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FCC SAR COMPLIANCE EVALUATION REPORT (with WIMAX)

Applicant Name:
Samsung Electronics, Co. Ltd.
18600 Broadwick St.
Rancho Dominguez, CA 90220
United States

Test Report Serial No.:
0Y1103140517- R2.A3L
Date(s) of Testing:
03/02/11 - 04/07/11
Test Location:
Columbia, MD, USA

FCC ID: A3LSPHD720

APPLICANT: SAMSUNG ELECTRONICS, CO. LTD.

EUT Type:	Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX, RFID and Bluetooth
FCC Applicable Requirements:	CFR §2.1093, IEEE 1528-2003, FCC/OET Bulletin 65 Supplement C FCC KDB Publication 615223, April/Oct. 2010 and April 2011 TCB Workshop
FCC Classification:	Licensed Transmitter Held to Ear (PCE) / Digital Transmission System (DTS)
Model(s):	SPH-D720
Tx Frequency:	824.70-848.31 MHz (Cellular CDMA) / 1851.25 – 1908.75 MHz (PCS CDMA) 2498.5 - 2687.5 MHz (WIMAX – 5MHz BW) 2501 - 2685 MHz (WIMAX – 10MHz BW) 2412 - 2462 (WLAN)
Conducted Power	25.12 dBm Cell. CDMA / 25.25 dBm PCS CDMA 23.98 dBm WIMAX / 17.10 dBm 2.4 GHz WLAN
Max. SAR Measurement:	0.49 W/kg Cell. CDMA Head SAR / 0.56 W/kg Cell. CDMA Body SAR 0.64 W/kg PCS CDMA Head SAR / 0.95 W/kg PCS CDMA Body SAR 0.20 W/kg 2.4 GHz WLAN Head SAR / 0.08 W/kg 2.4 GHz WLAN Body SAR 0.42 W/kg WIMAX Head SAR (scaled) / 0.47 W/kg WIMAX Body SAR (scaled)
Test Device S/N:	Pre-Production [SN:62, RF #2]

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for the uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001), IEEE 1528-2003 and the most recent FCC KDB publications to the test dates. The test results apply for North American frequency bands only.

Note: This revised Test Report (S/N: 0Y1103140517- R2.A3L) supersedes and replaces the previously issued test report on the same subject EUT for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.
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. Test results reported herein relate only to the item(s) tested.

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

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1 WIMAX FCC SUMMARY

Based on *802.16e/WiMAX Permit-But-Ask and SAR Guidance*, November 2009
615223 D01 802 16e WiMax SAR Guidance v01

Table 1: General WiMAX System Operating Parameters

#	Description	Parameter	Comments
	FCC ID	A3LSPHD720	Identify all related FCC ID
	Radio Service	Part27 Subpart-M	Rule parts
	Transmit Frequency Range (MHz)	2498.5 ~ 2687.5 (5MHz) 2501.0 ~ 2685.0 (10MHz)	System parameter; list all applicable
	System/Channel Bandwidth (MHz)	5MHz 10MHz	System parameter; list all available. Tables for 5MHz and 10MHz BW listed below; table is required if other BW supported.
	System Profile	WiMAX Profile 3A	As defined by WiMAX Forum
	Modulation Schemes	QPSK 16QAM	Identify all applicable UL modulations

Note: The complete WIMAX Operating Parameters are included in the operational description.

2 INTRODUCTION

The FCC have 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 C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] 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.

2.1 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 Fig. 2-1).

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

Figure 2-1
SAR Mathematical Equation

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]

3 TEST SITE LOCATION

3.1 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.

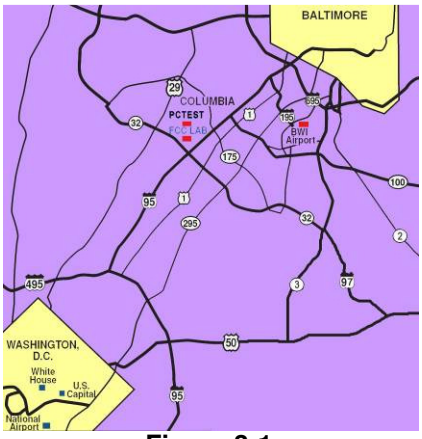


Figure 3-1
Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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.

3.2 Test Facility / Accreditations:

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

- 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), Battery Safety, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- 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 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 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 all 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 and CDMA, and EvDO mobile phones.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO Data, CDMA 1xRTT Data

4 SAR MEASUREMENT SETUP

4.1 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 a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the SAM phantom containing the head or body 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 4-1).

4.2 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 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, A/D 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 from the DAE and transfers data to the PC card.

4.3 System Electronics

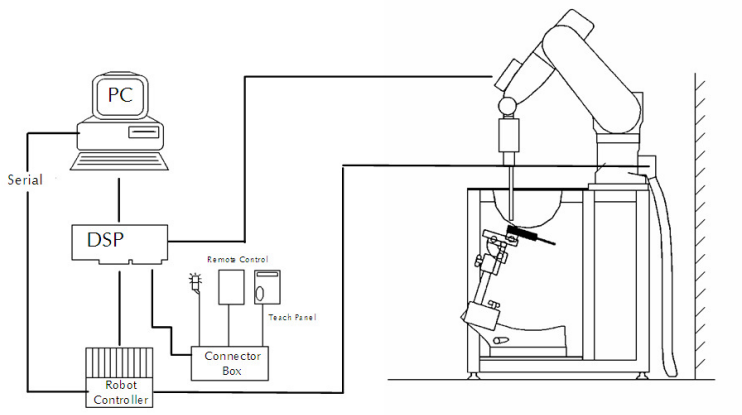


Figure 4-1
SAR Measurement System Setup

The DAE consists of a highly sensitive electrometer-grade auto-zeroing preamplifier, 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.

4.4 Automated Test System Specifications

Test Software: SPEAG DASY4 version 4.7 Measurement Software
Robot: Stäubli Unimation Corp. Robot RX60L
Repeatability: 0.02 mm
No. of Axes: 6

Data Acquisition Electronic System (DAE)

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

PC Interface Card
Function: Link to DAE
16-bit A/D converter for surface detection system
Two Serial & Ethernet link to robotics
Direct emergency stop output for robot

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

Figure 4-2
SAR Measurement System

5 DASY E-FIELD PROBE SYSTEM

5.1 Probe Measurement System

Figure 5-1
SAR System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration (see Figure 5-3) and optimized for dosimetric evaluation [9]. 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. 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 curve fitting (see Figure 6-1). The approach is stopped at reaching the maximum.

5.2 Probe Specifications

Model(s):	ES3DV2, ES3DV3, EX3DV4
Frequency Range:	10 MHz – 6.0 GHz (EX3DV4) 10 MHz – 4 GHz (ES3DV3)
Calibration:	In head and body simulating tissue at Frequencies from 300 up to 6000MHz
Linearity:	± 0.2 dB (30 MHz to 6 GHz) for EX3DV4 ± 0.2 dB (30 MHz to 4 GHz) for ES3DV3
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 (3.9mm for ES3DV3)
Tip-Center:	1 mm (2.0 mm for ES3DV3)
Application:	SAR Dosimetry Testing Compliance tests of mobile phones Dosimetry in strong gradient fields

Figure 5-2
Near-Field Probe

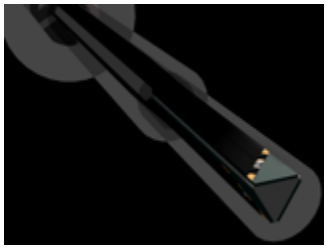


Figure 5-3
Triangular Probe Configuration

6 PROBE CALIBRATION PROCESS

6.1 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.

6.2 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.

6.3 Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head 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.

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

where:

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

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

where:

σ = simulated tissue conductivity,
ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

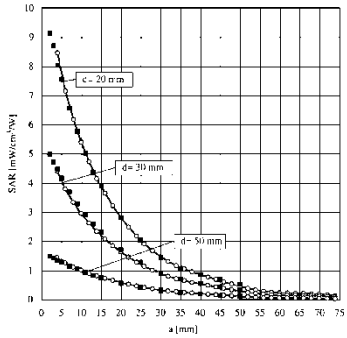


Figure 6-1 E-Field and Temperature measurements at 900MHz [9]

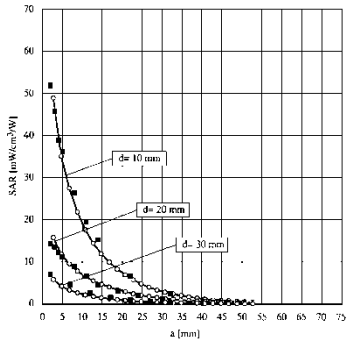


Figure 6-2 E-Field and temperature measurements at 1.9GHz [9]

7 PHANTOM AND EQUIVALENT TISSUES

7.1 SAM Phantoms

Figure 7-1
SAM Phantoms

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to represent the 90th percentile of the population [12][13]. The phantom enables the dosimetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. 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. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

7.2 Tissue Simulating Mixture Characterization

Figure 7-2
SAM Phantom with Simulating Tissue

The mixture is characterized to obtain proper dielectric constant (permittivity) and conductivity of the tissue of interest. The tissue dielectric parameters recommended in IEEE 1528 and IEC 62209 have been used as targets for the compositions, and are to match within 5%, per the FCC recommendations.

Table 7-1
Composition of the Tissue Equivalent Matter

Frequency (MHz)	835	835	1900	1900	2450-2700	2450-2700
Tissue	Head	Body	Head	Body	Head	Body
Ingredients (% by weight)						
Bactericide	0.1	0.1				
DGBE			44.92	29.44	7.99	26.7
HEC	1	1				
NaCl	1.45	0.94	0.18	0.39	0.16	0.1
Sucrose	57	44.9				
Triton X-100					19.97	
Water	40.45	53.06	54.9	70.17	71.88	73.2

8 DOSIMETRIC ASSESSMENT & PHANTOM SPECS

8.1 Measurement Procedure

The evaluation was performed using the following procedure:

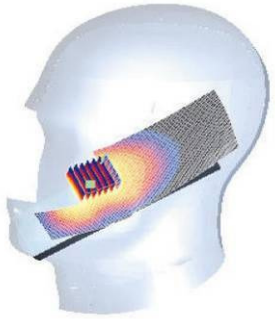


Figure 8-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm x 15mm.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during testing the 1 gram cube. This fixed point was measured and used as a reference value.
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 references or the DASY manual for more details):
   a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
   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 2, was re-measured after the zoom scan was complete. If the value deviated by more than 5%, the evaluation was repeated.

8.2 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 8-2). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimize reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15 cm.

Figure 8-2
SAM Twin Phantom Shell

9 DEFINITION OF REFERENCE POINTS

9.1 EAR REFERENCE POINT

Figure 8-1 shows the front, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 8-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 9-2). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

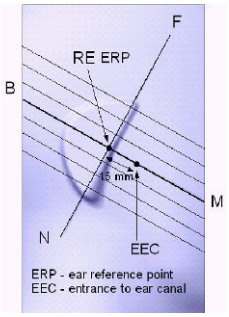


Figure 9-1
Close-Up Side view of ERP

9.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Figure 9-3). The "test device reference point" was than located at the same level as the center of the ear reference point. The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at it's top and bottom edges, positioning the "ear reference point" on the outer surface of the both the left and right head phantoms on the ear reference point.

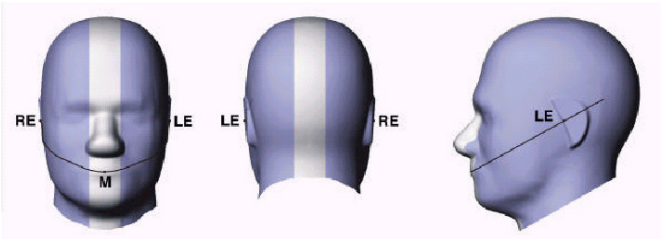


Figure 9-2
Front, back and side view of SAM Twin Phantom

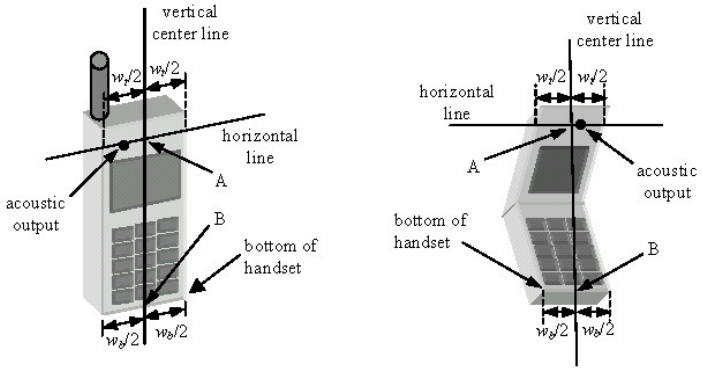


Figure 9-3
Handset Vertical Center & Horizontal Line Reference Points

10 TEST CONFIGURATION POSITIONS

10.1 Device Holder

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.

10.2 Positioning for Cheek/Touch

1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 10-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

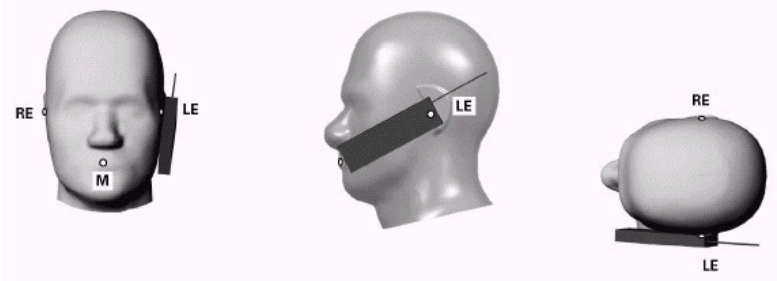


Figure 10-1 Front, Side and Top View of Cheek/Touch Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).
4. The phone was hen rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 10-2).

10.3 Positioning for Ear / 15º Tilt

With the test device aligned in the “Cheek/Touch Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degree.
2. The phone was then rotated around the horizontal line by 15 degree.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 10-2).

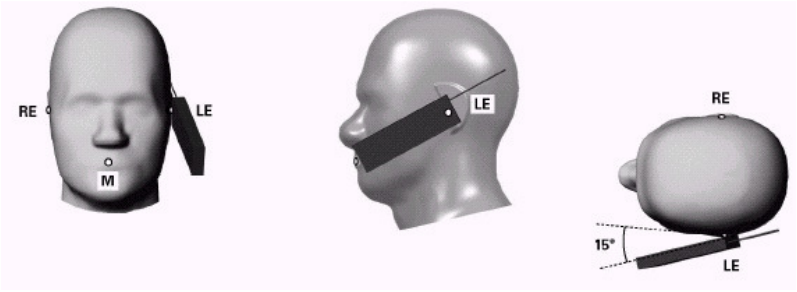


Figure 10-2 Front, Side and Top View of Ear/15º Tilt Position

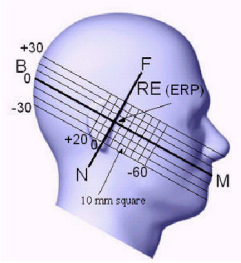


Figure 10-3
Side view w/ relevant markings

Figure 10-4 Body SAR Sample Photo
(Not Actual EUT)

10.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. It has been known for some time that there are SAR measurement difficulties in these regions of the SAM phantom. SAR probes are calibrated in tissue equivalent liquids with sufficient separation between the probe sensors and nearby physical boundaries to ensure scattering does not affect probe calibration. When the probe tip is moved into tight regions with multiple boundaries surrounding its sensors, probe calibration and measurement accuracy can become questionable. In addition, these measurement locations often require a probe to be tilted at steep angles, where it may no longer comply with calibration requirements and measurement protocols, or satisfy the required measurement uncertainty. In some situations it is not feasible to tilt the probe or rotate the phantom, as suggested by measurement standards, to conduct these measurements.

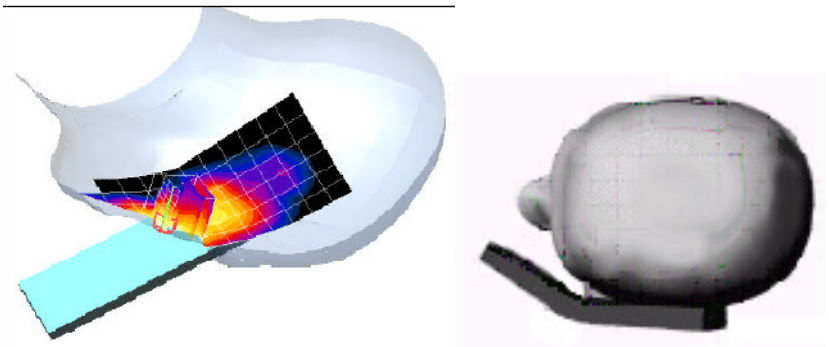


Figure 10-5
SAR Scans near the Jaw/Mouth

In order to ensure there is sufficient conservativeness for ensuring compliance until practical solutions are available, additional measurement considerations are necessary to address these technical difficulties. When measurements are required near the mouth, nose, jaw or similar tight regions of the SAM phantom,

area or zoom scans are often unable to fully enclose the peak SAR location as required by IEEE 1528 and Supplement C, due to probe orientation and positioning difficulties. Even when limited measurements are possible, the test results could be questionable due to probe calibration and measurement uncertainty issues. Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document publication 648474. The SAR required in these regions of SAM should be measured using a flat phantom. **Rectangular shaped phones** should be positioned with its bottom edge positioned from the flat phantom with the same distance provided by the cheek touching position using SAM. The ear reference point (ERP, as defined for SAM) of the phone should be positioned ½ cm from the flat phantom shell. **Clam-shell phones** should be positioned with the hinge against a smooth edge of the flat phantom where the upper half of the phone is unfolded and extended beyond the phantom side wall. The lower half of the phone is secured in the test device holder at a fixed distance below the flat phantom determined by the minimum separation along the lower edge of the phone in the cheek touching position using SAM. Any case with substantial variation in separation distance along the lower edge of a clam shell is discussed with the FCC for best-to-use methodology.

The flat phantom data should allow test results to be compared uniformly across measurement systems, until suitable solutions are available in measurement standards to address certain probe calibration and positioning issues, due to implementation differences between horizontal and upright SAM configurations. These flat phantom procedures are only applicable for stand-alone SAR evaluation in tight regions of the SAM phantom, where measurement is not feasible or test results can be questionable due to probe calibration and accessibility issues. Details on device positioning and photos showing how separation distances are determined are included in the SAR report Photographs. SAR for other regions of the head must be evaluated using SAM; therefore, a phone with antennas at different locations may require flat and SAM phantom evaluation for the different antennas.

10.5 Body Holster /Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 10-4). A device with a headset output is tested with a headset connected to the device.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

11 FCC RF EXPOSURE LIMITS

11.1 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.

11.2 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 11-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992

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.

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

12.1 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 SAR deviations of more than 5% occurred, the tests were repeated.

12.2 SAR Measurement Conditions for CDMA2000

The following procedures were performed according to FCC "SAR Measurement Procedures for 3G Devices" v02, October 2007.

12.2.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. 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 the "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 12-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH_0 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 12-1
Parameters for Max. Power for RC1

Parameter	Units	Value
$\hat{I}_{or}$	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 12-2
Parameters for Max. Power for RC3

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

12.2.2 Head SAR Measurements

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for 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 using the exposure configuration that results in the highest SAR for that channel in RC3.

12.2.3 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 + SCH_n) 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 + SCH_n) with FCH at full rate and SCH_0 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.

12.2.4 Handsets with EVDO

For handsets 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-worn SAR for EV-DO is not required. 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. 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 would be configured in the downlink for both Rev. 0 and Rev. A.

12.2.5 Body SAR Measurements for EVDO Hotspot

Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations. Both FTAP and FETAP are configured with a Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. AT power control should be in "All Bits Up" conditions for TAP/ETAP.

12.3 RF Conducted Powers

12.3.1 CDMA Conducted Powers

Band	Channel	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC	RC1	RC3	RC3	RC3	(RTAP)	(RETAP)
	Vocoder Rate	Full	Full	+SCH	F-SCH	N/A	N/A
Cellular	1013	25.01	**24.97**	24.89	25.10	25.06	24.88
	384	25.01	**24.95**	24.98	24.98	24.95	24.91
	777	25.06	**24.97**	25.05	25.04	25.12	24.88
PCS	25	25.20	**25.16**	24.90	24.86	25.11	25.16
	600	25.05	**25.00**	24.96	24.76	25.11	25.00
	1175	25.16	**25.10**	24.88	24.78	25.25	25.20

Note: RC1 is only applicable for IS-95 compatibility.

Figure 12-1
Power Measurement Setup

13 SAR TESTING WITH IEEE 802.11 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.

13.1 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.

13.2 Frequency Channel Configurations [27]

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 13-1
802.11 Test Channels per FCC Requirements

Mode		GHz	Channel	Turbo Channel	“Default Test Channels” §15.247 802.11b	“Default Test Channels” §15.247 802.11g	“Default Test Channels” UNII	
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		√			

Table 13-2
IEEE 802.11b Average RF Power

Freq [MHz]	Channel	Data Rate [Mbps]	Measured Average Power [dBm]
2412	1	1	13.75
		2	13.75
		5.5	13.78
		11	13.8
2437	6	1	16.9
		2	17.1
		5.5	17.06
		11	16.95
2462	11	1	14.95
		2	15.08
		5.5	14.99
		11	15.2

Table 13-3
IEEE 802.11g Average RF Power

Freq [MHz]	Channel	Data Rate [Mbps]	Measured Average Power [dBm]
2412	1	6	12
		9	12.1
		12	11.9
		18	11.8
		24	11.98
		36	11.93
		48	12.05
		54	12
2437	6	6	14.6
		9	14.62
		12	14.64
		18	14.7
		24	14.47
		36	14.4
		48	14.71
		54	14.58
2462	11	6	13
		9	12.9
		12	12.95
		18	13
		24	12.8
		36	12.9
		48	12.85
		54	12.82

Table 13-4
IEEE 802.11n Average RF Power

Freq [MHz]	Channel	MCS Index	Data Rate [Mbps]	Measured Average Power [dBm]
2412	1	0	6.5/7.2	9.85
		1	13/14.4	9.75
		2	19.5/21.7	9.66
		3	26/28.9	9.73
		4	39/43.3	9.6
		5	52/57.8	9.5
		6	58.5/65	9.59
		7	65/72.2	9.6
2437	6	0	6.5/7.2	12.25
		1	13/14.4	12.25
		2	19.5/21.7	12.35
		3	26/28.9	12.35
		4	39/43.3	12.22
		5	52/57.8	12.26
		6	58.5/65	12.32
		7	65/72.2	12.15
2462	11	0	6.5/7.2	10.5
		1	13/14.4	10.3
		2	19.5/21.7	10.45
		3	26/28.9	10.35
		4	39/43.3	10.31
		5	52/57.8	10.4
		6	58.5/65	10.26
		7	65/72.2	10.23

Figure 13-1
Power Measurement Setup

14 4G WIMAX LINEARITY & SAR CONSIDERATIONS

14.1 WIMAX Measured Maximum RF Output Conducted Powers

A. This device is capable of two different Channel Bandwidths (5MHz, 10 MHz).

B. Specific WIMAX configurations were selected for SAR testing according to WIMAX procedures in FCC KDB 615223 publication D01, and April & October 2010 TCB Workshop slides. Please see the notes following Table 17-4 and Table 17-8 for the determination of the required test configurations.

Table 14-1
Measured WIMAX RF Output Powers

Channel	Modulation	Coding Rate	PUSC	
			5 MHz BW	10 MHz BW
			Avg	Avg
Low	QPSK	1/2	23.79	23.58
		3/4	23.69	23.64
	16QAM	1/2	**23.55**	**23.67**
		3/4	23.77	23.77
Mid	QPSK	1/2	23.70	23.98
		3/4	23.69	23.93
	16QAM	1/2	**23.62**	**23.57**
		3/4	23.45	23.55
High	QPSK	1/2	**23.71**	**23.77**
		3/4	23.47	23.61
	16QAM	1/2	23.77	23.74
		3/4	23.52	23.82

Figure 14-1
Power Measurement Setup

14.2 SAR Probe Linearity Considerations for WIMAX Signals

Testing was performed using test software in order to simulate WIMAX transmission for the purpose of SAR testing; specifically with control symbols deactivated for proper SAR measurements according to the FCC WIMAX KDB Procedures. The operational description includes details regarding the operation of the software with WIMAX transmission characteristics.

For each modulation, BW, and zone type tested for SAR, the probe was moved to an arbitrary location with the EUT touching the flat phantom in order to be able to achieve SAR values over the range of linearity measurements. Then the point SAR readings from the DASY software were measured using the multi-meter function and recorded with decreasing the RF powers starting from the highest maximum output power to a level closest to 10 mW.

14.3 Variation from Expected SAR to do WIMAX PAR

The error due to the PAR of WIMAX was between 7-10%.

14.4 Probe Linearity Data and Linearity Graphs

SAR linearity was measured for the zone type, bandwidth, channel and mode that was tested for SAR per April 2010 TCB Workshop guidance. Please note that according to October 2010 TCBC Workshop notes 16-QAM test reduction was not required for SAR given the conducted power measurements and SAR measurements. Therefore 16-QAM linearity plots were not required. See notes for Table 17-4 and Table 17-8 for description of test configurations used for the SAR assessment.

Table 14-2
WIMAX PUSC QPSK Linearity for 5 MHz Bandwidth

	PUSC					
Modulation	QPSK					
Power (mW)	**15.63**	**31.92**	**58.61**	**105.20**	**165.58**	**248.31**
point SAR	0.193	0.401	0.761	1.395	2.222	3.375
linear line	**0.193**	**0.394**	**0.724**	**1.299**	**2.045**	**3.066**
ε	**0.0%**	**1.7%**	**4.9%**	**6.9%**	**8.0%**	**9.2%**

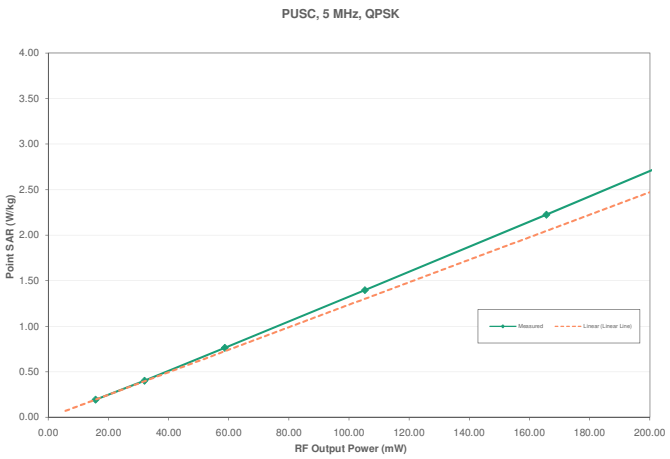
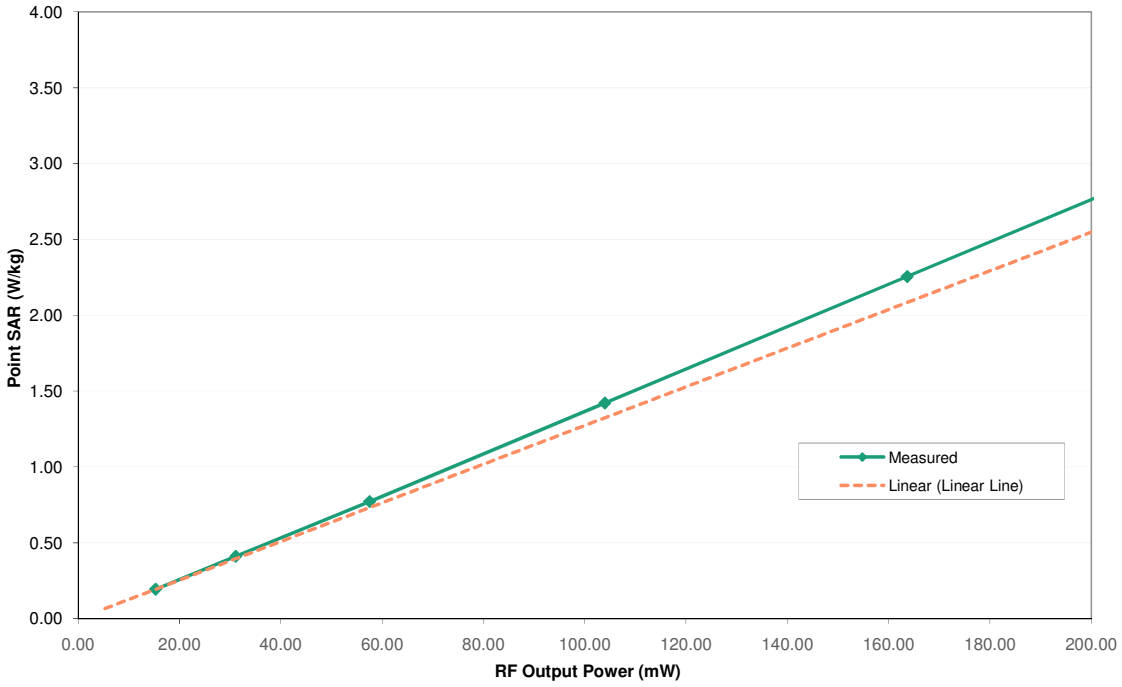


Table 14-3
WIMAX PUSC QPSK Linearity for 10 MHz Bandwidth

Zone	PUSC					
Modulation	QPSK					
Power (mW)	15.31	31.12	57.54	103.99	163.68	248.31
point SAR	0.195	0.412	0.773	1.422	2.256	3.435
linear line	0.195	0.396	0.733	1.325	2.085	3.163
ε	0.0%	3.9%	5.2%	6.8%	7.6%	7.9%

PUSC, 10 MHz, QPSK



14.5 Spectrum Analyzer Plots for WIMAX

Timing plots for the signal were analyzed to confirm control and traffic symbol duration. The below plots represent the 10 MHz PUSC QPSK mode. All other bandwidths, channels and modulation types have identical timing plots for this device.

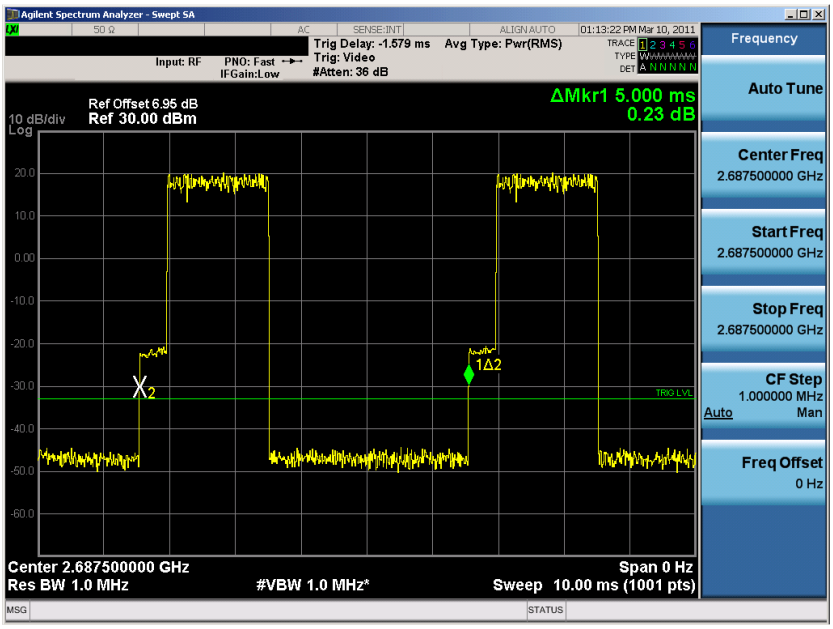


Figure 14-2
Timing Plot for WIMAX Signal

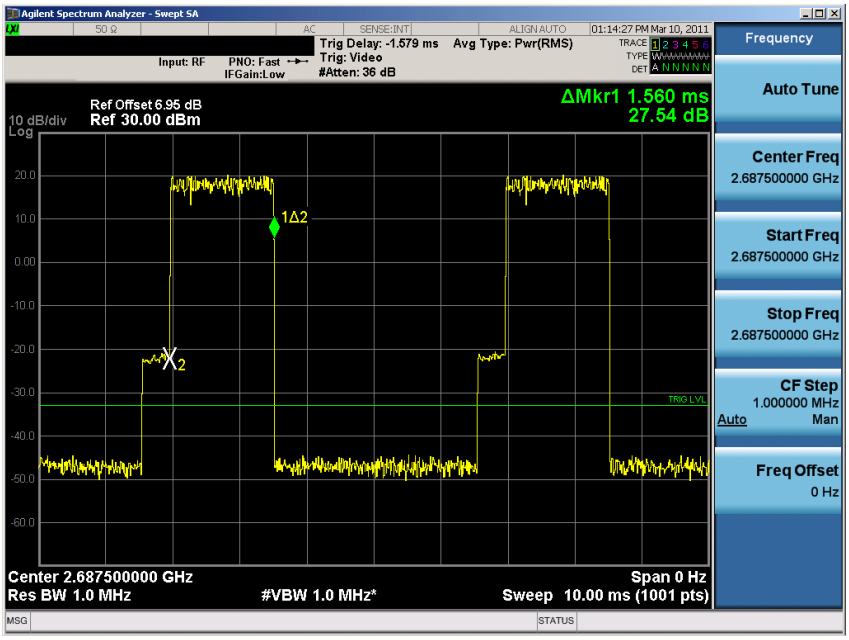


Figure 14-3
WIMAX Pulse with 15 Traffic on, 3 Controls Inactive (DC)

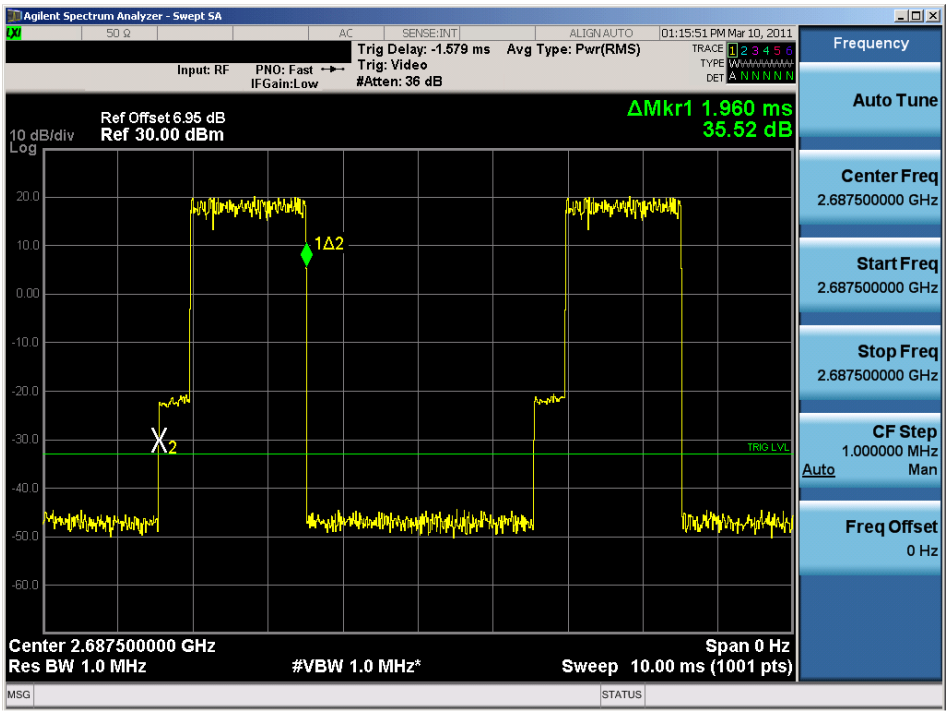


Figure 14-4
WIMAX Timing Plot Burst

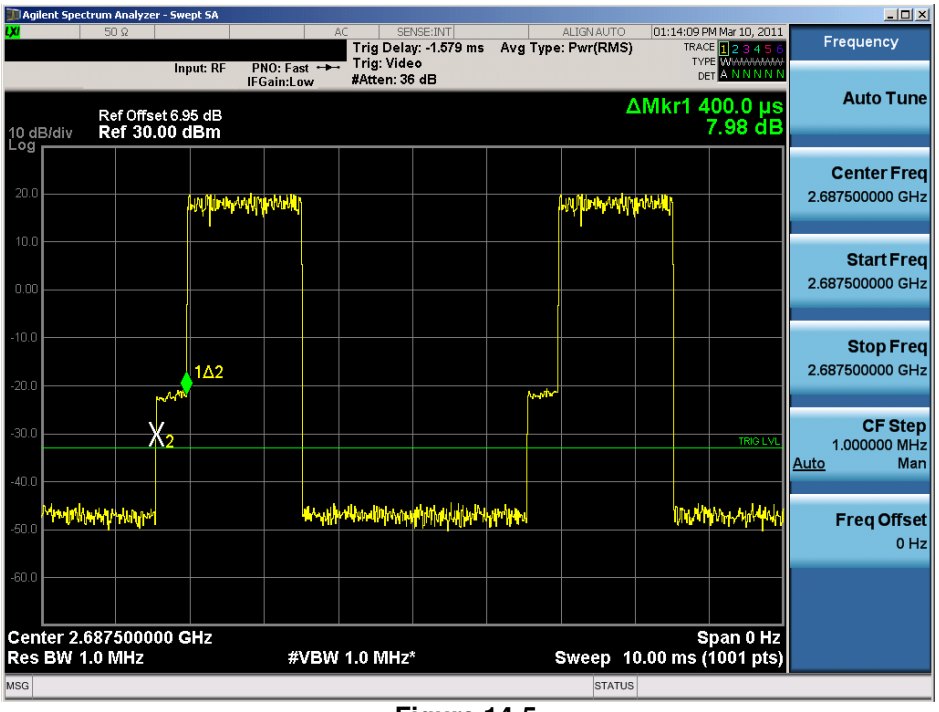


Figure 14-5
WIMAX Timing Plot Control Bits

14.6 DASY Crest Factor Calculations

For 5 MHz and 10 MHz:

Frame Averaged Duty Cycle: 15/48 = 0.3125
Duty Cycle: 1/0.3125 = **3.2**

14.7 WIMAX Scaling Factors

The WIMAX scaling factors below in Table 14-4 were applied to the measured SAR results per April 2010 TCB Workshop Guidance.

