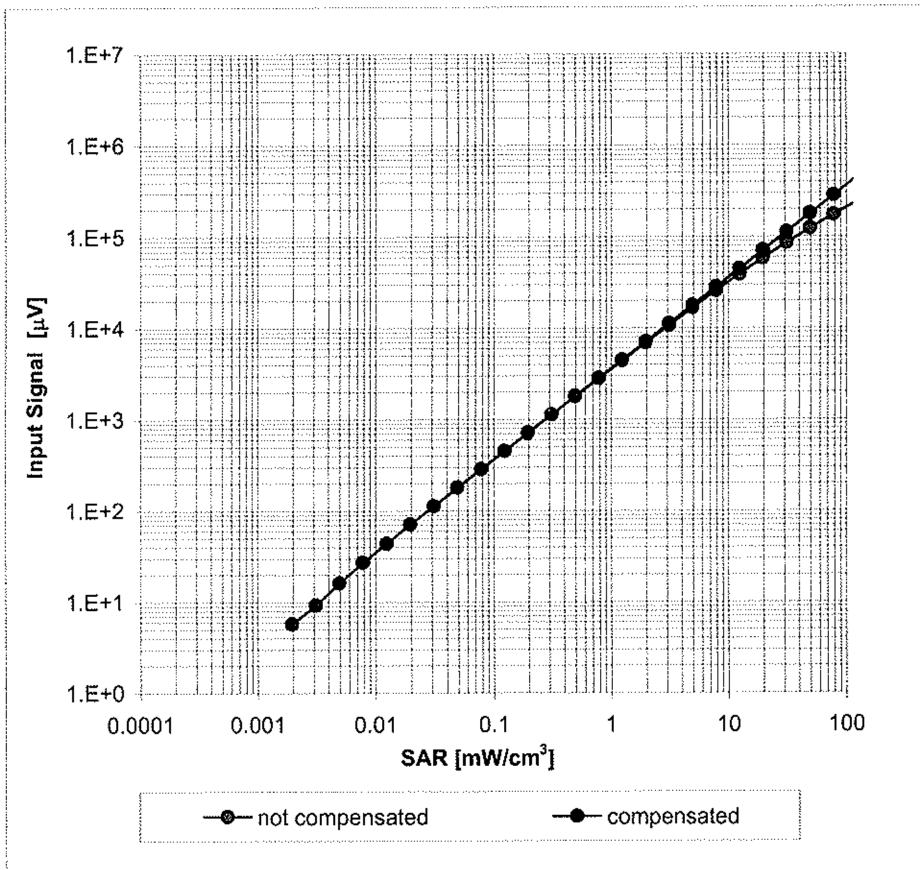


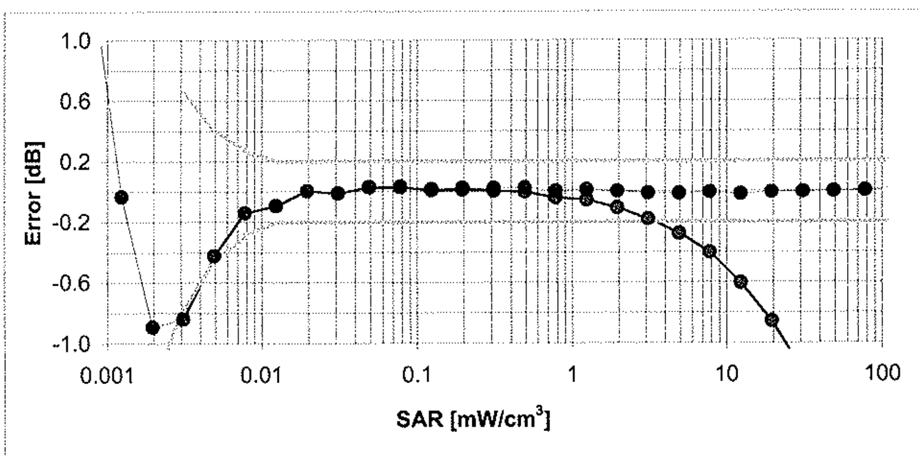


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

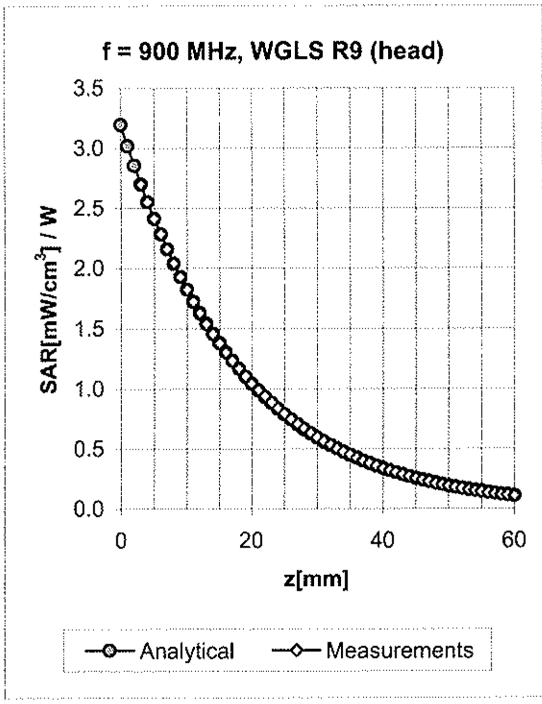
(Waveguide R22, f = 1800 MHz)