The maximum rated power for WIMAX is 251.19 mW. The control symbol power is calculated from this level, to be 35.88 mW.

Control channels for PUSC occupy 5 slots for operations in the 5MHz and 10MHz bandwidths. For the 10 MHz bandwidth, there are 35 total slots. For the 5 MHz bandwidth, there are 17 total slots. This device transmits 15 traffic symbols and 3 control symbols for all modulations and bandwidths.

Scaling Factors were calculated based on the following equation.

$$SAR\ Scaling\ Factor = \frac{\left(P_{Max} * \frac{\#\ of\ Control\ Slots\ Occupied}{\#\ of\ Slots\ (total)}\right) * \#\ of Control\ Symbols + P_{Max} * \#\ of\ Traffic\ Symbols}{P * \#\ of\ Traffic\ Symbols}$$

Given:
P_{Max} = Maximum Rated Power (mW)
P = Measured Maximum Output Power (mW)

The following is a sample calculation of the SAR Scaling factors:

$$SAR\ Scaling\ Factor(Mid\ Ch, 10MHz\ BW, PUSC, QPSK) = \frac{\left(251.19\ mW * \frac{5}{35}\right) * 3 + 251.19\ mW * 15}{250.03\ mW * 15} = 1.03$$

Table 14-4
WIMAX Scaling Factors (10 MHz Bandwidth)

Frequency [MHz]	Zone Type	Modulation	BW	Tune Up Max in mW	CS+TS Slots	CS Slots	1 Control Symbol Power [a*c/b] (mW)	Combined power of CS [d*3] (mW)	Measured Average RF Output Power		SAR Scaling Factor
									dBm	mW	
Low	PUSC	QPSK	10 MHz	251.19	35	5	35.88	107.65	23.58	228.03	1.13
	PUSC	16QAM	10 MHz	251.19	35	5	35.88	107.65	23.67	232.81	1.11
Mid	PUSC	QPSK	10 MHz	251.19	35	5	35.88	107.65	**23.98**	**250.03**	1.03
	PUSC	16QAM	10 MHz	251.19	35	5	35.88	107.65	23.57	227.51	1.14
High	PUSC	QPSK	10 MHz	251.19	35	5	35.88	107.65	23.77	238.23	1.08
	PUSC	16QAM	10 MHz	251.19	35	5	35.88	107.65	23.74	236.59	1.09

Note:
The rated power for each zone is within the tune-up range of 23.0 – 24.0 dBm. The rated maximum power is the same for all higher coding rates.

Table 14-5
WIMAX Scaling Factors (5 MHz Bandwidth)

Frequency [MHz]	Zone Type	Modulation	BW	Tune Up Max in mW	CS+TS Slots	CS Slots	1 Control Symbol Power [a*c/b] (mW)	Combined power of CS [d*3] (mW)	Measured Average RF Output Power		SAR Scaling Factor
									dBm	mW	
Low	PUSC	QPSK	5 MHz	251.19	17	5	73.88	221.64	23.79	239.33	1.11
	PUSC	16QAM	5 MHz	251.19	17	5	73.88	221.64	23.55	226.46	1.17
Mid	PUSC	QPSK	5 MHz	251.19	17	5	73.88	221.64	**23.70**	**234.42**	1.13
	PUSC	16QAM	5 MHz	251.19	17	5	73.88	221.64	23.62	230.14	1.16
High	PUSC	QPSK	5 MHz	251.19	17	5	73.88	221.64	23.71	234.96	1.13
	PUSC	16QAM	5 MHz	251.19	17	5	73.88	221.64	23.77	238.23	1.12

Note:
The rated power for each zone is within the tune-up range of 23.0 – 24.0 dBm. The rated maximum power is the same for all higher coding rates.

15 SYSTEM VERIFICATION

15.1 Tissue Verification

Table 15-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
03/14/2011	835H	820	0.867	42.27	0.898	41.571	-3.45%	1.68%
		835	0.872	41.88	0.900	41.500	-3.11%	0.92%
		850	0.893	41.84	0.916	41.500	-2.51%	0.82%
03/15/2011	835B	820	0.941	52.96	0.969	55.284	-2.89%	-4.20%
		835	0.961	52.86	0.970	55.200	-0.93%	-4.24%
		850	0.968	52.69	0.988	55.154	-2.02%	-4.47%
03/16/2011	1900H	1850	1.370	41.96	1.400	40.000	-2.14%	4.90%
		1880	1.405	41.91	1.400	40.000	0.36%	4.77%
		1910	1.429	41.72	1.400	40.000	2.07%	4.30%
03/15/2011	1900B	1850	1.469	53.02	1.520	53.300	-3.36%	-0.53%
		1880	1.484	53.02	1.520	53.300	-2.37%	-0.53%
		1910	1.514	52.77	1.520	53.300	-0.39%	-0.99%
03/02/2011	2450H	2401	1.785	38.29	1.758	39.298	1.54%	-2.57%
		2450	1.825	38.08	1.800	39.200	1.39%	-2.86%
		2499	1.896	37.91	1.852	39.135	2.38%	-3.13%
03/02/2011	2450B	2401	1.814	51.23	1.903	52.765	-4.68%	-2.91%
		2450	1.879	51.11	1.950	52.700	-3.64%	-3.02%
		2499	1.946	50.99	2.019	52.638	-3.62%	-3.13%
04/07/2011	2600H	2600	2.044	37.49	1.960	39.000	4.29%	-3.87%
04/07/2011	2600B	2600	2.253	50.17	2.163	52.509	4.16%	-4.45%

Note: FCC KDB Publication 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the DUT frequencies.

The above measured tissue parameter measurement points were imported into the DASY software in order for the system manufacturer software interpolate the dielectric parameters at the DUT test frequencies according to IEEE 1528 6.6.1.2. The parameters indicated on the SAR test plots may slightly differ from the table above since the DASY software rounds to three significant digits.

15.2 Measurement Procedure for Tissue verification

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity , for example from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{\left[\ln(b/a)\right]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

15.3 Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D2450V2 SN: 719								
	Head				Body			
Date of Measurement	Return Loss (dB)	Δ %	Impedance (Ω)	ΔΩ	Return Loss (dB)	Δ %	Impedance (Ω)	ΔΩ
8/27/2009	-28.6		53.4		-27.2		48.2	0.0
3/2/2011	-28.6	0.0%	52	-1.4	-27.4	0.7%	49.9	1.7

15.4 Test System Verification

Prior to SAR testing, the SAR measurement system was verified to ±10% of the SAR reference measurement using a calibrated SAR dipole. This reference measurement for SAR was considered for the target value (Determined from the SAR dipole calibration certificate).

Table 15-2
System Verification Results

System Verification TARGET & MEASURED										
Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Tissue Frequency (MHz)	Dipole SN	Tissue Type	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	Deviation (%)
03/14/2011	24.3	22.4	0.063	835	4d047	Head	0.589	9.530	9.349	-1.90%
03/15/2011	23.8	22.1	0.063	835	4d047	Body	0.622	9.850	9.873	0.23%
03/16/2011	23.9	22.3	0.040	1900	502	Head	1.58	40.200	39.500	-1.74%
03/15/2011	24.1	22.8	0.040	1900	502	Body	1.62	41.100	40.500	-1.46%
03/02/2011	23.8	21.9	0.025	2450	719	Head	1.27	53.500	50.800	-5.05%
03/02/2011	23.5	21.7	0.025	2450	719	Body	1.35	51.400	54.000	5.06%
04/07/2011	23.8	22.2	0.0129	2600	1004	Head	0.794	56.600	61.550	8.75%
04/07/2011	22.5	21.1	0.0158	2600	1027	Body	0.945	58.700	59.810	1.89%

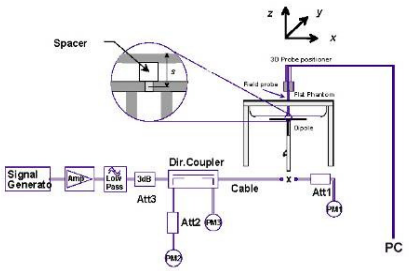


Figure 15-1
System Verification Setup Diagram

Figure 15-2
System Verification Sample Setup

16 PERSONAL WIRELESS ROUTER CONSIDERATIONS

16.1 Personal Wireless Router Considerations by the FCC

Some battery-operated handsets have the capability to transmit and receive internet connectivity through simultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC has provided guidance in KDB Publication 941225 D06 where SAR test considerations are based on a composite test separation distance of 10 mm from the edges, front and back of the device with antennas 2.5 cm or closer to the edge of the device, determined from general mixed use conditions for this type of devices.

Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

16.2 SAR Test Setup for Personal Wireless Router Features

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions.

Therefore, SAR must be evaluated for each frequency transmission and mode separately and summed with the WIFI transmitter according to KDB 648474 publication procedures. Therefore, the measurements were performed for each standalone transmitter for the required exposure conditions. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SAR measurements were valid within a single transmission frequency.

16.3 Power Reduction for Portable Hotspot Mode

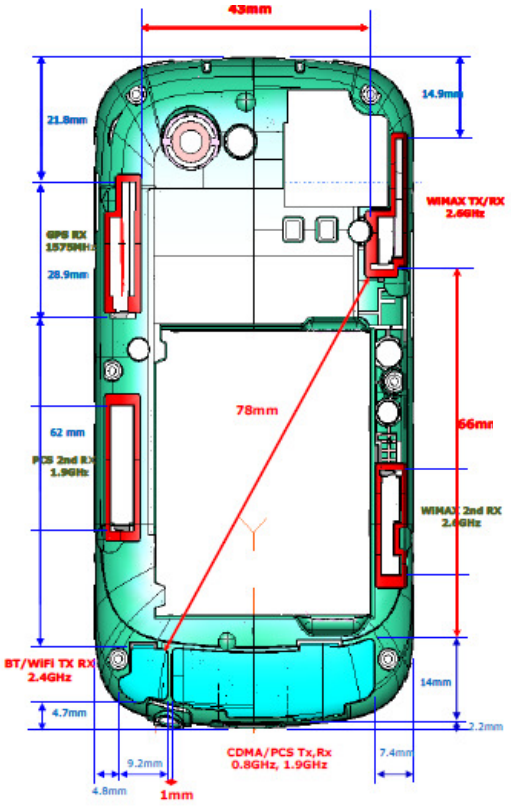
This device does not implement any power reduction when placed in “Portable Hotspot” mode.

16.4 Hotspot SAR Test Configurations

Table 16-1
Mobile Hotspot Side Exclusions

Mobile Hotspot Side for SAR Testing						
Mode	**Back**	**Front**	**Top**	**Bottom**	**Right**	**Left**
Cellular EVDO	Yes	Yes	No	Yes	Yes	Yes
PCS EVDO	Yes	Yes	No	Yes	Yes	Yes
WIFI	Yes	Yes	No	Yes	Yes	No
WIMAX	Yes	Yes	Yes	No	No	Yes

Top



Right Left

Bottom

Figure 16-1
Identification of Sides for SAR Testing (Back View)

Note: Per FCC KDB Publication 941225 D06, the edges with antennas within 2.5 cm are required to be evaluated for SAR. See
Figure 16-1 for distances of the actual device.

17 SAR DATA SUMMARY

Table 17-1
Standalone Cell CDMA Head SAR

MEASUREMENT RESULTS								
FREQUENCY		Mode/Band	C_Power[dBm]		Side	Test Position	Serial Number	SAR (1g)
MHz	Ch.		Start	End				(W/kg)
836.52	384	Cell. CDMA	24.95	25.01	Right	Touch	62	**0.468**
836.52	384	Cell. CDMA	24.95	24.87	Right	Tilt	62	**0.404**
836.52	384	Cell. CDMA	24.95	24.99	Left	Touch	62	**0.488**
836.52	384	Cell. CDMA	24.95	24.86	Left	Tilt	62	**0.382**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Brain** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. All samples tested were electrically identical per the applicant.
7. CDMA200 mode Head SAR was tested under RC3/SO55.
8. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard RFID cover. The technical description contains detailed information about the near field communications antenna.
9. All samples tested were electrically identical per the manufacturer.

Table 17-2
Standalone PCS CDMA Head SAR

MEASUREMENT RESULTS								
FREQUENCY		Mode/Band	C_Power[dBm]		Side	Test Position	Serial Number	SAR (1g)
MHz	Ch.		Start	End				(W/kg)
1880.00	600	PCS CDMA	25.00	25.02	Right	Touch	62	**0.644**
1880.00	600	PCS CDMA	25.00	25.00	Right	Tilt	62	**0.214**
1880.00	600	PCS CDMA	25.00	25.08	Left	Touch	62	**0.365**
1880.00	600	PCS CDMA	25.00	24.97	Left	Tilt	62	**0.229**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Brain** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. All samples tested were electrically identical per the applicant.
7. CDMA200 mode Head SAR was tested under RC3/SO55.
8. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard RFID cover. The technical description contains detailed information about the near field communications antenna.
9. All samples tested were electrically identical per the manufacturer.

Table 17-3
Standalone 2.4 GHz WIFI Data Head SAR

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	C_Power[dBm]		Side	Test Position	Serial Number	Data Rate (Mbps)	SAR (1g)
MHz	Ch.			Start	End					(W/kg)
2437	6	IEEE 802.11b	DSSS	16.90	16.84	Right	Touch	RF #2	1	**0.195**
2437	6	IEEE 802.11b	DSSS	16.90	16.86	Right	Tilt	RF #2	1	**0.044**
2437	6	IEEE 802.11b	DSSS	16.90	16.90	Left	Touch	RF #2	1	**0.070**
2437	6	IEEE 802.11b	DSSS	16.90	16.87	Left	Tilt	RF #2	1	**0.048**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**						**Brain** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n) were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
6. WLAN transmission was verified using a spectrum analyzer.
7. All samples tested were electrically identical per the applicant.
8. WIFI mode does not have voice capability, but can transmit simultaneously with a CDMA voice call. Therefore, the WIFI Head SAR results were used to evaluate simultaneous transmission cases only (see Section 19.2.1).
9. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard RFID cover. The technical description contains detailed information about the near field communications antenna.
10. All samples tested were electrically identical per the manufacturer.

Table 17-4
Standalone WIMAX Head SAR

MEASUREMENT RESULTS													
FREQUENCY		Mode/Band	Zone Type	Modulation	Bandwidth (MHz)	C_Power[dBm]		Side	Test Position	Serial Number	SAR (1g)	Scaling Factor	Scaled SAR (1g)
MHz	Ch.					Start	End				(W/kg)		(W/kg)
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.78	Right	Touch	62	0.332	**1.13**	0.377
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	24.04	Right	Touch	62	**0.407**	**1.03**	**0.421**
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.73	Right	Tilt	62	0.121	**1.13**	0.137
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	24.00	Right	Tilt	62	**0.150**	**1.03**	0.155
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.74	Left	Touch	62	0.176	**1.13**	0.200
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	23.99	Left	Touch	62	**0.190**	**1.03**	0.196
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.65	Left	Tilt	62	0.152	**1.13**	0.172
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	24.01	Left	Tilt	62	**0.154**	**1.03**	0.159
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**								**Brain** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. All samples tested were electrically identical per the applicant.
7. WIMAX mode does not have voice capability, but can transmit simultaneously with a CDMA voice call. Therefore, the WIMAX Head SAR results were used to evaluate simultaneous transmission cases only (see Section 19.2.1).
8. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard cover. The technical description contains further technical information about the near field communications antenna.
9. All samples tested were electrically identical per the manufacturer.
10. SAR Test configurations per April and Oct. 2010 TCB Workshop Notes:
    a. This device supports two coding rates (1/2 and 3/4) that are rated to the same maximum output power. Since the higher rates were not more than 0.25 dB from the lowest coding rate, only the lowest coding rate (1/2) was tested.
    b. 16 QAM was not required to be tested since the output power for 16-QAM was not more than 0.25 higher than QPSK and the QPSK SAR was less than 0.8 W/kg.
    c. This device supports only PUSC zone type.
    d. WIMAX SAR was scaled according to FCC WIMAX requirements (See Section 14.7). The device was configured to operate with 15 traffic symbols active and the 3 control symbols inactive for SAR testing purposes. The SAR result was then scaled up to the maximum tune up power for both the maximum output power for 15 traffic symbols and 3 control symbols. The SAR plots reflect measured SAR values.
    e. Crest Factor used for the SAR system for the WIMAX signal for 5 MHz and 10 MHz BW was 1/(15/48) = 3.2.
    f. The scaled SAR was used to determine test reduction scenarios.

Table 17-5
Standalone CDMA Body-Worn SAR

MEASUREMENT RESULTS									
FREQUENCY		Mode	Service	C_Power[dBm]		Spacing	Serial Number	Side	SAR (1g)
MHz	Ch.			Start	End				(W/kg)
836.52	384	Cell. CDMA	TDSO32	24.98	25.01	1.0 cm	62	back	**0.548**
1851.25	25	PCS CDMA	TDSO32	24.86	24.93	1.0 cm	62	back	0.712
1880.00	600	PCS CDMA	TDSO32	24.76	24.69	1.0 cm	62	back	**0.916**
1908.75	1175	PCS CDMA	TDSO32	24.78	24.71	1.0 cm	62	back	0.834
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**						**Body** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard RFID cover. The technical description contains detailed information about the near field communications antenna.
7. Body-Worn SAR was tested under RC3/SO32 with FCH only since FCH+SCH modes are not greater than 0.25 dB of the FCH only mode.
8. All samples tested were electrically identical per the manufacturer.

Table 17-6
Standalone CDMA Body Hotspot SAR

MEASUREMENT RESULTS									
FREQUENCY		Mode	Service	C_Power[dBm]		Spacing	Serial Number	Side	SAR (1g)
MHz	Ch.			Start	End				(W/kg)
836.52	384	Cell. CDMA	EVDO	24.95	24.95	1.0 cm	62	back	**0.559**
836.52	384	Cell. CDMA	EVDO	24.95	24.95	1.0 cm	62	front	**0.333**
836.52	384	Cell. CDMA	EVDO	24.95	24.95	1.0 cm	62	left	**0.359**
836.52	384	Cell. CDMA	EVDO	24.95	24.95	1.0 cm	62	right	**0.310**
836.52	384	Cell. CDMA	EVDO	24.95	24.94	1.0 cm	62	bottom	**0.076**
1851.25	25	PCS CDMA	EVDO	25.11	25.15	1.0 cm	62	back	**0.817**
1880.00	600	PCS CDMA	EVDO	25.11	25.16	1.0 cm	62	back	**0.951**
1908.75	1175	PCS CDMA	EVDO	25.25	25.18	1.0 cm	62	back	**0.905**
1880.00	600	PCS CDMA	EVDO	25.11	25.07	1.0 cm	62	front	**0.235**
1851.25	25	PCS CDMA	EVDO	25.11	25.11	1.0 cm	62	bottom	**0.593**
1880.00	600	PCS CDMA	EVDO	25.11	25.20	1.0 cm	62	bottom	**0.814**
1908.75	1175	PCS CDMA	EVDO	25.25	25.30	1.0 cm	62	bottom	**0.643**
1880.00	600	PCS CDMA	EVDO	25.11	25.05	1.0 cm	62	right	**0.096**
1880.00	600	PCS CDMA	EVDO	25.11	25.11	1.0 cm	62	left	**0.103**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**						**Body** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. SAR evaluation requires a single frequency of measurement for valid measurements using the SAR probe and tissue calibrated which are calibrated for specific limited frequency ranges. Therefore, during SAR evaluation it was ensured that the WIFI transmission was disabled by the manufacturer to assess the standalone SAR to be evaluated for SAR. WIFI SAR was separately evaluated to account for the WIFI SAR for portable hotspot exposure conditions (See Section 6).
7. Top edge for was not required since the antenna distance from the respective edges were greater than 2.5 cm according to the FCC KDB Publication 941225 D06. (See Section 16.4).
8. CDMA Hotspot Body SAR was tested under EVDO Rev. 0 per FCC 3G Guidance (See Section 12.2.5).
9. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard RFID cover. The technical description contains detailed information about the near field communications antenna.
10. All samples tested were electrically identical per the manufacturer.

Table 17-7
Standalone WLAN Hotspot SAR

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	C_Power[dBm]		Spacing	Serial Number	Data Rate (Mbps)	Side	SAR
MHz	Ch.			Start	End					(W/kg)
2437	6	IEEE 802.11b	DSSS	16.90	16.97	1.0 cm	RF #2	1	back	0.081
2437	6	IEEE 802.11b	DSSS	16.90	16.93	1.0 cm	RF #2	1	front	0.053
2437	6	IEEE 802.11b	DSSS	16.90	16.81	1.0 cm	RF #2	1	bottom	0.045
2437	6	IEEE 802.11b	DSSS	16.90	16.86	1.0 cm	RF #2	1	right	0.078
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**						**Body** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. Top and left edges for were not required since the antenna distance from the respective edges were greater than 2.5 cm according to the FCC KDB Publication 941225 D06. (See Section 16.4).
7. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n) were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
8. WLAN transmission was verified using a spectrum analyzer.
9. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard RFID cover. The technical description contains detailed information about the near field communications antenna.
10. All samples tested were electrically identical per the manufacturer.

Table 17-8
Standalone WIMAX Hotspot SAR

MEASUREMENT RESULTS													
FREQUENCY		Mode	Zone Type	Modulation	Bandwidth (MHz)	C_Power[dBm]		Spacing	Serial Number	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)
MHz	Ch.					Start	End				(W/kg)		(W/kg)
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.78	1.0 cm	62	back	**0.357**	**1.13**	**0.405**
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	23.98	1.0 cm	62	back	**0.455**	**1.03**	**0.470**
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.62	1.0 cm	62	front	**0.072**	**1.13**	**0.082**
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	23.98	1.0 cm	62	front	**0.088**	**1.03**	**0.091**
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.70	1.0 cm	62	top	**0.085**	**1.13**	**0.097**
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	24.00	1.0 cm	62	top	**0.068**	**1.03**	**0.070**
2600	Mid	WIMAX	PUSC	QPSK	5	23.70	23.70	1.0 cm	62	left	**0.308**	**1.13**	**0.349**
2600	Mid	WIMAX	PUSC	QPSK	10	23.98	23.92	1.0 cm	62	left	**0.369**	**1.03**	**0.381**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**								**Body** **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 were according to FCC/OET Bulletin 65, Supplement C.
2. Tissue parameters and temperatures are listed on the SAR plots.
3. Batteries are fully charged for all readings. Standard battery was used.
4. Liquid tissue depth was at least 15.0 cm.
5. Justification for reduced test configurations for mid channel: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6. SAR evaluation requires a single frequency of measurement for valid measurements using the SAR probe and tissue calibrated which are calibrated for specific limited frequency ranges. Therefore, during SAR evaluation it was ensured that the WIFI transmission was disabled by the manufacturer to assess the standalone SAR to be evaluated for SAR. WIFI SAR was separately evaluated to account for the WIFI SAR for portable hotspot exposure conditions (See Section 16).
7. Bottom and right edges for was not required since the antenna distance from the respective edges were greater than 2.5 cm according to the FCC KDB Publication 941225 D06 (See Section 16.4).
8. The standard battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard cover. The technical description contains further technical information about the near field communications antenna.
9. All samples tested were electrically identical per the manufacturer.
10. SAR Test configurations:
    a. This device supports two coding rates (1/2 and 3/4) that are rated to the same maximum output power. Since the higher rates were not more than 0.25 dB from the lowest coding rate, only the lowest coding rate (1/2) was tested.
    b. 16 QAM was not required to be tested since the output power for 16-QAM was not more than 0.25 higher than QPSK and the QPSK SAR was less than 0.8 W/kg (Oct 2010 TCB Workshop Notes)
    c. This device supports only PUSC zone type.
    d. WIMAX SAR was scaled according to FCC WIMAX requirements (See Section 14.7). The device was configured to operate with 15 traffic symbols active and the 3 control symbols inactive for SAR testing purposes. The SAR result was then scaled up to the maximum tune up power for both the maximum output power for 15 traffic symbols and 3 control symbols. The SAR plots reflect measured SAR values.
    e. Crest Factor used for the SAR system for the WIMAX signal for 5 MHz and 10 MHz BW was 1/(15/48) = 3.2.
    f. The scaled SAR was used to determine test reduction scenarios.

18 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

18.1 Introduction

The following procedures adopted from "FCC SAR Considerations for Cell Phones with Multiple Transmitters" FCC KDB Publication 648474 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

18.2 FCC Power Tables & Conditions

	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P_{Ref}	12	6	5	mW
Device output power should be rounded to the nearest mW to compare with values specified in this table.				

Figure 18-1
Output Power Thresholds for Unlicensed Transmitters

	Individual Transmitter	Simultaneous Transmission
Licensed Transmitters	Routine evaluation required	SAR not required: Unlicensed only ○ when stand-alone 1-g SAR is not required and antenna is ≥ 5 cm from other antennas Licensed & Unlicensed ○ when the sum of the 1-g SAR is < 1.6 W/kg for all simultaneous transmitting antennas ○ when SAR to peak location separation ratio of simultaneous transmitting antenna pair is < 0.3
Unlicensed Transmitters	When there is no simultaneous transmission – ○ output ≤ 60/f: SAR not required ○ output > 60/f: stand-alone SAR required When there is simultaneous transmission – Stand-alone SAR not required when ○ output ≤ 2·P_{Ref} and antenna is ≥ 5.0 cm from other antennas ○ output ≤ P_{Ref} and antenna is ≥ 2.5 cm from other antennas ○ output ≤ P_{Ref} and antenna is < 2.5 cm from other antennas, each with either output power ≤ P_{Ref} or 1-g SAR < 1.2 W/kg Otherwise stand-alone SAR is required When stand-alone SAR is required ○ test SAR on highest output channel for each wireless mode and exposure condition ○ if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures	SAR required: Licensed & Unlicensed antenna pairs with SAR to peak location separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply

Figure 18-2
SAR Evaluation Requirements for Multiple Transmitter Handsets

18.3 Multiple Antenna/Transmission Information

RF Conducted Power of Bluetooth Tx is 11.402 mW. RF Conducted Power of WLAN is 51.29 mW.

Based on the output power, antenna separation distance and the body SAR of the dominant licensed transmitter, a stand-alone Bluetooth SAR test was not required, but stand-alone SAR is required for WLAN.

19 MULTIPLE TRANSMITTER SAR EVALUATION

These following sections include multiple transmitter SAR calculations and measurement in accordance with KDB 648474 publication FCC guidance.

19.1 Simultaneous Transmission Scenarios

All possible simultaneous transmission scenarios are shown in Table 17-8. Bluetooth cannot transmit with WIFI (same RF path) but can additionally transmit with CDMA/EVDO and WIMAX for Body SAR conditions only. Bluetooth was not required to be required to be measured and is 0 W/kg for all summation analysis. WIMAX and WLAN can transmit simultaneously as a hotspot condition.

CDMA supports voice and data modes. WIFI and WIMAX support data communication only.

Table 19-1
Possible Simultaneous Transmission Scenarios

No.	Capable Tx Configurations	Head SAR	Body SAR	Note
1	CDMA	√	√	Standalone 1X-RTT CDMA
2	EVDO	x	√	Standalone EVDO
3	WIMAX	x	√	Standalone WIMAX
4	WIFI	x	√	Standalone WIFI
5	CDMA+WIMAX	√	√	1X Voice + WIMAX Data
6	CDMA+WIFI	√	√	1X Voice + WIFI Data
7	WIMAX+WIFI	x	√	WIMAX+WIFI Hotspot
8	EVDO+WIFI	x	√	EVDO+WIFI Hotspot
9	WIMAX+EVDO	-	-	Not supported. SW disabled by Samsung
10	WIMAX+EVDO+WIFI	-	-	Not supported. SW disabled by Samsung
11	CDMA+WIMAX+WIFI	-	-	Not supported. SW disabled by Samsung
12	CDMA+EVDO	-	-	Not Supported on current HW structure (CDMA and EVDO use same RF Path)
13	CDMA+EVDO+WIFI	-	-	Not supported. SW disabled by Samsung
14	CDMA+WIMAX+EVDO	-	-	Not supported. SW disabled by Samsung
15	CDMA+WIMAX+EVDO+WIFI	-	-	Not supported. SW disabled by Samsung

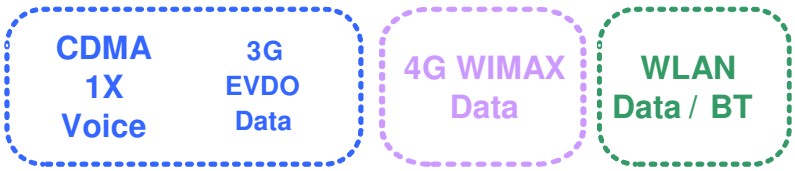


Figure 19-1
Simultaneous Transmission Paths

19.2 Simultaneous Transmission SAR Numerical Summed SAR

19.2.1 Head SAR Simultaneous Transmission Analysis

Table 19-2
Cellular CDMA + WIMAX + WIFI Simultaneous Tx Held-to-Ear

	Configuration	Cell CDMA SAR (W/kg)	WIMAX SAR (Scaled) (W/kg)	WIFI SAR (W/kg)	Σ SAR (W/kg)				SPLS Ratio per KDB Pub 648474	Simultaneous Transmission (with Volume Scan) SAR (W/kg)
Head SAR	Output Power	25	24	17	CDMA Voice + WIMAX	CDMA Voice + WIFI	WIMAX + WIFI	CDMA Voice + WIMAX + WIFI Hotspot		
	Transmitter	1	2	3	1+2	1+3	2+3	1+2+3		
	Right Cheek	0.468	0.421	0.195	0.889	0.663	N/A	N/A	N/A	N/A
	Right Tilt	0.404	0.155	0.044	0.559	0.448	N/A	N/A	N/A	N/A
	Left Cheek	0.488	0.200	0.070	0.688	0.558	N/A	N/A	N/A	N/A
	Left Tilt	0.382	0.172	0.048	0.554	0.430	N/A	N/A	N/A	N/A

Note:
1. Voice is only supported with CDMA transmission. WIMAX and WIFI were additionally measured in the head to support simultaneous transmission scenarios. WIMAX + WIFI is not a possible simultaneous transmission scenario in a held to ear position because there is no voice transmission.
2. Since the numerical sums were below 1.6 W/kg for, no SAR ratio analysis or aggregate volumetric SAR evaluations for the transmitters was required.

Table 19-3
PCS CDMA + WIMAX + WIFI Simultaneous Tx Held-to-Ear

	Configuration	PCS CDMA SAR (W/kg)	WIMAX SAR (Scaled) (W/kg)	WIFI SAR (W/kg)	Σ SAR (W/kg)				SPLS Ratio per KDB Pub 648474	Simultaneous Transmission (with Volume Scan) SAR (W/kg)
Head SAR	Output Power	25	24	17	CDMA Voice + WIMAX	CDMA Voice + WIFI	WIMAX + WIFI	CDMA Voice + WIMAX + WIFI Hotspot		
	Transmitter	1	2	3	1+2	1+3	2+3	1+2+3		
	Right Cheek	0.644	0.421	0.195	1.065	0.839	N/A	N/A	N/A	N/A
	Right Tilt	0.214	0.155	0.044	0.369	0.258	N/A	N/A	N/A	N/A
	Left Cheek	0.365	0.200	0.070	0.565	0.435	N/A	N/A	N/A	N/A
	Left Tilt	0.229	0.172	0.048	0.401	0.277	N/A	N/A	N/A	N/A

Note:
1. Voice is only supported with CDMA transmission. WIMAX and WIFI were additionally measured in the head to support simultaneous transmission scenarios. WIMAX + WIFI is not a possible simultaneous transmission scenario in a held to ear position because there is no voice transmission.
2. Since the numerical sums were below 1.6 W/kg for, no SAR ratio analysis or aggregate volumetric SAR evaluations for the transmitters was required.

Table 19-4
Cellular CDMA + WIMAX + WIFI Simultaneous Tx

	Configuration	Cell CDMA/EVDO SAR (W/kg)	WIMAX SAR (Scaled) (W/kg)	WIFI SAR (W/kg)	Σ SAR (W/kg)				SPLS Ratio per KDB Pub 648474	Simultaneous Transmission (with Volume Scan) SAR (W/kg)
Body SAR	Output Power	25	24	17	1x Voice + WIMAX Data	EVDO + WIFI Hotspot	WIMAX + WIFI Hotspot	1x Voice + WIMAX Data + WIFI Hotspot		
	Transmitter	1	2	3	1+2	1+3	2+3	1+2+3		
	Back	0.559	0.470	0.081	1.029	0.640	0.551	N/A	N/A	N/A
	Front	0.333	0.091	0.053	0.424	0.386	0.144	N/A	N/A	N/A
	Top	0.000	0.097	0.000	0.097	0.000	0.097	N/A	N/A	N/A
	Bottom	0.076	0.000	0.045	0.076	0.121	0.045	N/A	N/A	N/A
	Right	0.310	0.000	0.078	0.310	0.388	0.078	N/A	N/A	N/A
	Left	0.359	0.381	0.000	0.740	0.359	0.381	N/A	N/A	N/A

Notes:

1. Per FCC KDB Publication 941225 D06, when the antenna distance from the edge was greater than 2.5 cm, SAR is not required and is 0 W/kg for summation analysis..
2. All Body SAR was performed at 1.0 cm spacing.
3. Bluetooth can transmit simultaneously with CDMA/EVDO and WIMAX (but not WIFI) and is 0 W/kg for summation analysis purposes.
4. Since the numerical sums were below 1.6 W/kg for, no SAR ratio analysis or aggregate volumetric SAR evaluations for the transmitters was required.

Table 19-5
PCS CDMA + WIMAX + WIFI Simultaneous Tx

	Configuration	PCS CDMA/EVDO SAR (W/kg)	WIMAX SAR (Scaled) (W/kg)	WIFI SAR (W/kg)	Σ SAR (W/kg)				SPLS Ratio per KDB Pub 648474	Simultaneous Transmission (with Volume Scan) SAR (W/kg)
Body SAR	Output Power	25	24	17	1x Voice + WIMAX Data	EVDO + WIFI Hotspot	WIMAX + WIFI Hotspot	1x Voice + WIMAX Data + WIFI Hotspot		
	Transmitter	1	2	3	1+2	1+3	2+3	1+2+3		
	Back	0.951	0.470	0.081	1.421	1.032	0.551	N/A	N/A	N/A
	Front	0.235	0.091	0.053	0.326	0.288	0.144	N/A	N/A	N/A
	Top	0.000	0.097	0.000	0.097	0.000	0.097	N/A	N/A	N/A
	Bottom	0.814	0.000	0.045	0.814	0.859	0.045	N/A	N/A	N/A
	Right	0.096	0.000	0.078	0.096	0.174	0.078	N/A	N/A	N/A
	Left	0.103	0.381	0.000	0.484	0.103	0.381	N/A	N/A	N/A

Notes:

1. Per FCC KDB Publication 941225 D06, when the antenna distance from the edge was greater than 2.5 cm, SAR is not required and is 0 W/kg for summation analysis.
2. All Body SAR was performed at 1.0 cm spacing.
3. Bluetooth can transmit simultaneously with CDMA/EVDO and WIMAX (but not WIFI) and is 0 W/kg for summation analysis purposes
4. Since the numerical sums were below 1.6 W/kg for, no SAR ratio analysis or aggregate volumetric SAR evaluations for the transmitters was required.

20 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	85070B	Dielectric Probe Kit	8/22/2010	Annual	8/22/2011	US33020316
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/13/2010	Annual	10/13/2011	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	3/31/2010	Annual	3/31/2011	JP38020182
Agilent	E5515C	Wireless Communications Test Set	10/11/2010	Annual	10/11/2011	GB46110872
Agilent	E5515C	Wireless Communications Test Set	10/8/2010	Annual	10/8/2011	GB46310798
Agilent	E5515C	Wireless Communications Test Set	8/13/2010	Annual	8/13/2011	GB41450275
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/30/2010	Annual	3/30/2011	MY45470194
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/11/2010	Annual	10/11/2011	1833460
Gigatronics	8651A	Universal Power Meter	10/11/2010	Annual	10/11/2011	8650319
Index SAR	IXTL-010	Dielectric Measurement Kit	N/A		N/A	N/A
Index SAR	IXTL-030	30MM TEM line for 6 GHz	N/A		N/A	N/A
Pasternack	PE2208-6	Bidirectional Coupler	N/A		N/A	N/A
Pasternack	PE2209-10	Bidirectional Coupler	N/A		N/A	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	11/11/2010	Annual	11/11/2011	836371/0079
Rohde & Schwarz	CMU200	Base Station Simulator	6/21/2010	Annual	6/21/2011	833855/0010
SPEAG	D1450V2	1450 MHz SAR Dipole	5/20/2009	Biennial	5/20/2011	1025
SPEAG	D1765V2	1765 MHz SAR Dipole	5/19/2009	Biennial	5/19/2011	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	2/17/2011	Annual	2/17/2012	502
SPEAG	D1900V2	1900 MHz SAR Dipole	8/18/2009	Biennial	8/18/2011	5d080
SPEAG	D2450V2	2450 MHz SAR Dipole	8/27/2009	Biennial	8/27/2011	719
SPEAG	D2450V2	2450 MHz SAR Dipole	2/8/2011	Annual	2/8/2012	797
SPEAG	D2600V2	2600 MHz SAR Dipole	4/16/2010	Biennial	4/16/2011	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	8/19/2009	Biennial	8/19/2011	1007
SPEAG	D5GHzV2	5 GHz SAR Dipole	2/11/2011	Annual	2/11/2012	1057
SPEAG	D835V2	835 MHz SAR Dipole	2/9/2011	Annual	2/9/2012	4d047
SPEAG	D835V2	835 MHz SAR Dipole	8/24/2009	Biennial	8/24/2011	4d026
SPEAG	DAE3	Dasy Data Acquisition Electronics	11/18/2010	Annual	11/18/2011	455
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/22/2010	Annual	3/22/2011	704
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/21/2010	Annual	4/21/2011	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/21/2011	Annual	2/21/2012	649
SPEAG	ES3DV2	SAR Probe	9/21/2010	Annual	9/21/2011	3022
SPEAG	EX3DV4	SAR Probe	8/19/2010	Annual	8/19/2011	3561
SPEAG	EX3DV4	SAR Probe	2/14/2011	Annual	2/14/2012	3550
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/8/2010	Annual	7/8/2011	859
SPEAG	D750V3	750 MHz Dipole	2/14/2011	Annual	2/14/2012	1003
SPEAG	ES3DV3	SAR Probe	4/20/2010	Annual	4/20/2011	3209
Rohde & Schwarz	SMIQ03B	Signal Generator	4/1/2010	Annual	4/1/2011	DE27259
SPEAG	D1640V2	1640 MHz Dipole	8/17/2010	Biennial	8/17/2012	321
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	8/30/2010	Annual	8/30/2011	100976
Agilent	8648D	Signal Generator	4/1/2010	Annual	4/1/2011	3629U00687
Aprel	ALS-PR-DIEL	Dielectric Probe Kit	N/A		N/A	260-00959
Agilent	E5515C	Wireless Communications Test Set	8/13/2010	Annual	8/13/2011	GB43304447
Agilent	E5515C	Wireless Communications Tester	4/14/2010	Annual	4/14/2011	US41140256
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	N/A			17042
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	N/A			N/A
Agilent	E5515C	Wireless Communications Test Set	2/8/2011	Annual	2/8/2012	GB45360985
SPEAG	D2600V2	2600 MHz SAR Dipole	6/17/2010	Annual	6/17/2011	1027

Justification for 2-year calibration cycle for SAR dipoles is found in Section 15.3.

21 MEASUREMENT UNCERTAINTIES

Applicable for 750 – 3000 MHz.

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	5.5	N	1	1.0	1.0	5.5	5.5	∞
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				11.8	11.5	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				23.7	23.0	

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

22 CONCLUSION

22.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, 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: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX, RFID and Bluetooth; Serial: 62

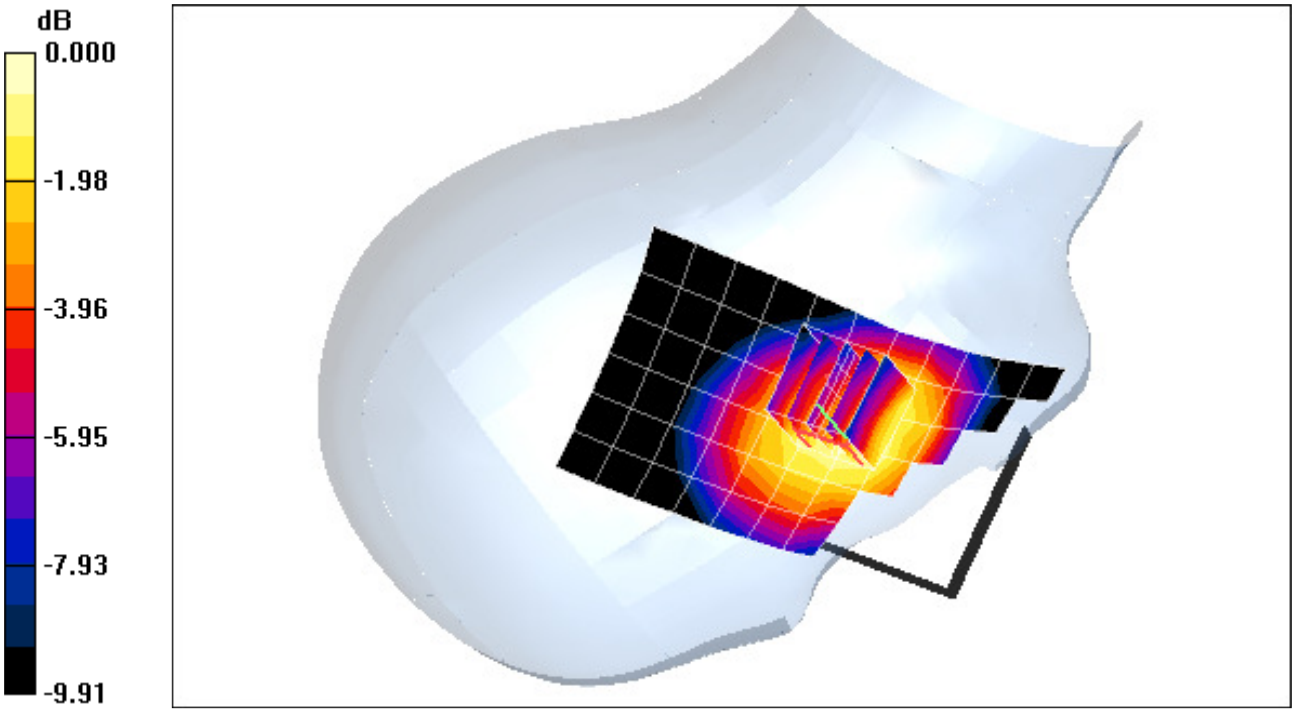
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.874 mho/m; ε_r = 41.88; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-14-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.4 °C

Probe: EX3DV4 - SN3561; ConvF(7.96, 7.96, 7.96); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA, Right Head, Touch, Mid.ch

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.7 V/m
Peak SAR (extrapolated) = 0.712 W/kg
SAR(1 g) = 0.468 mW/g; SAR(10 g) = 0.346 mW/g



0 dB = 0.487mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX, RFID and Bluetooth; Serial: 62

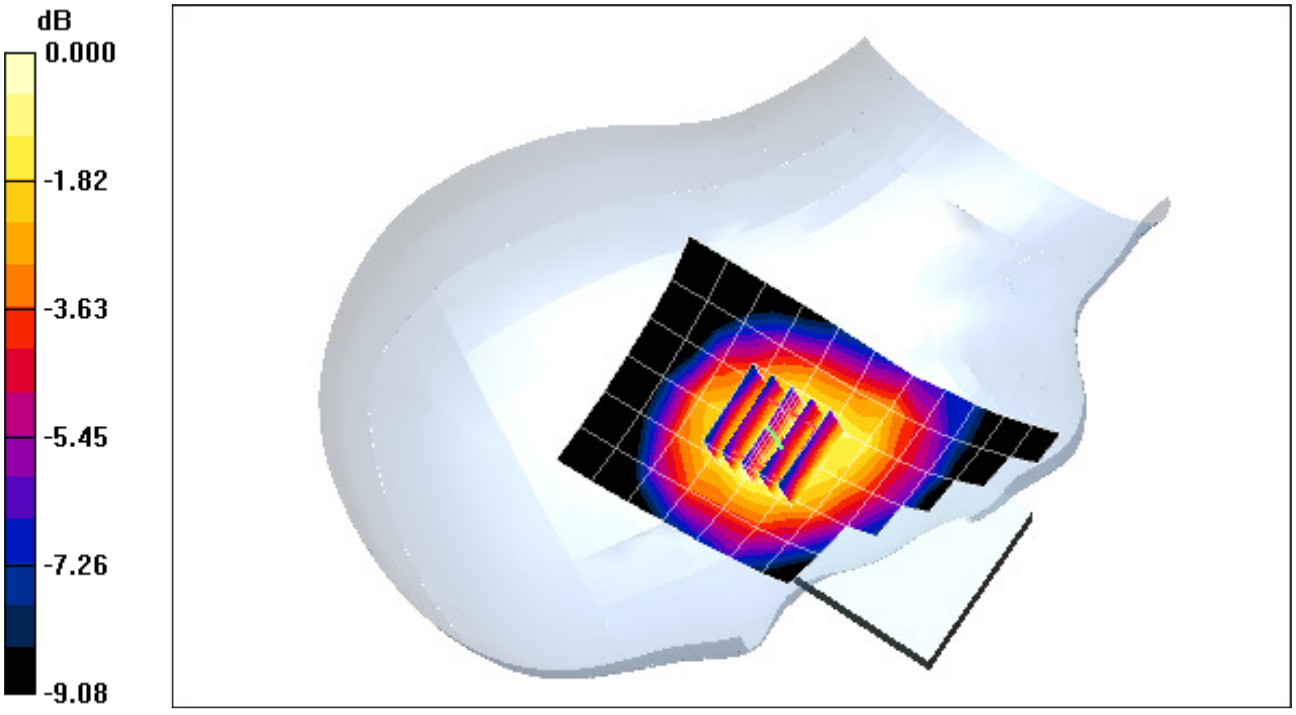
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.874 mho/m; ε_r = 41.88; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-14-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.4 °CC

Probe: EX3DV4 - SN3561; ConvF(7.96, 7.96, 7.96); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA, Right Head, Tilt, Mid.ch

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.7 V/m
Peak SAR (extrapolated) = 0.534 W/kg
SAR(1 g) = 0.404 mW/g; SAR(10 g) = 0.290 mW/g



0 dB = 0.430mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

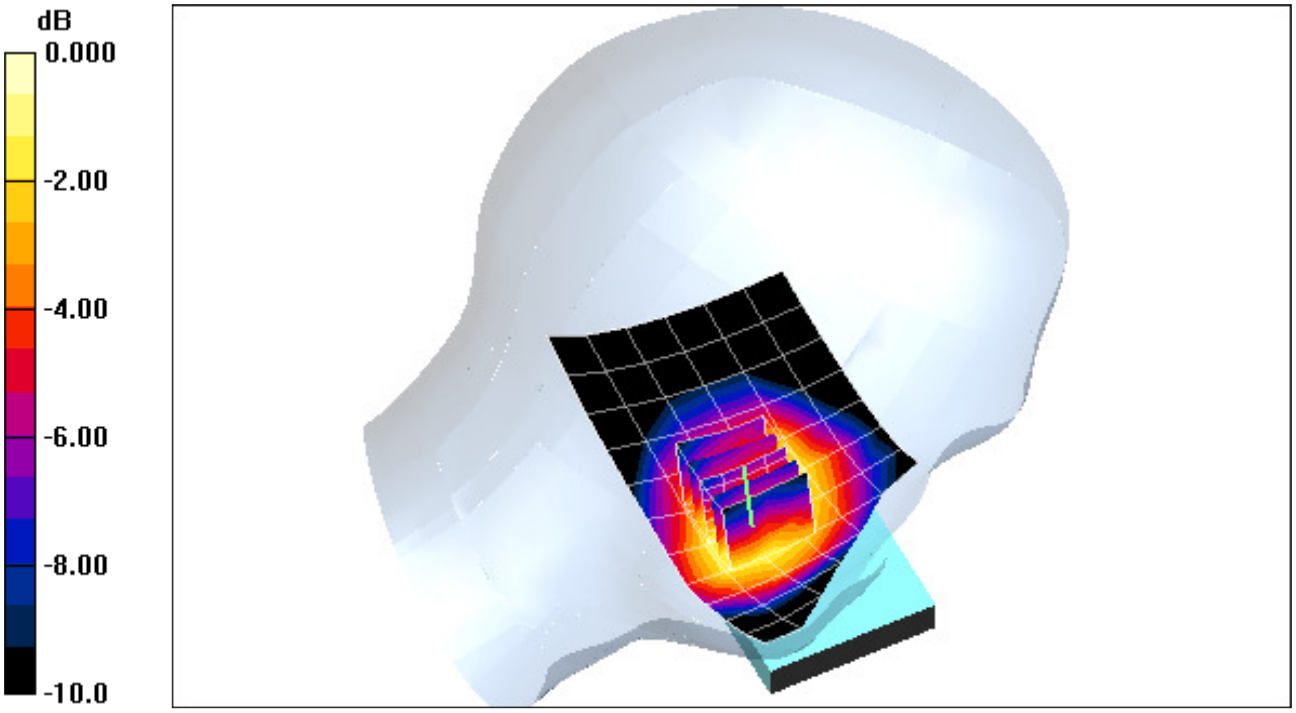
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.874 mho/m; ε_r = 41.88; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-14-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.4 °C

Probe: EX3DV4 - SN3561; ConvF(7.96, 7.96, 7.96); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA, Left Head, Touch, Mid.ch

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.8 V/m
Peak SAR (extrapolated) = 0.634 W/kg
SAR(1 g) = 0.488 mW/g; SAR(10 g) = 0.358 mW/g



0 dB = 0.519mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

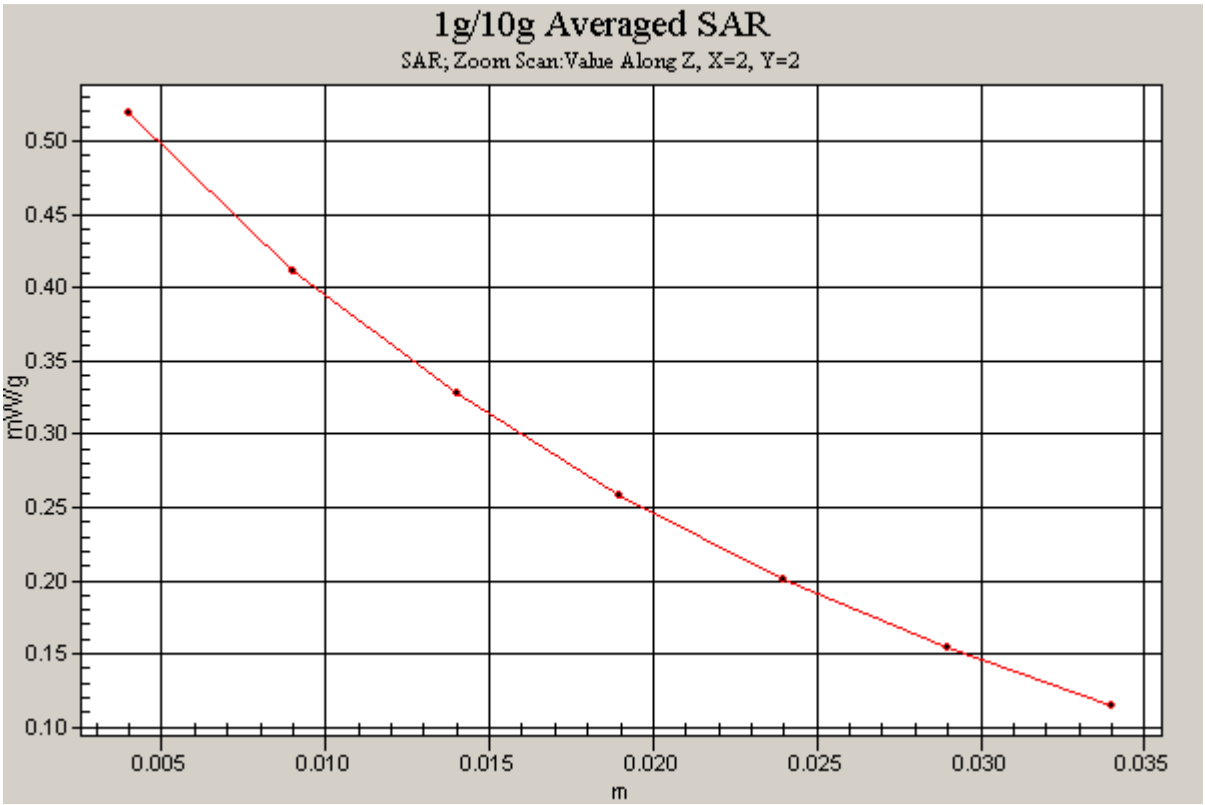
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.874 mho/m; ε_r = 41.88; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-14-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.4 °C

Probe: EX3DV4 - SN3561; ConvF(7.96, 7.96, 7.96); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA, Left Head, Touch, Mid.ch

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.8 V/m
Peak SAR (extrapolated) = 0.634 W/kg
SAR(1 g) = 0.488 mW/g; SAR(10 g) = 0.358 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

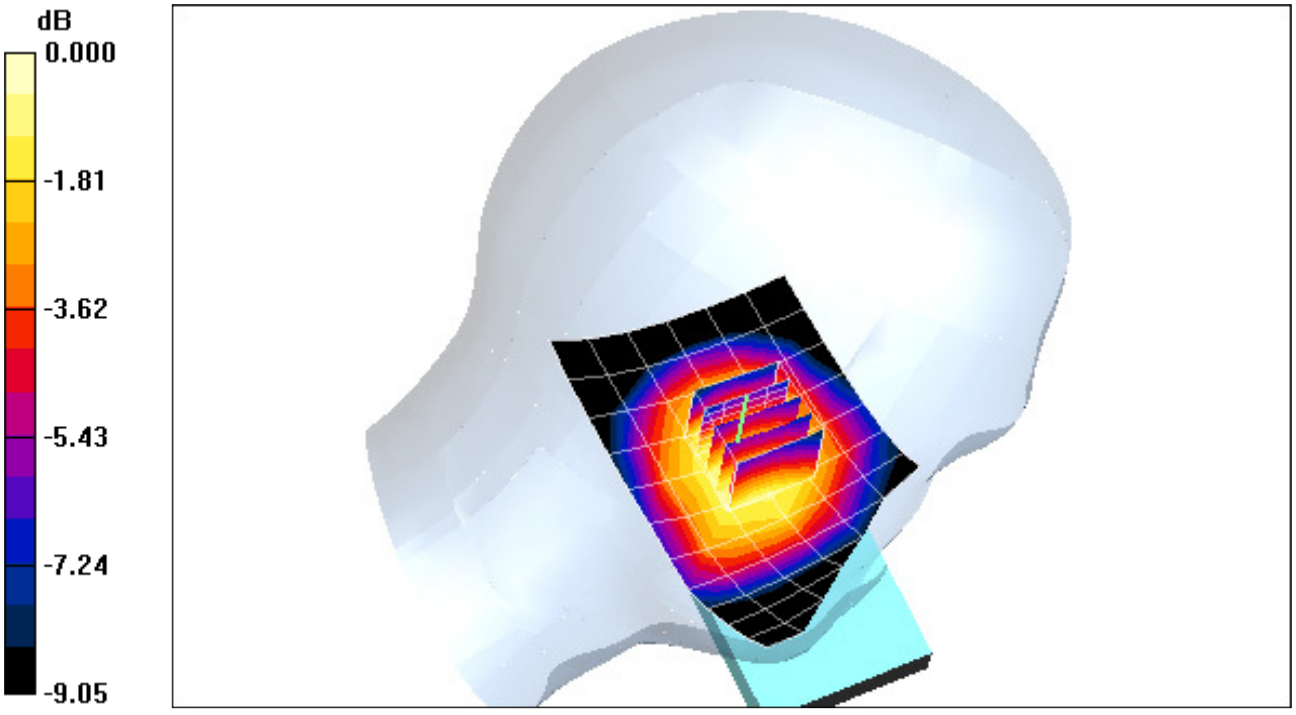
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.874 mho/m; ε_r = 41.88; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-14-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.4 °C

Probe: EX3DV4 - SN3561; ConvF(7.96, 7.96, 7.96); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA, Left Head, Tilt, Mid.ch

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.2 V/m
Peak SAR (extrapolated) = 0.471 W/kg
SAR(1 g) = 0.382 mW/g; SAR(10 g) = 0.290 mW/g



0 dB = 0.402mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

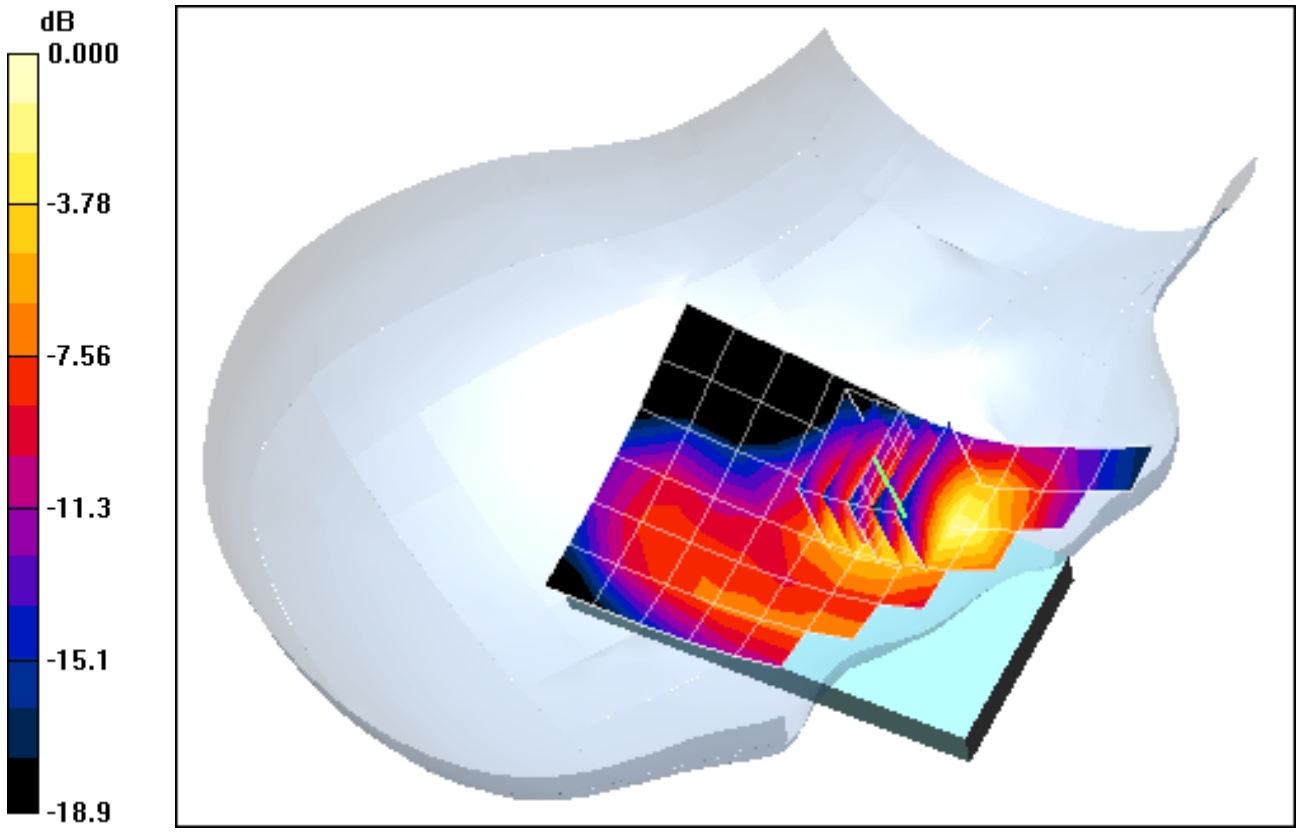
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.41 mho/m; ε_r = 41.9; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-16-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.3 °C

Probe: EX3DV4 - SN3550; ConvF(7.01, 7.01, 7.01); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA, Right Head, Touch, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.0 V/m
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.644 mW/g; SAR(10 g) = 0.354 mW/g



0 dB = 0.710mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

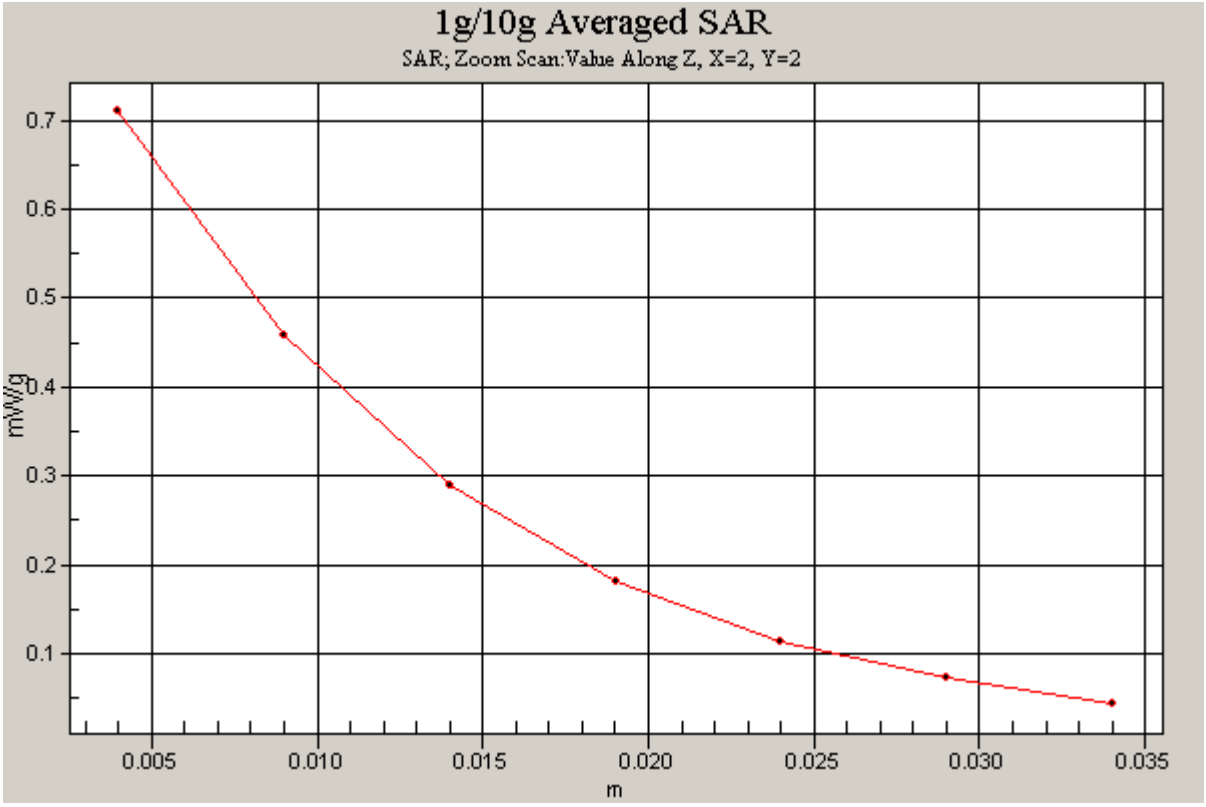
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.41 mho/m; ε_r = 41.9; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-16-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.3 °C

Probe: EX3DV4 - SN3550; ConvF(7.01, 7.01, 7.01); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA, Right Head, Touch, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.0 V/m
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.644 mW/g; SAR(10 g) = 0.354 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

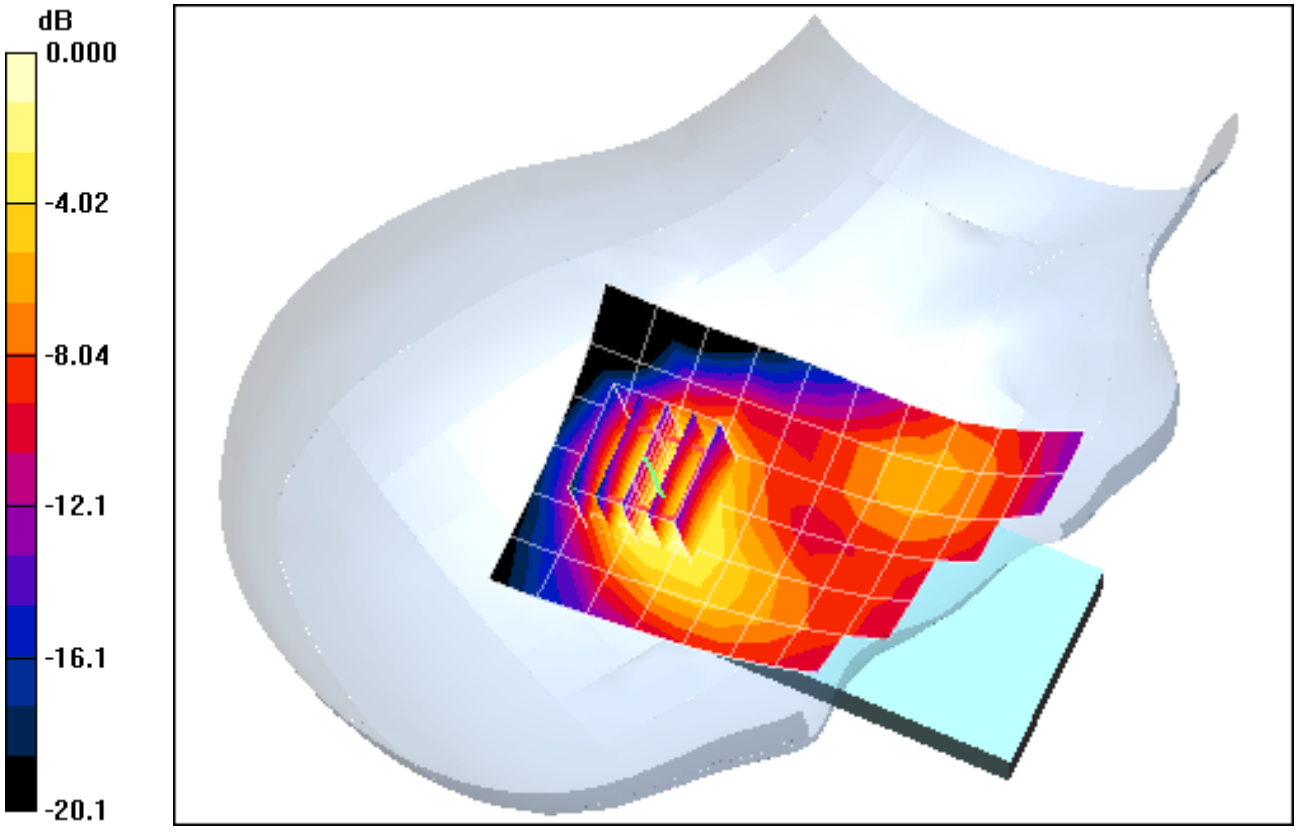
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.41 mho/m; ε_r = 41.9; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-16-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.3 °C

Probe: EX3DV4 - SN3550; ConvF(7.01, 7.01, 7.01); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA, Right Head, Tilt, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.1 V/m
Peak SAR (extrapolated) = 0.354 W/kg
SAR(1 g) = 0.214 mW/g; SAR(10 g) = 0.121 mW/g



0 dB = 0.238mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

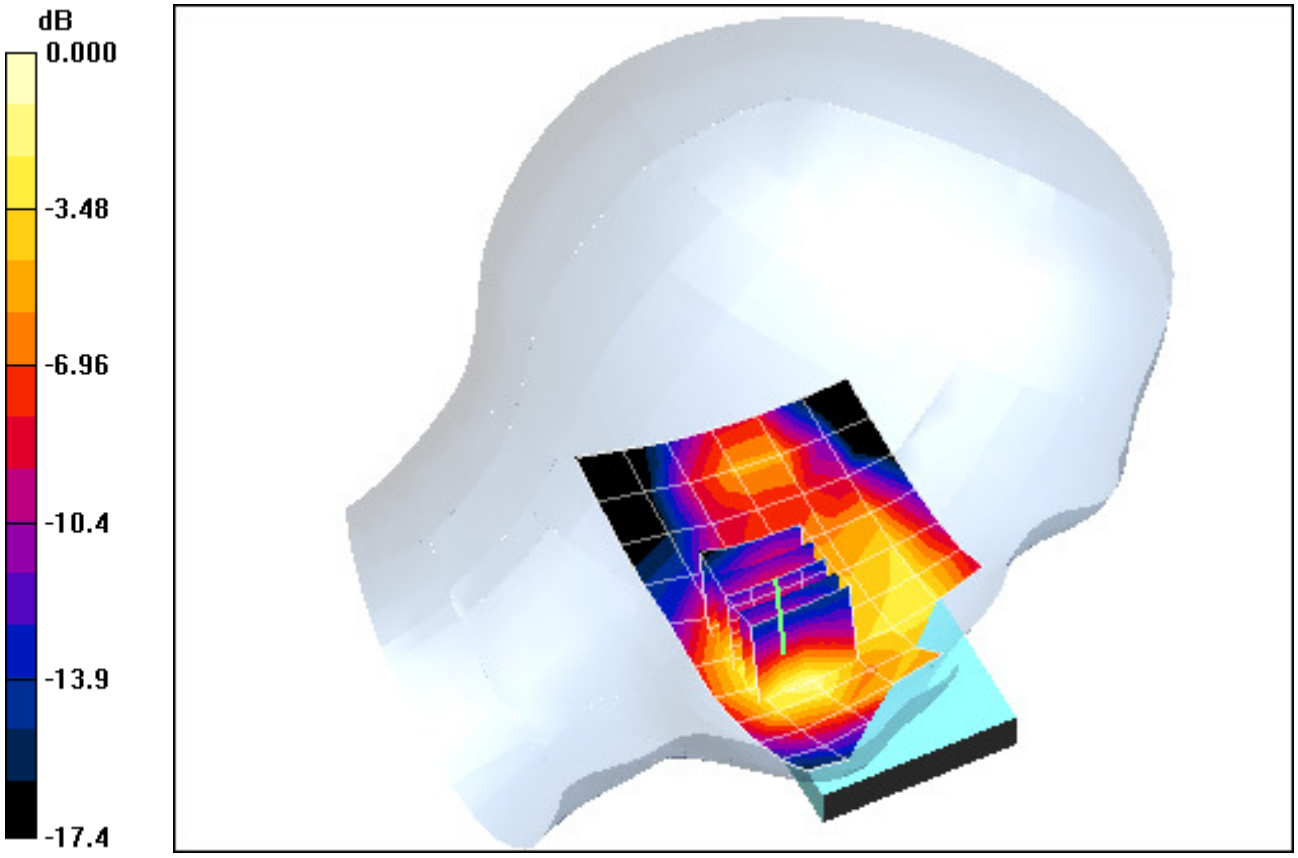
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.41 mho/m; ε_r = 41.9; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-16-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.3 °C

Probe: EX3DV4 - SN3550; ConvF(7.01, 7.01, 7.01); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA, Left Head, Touch, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.7 V/m
Peak SAR (extrapolated) = 0.589 W/kg
SAR(1 g) = 0.365 mW/g; SAR(10 g) = 0.210 mW/g