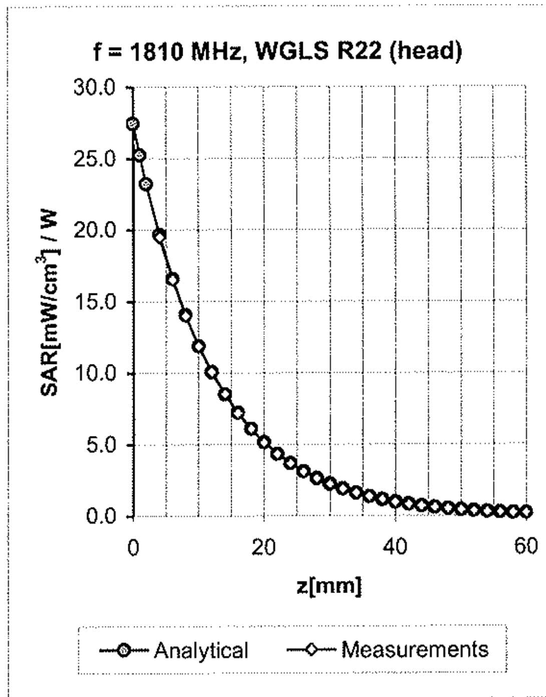




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



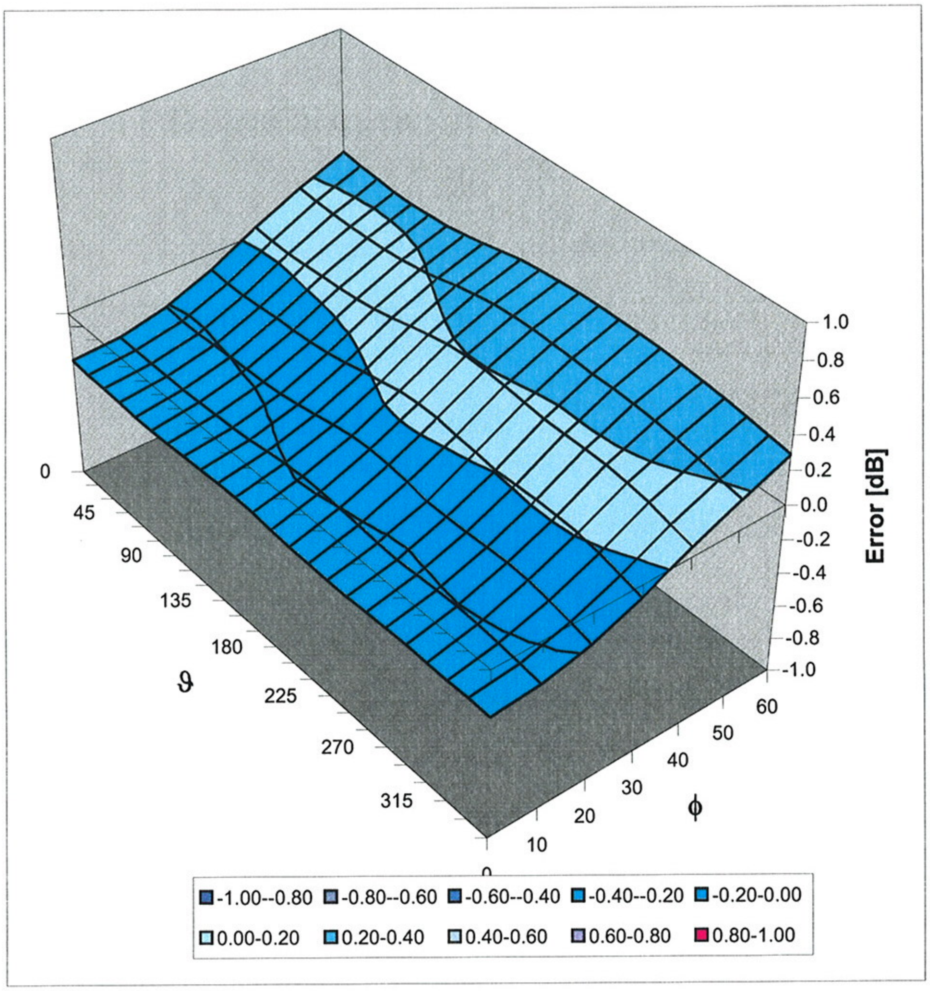


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.35	1.57	6.05	± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.59	1.39	5.03	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.50	1.44	4.49	± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.42	1.47	5.95	± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.64	1.38	4.69	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.65	1.06	4.16	± 11.8% (k=2)

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV2**
Serial Number:	**3022**
Place of Assessment:	**Zurich**
Date of Assessment:	**September 22, 2006**
Probe Calibration Date:	**September 20, 2006**

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. The evaluation is coupled with measured conversion factors (probe calibration date indicated above). The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1810 MHz.

Assessed by:

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

Dosimetric E-Field Probe ES3DV2 SN:3022

Conversion factor (± standard deviation)

615 ± 50 MHz	*ConvF*	**6.57 ± 7%**	**ε_r = 42.6 ± 5%** **σ = 0.88 ± 5% mho/m** (head tissue)
615 ± 50 MHz	*ConvF*	**6.36 ± 7%**	**ε_r = 56.1 ± 5%** **σ = 0.95 ± 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.