0 dB = 0.398mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

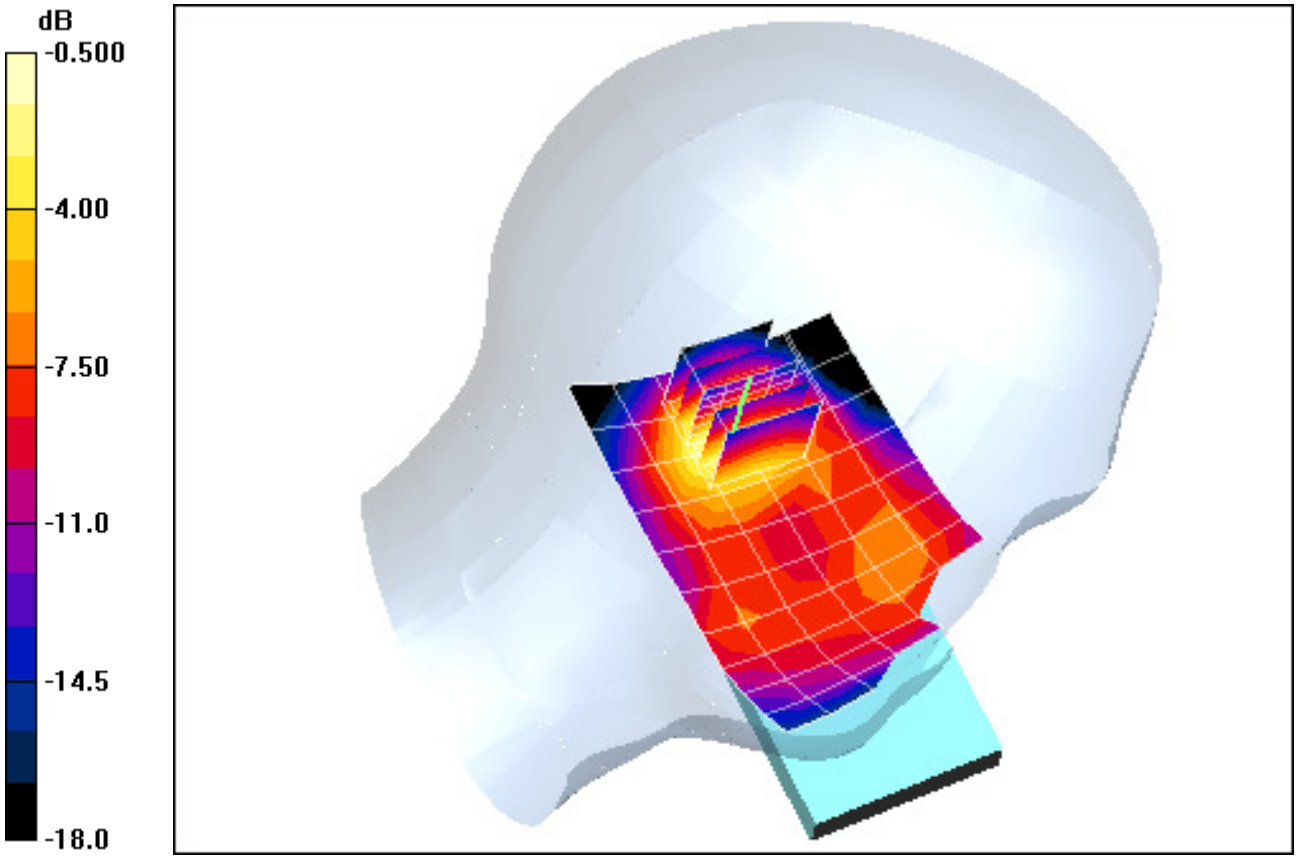
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.41 mho/m; ε_r = 41.9; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-16-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.3 °C

Probe: EX3DV4 - SN3550; ConvF(7.01, 7.01, 7.01); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA, Left Head, Tilt, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.0 V/m
Peak SAR (extrapolated) = 0.385 W/kg
SAR(1 g) = 0.229 mW/g; SAR(10 g) = 0.127 mW/g



0 dB = 0.251mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

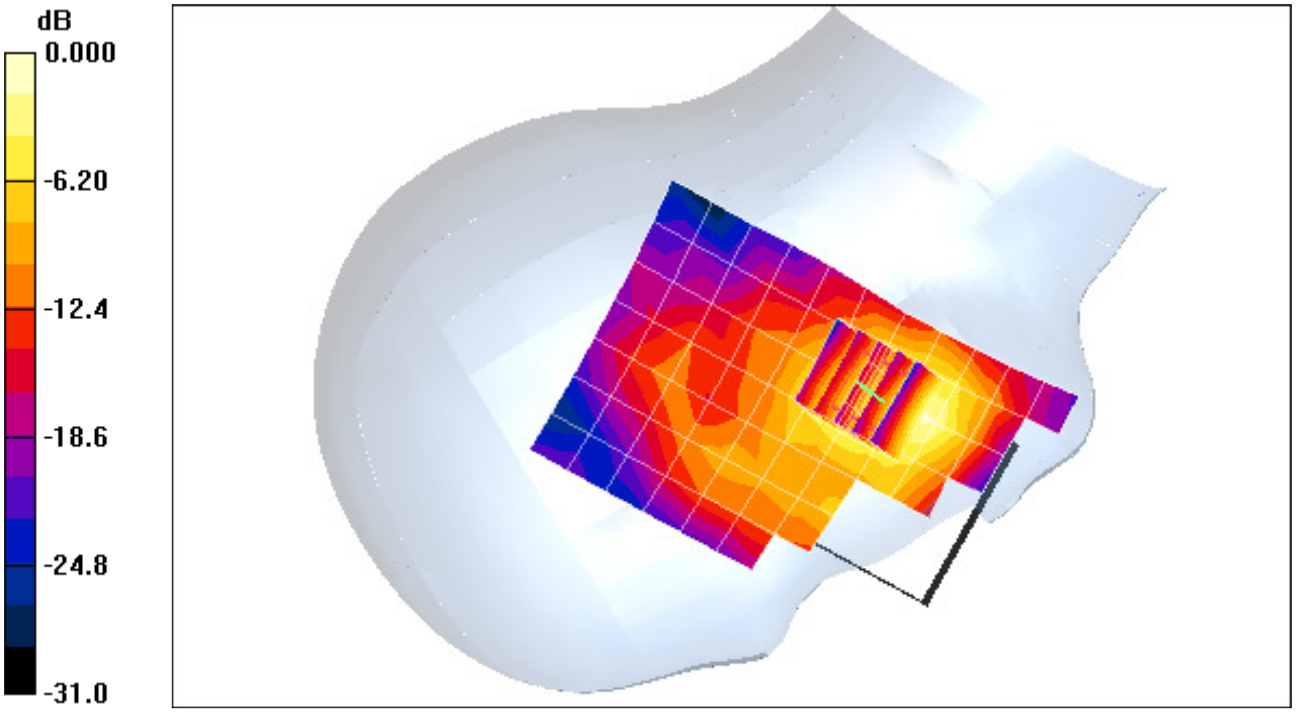
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.81 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-02-2011; Ambient Temp: 23.8 °C; Tissue Temp: 21.9 °C

Probe: EX3DV4 - SN3550; ConvF(6.29, 6.29, 6.29); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Right Head, Touch, Ch 06, 1 Mbps

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.1 V/m
Peak SAR (extrapolated) = 0.376 W/kg
SAR(1 g) = 0.195 mW/g; SAR(10 g) = 0.097 mW/g



0 dB = 0.248mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

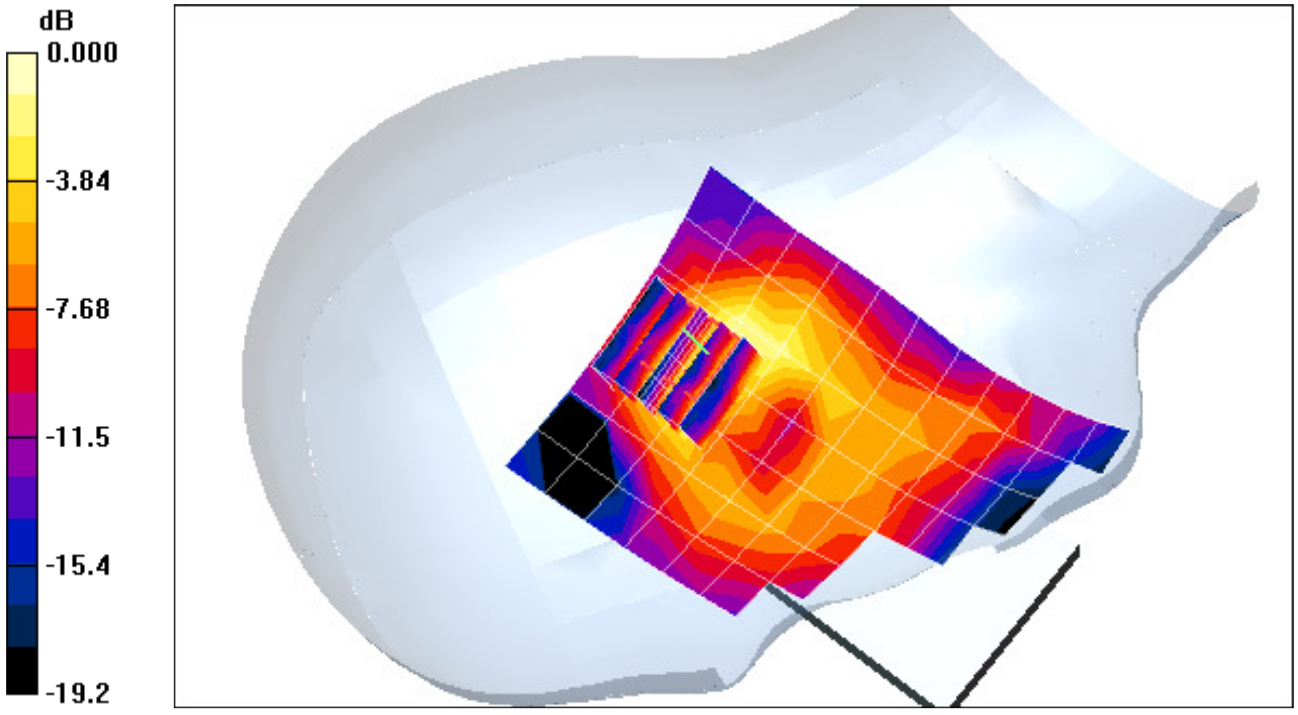
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.81 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-02-2011; Ambient Temp: 23.8 °C; Tissue Temp: 21.9 °C

Probe: EX3DV4 - SN3550; ConvF(6.29, 6.29, 6.29); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Right Head, Tilt, Ch 06, 1 Mbps

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.14 V/m
Peak SAR (extrapolated) = 0.084 W/kg
SAR(1 g) = 0.044 mW/g; SAR(10 g) = 0.022 mW/g



0 dB = 0.055mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

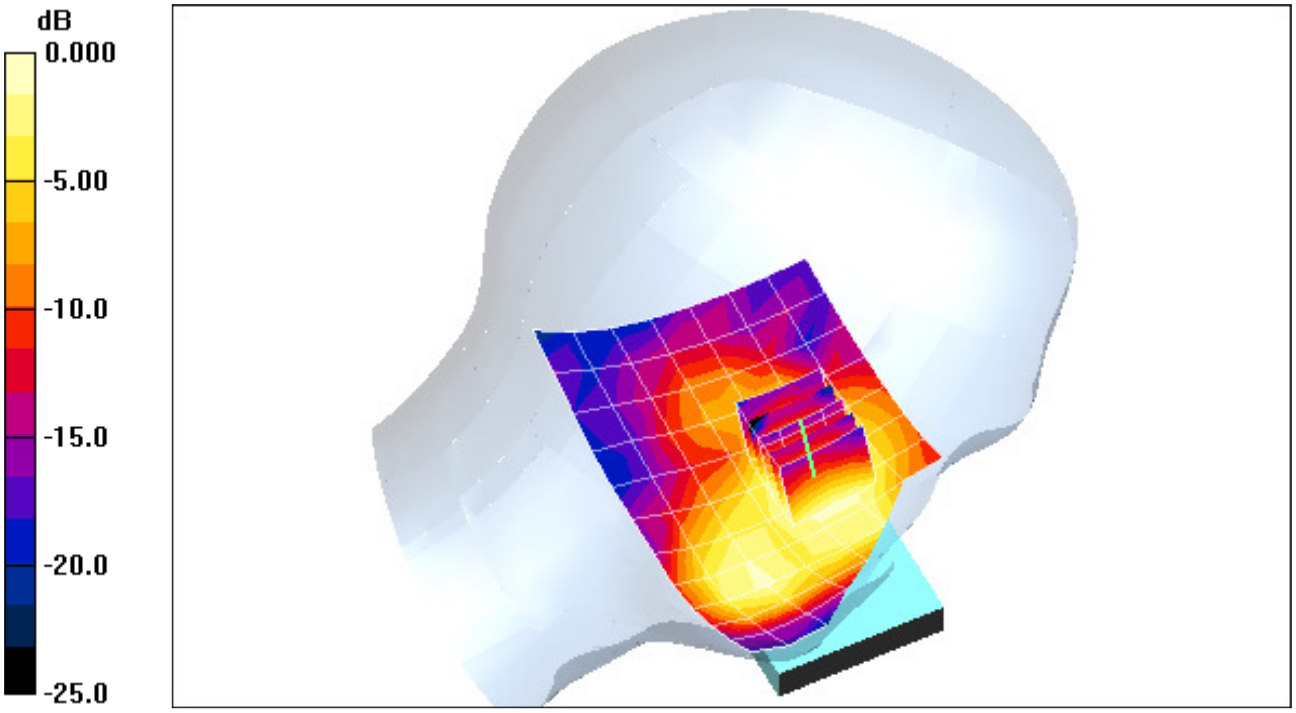
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.81 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-02-2011; Ambient Temp: 23.8 °C; Tissue Temp: 21.9 °C

Probe: EX3DV4 - SN3550; ConvF(6.29, 6.29, 6.29); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Left Head, Touch, Ch 06, 1 Mbps

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.01 V/m
Peak SAR (extrapolated) = 0.126 W/kg
SAR(1 g) = 0.070 mW/g; SAR(10 g) = 0.039 mW/g



0 dB = 0.084mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

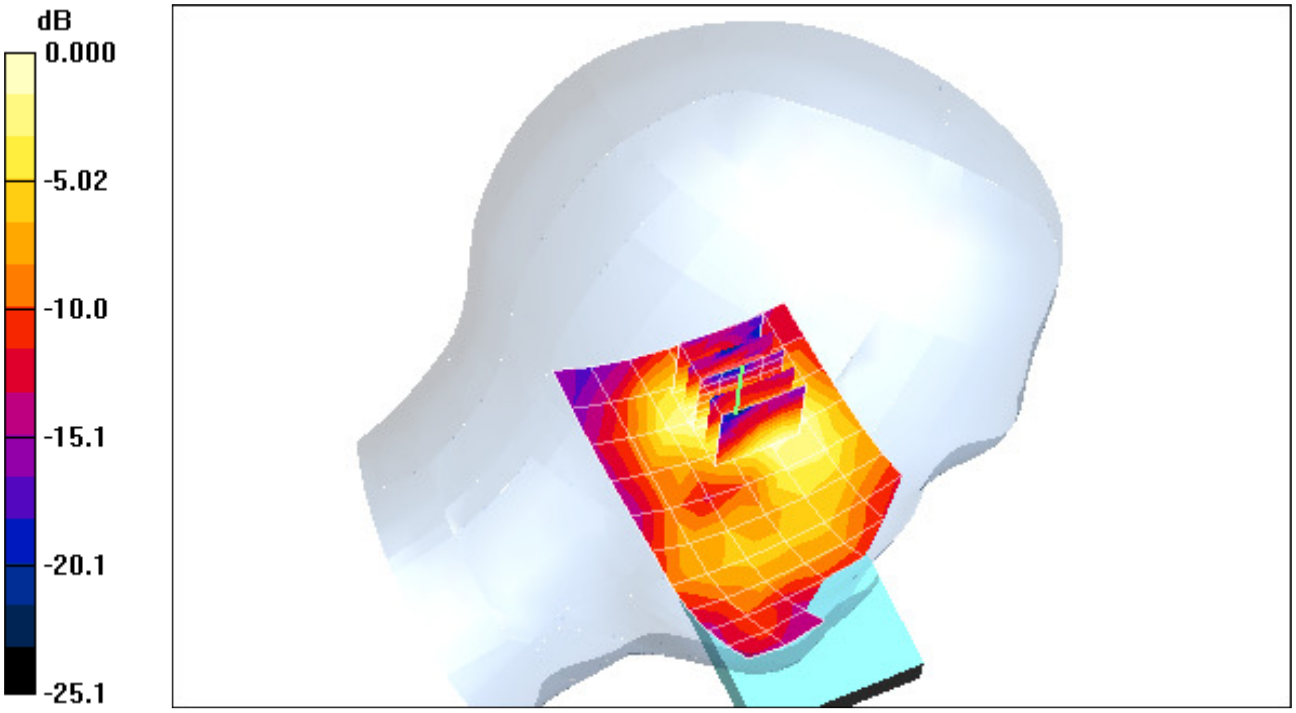
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.81 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-02-2011; Ambient Temp: 23.8 °C; Tissue Temp: 21.9 °C

Probe: EX3DV4 - SN3550; ConvF(6.29, 6.29, 6.29); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Left Head, Tilt, Ch 06, 1 Mbps

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.42 V/m
Peak SAR (extrapolated) = 0.091 W/kg
SAR(1 g) = 0.048 mW/g; SAR(10 g) = 0.026 mW/g



0 dB = 0.058mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

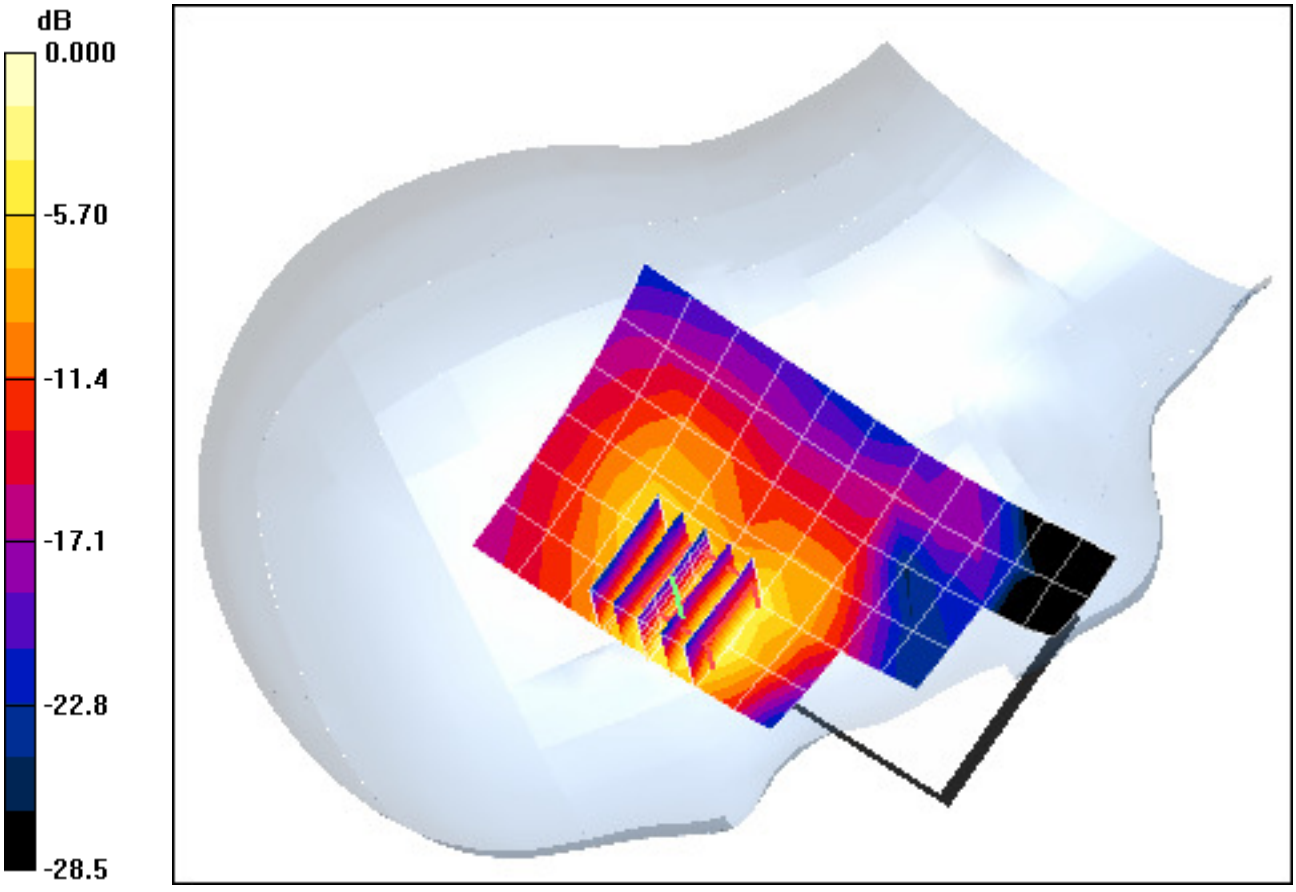
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 2.044 mho/m; ε_r = 37.49; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-07-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.2 °C

Probe: ES3DV2 - SN3022; ConvF(4.14, 4.14, 4.14); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WIMAX, Right Head, Touch, Mid.ch, PUSC, QPSK, 10 Mhz BW

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.70 V/m
Peak SAR (extrapolated) = 0.931 W/kg
SAR(1 g) = 0.407 mW/g; SAR(10 g) = 0.183 mW/g



0 dB = 0.514mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

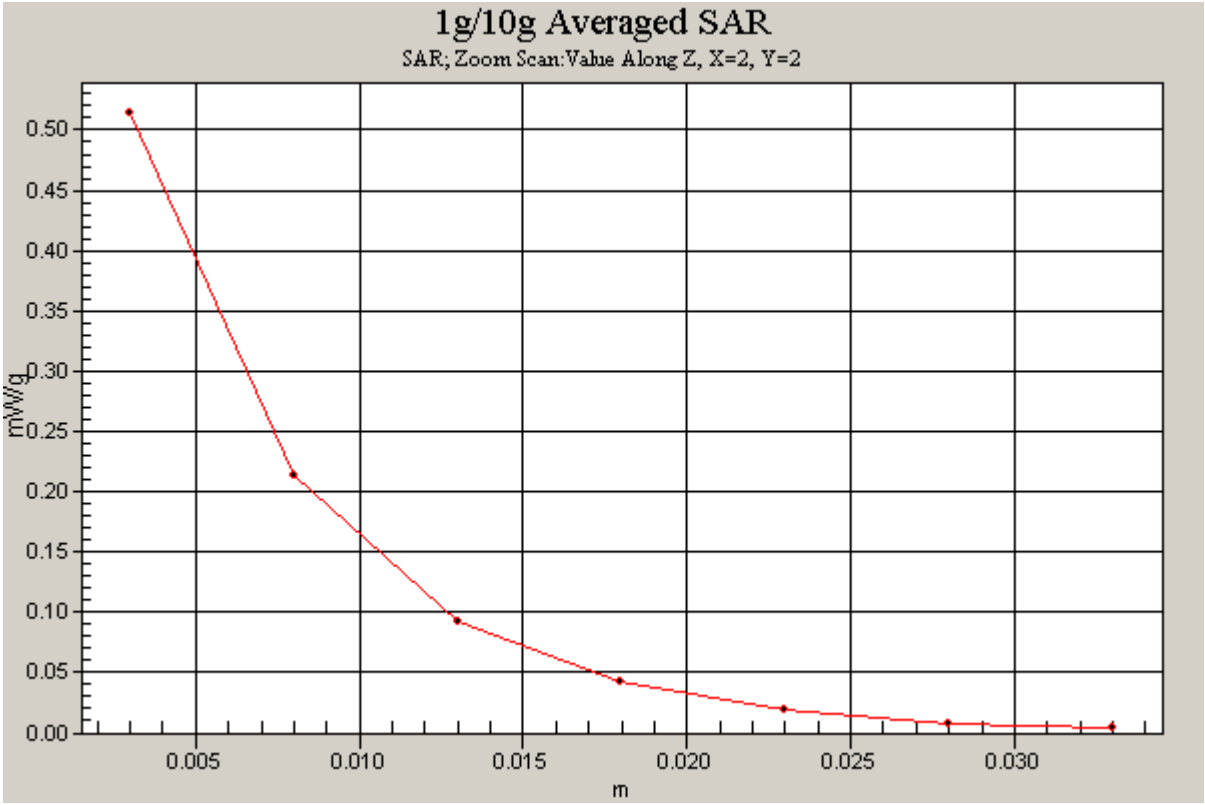
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 2.044 mho/m; ε_r = 37.49; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-07-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.2 °C

Probe: ES3DV2 - SN3022; ConvF(4.14, 4.14, 4.14); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WIMAX, Right Head, Touch, Mid.ch, PUSC, QPSK, 10 Mhz BW

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.70 V/m
Peak SAR (extrapolated) = 0.931 W/kg
SAR(1 g) = 0.407 mW/g; SAR(10 g) = 0.183 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

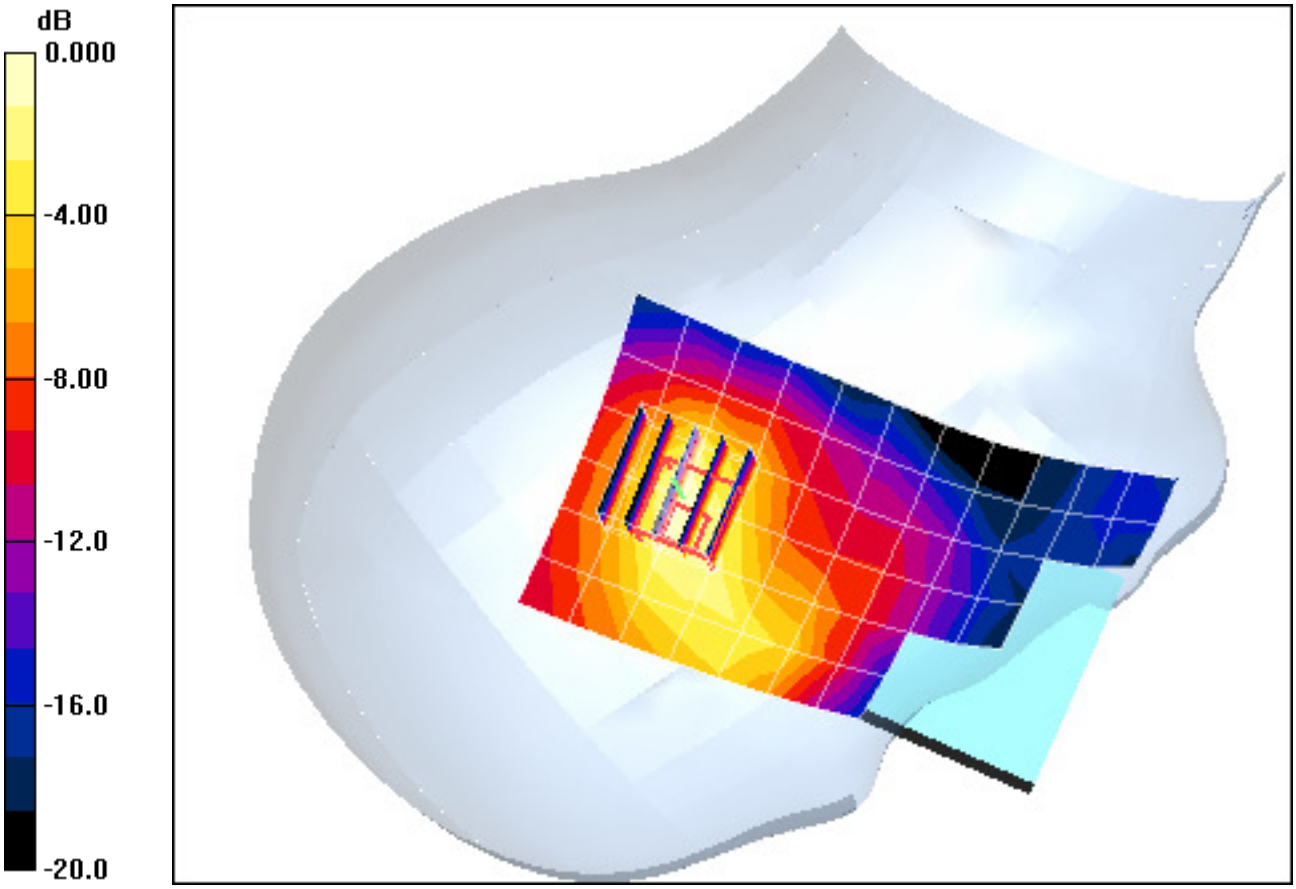
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 2.044 mho/m; ε_r = 37.49; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-07-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.2 °C

Probe: ES3DV2 - SN3022; ConvF(4.14, 4.14, 4.14); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Wimax, Right Head, Tilt, Mid.ch, PUSC, QPSK, 10 Mhz BW

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.06 V/m
Peak SAR (extrapolated) = 0.296 W/kg
SAR(1 g) = 0.150 mW/g; SAR(10 g) = 0.077 mW/g



0 dB = 0.188mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

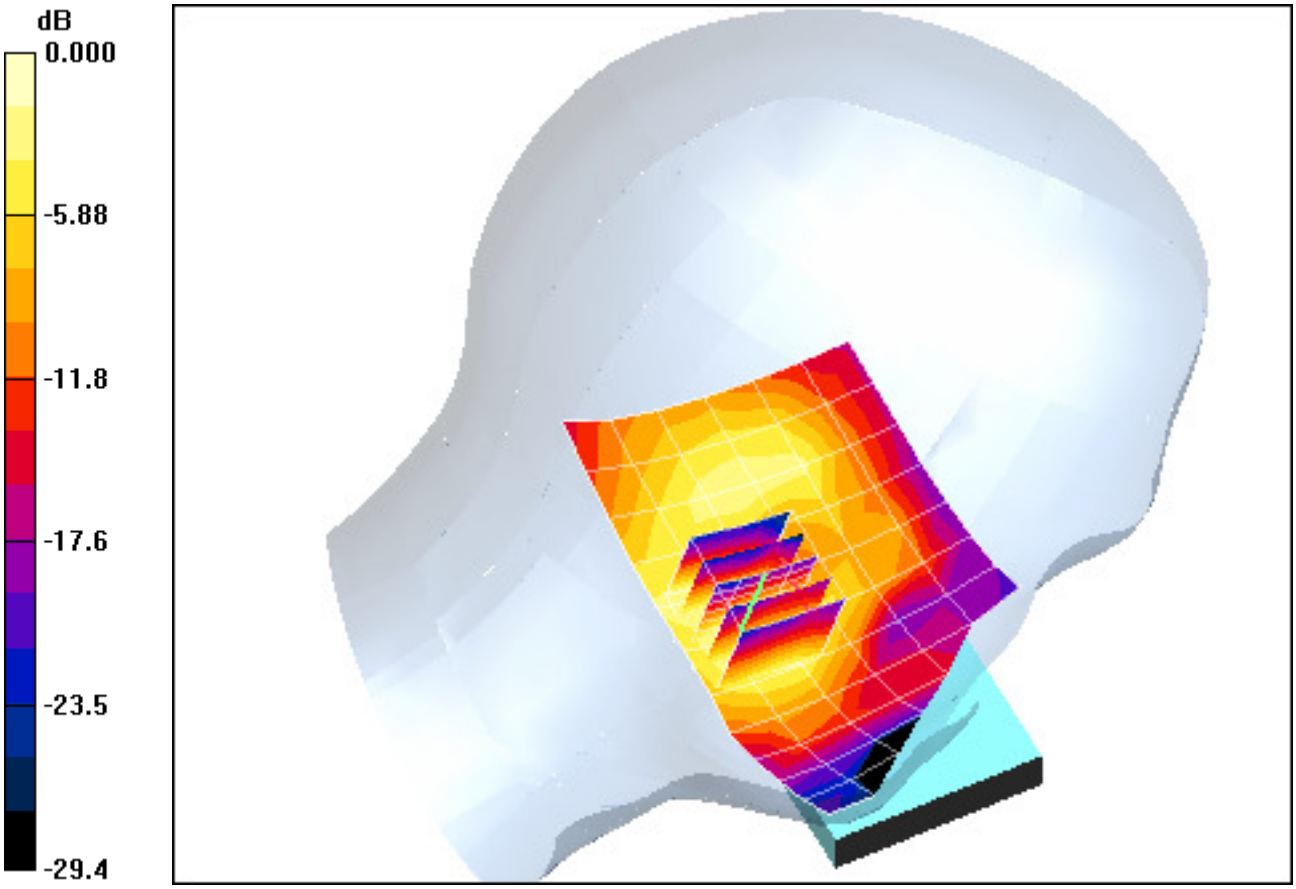
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 2.044 mho/m; ε_r = 37.49; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-07-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.2 °C

Probe: ES3DV2 - SN3022; ConvF(4.14, 4.14, 4.14); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WIMAX, Left Head, Touch, Mid. Ch, PUSC, QPSK, 10 MHz BW

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.1 V/m
Peak SAR (extrapolated) = 0.379 W/kg
SAR(1 g) = 0.190 mW/g; SAR(10 g) = 0.096 mW/g



0 dB = 0.246mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial:62

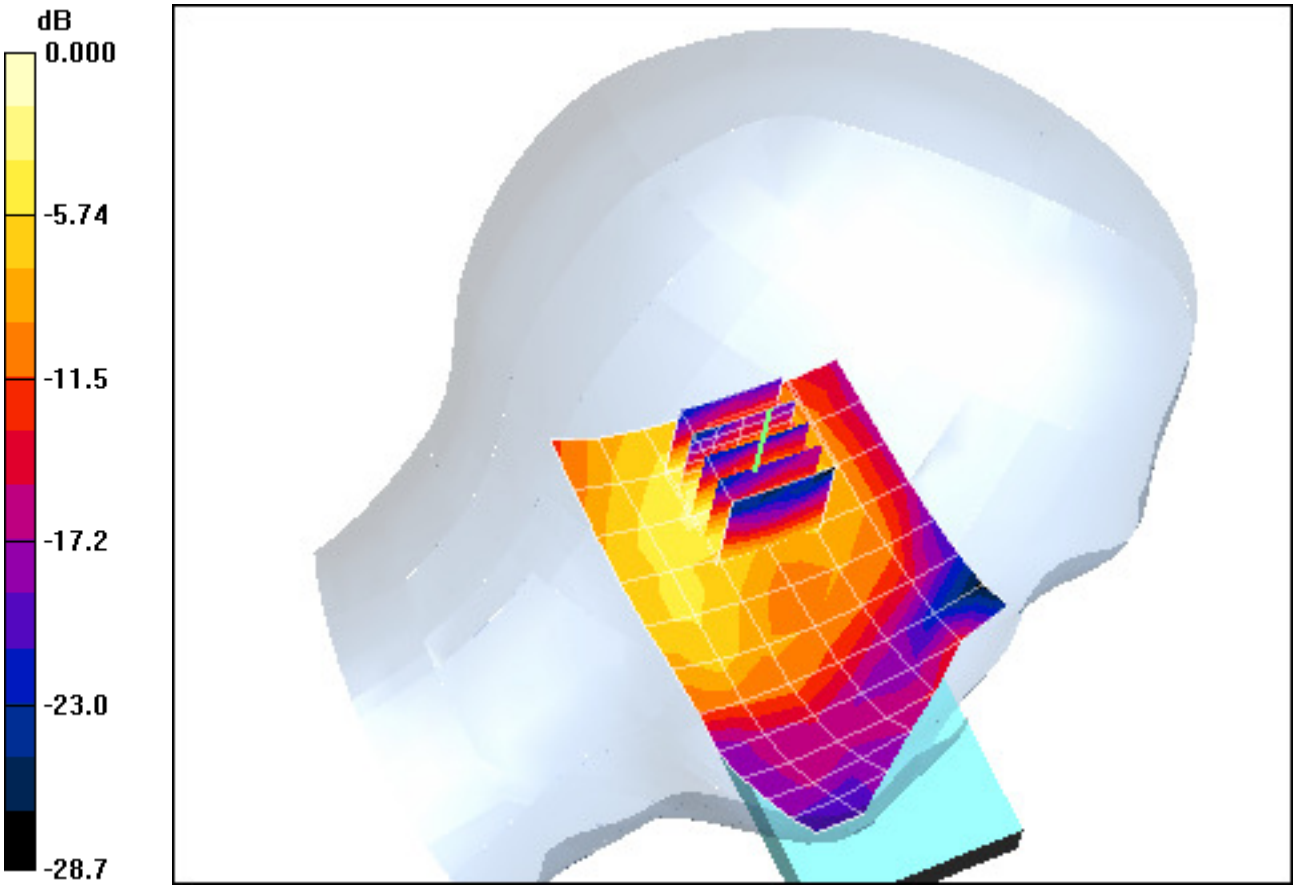
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 2.044 mho/m; ε_r = 37.49; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-07-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.2 °C

Probe: ES3DV2 - SN3022; ConvF(4.14, 4.14, 4.14); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WIMAX, Left Head, Tilt, Mid. Ch, PUSC, QPSK, 5 MHz BW

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.17 V/m
Peak SAR (extrapolated) = 0.314 W/kg
SAR(1 g) = 0.154 mW/g; SAR(10 g) = 0.074 mW/g



0 dB = 0.199mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

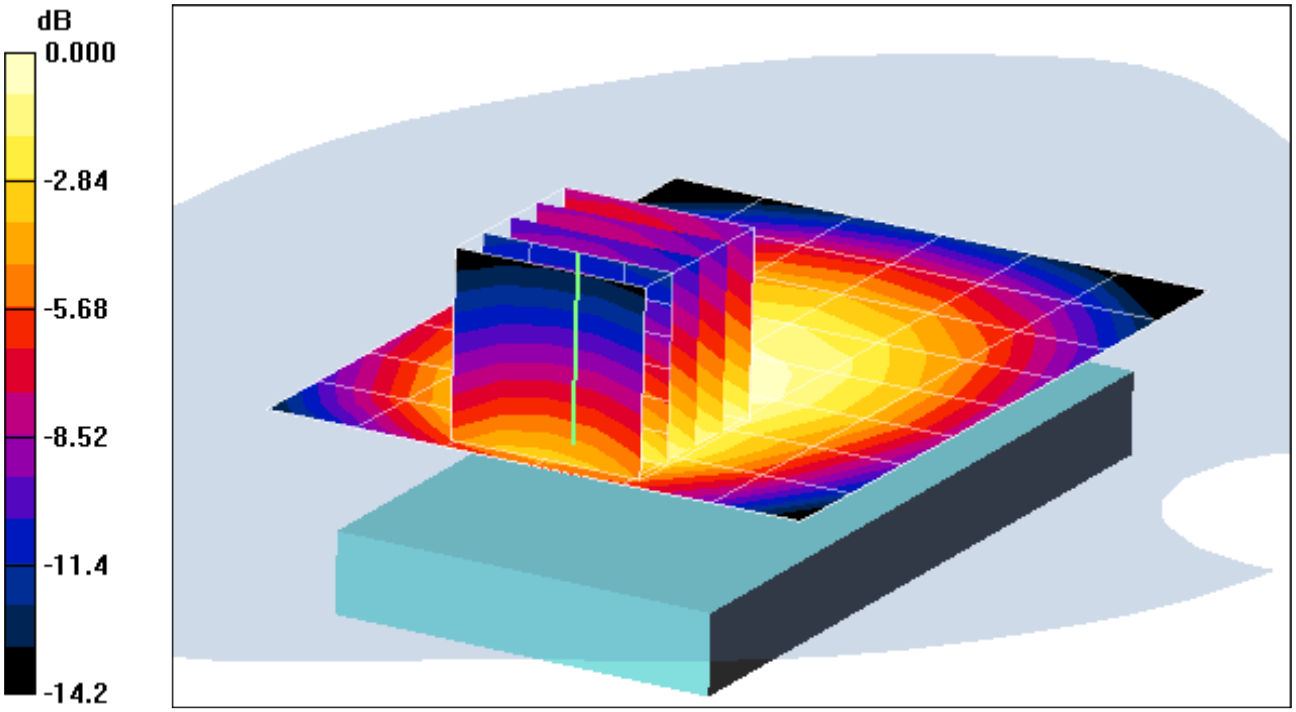
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.962 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular EVDO, Body SAR, Back side, Mid.ch

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.8 V/m
Peak SAR (extrapolated) = 0.970 W/kg
SAR(1 g) = 0.559 mW/g; SAR(10 g) = 0.375 mW/g



0 dB = 0.596mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

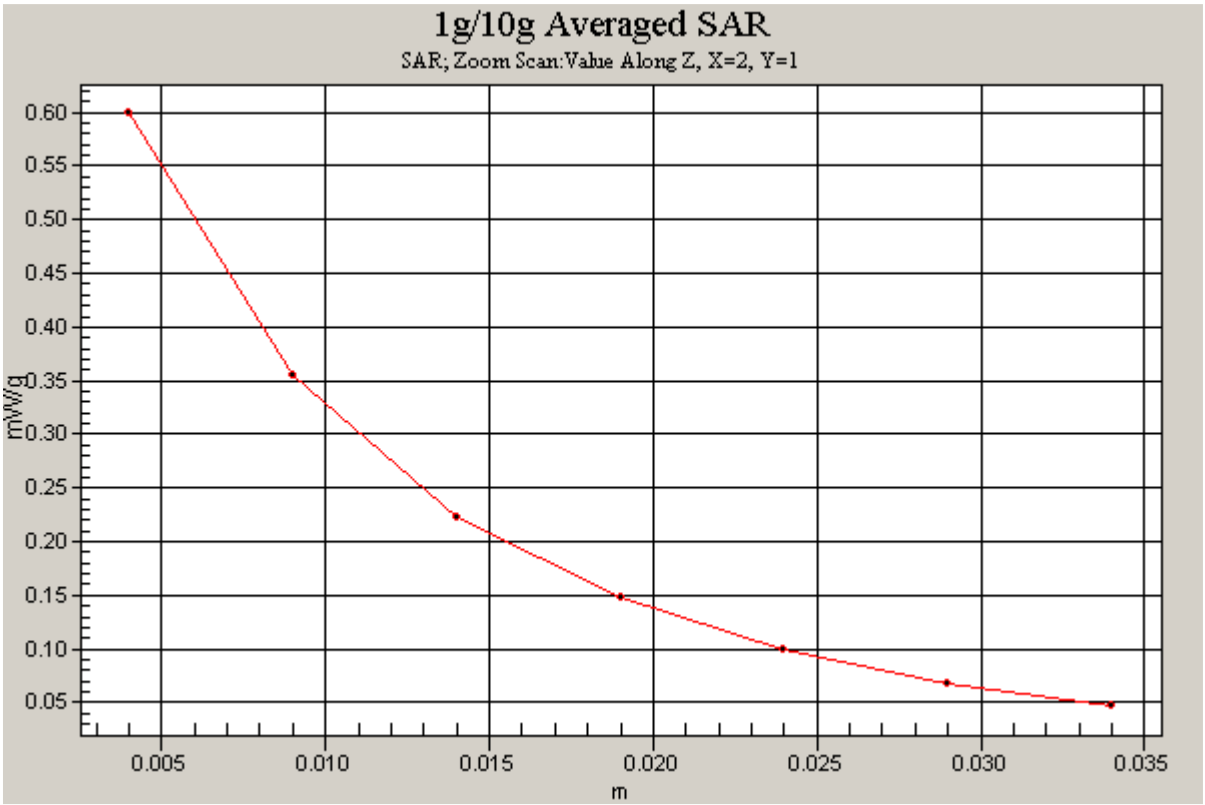
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.962 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular EVDO, Body SAR, Back side, Mid.ch

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.8 V/m
Peak SAR (extrapolated) = 0.970 W/kg
SAR(1 g) = 0.559 mW/g; SAR(10 g) = 0.375 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

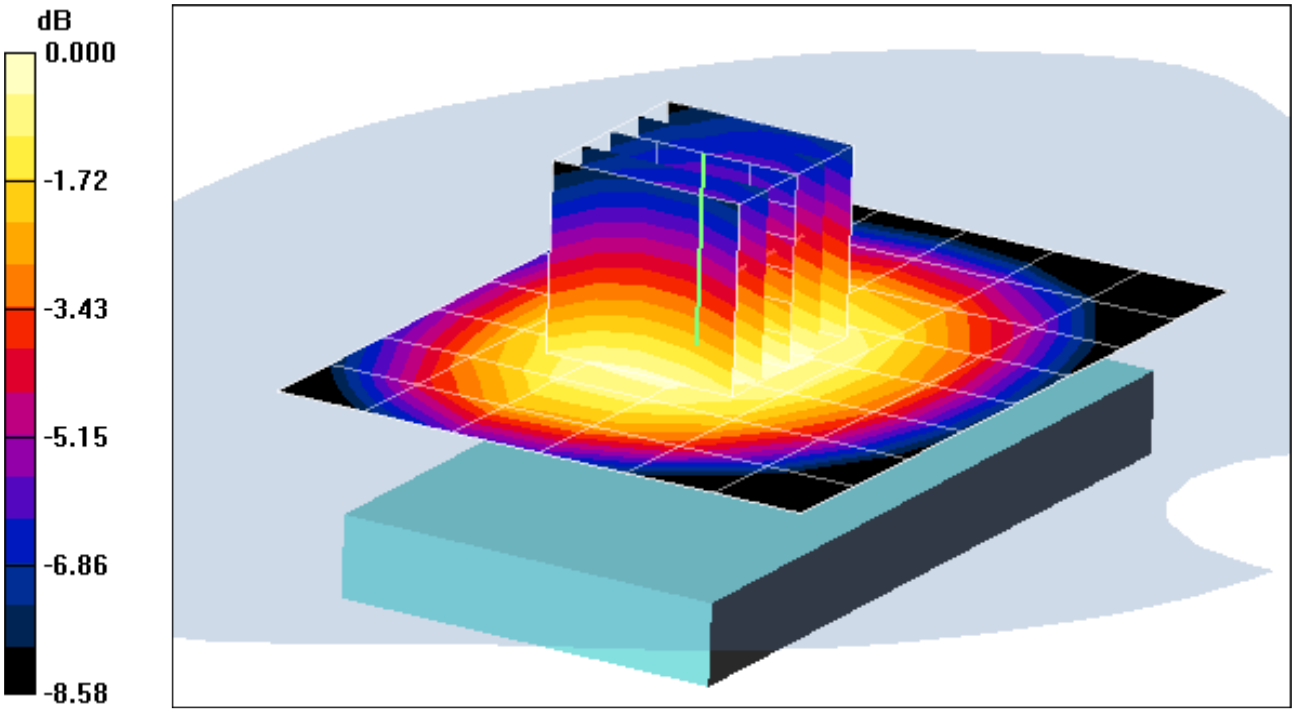
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.962 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular EVDO, Body SAR, Front side, Mid.ch

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.4 V/m
Peak SAR (extrapolated) = 0.420 W/kg
SAR(1 g) = 0.333 mW/g; SAR(10 g) = 0.253 mW/g



0 dB = 0.349mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

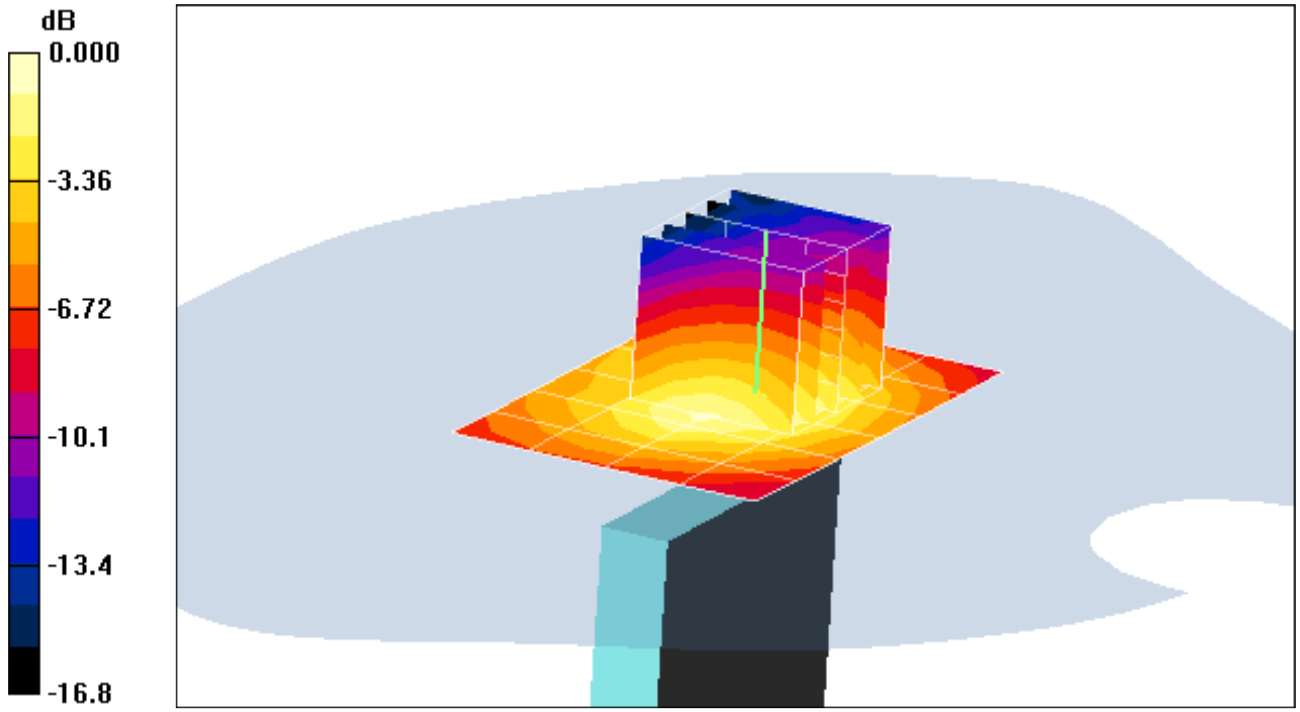
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.962 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular EVDO, Body SAR, Bottom Edge, Mid.ch

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.58 V/m
Peak SAR (extrapolated) = 0.134 W/kg
SAR(1 g) = 0.076 mW/g; SAR(10 g) = 0.046 mW/g



0 dB = 0.081mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

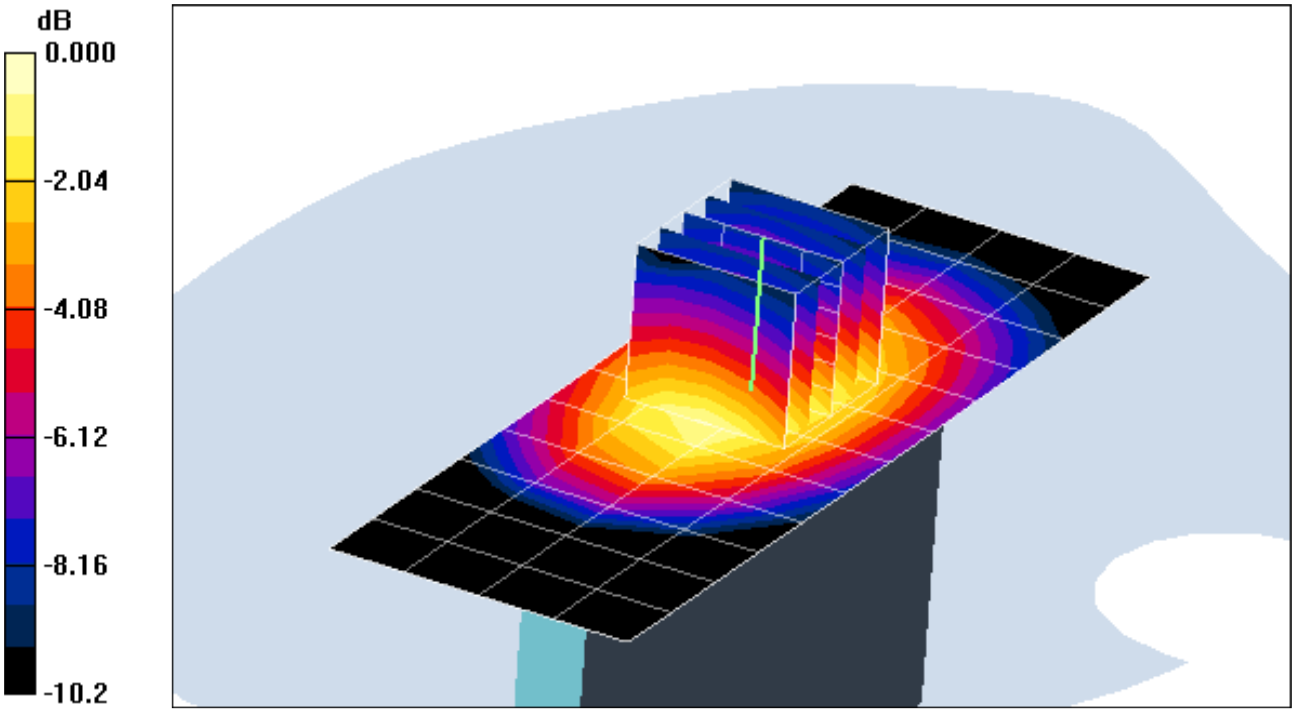
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.962 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular EVDO, Body SAR, Right Edge, Mid.ch

Area Scan (5x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.0 V/m
Peak SAR (extrapolated) = 0.437 W/kg
SAR(1 g) = 0.310 mW/g; SAR(10 g) = 0.213 mW/g



0 dB = 0.331mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

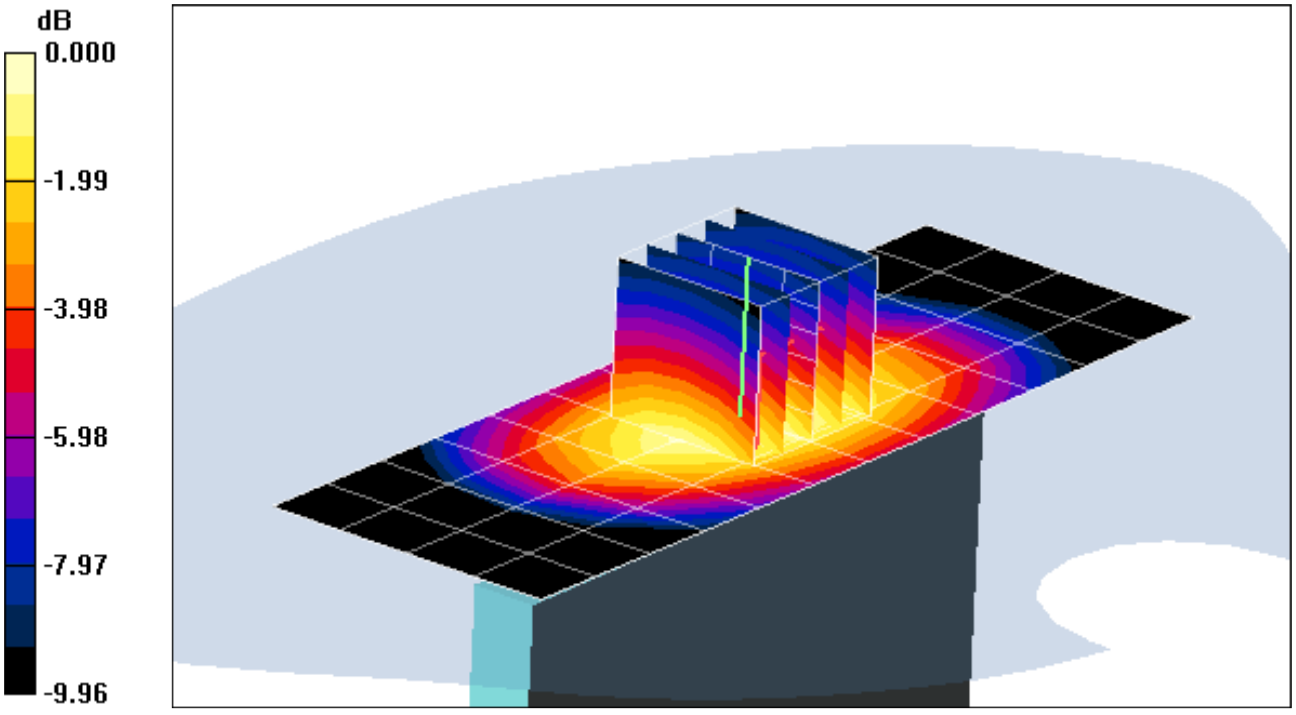
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.962 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular EVDO, Body SAR, Left Edge, Mid.ch

Area Scan (5x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.8 V/m
Peak SAR (extrapolated) = 0.512 W/kg
SAR(1 g) = 0.359 mW/g; SAR(10 g) = 0.246 mW/g



0 dB = 0.385mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

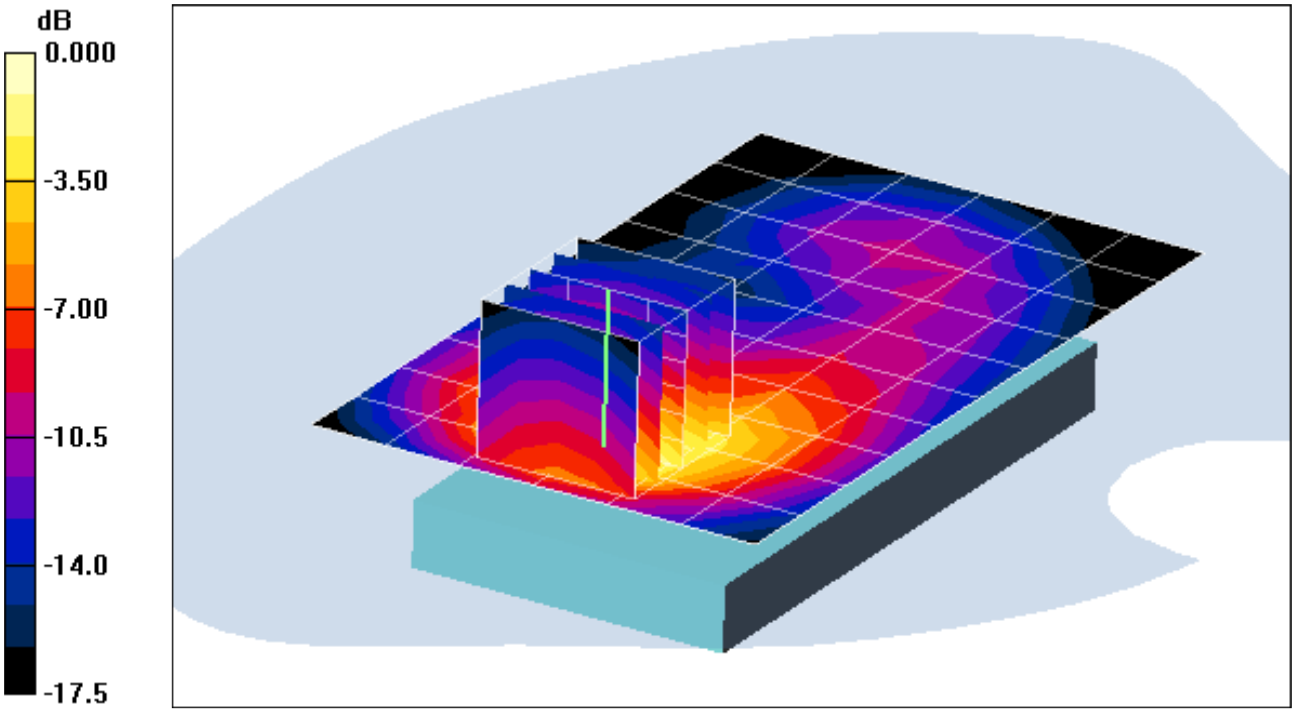
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS EVDO, Body SAR, Back side, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.3 V/m
Peak SAR (extrapolated) = 1.63 W/kg
SAR(1 g) = 0.951 mW/g; SAR(10 g) = 0.503 mW/g



0 dB = 1.09mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

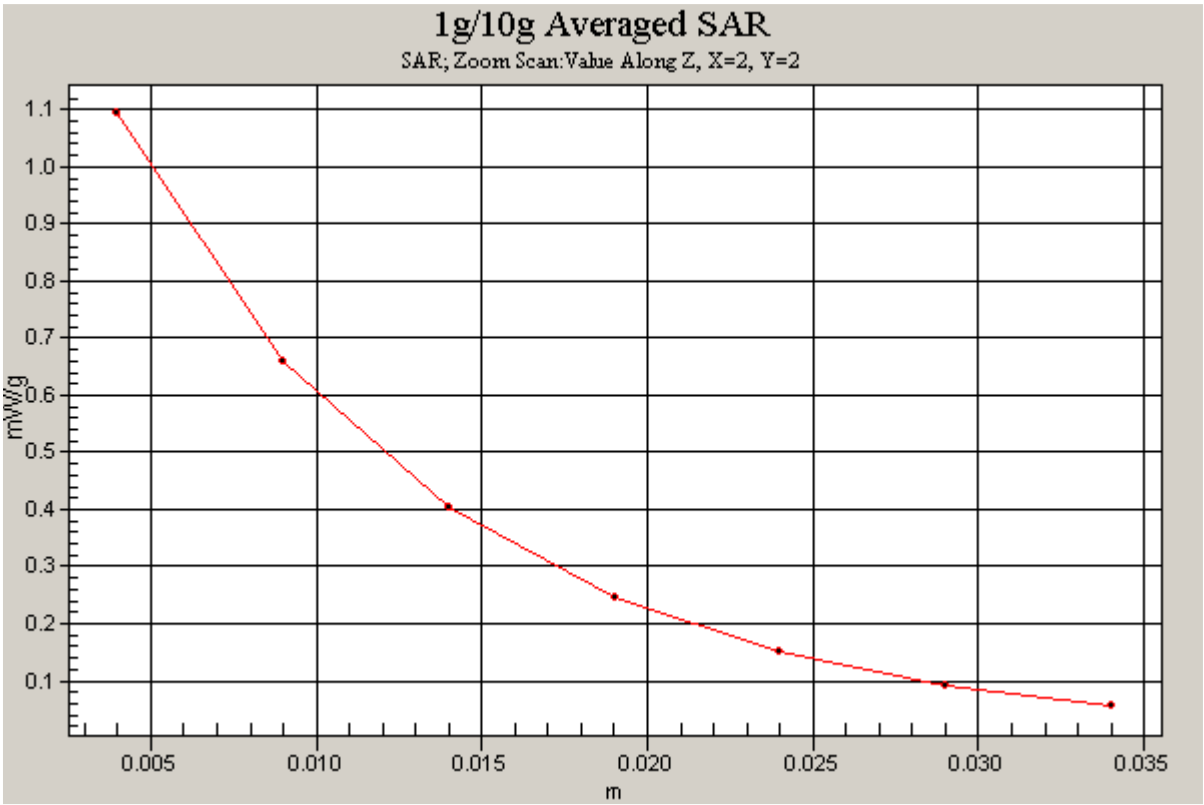
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS EVDO, Body SAR, Back side, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.3 V/m
Peak SAR (extrapolated) = 1.63 W/kg
SAR(1 g) = 0.951 mW/g; SAR(10 g) = 0.503 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

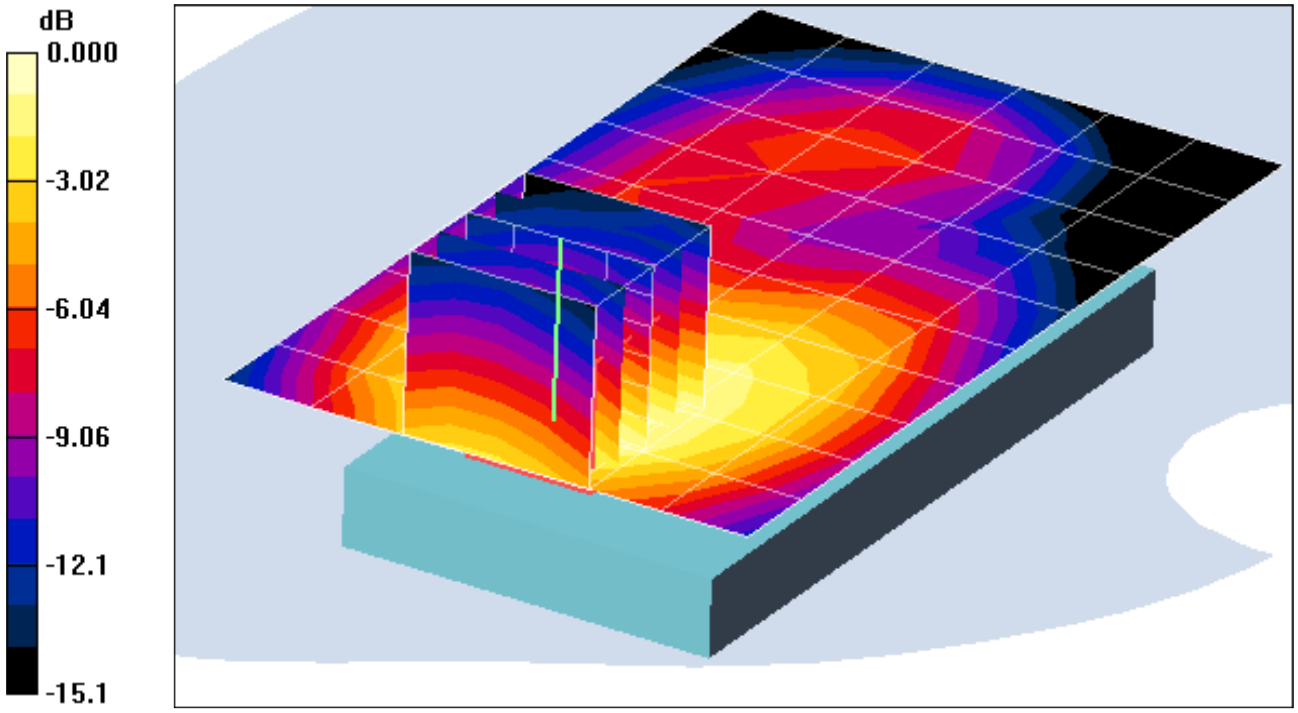
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS EVDO, Body SAR, Front side, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.9 V/m
Peak SAR (extrapolated) = 0.365 W/kg
SAR(1 g) = 0.235 mW/g; SAR(10 g) = 0.143 mW/g



0 dB = 0.260mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

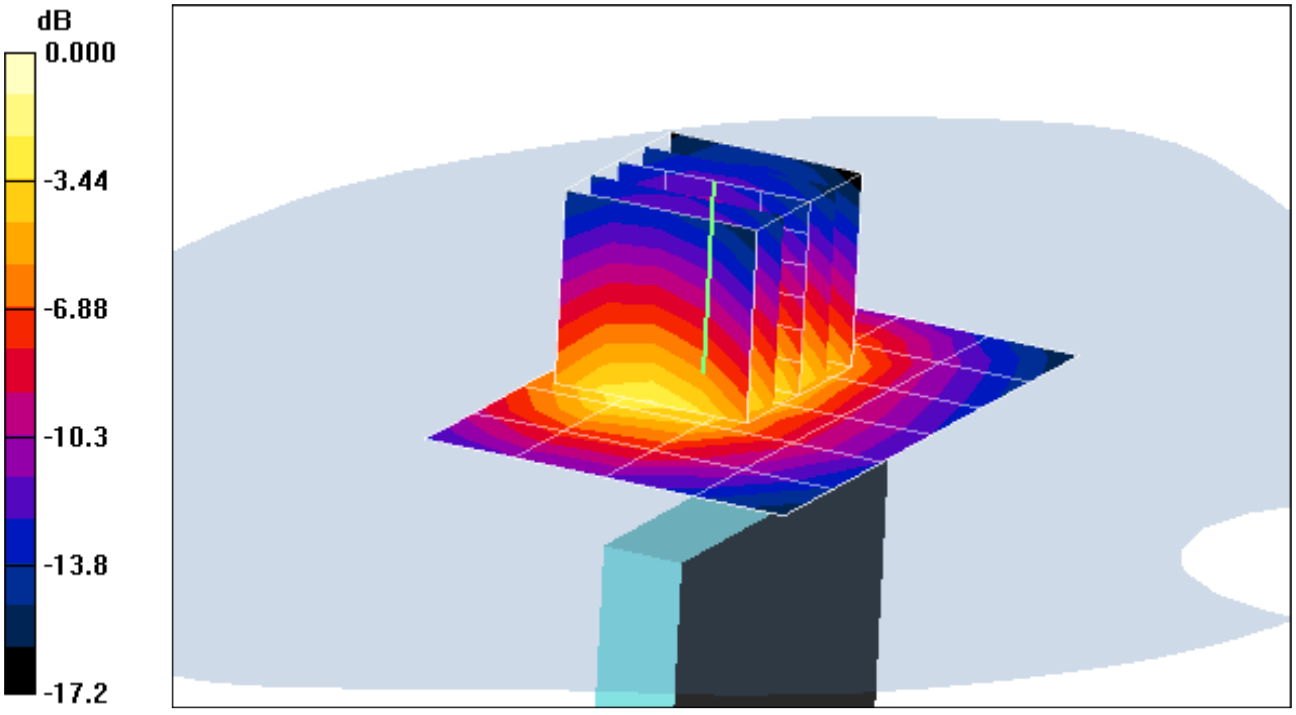
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS EVDO, Body SAR, Bottom Edge, Mid.ch

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.06 V/m
Peak SAR (extrapolated) = 1.37 W/kg
SAR(1 g) = 0.814 mW/g; SAR(10 g) = 0.448 mW/g



0 dB = 0.915mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

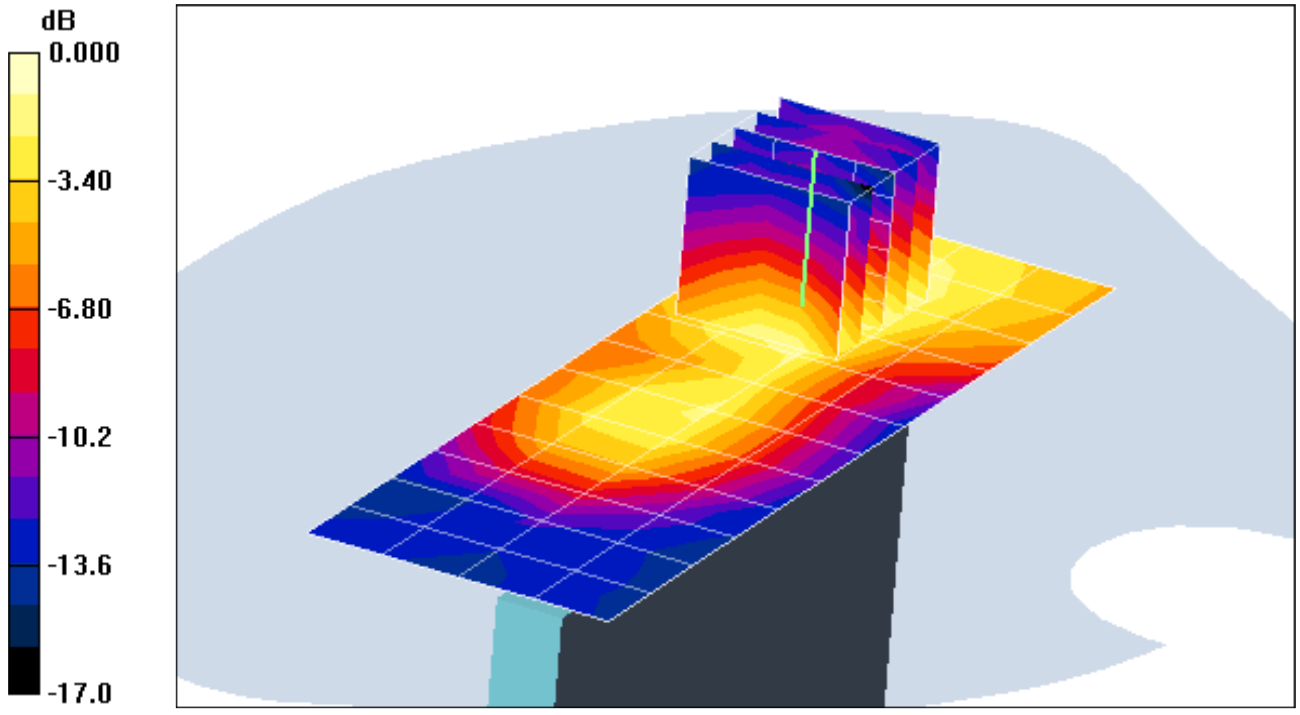
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS EVDO, Body SAR, Right Edge, Mid.ch

Area Scan (5x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.28 V/m
Peak SAR (extrapolated) = 0.156 W/kg
SAR(1 g) = 0.096 mW/g; SAR(10 g) = 0.058 mW/g



0 dB = 0.105mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: 62

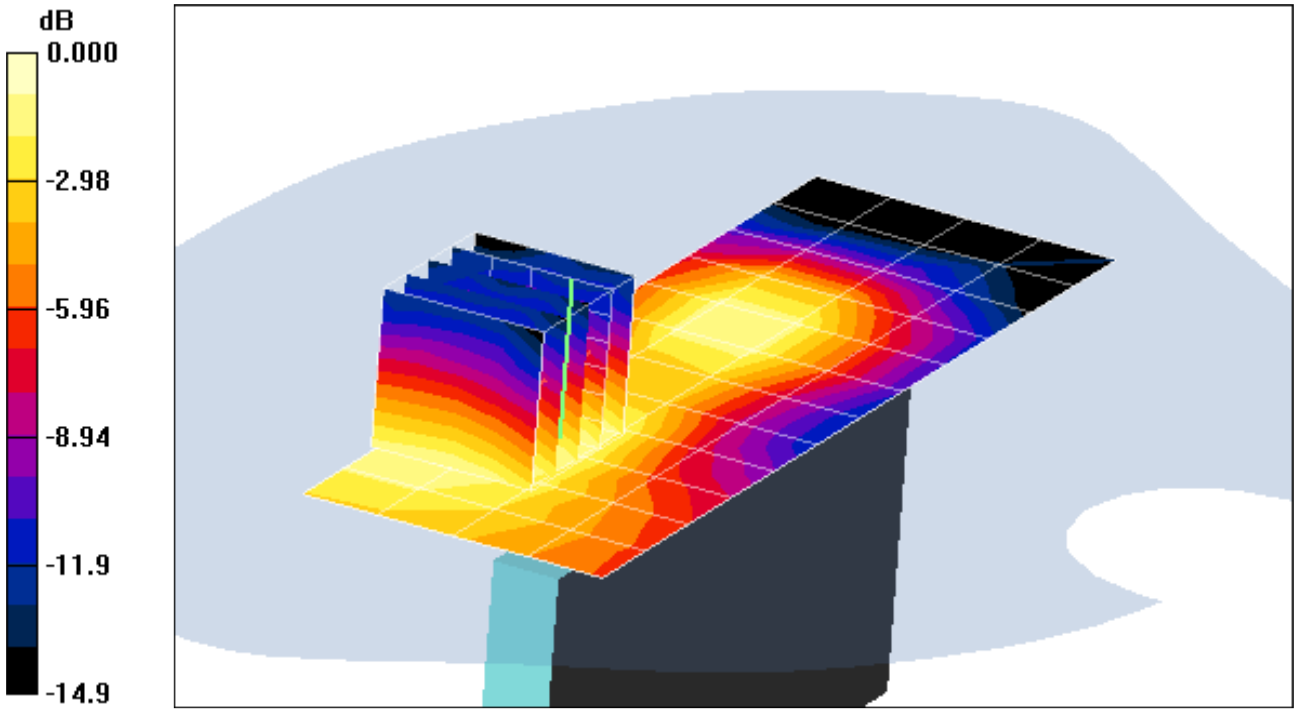
Communication System: PCS CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS EVDO, Body SAR, Left Edge, Mid.ch

Area Scan (5x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.91 V/m
Peak SAR (extrapolated) = 0.168 W/kg
SAR(1 g) = 0.103 mW/g; SAR(10 g) = 0.062 mW/g



0 dB = 0.110mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

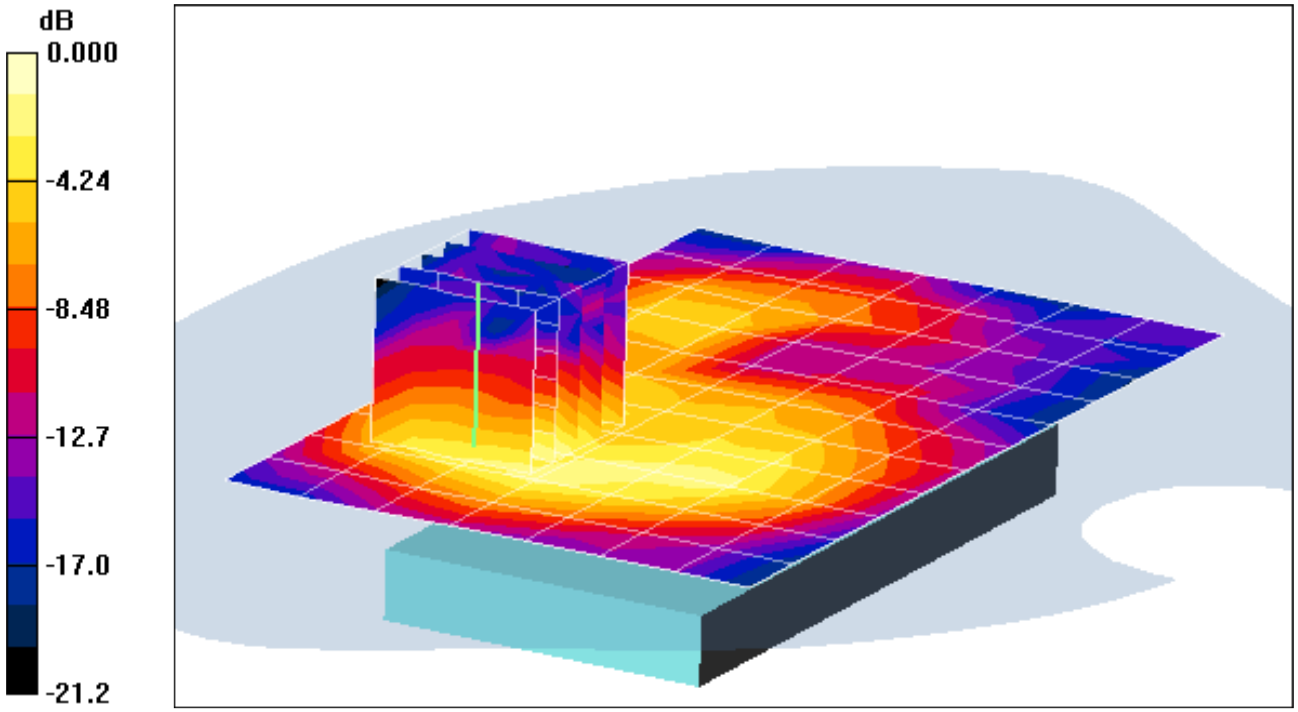
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.86 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-02-2011; Ambient Temp: 23.5 °C; Tissue Temp: 21.7 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Back Side

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.93 V/m
Peak SAR (extrapolated) = 0.160 W/kg
SAR(1 g) = 0.081 mW/g; SAR(10 g) = 0.042 mW/g



0 dB = 0.099mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

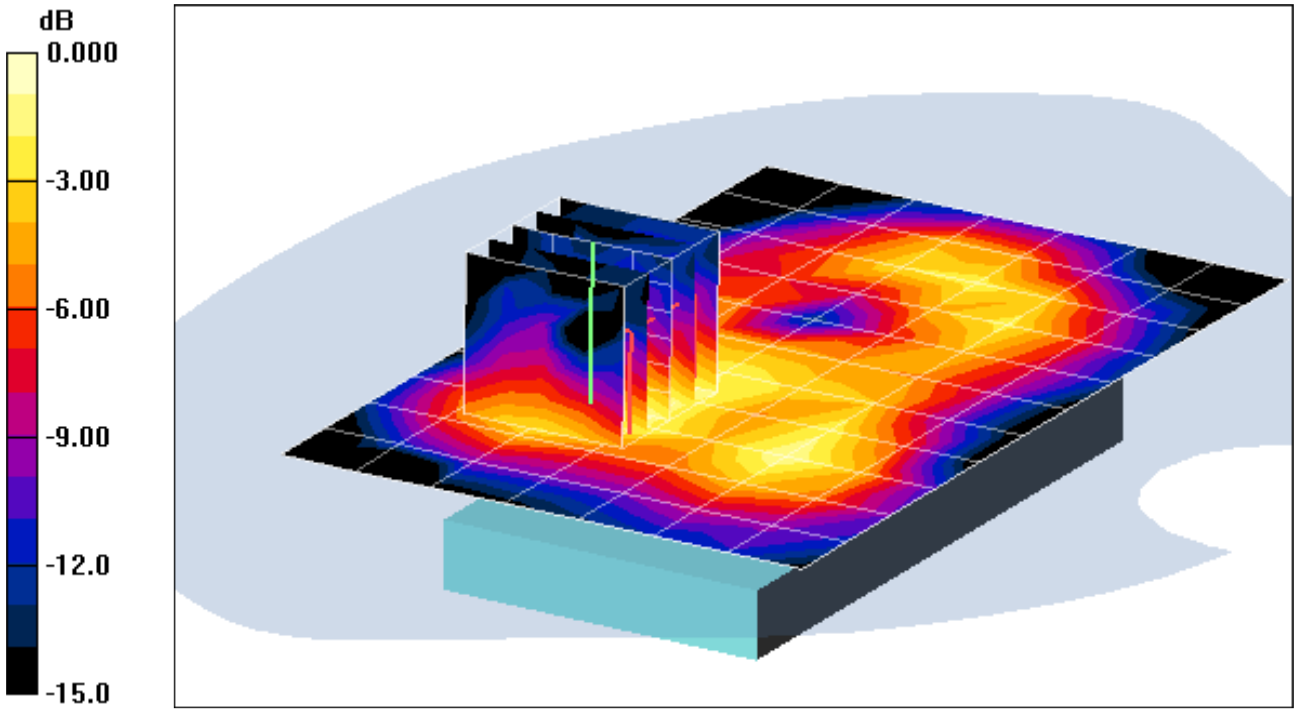
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.86 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-02-2011; Ambient Temp: 23.5 °C; Tissue Temp: 21.7 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Front Side

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.33 V/m
Peak SAR (extrapolated) = 0.099 W/kg
SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.030 mW/g



0 dB = 0.065mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

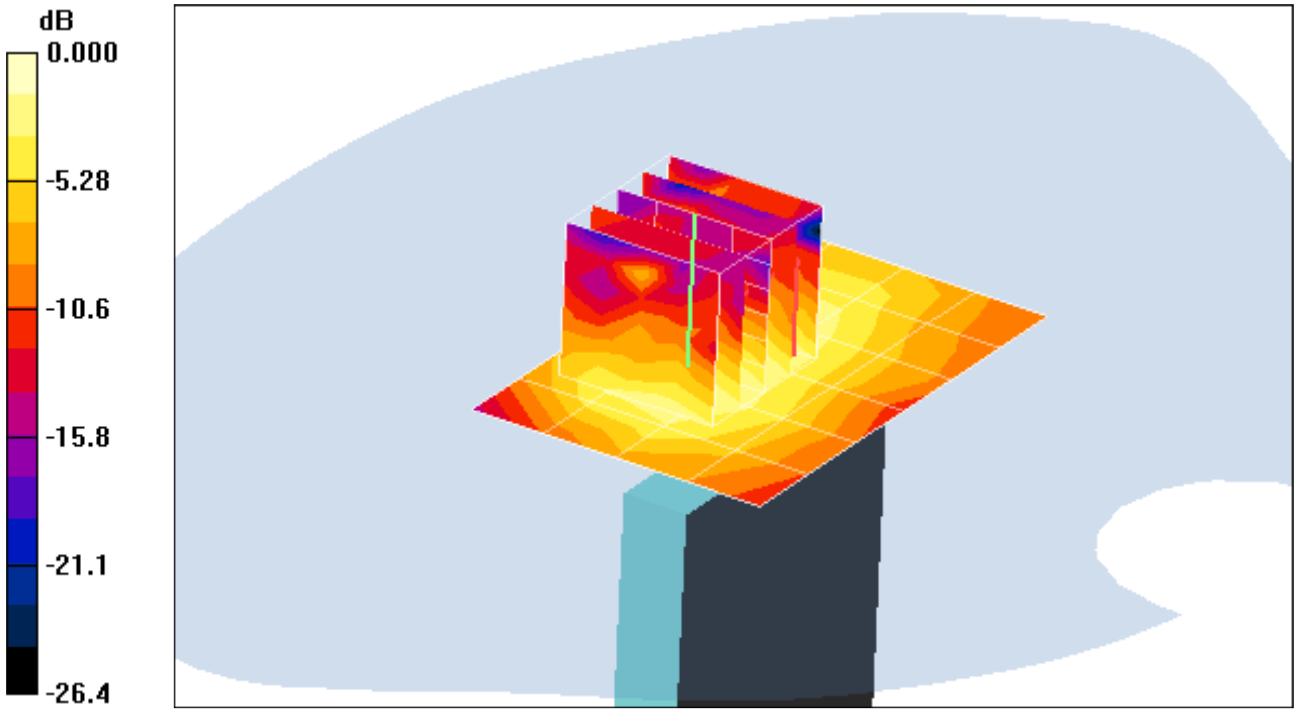
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.86 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-02-2011; Ambient Temp: 23.5 °C; Tissue Temp: 21.7 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Bottom Edge

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.38 V/m
Peak SAR (extrapolated) = 0.210 W/kg
SAR(1 g) = 0.045 mW/g; SAR(10 g) = 0.020 mW/g



0 dB = 0.049mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX RFID and Bluetooth; Serial: RF #2

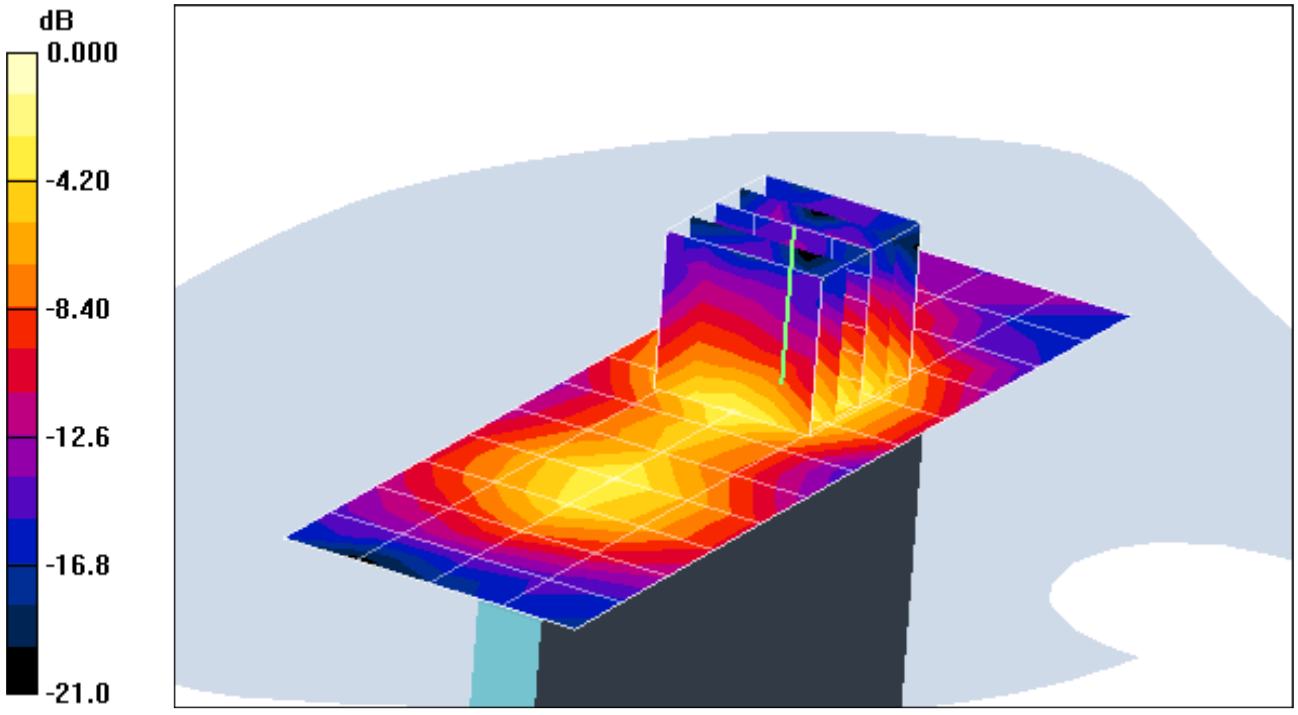
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.86 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-02-2011; Ambient Temp: 23.5 °C; Tissue Temp: 21.7 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Right Edge

Area Scan (5x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.78 V/m
Peak SAR (extrapolated) = 0.149 W/kg
SAR(1 g) = 0.078 mW/g; SAR(10 g) = 0.041 mW/g



0 dB = 0.099mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

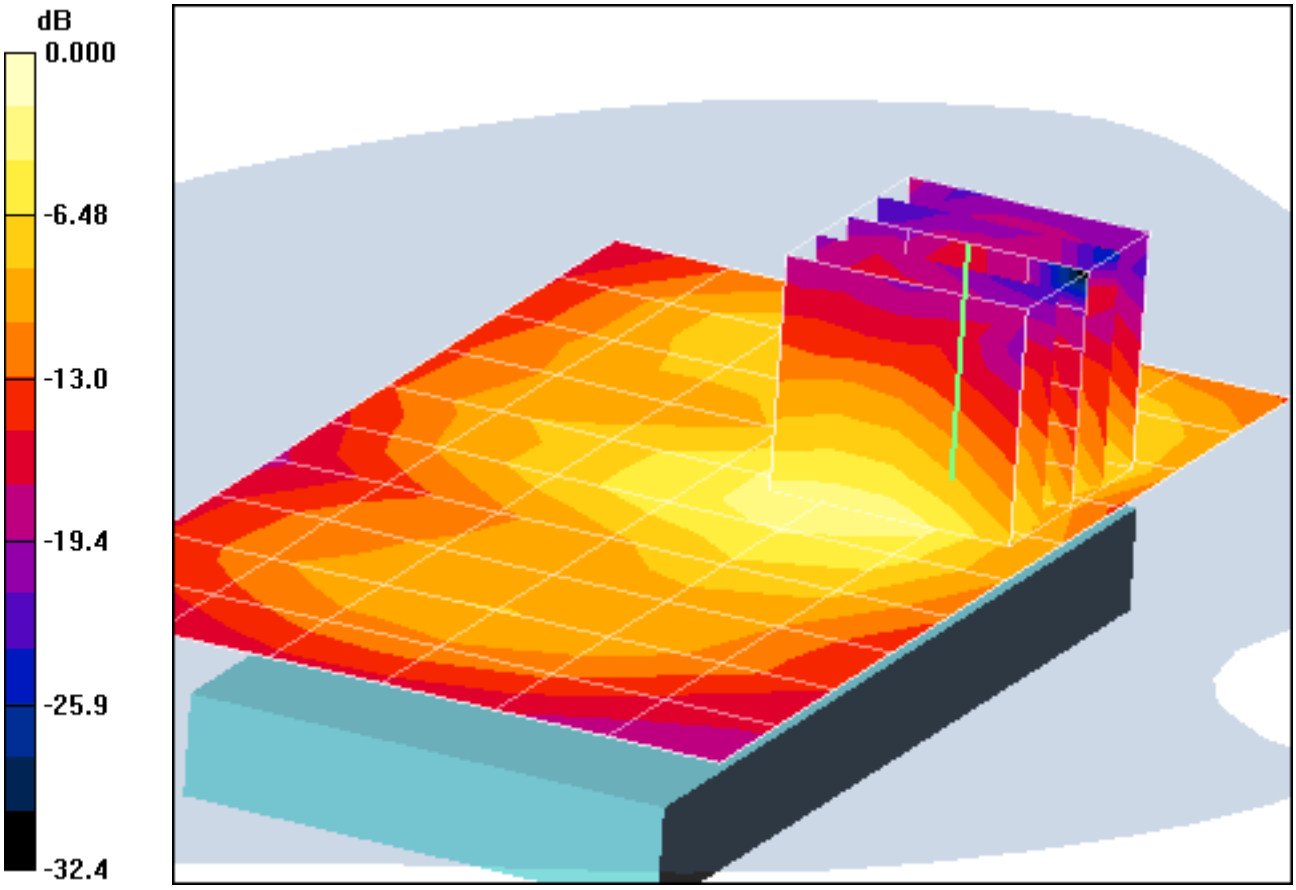
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Body Medium parameters used:
f = 2600 MHz; σ = 2.253 mho/m; ε_r = 50.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 22.5°C; Tissue Temp: 21.1°C

Probe: ES3DV2 - SN3022; ConvF(4.06, 4.06, 4.06); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WiMAX, Body SAR, Mid Ch., PUSC, QPSK, 10MHz BW, Back Side

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.0 V/m
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.455 mW/g; SAR(10 g) = 0.203 mW/g



0 dB = 0.614mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

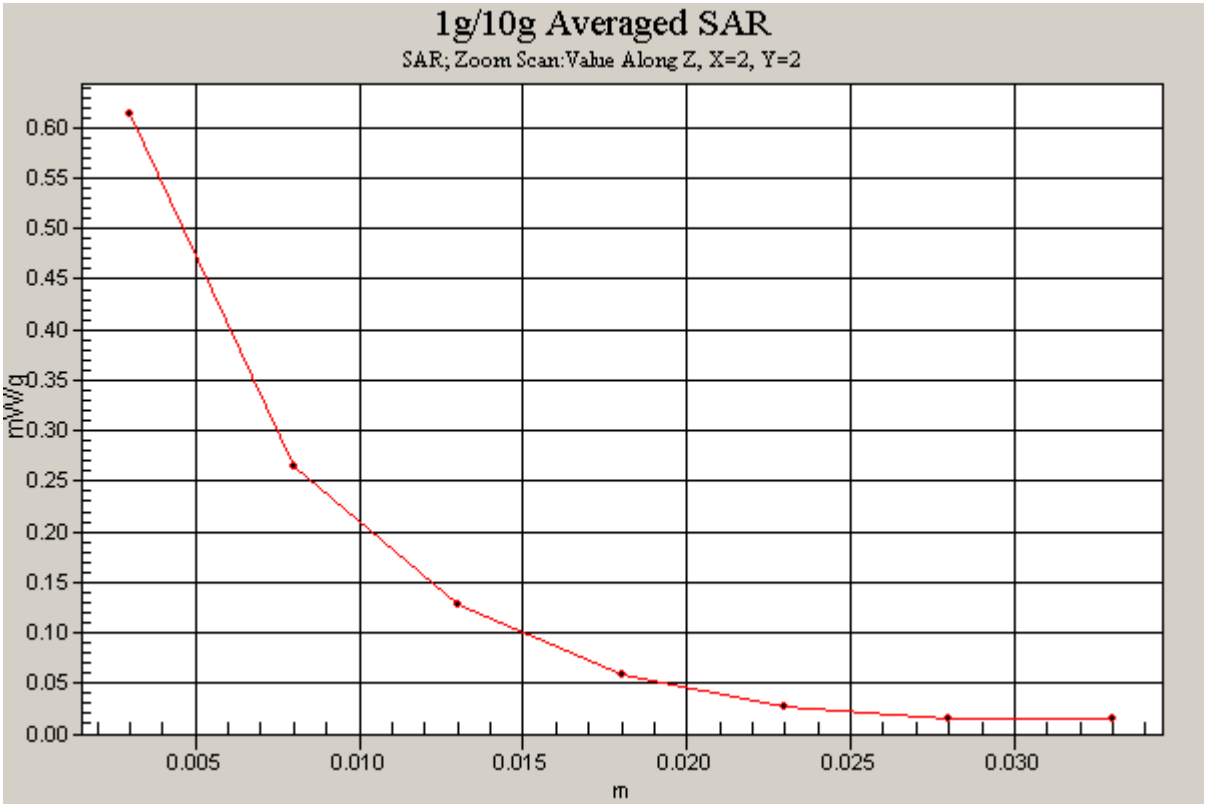
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Body Medium parameters used:
f = 2600 MHz; σ = 2.253 mho/m; ε_r = 50.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 22.5°C; Tissue Temp: 21.1°C

Probe: ES3DV2 - SN3022; ConvF(4.06, 4.06, 4.06); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WiMAX, Body SAR, Mid Ch., PUSC, QPSK, 10MHz BW, Back Side

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.0 V/m
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.455 mW/g; SAR(10 g) = 0.203 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

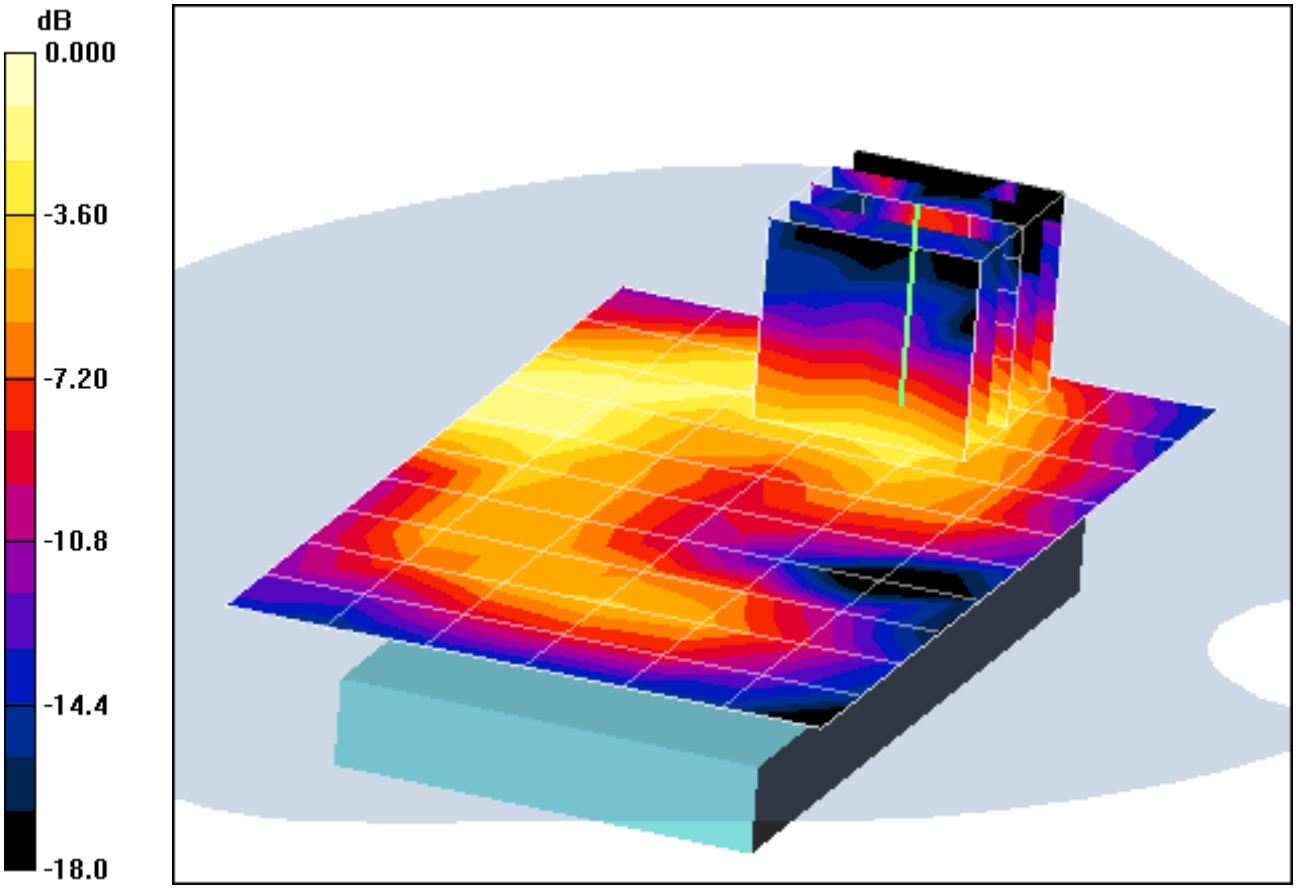
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Body Medium parameters used:
f = 2600 MHz; σ = 2.253 mho/m; ε_r = 50.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 22.5°C; Tissue Temp: 21.1°C

Probe: ES3DV2 - SN3022; ConvF(4.06, 4.06, 4.06); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WiMAX, Body SAR, Mid Ch., PUSC, QPSK, 10MHz BW, Front Side

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.12 V/m
Peak SAR (extrapolated) = 0.179 W/kg
SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.047 mW/g



0 dB = 0.108mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

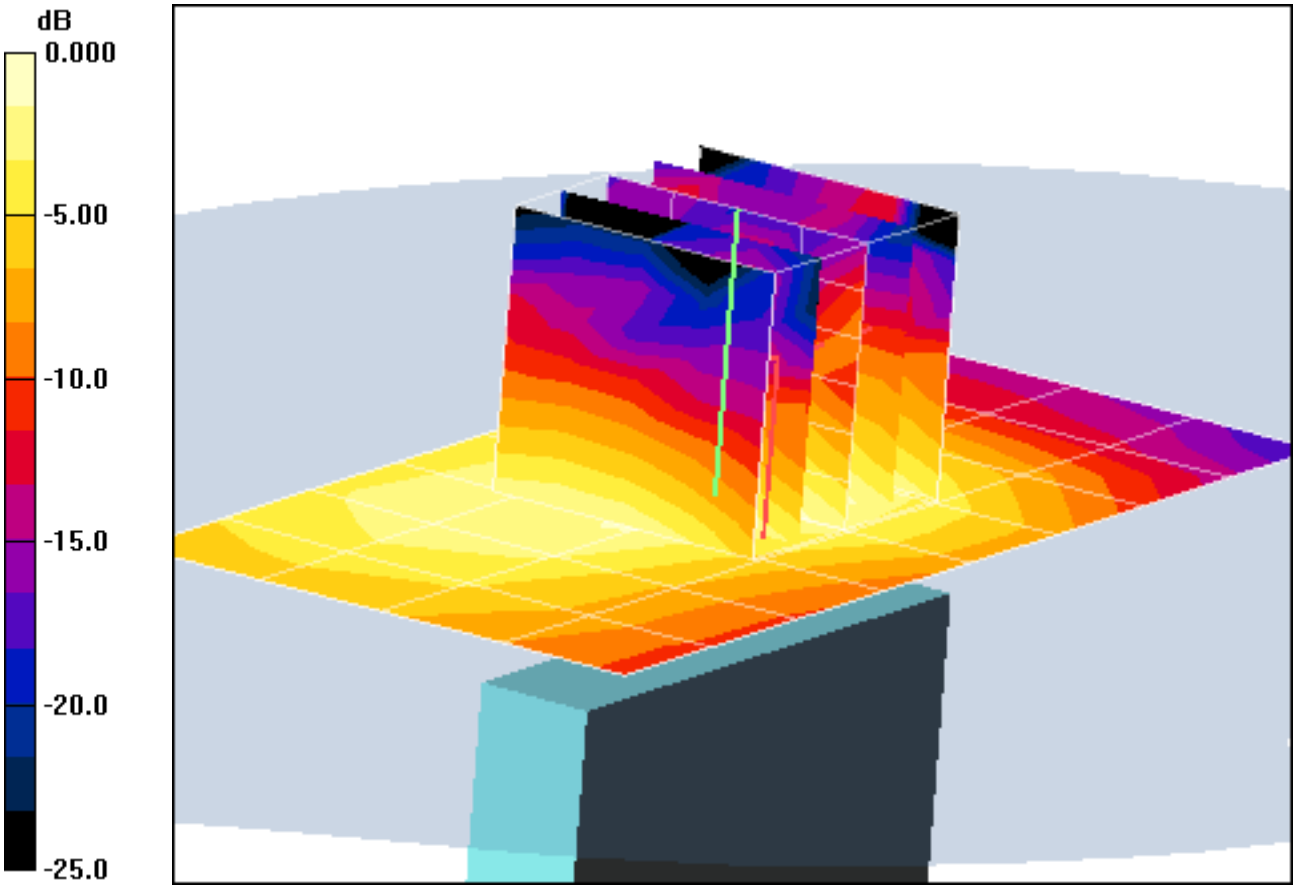
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Body Medium parameters used:
f = 2600 MHz; σ = 2.253 mho/m; ε_r = 50.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 22.5°C; Tissue Temp: 21.1°C

Probe: ES3DV2 - SN3022; ConvF(4.06, 4.06, 4.06); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WiMAX, Body SAR, Mid Ch., PUSC, QPSK, 5 MHz BW, Top Edge

Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.57 V/m
Peak SAR (extrapolated) = 0.182 W/kg
SAR(1 g) = 0.085 mW/g; SAR(10 g) = 0.044 mW/g



0 dB = 0.105mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSPHD720; Type: Cellular/PCS CDMA/EVDO Phone with WLAN, WIMAX Bluetooth and RFID; Serial: 62

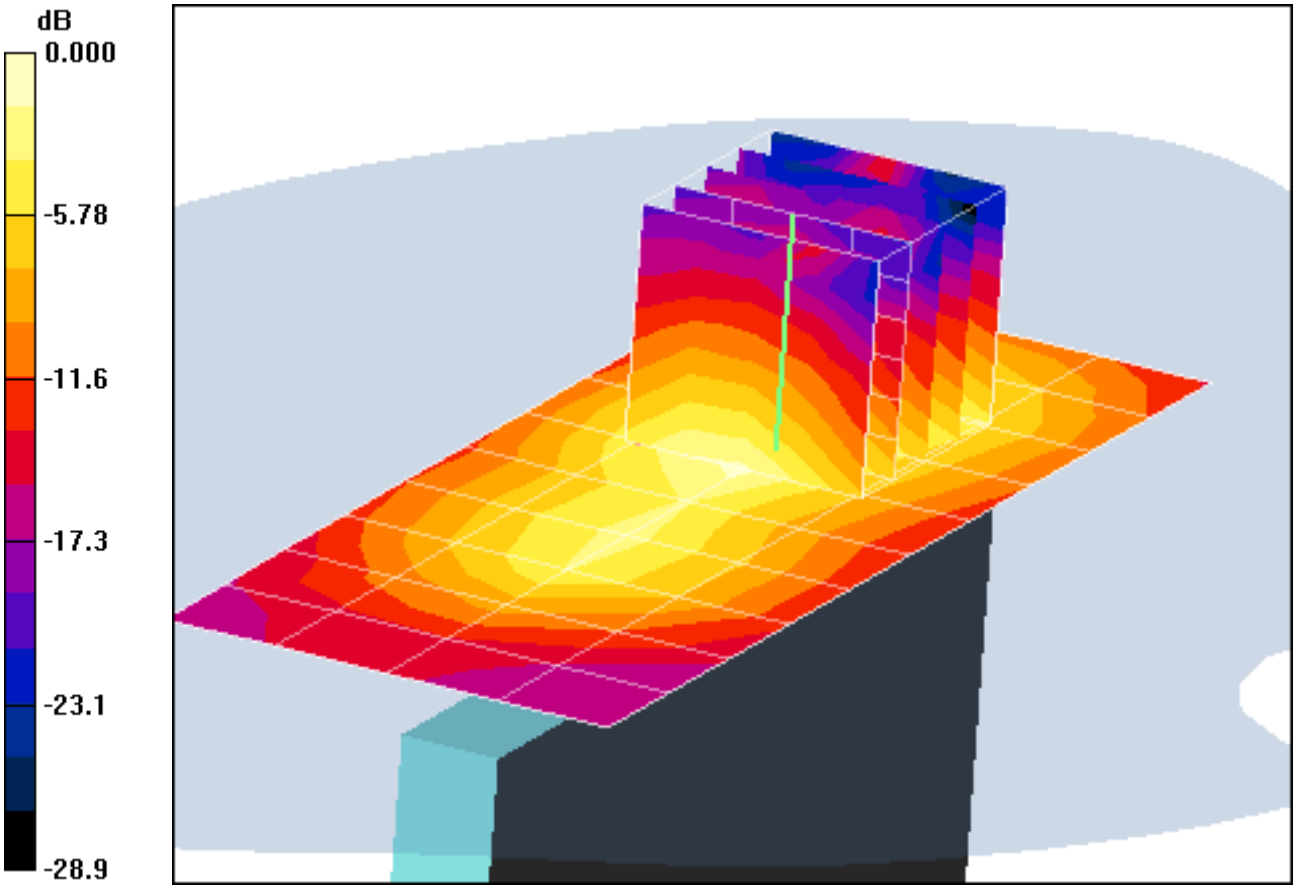
Communication System: WiMAX RF; Frequency: 2600 MHz;Duty Cycle: 1:3.2
Medium: 2600 Body Medium parameters used:
f = 2600 MHz; σ = 2.253 mho/m; ε_r = 50.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 22.5°C; Tissue Temp: 21.1°C

Probe: ES3DV2 - SN3022; ConvF(4.06, 4.06, 4.06); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WiMAX, Body SAR, Mid Ch., PUSC, QPSK, 10MHz BW, Left Side

Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.12 V/m
Peak SAR (extrapolated) = 0.852 W/kg
SAR(1 g) = 0.369 mW/g; SAR(10 g) = 0.166 mW/g



0 dB = 0.440mW/g

APPENDIX B: DIPOLE VALIDATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047

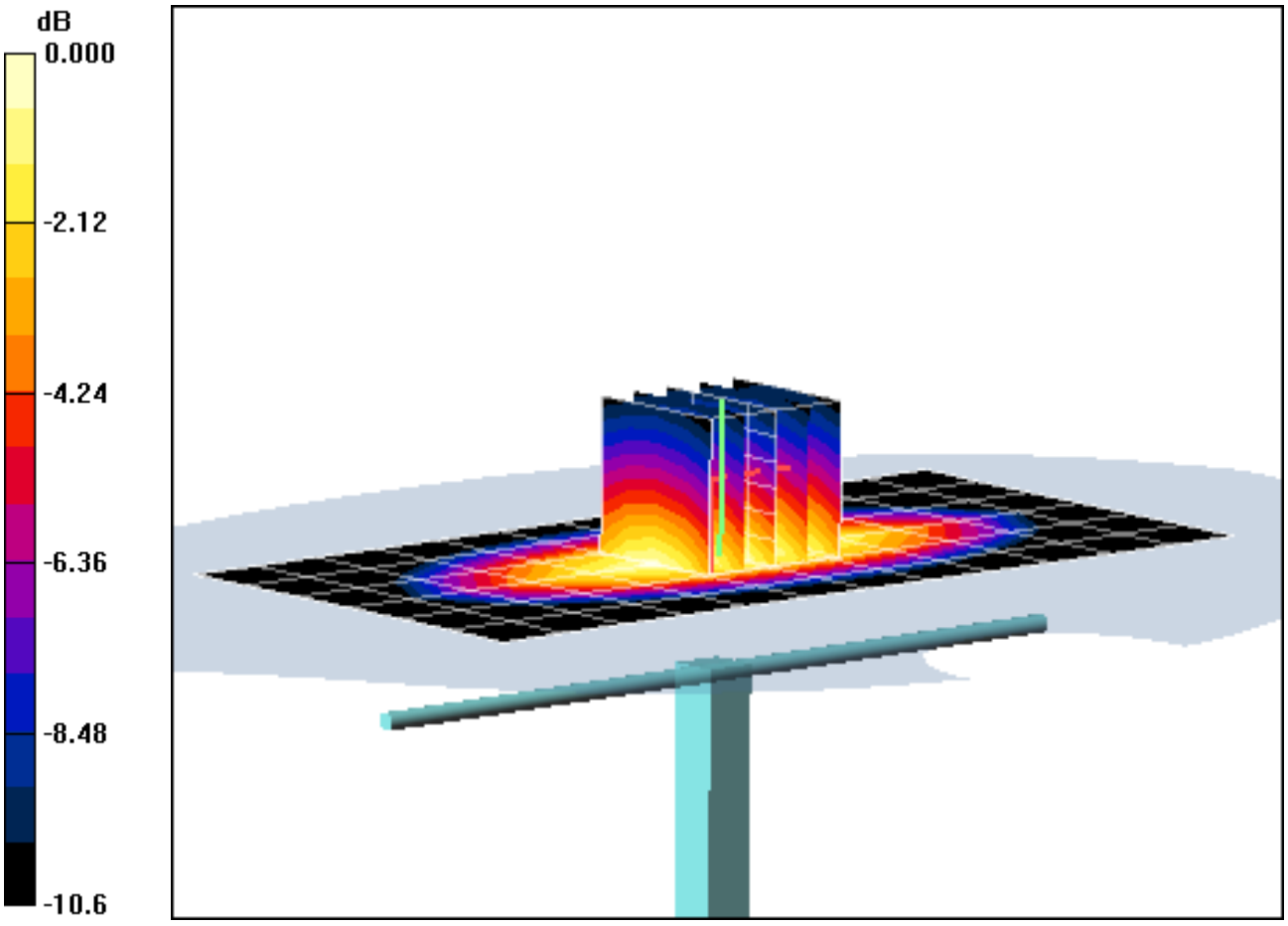
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.872 mho/m; ε_r = 41.88; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-14-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.4 °C

Probe: EX3DV4 - SN3561; ConvF(7.96, 7.96, 7.96); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

835MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 18.0 dBm (63 mW)
SAR(1 g) = 0.589 mW/g; SAR(10 g) = 0.383 mW/g
Deviation = -1.90 %



0 dB = 0.637mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047

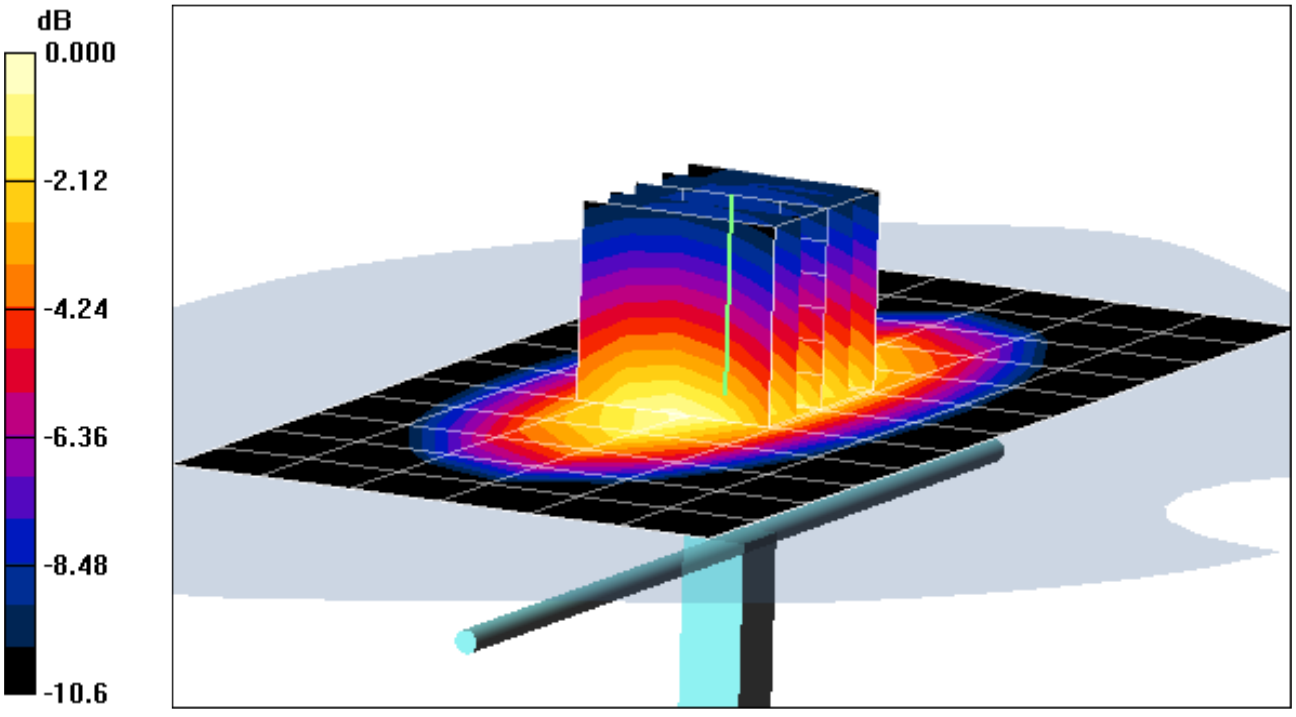
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 0.961 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-15-2011; Ambient Temp: 23.8 °C; Tissue Temp: 22.1 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

835MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 18.0 dBm (63 mW)
SAR(1 g) = 0.622 mW/g; SAR(10 g) = 0.408 mW/g
Deviation = 0.23 %



0 dB = 0.672mW/g

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.42 mho/m; ε_r = 41.8; ρ = 1000 kg/m^3

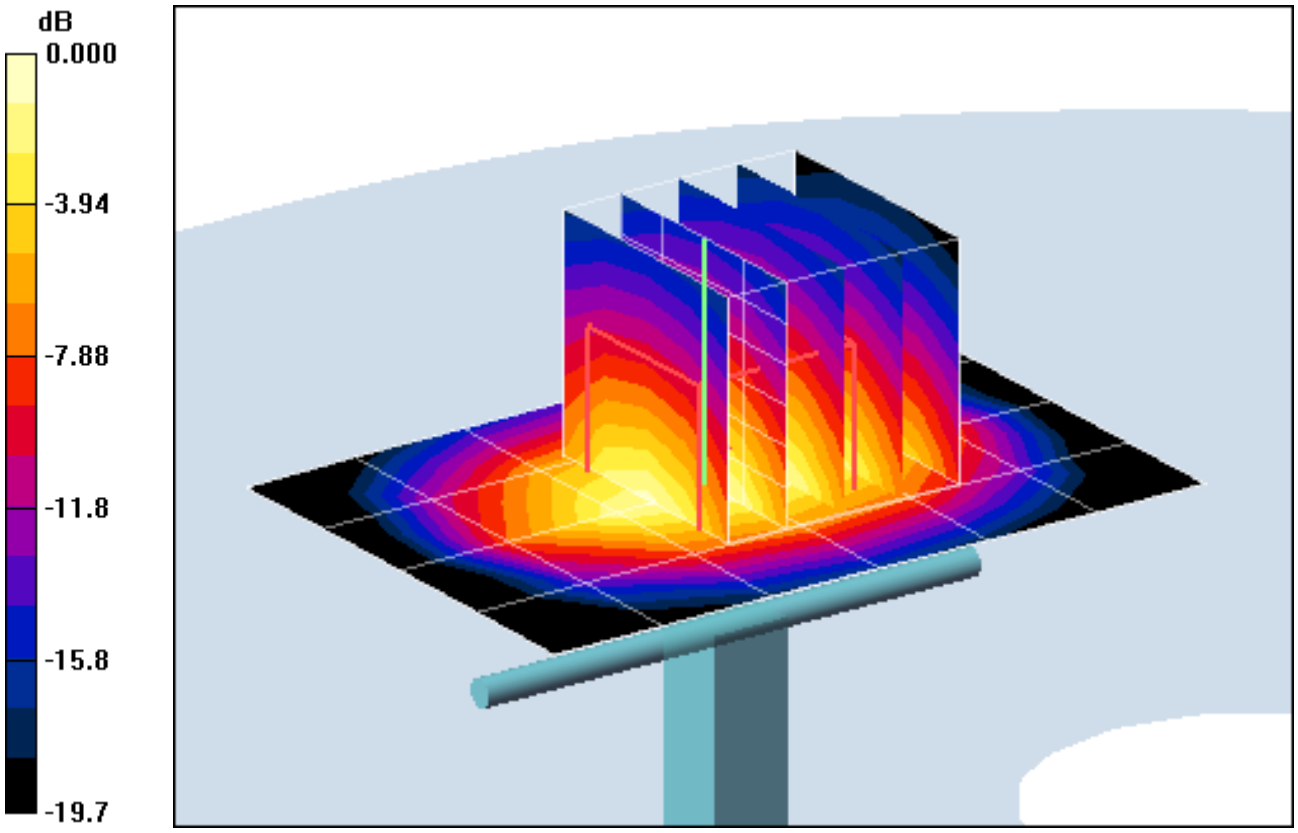
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-16-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.3 °C

Probe: EX3DV4 - SN3550; ConvF(7.01, 7.01, 7.01); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 16.0 dBm (40 mW)
SAR(1 g) = 1.58 mW/g; SAR(10 g) = 0.803 mW/g
Deviation = -1.74 %



0 dB = 1.76mW/g

PCTEST ENGINEERING LABORATORY, INC.

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

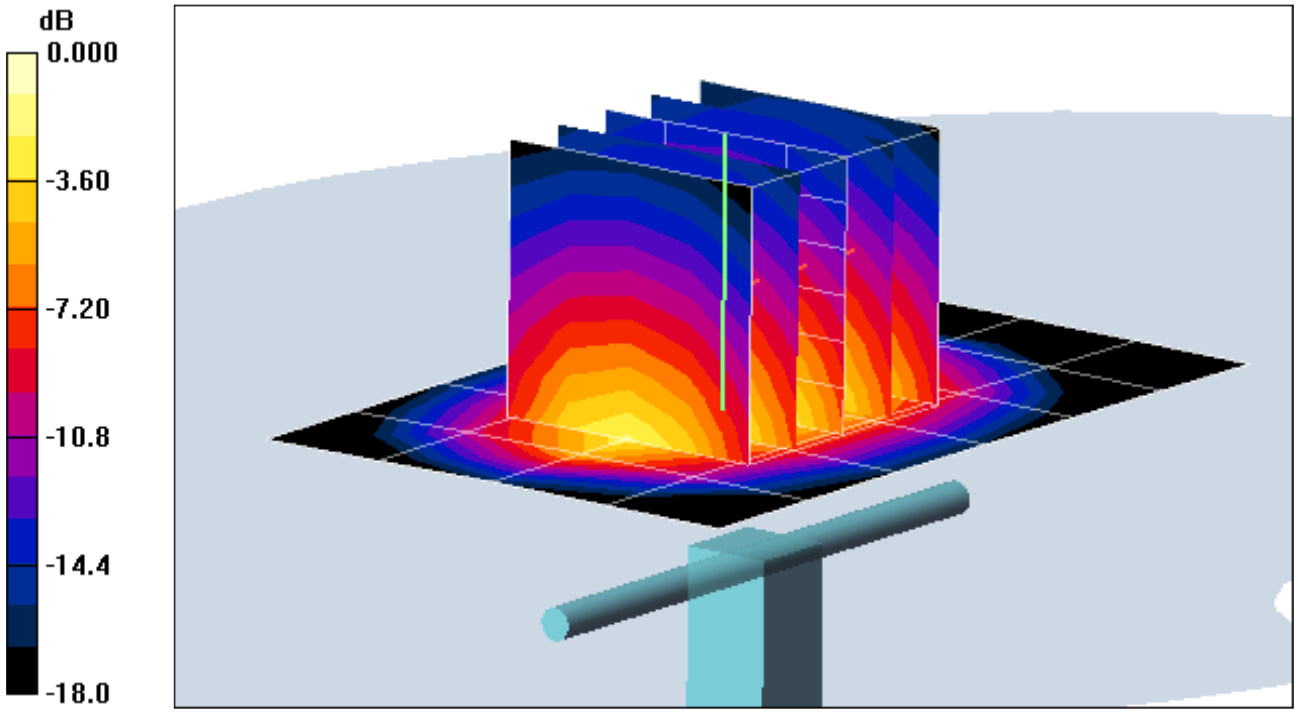
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.5 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-15-2011; Ambient Temp: 24.1 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 16.0 dBm (40 mW)
SAR(1 g) = 1.62 mW/g; SAR(10 g) = 0.833 mW/g
Deviation = -1.46 %



0 dB = 1.84mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 719

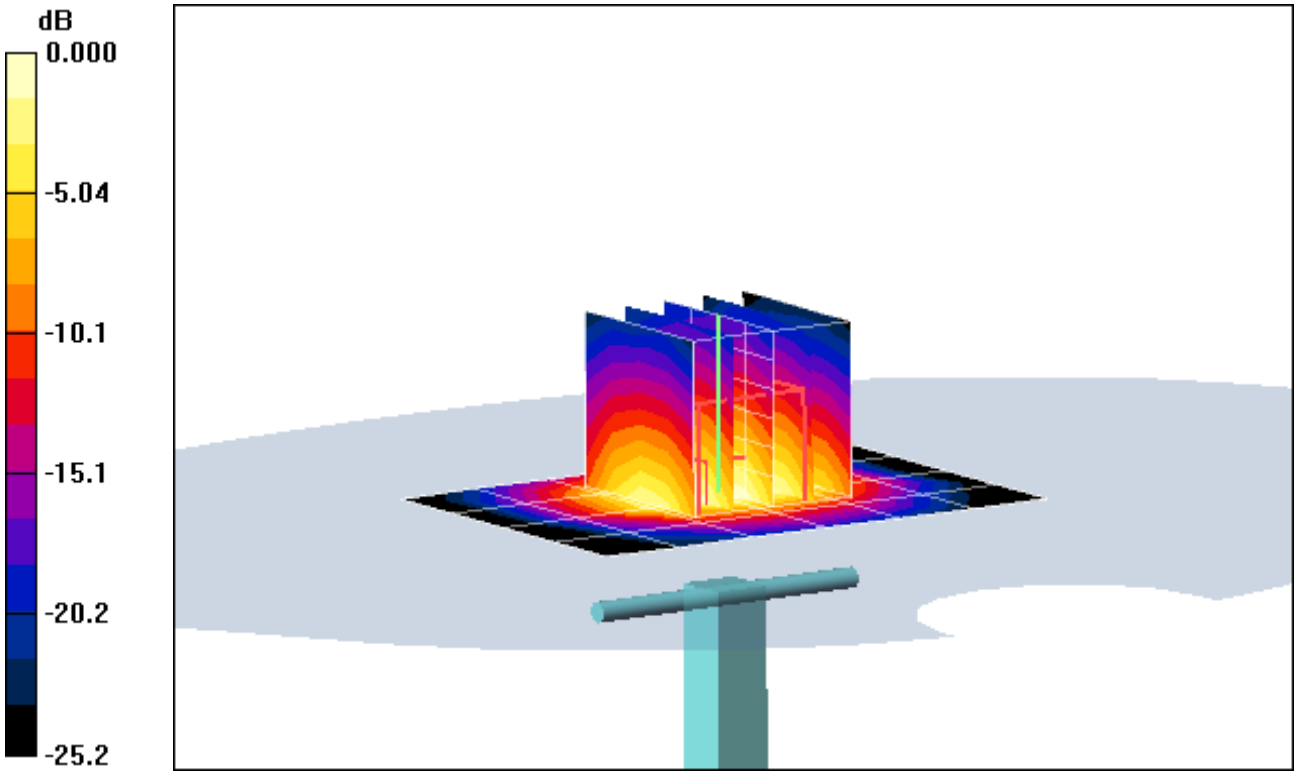
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.83 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-02-2011; Ambient Temp: 23.8 °C; Tissue Temp: 21.9 °C

Probe: EX3DV4 - SN3550; ConvF(6.29, 6.29, 6.29); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 1.27 mW/g; SAR(10 g) = 0.572 mW/g
Deviation = -5.05 %



0 dB = 1.56mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 719

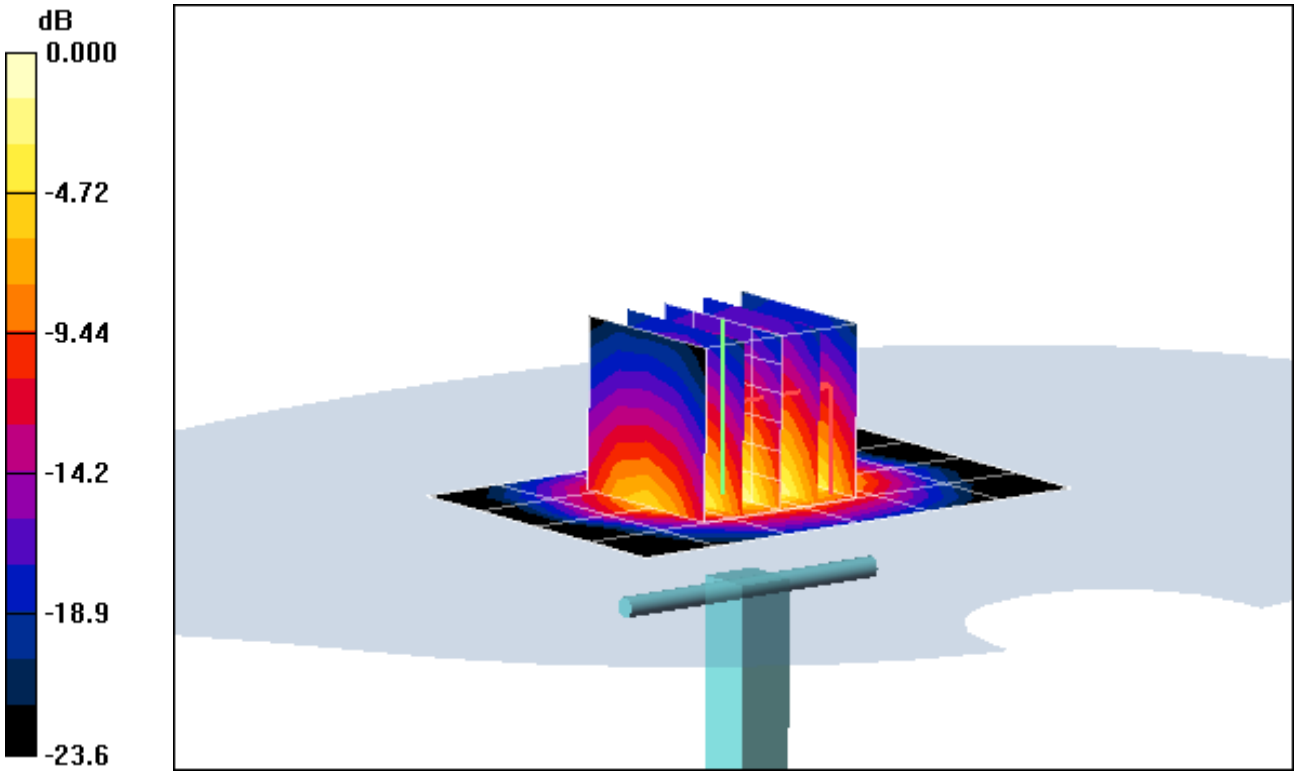
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 1.88 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-02-2011; Ambient Temp: 23.5 ° C; Tissue Temp: 21.7 ° C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 1.35 mW/g; SAR(10 g) = 0.620 mW/g
Deviation = 5.06 %



0 dB = 1.74mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 2600 MHz; Type: D2600V2; Serial: 1004

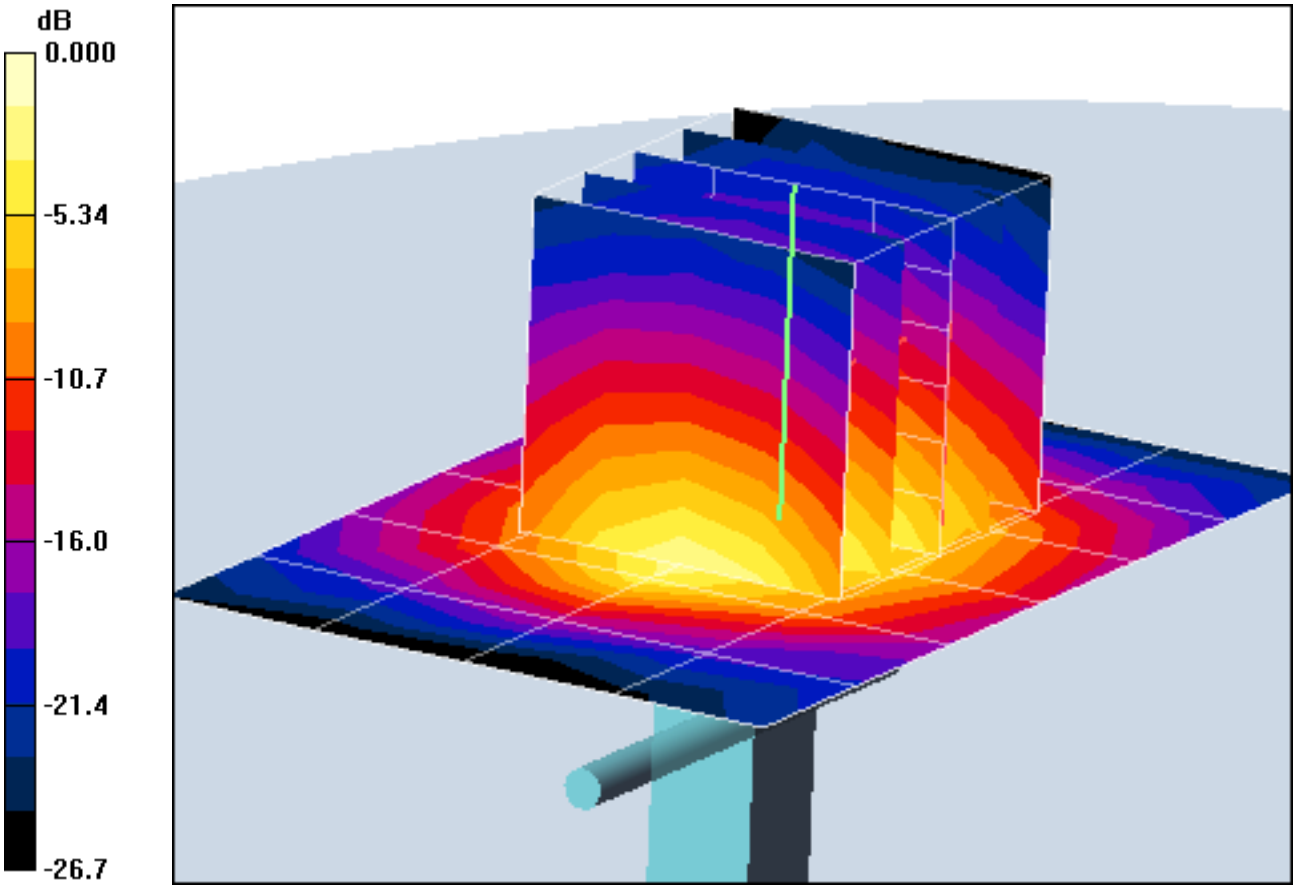
Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 2.044 mho/m; ε_r = 37.49; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 23.8°C; Tissue Temp: 22.2°C

Probe: ES3DV2 - SN3022; ConvF(4.14, 4.14, 4.14); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2600MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 11 dBm (12.9 mW)
SAR(1 g) = 0.794 mW/g; SAR(10 g) = 0.349 mW/g
Deviation = 8.75 %



0 dB = 1.02mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 2600 MHz; Type: D2600V2; Serial: 1027

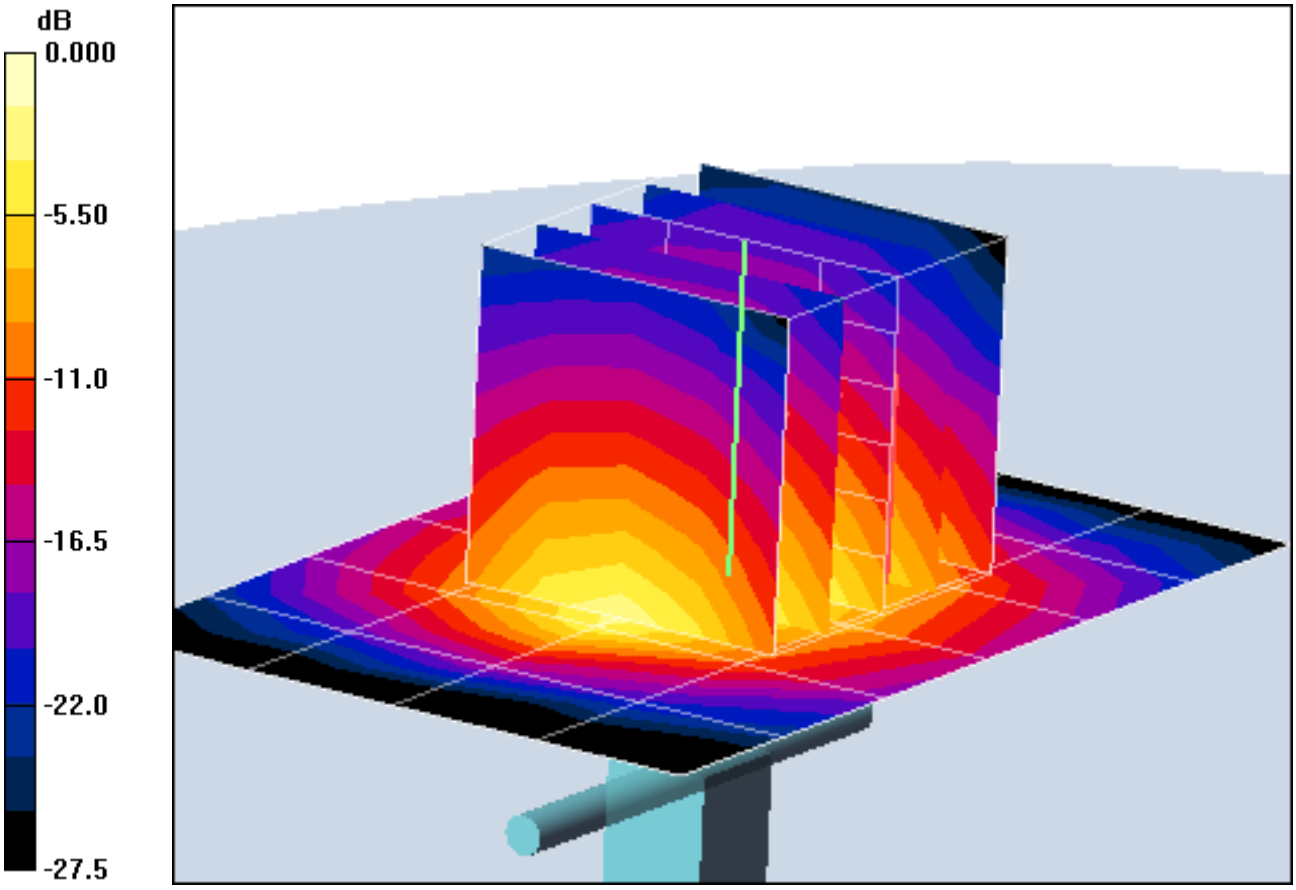
Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: 2600 Body Medium parameters used:
f = 2600 MHz; σ = 2.253 mho/m; ε_r = 50.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-07-2011; Ambient Temp: 22.5°C; Tissue Temp: 21.1°C

Probe: ES3DV2 - SN3022; ConvF(4.06, 4.06, 4.06); Calibrated: 9/21/2010
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2600MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 12.0 dBm (15.8 mW)
SAR(1 g) = 0.945 mW/g; SAR(10 g) = 0.411 mW/g
Deviation = 1.89 %



0 dB = 1.24mW/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
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
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_Sep10

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3022

Calibration procedure(s): QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes

Calibration date: September 21, 2010

KOK 9/29/10

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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 22, 2010

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *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:	September 18, 2009
Recalibrated:	September 21, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV2 SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.01	1.05	1.01	± 10.1%
DCP (mV)[B]	92.8	92.5	89.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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 Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV2 SN:3022

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	6.32	6.32	6.32	0.87	1.01 ± 11.0%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.02	6.02	6.02	0.62	1.20 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	5.01	5.01	5.01	0.27	2.23 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.83	4.83	4.83	0.25	2.29 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.21	4.21	4.21	0.25	2.62 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.14	4.14	4.14	0.25	2.64 ± 11.0%

[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.

DASY/EASY - Parameters of Probe: ES3DV2 SN:3022

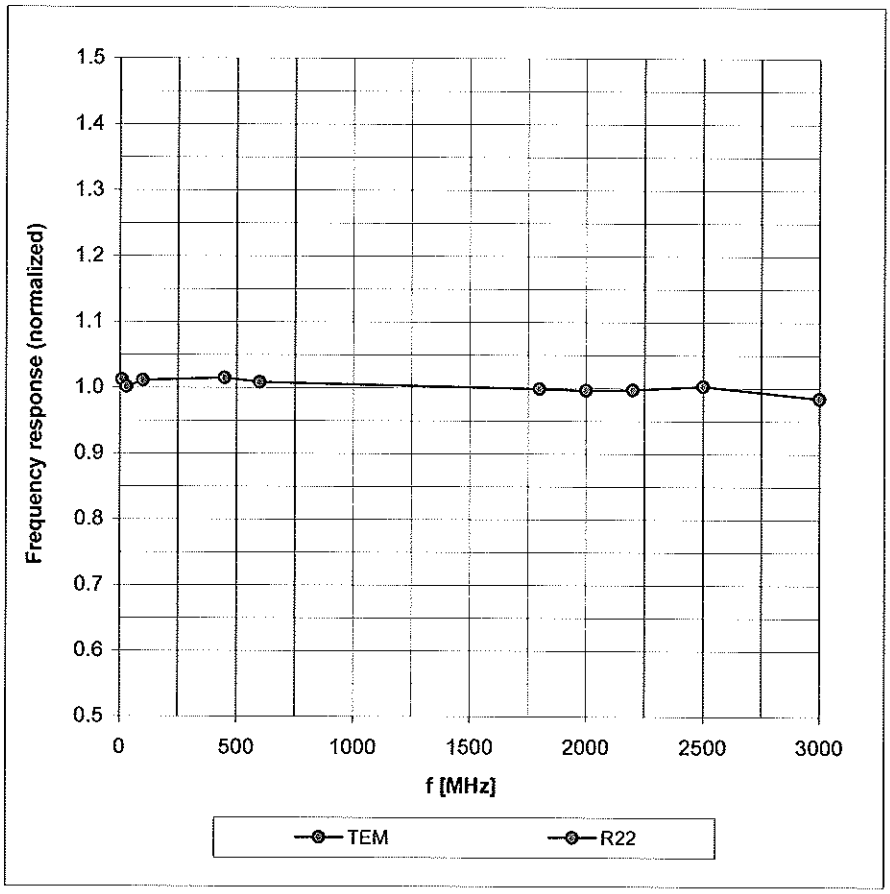
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	6.09	6.09	6.09	0.68	1.20 ± 11.0%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	5.89	5.89	5.89	0.65	1.20 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	4.59	4.59	4.59	0.23	2.83 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.34	4.34	4.34	0.22	3.71 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.06	4.06	4.06	0.41	1.42 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	4.06	4.06	4.06	0.53	1.23 ± 11.0%

[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.

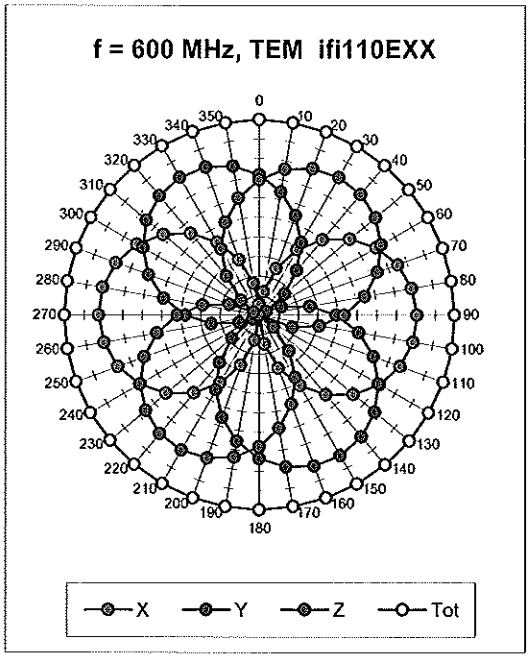
Frequency Response of E-Field

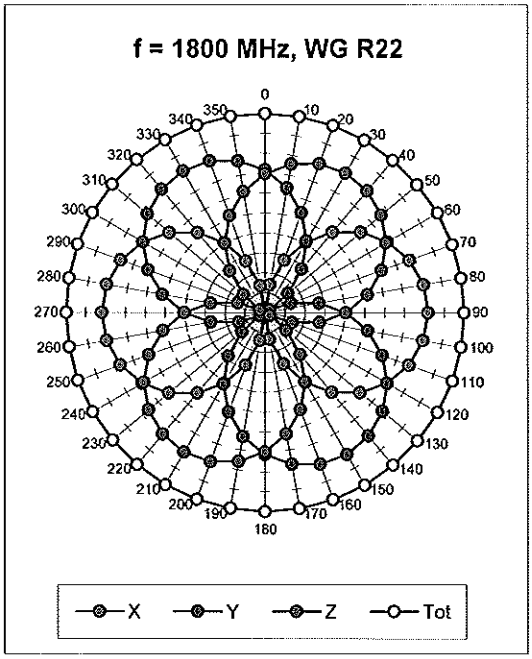
(TEM-Cell:ifi110 EXX, Waveguide: R22)

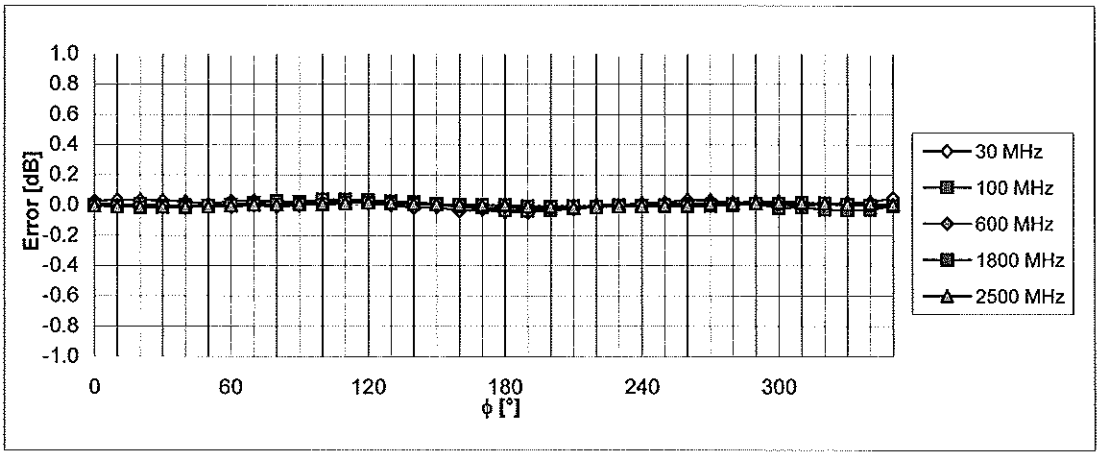


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



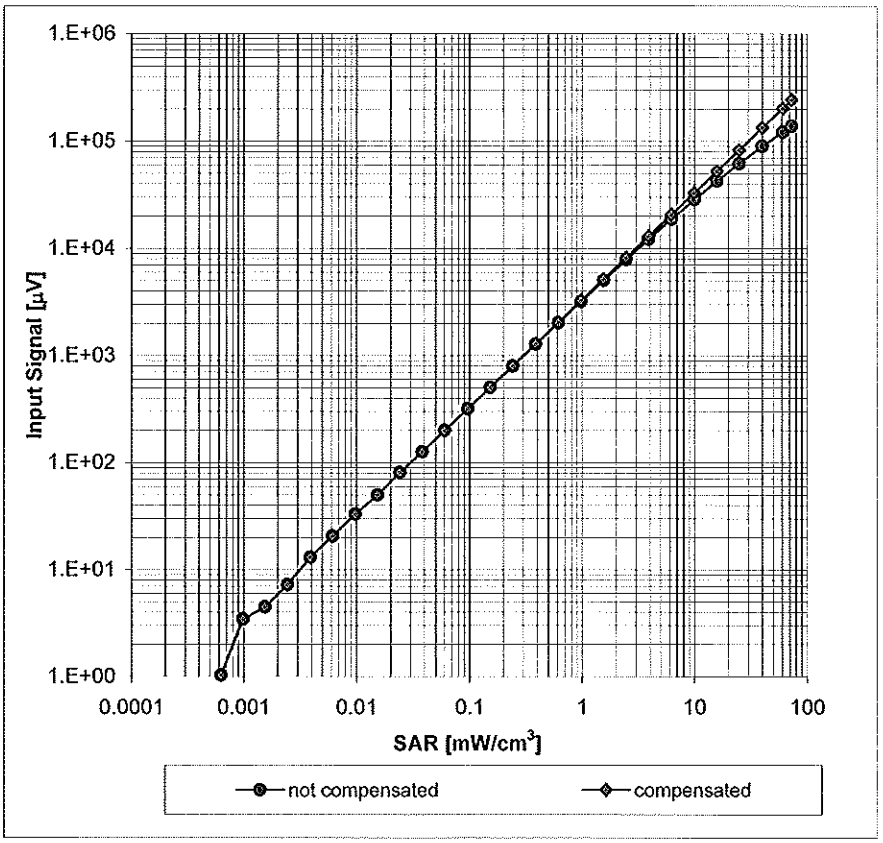


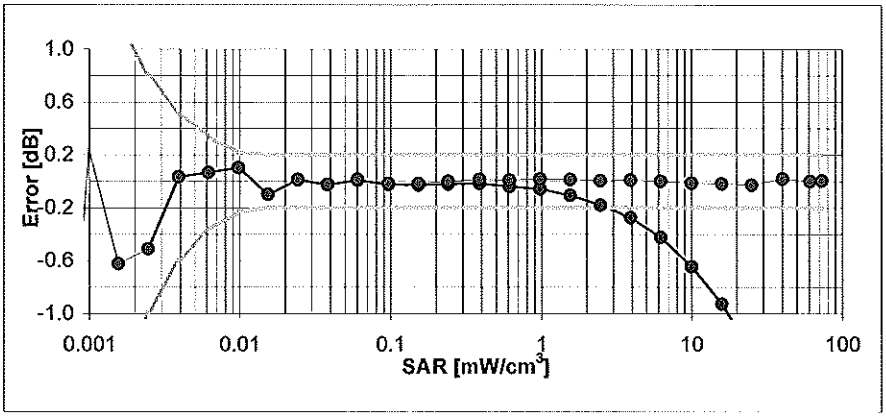


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

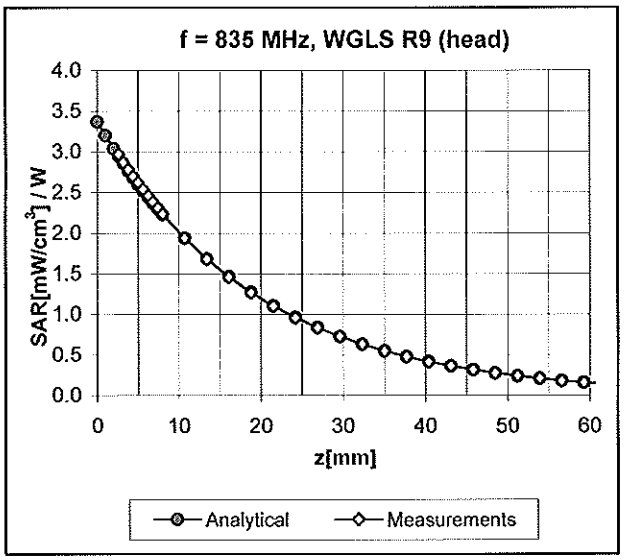
(Waveguide R22, f = 1800 MHz)

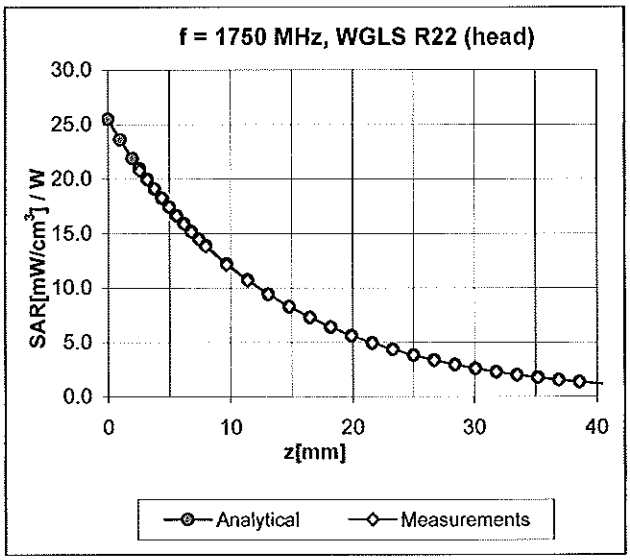




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

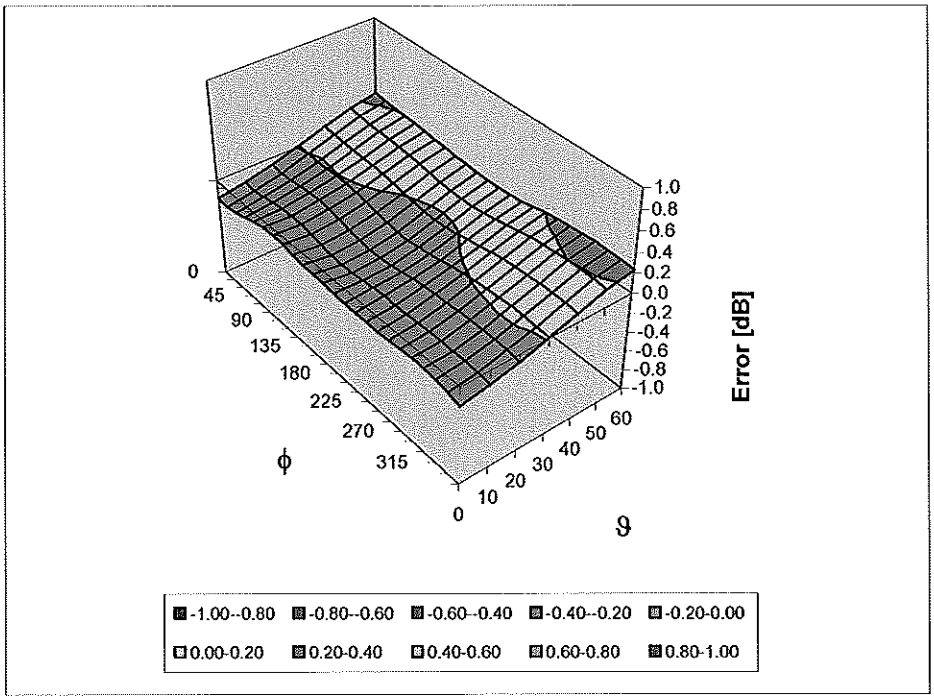
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4.0 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3209_Apr10

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3209

Calibration procedure(s): QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes

Calibration date: April 20, 2010

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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 22, 2010

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z*: *A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 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 ES3DV3

SN:3209

Manufactured:	October 14, 2008
Last calibrated:	April 15, 2009
Recalibrated:	April 20, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3209

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.35	1.35	1.15	± 10.1%
DCP (mV)[B]	94.4	93.7	94.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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 Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: ES3DV3 SN:3209

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.39	6.39	6.39	0.99	1.03 ± 11.0%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.12	6.12	6.12	0.92	1.07 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	5.34	5.34	5.34	0.62	1.33 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.16	5.16	5.16	0.48	1.52 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.56	4.56	4.56	0.47	1.66 ± 11.0%

[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.

DASY - Parameters of Probe: ES3DV3 SN:3209

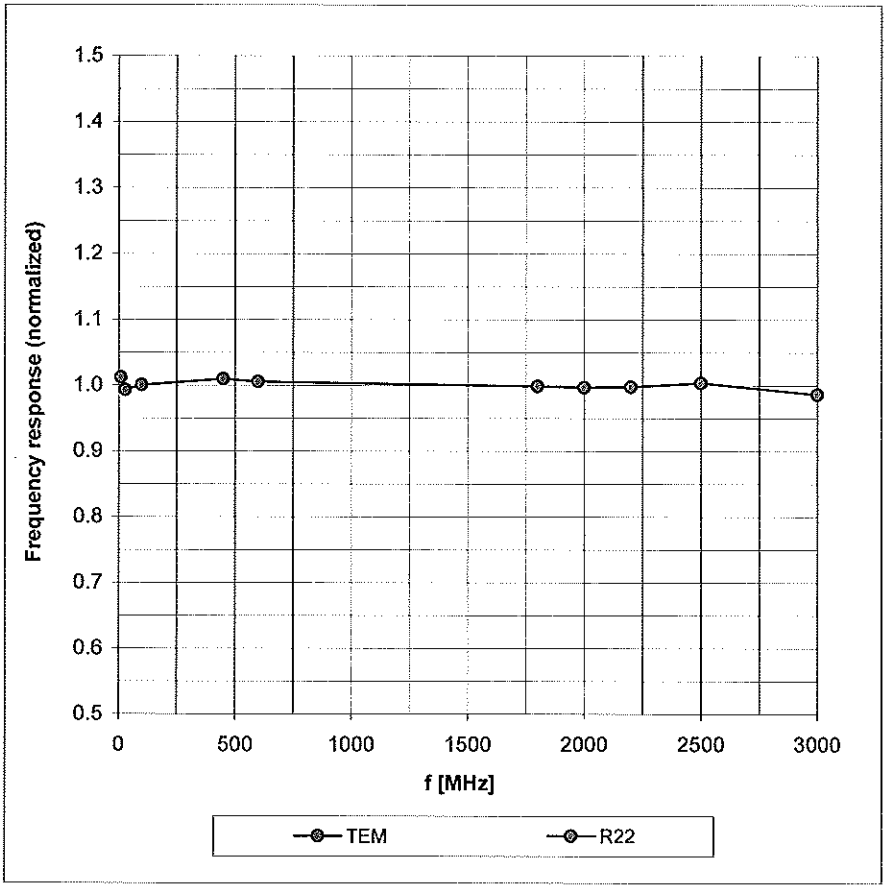
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	6.24	6.24	6.24	0.99	1.08 ± 11.0%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	6.09	6.09	6.09	0.89	1.15 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	4.85	4.85	4.85	0.32	2.16 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.65	4.65	4.65	0.36	2.14 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.35	4.35	4.35	0.74	1.25 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	4.25	4.25	4.25	0.99	1.06 ± 11.0%

[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.

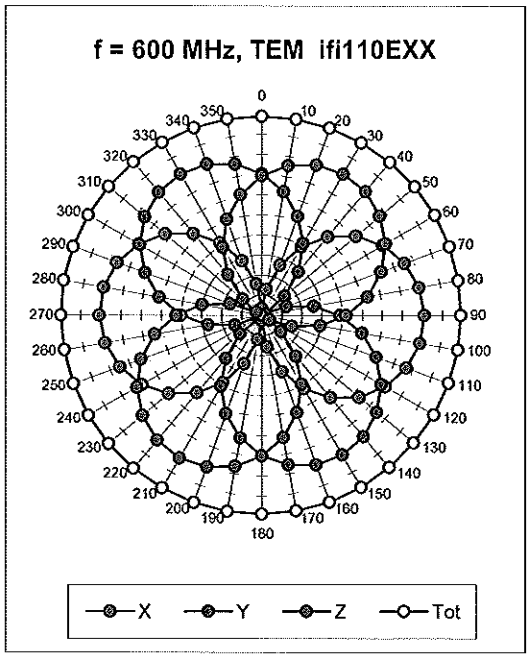
Frequency Response of E-Field

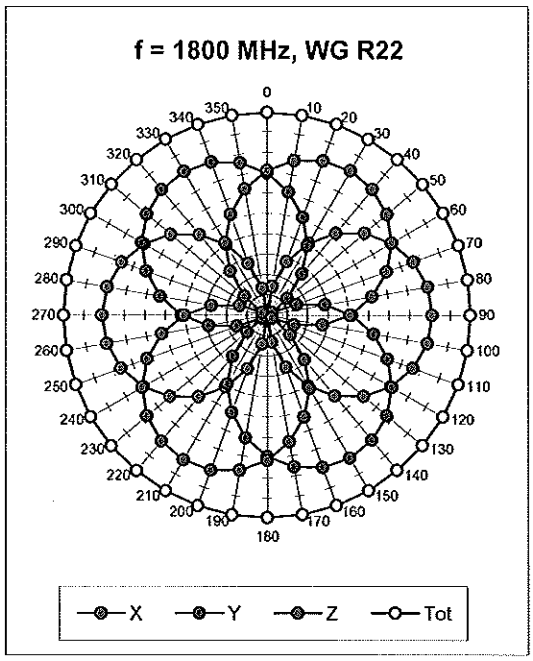
(TEM-Cell:ifi110 EXX, Waveguide: R22)

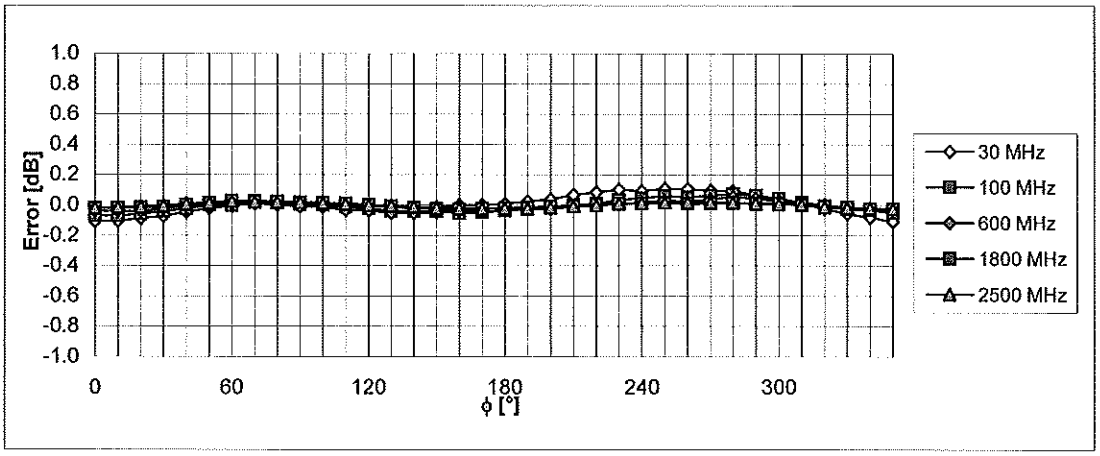


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



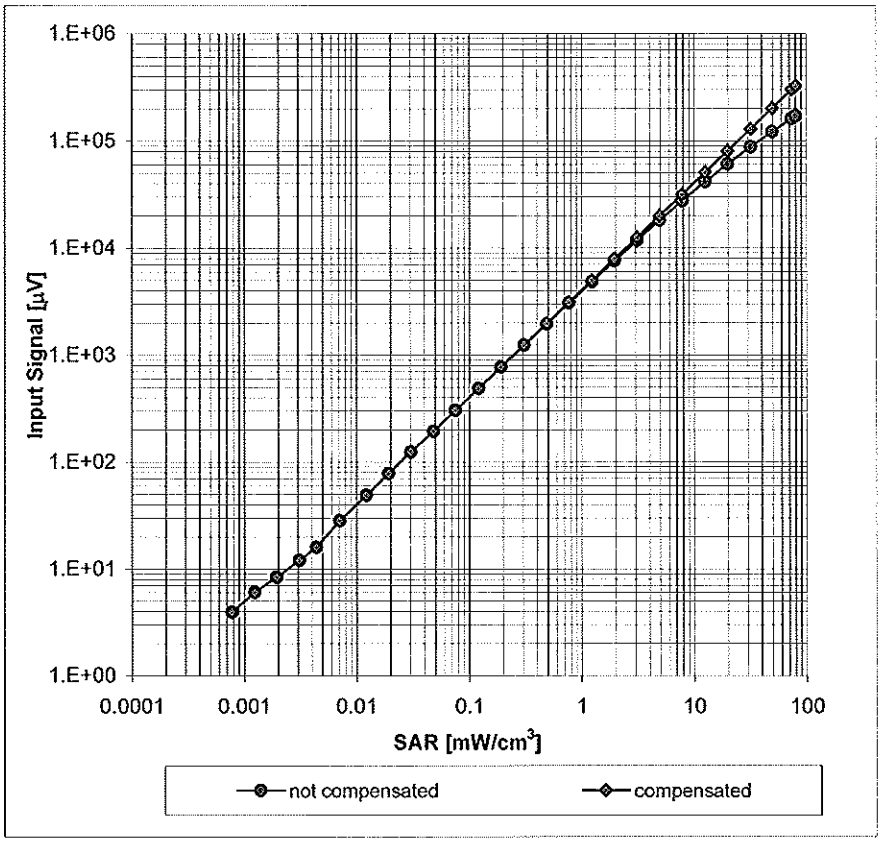


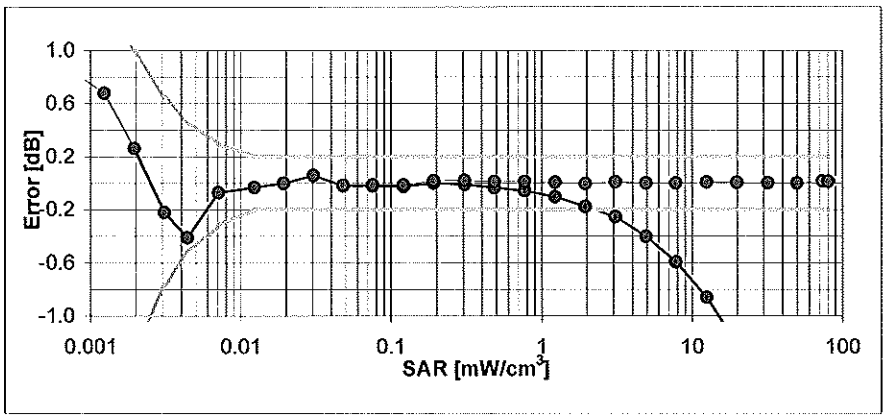


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

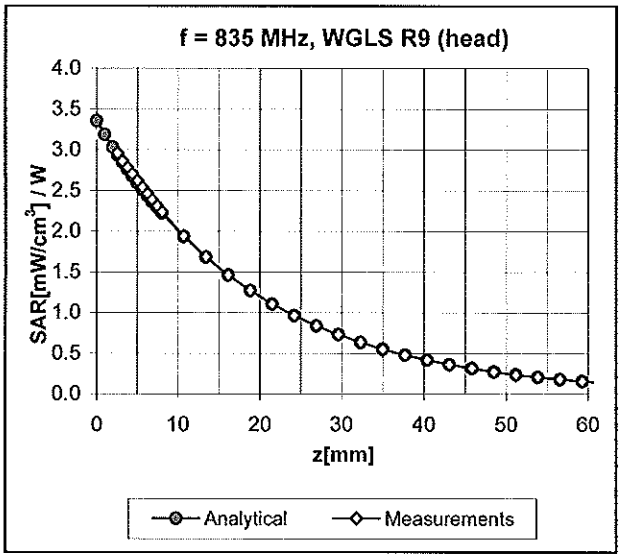
(Waveguide R22, f = 1800 MHz)

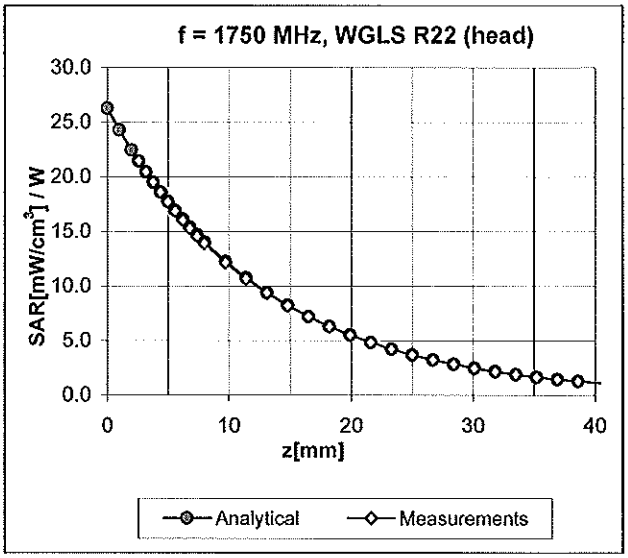




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

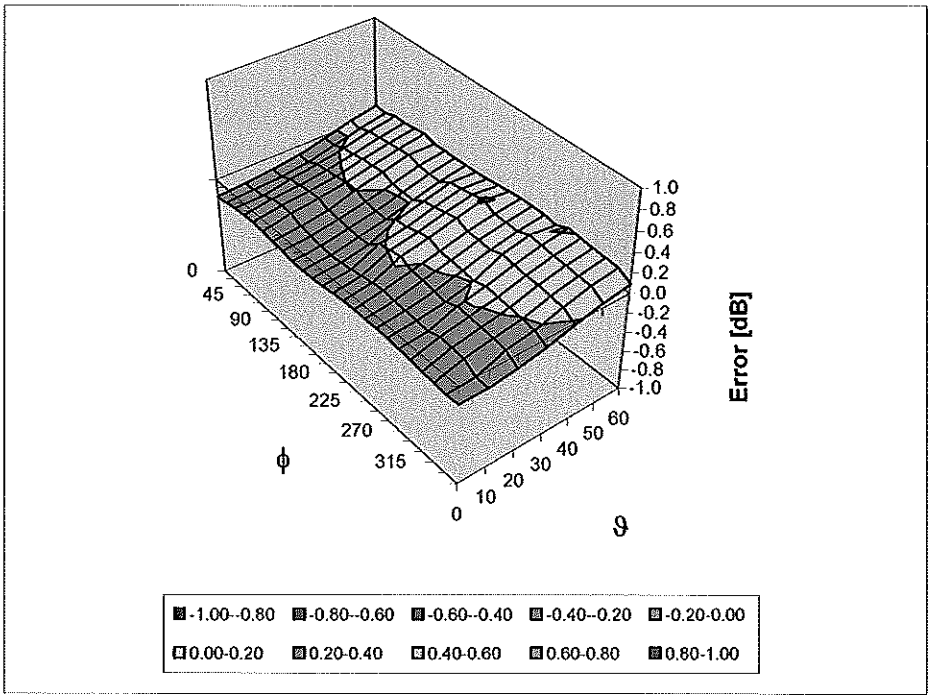
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4.0 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client PC Test

Certificate No: EX-3550_Feb11

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3550

Calibration procedure(s): QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes

Calibration date: February 14, 2011

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)

KOK 2/22/11

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: February 14, 2011

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization ω	ω 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., $\vartheta = 0$ 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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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 affect 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z* are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- *VR:* VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- *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 EX3DV4

SN:3550

Manufactured: May 19, 2004
Calibrated: February 14, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.52	0.45	0.50	± 10.1 %
DCP (mV)[B]	100.3	98.8	99.0	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	110.7	±2.2 %
			Y	0.00	0.00	1.00	145.7	
			Z	0.00	0.00	1.00	148.8	

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 Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	8.42	8.42	8.42	0.48	0.69	± 12.0 %
835	41.5	0.90	8.04	8.04	8.04	0.33	0.84	± 12.0 %
1750	40.1	1.37	7.33	7.33	7.33	0.46	0.65	± 12.0 %
1900	40.0	1.40	7.01	7.01	7.01	0.42	0.72	± 12.0 %
2450	39.2	1.80	6.29	6.29	6.29	0.13	1.57	± 12.0 %
2600	39.0	1.96	6.13	6.13	6.13	0.20	1.32	± 12.0 %
4950	36.3	4.40	4.37	4.37	4.37	0.35	1.80	± 13.1 %
5200	36.0	4.66	4.06	4.06	4.06	0.35	1.80	± 13.1 %
5300	35.9	4.76	3.92	3.92	3.92	0.35	1.80	± 13.1 %
5500	35.6	4.96	3.77	3.77	3.77	0.35	1.80	± 13.1 %
5600	35.5	5.07	3.50	3.50	3.50	0.40	1.80	± 13.1 %
5800	35.3	5.27	3.64	3.64	3.64	0.40	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4- SN:3550

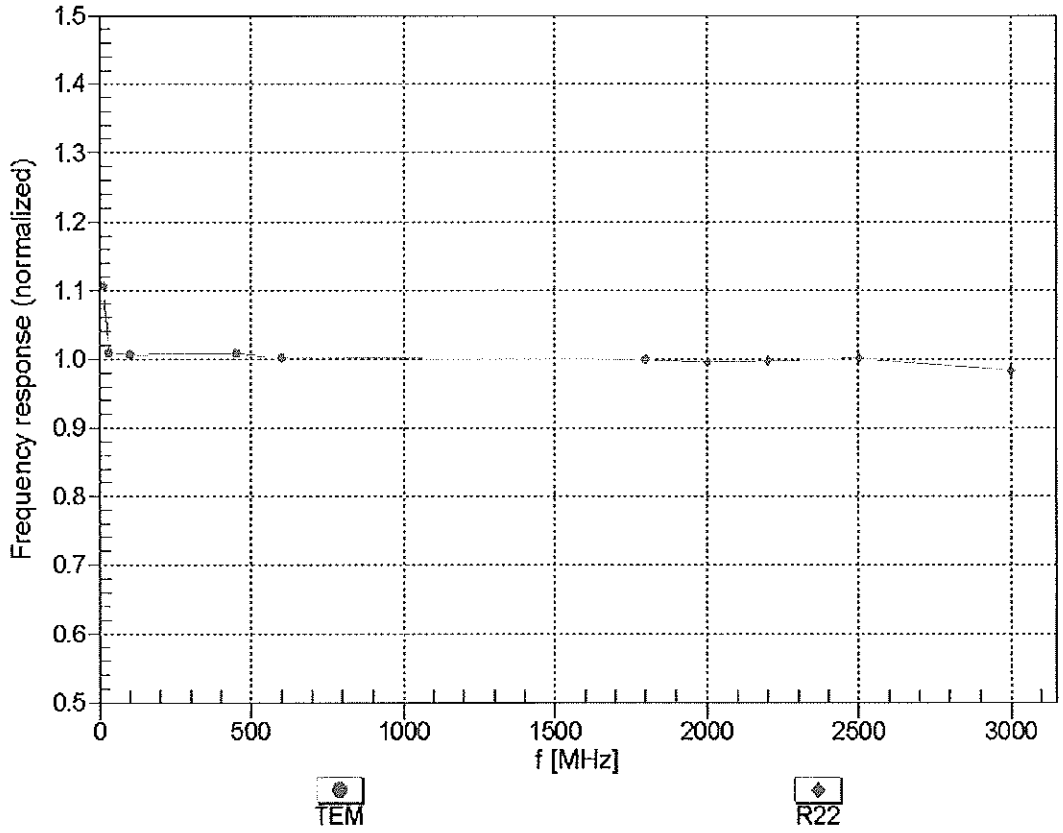
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	8.18	8.18	8.18	0.23	1.09	± 12.0 %
835	55.2	0.97	8.11	8.11	8.11	0.25	1.05	± 12.0 %
1750	53.4	1.49	7.21	7.21	7.21	0.42	0.89	± 12.0 %
1900	53.3	1.52	6.77	6.77	6.77	0.35	0.84	± 12.0 %
2450	52.7	1.95	6.25	6.25	6.25	0.30	0.86	± 12.0 %
2600	52.5	2.16	5.98	5.98	5.98	0.21	1.03	± 12.0 %
3700	51.0	3.55	5.42	5.42	5.42	0.20	1.95	± 13.1 %
4950	49.4	5.01	3.72	3.72	3.72	0.45	1.90	± 13.1 %
5200	49.0	5.30	3.58	3.58	3.58	0.45	1.90	± 13.1 %
5300	48.9	5.42	3.31	3.31	3.31	0.48	1.90	± 13.1 %
5500	48.6	5.65	3.21	3.21	3.21	0.47	1.90	± 13.1 %
5600	48.5	5.77	3.19	3.19	3.19	0.45	1.90	± 13.1 %
5800	48.2	6.00	3.29	3.29	3.29	0.50	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

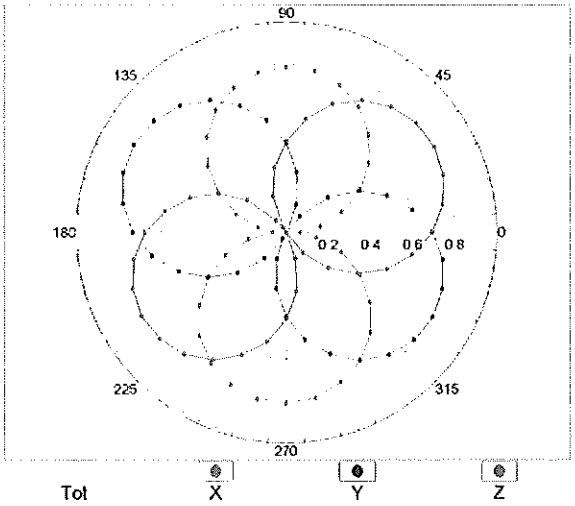
(TEM-Cell:ifi110 EXX, Waveguide: R22)



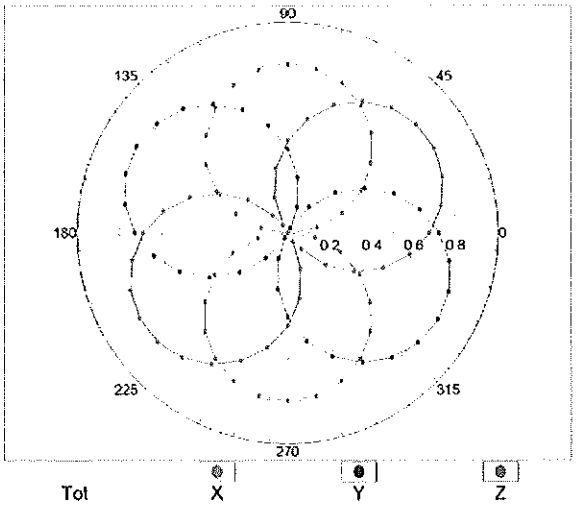
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

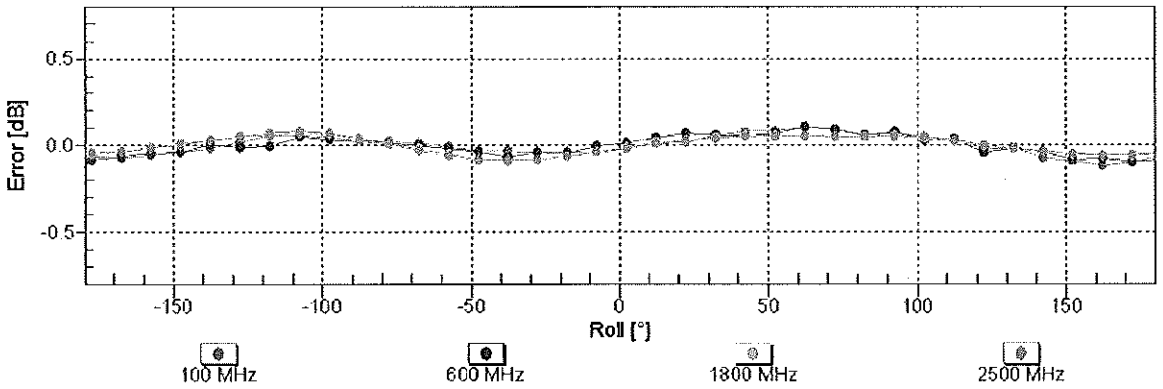
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



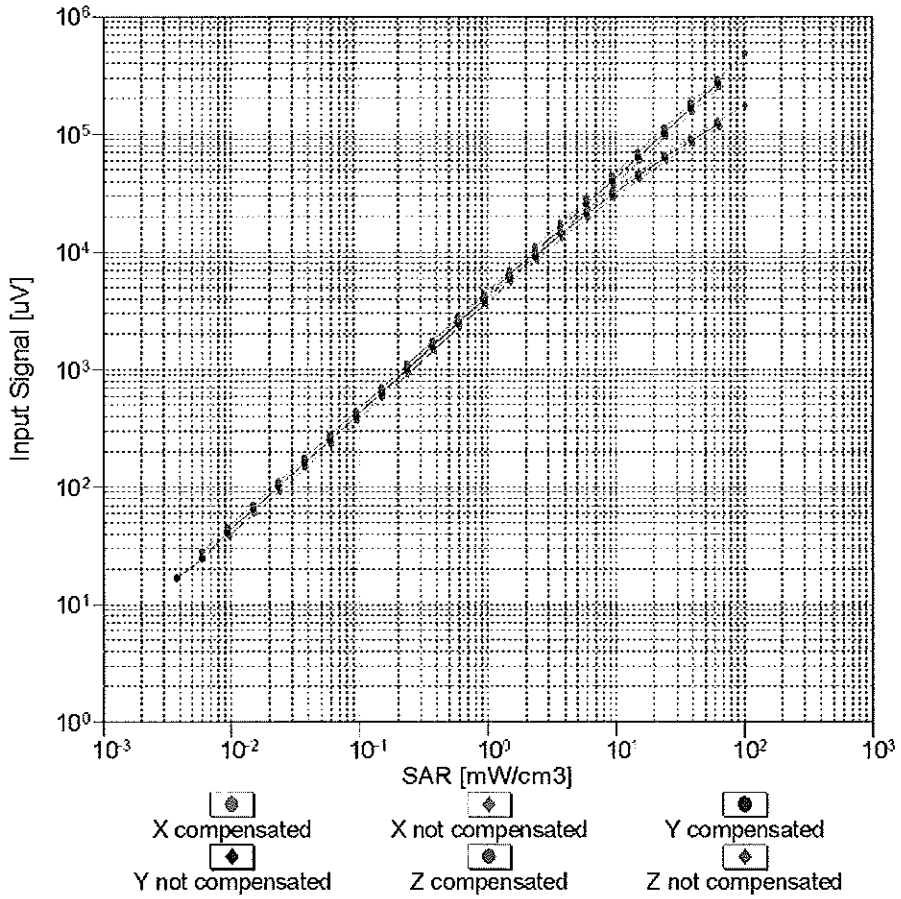
f=1800 MHz,R22

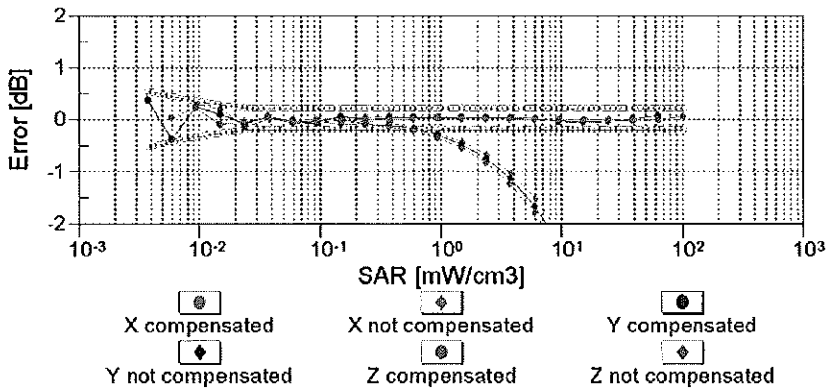




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

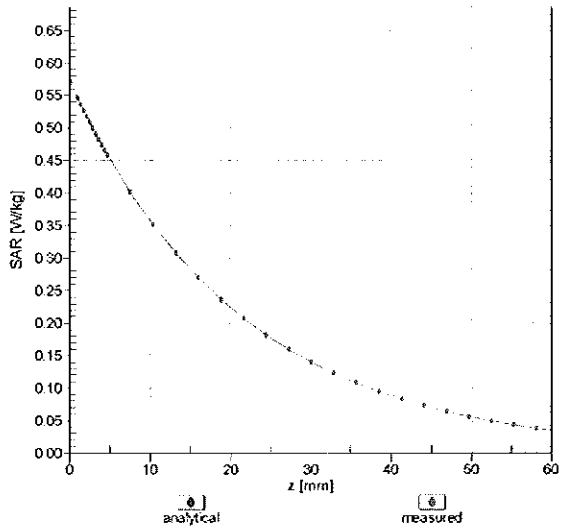




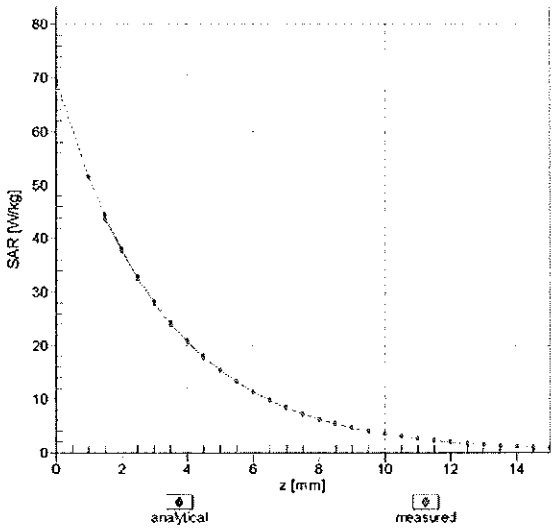
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 750 MHz,WGLS R9 (H_convF)

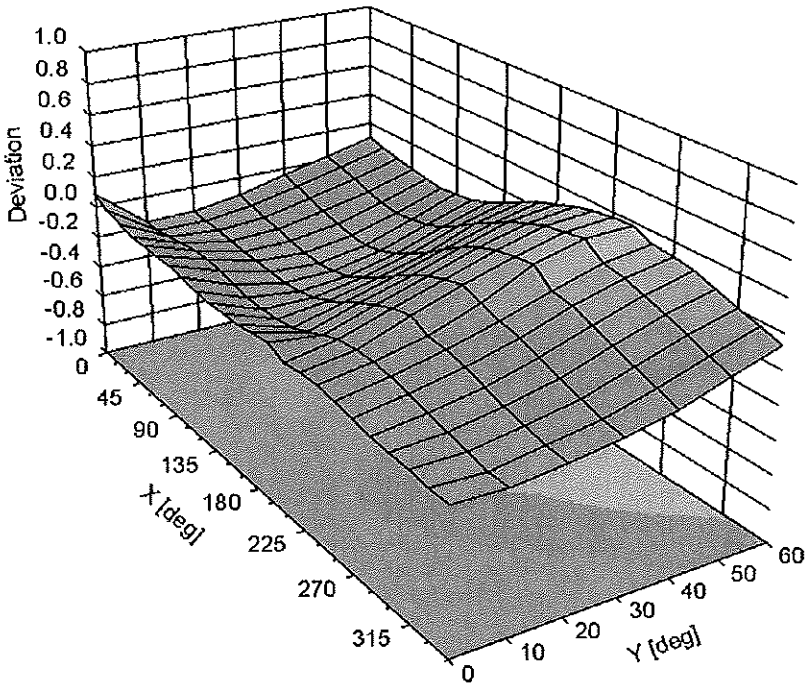


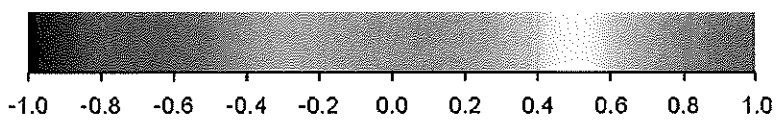
f = 5800 MHz,WGLS R58 (H_convF)-SCS



Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	3 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm