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SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
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Gyeonggi-do, 443-742
Republic of Korea

Date of Testing:
09/28/12 – 10/02/12, 11/07/12 – 11/08/12
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1211071601.A3L

FCC ID: **A3LGTI8190N**

APPLICANT: **SAMSUNG ELECTRONICS CO., LTD.**

DUT Type: Portable Handset
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): GT-I8190N

Band & Mode	Tx Frequency	Conducted Power [dBm]	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	32.80	0.10	0.50	0.50
GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	30.19	0.27	0.99	0.99
UMTS 1900	1852.4 - 1907.6 MHz	22.93	0.51	0.91	0.91
2.4 GHz WLAN	2412 - 2462 MHz	15.51	< 0.1	< 0.1	< 0.1
5.8 GHz WLAN	5745 - 5825 MHz	13.33	< 0.1	0.18	
5.2 GHz WLAN	5180 - 5240 MHz	12.38	< 0.1	0.36	
5.3 GHz WLAN	5260 - 5320 MHz	12.40	0.10	0.39	
5.5 GHz WLAN	5500 - 5700 MHz	12.47	< 0.1	0.24	
Bluetooth	2402 - 2480 MHz	10.51	N/A		
Simultaneous SAR per KDB 690783 D01:			0.53	1.30	1.00

Note: Powers in the above table represent output powers for the SAR test configurations and may not represent the highest output powers for all configurations for each mode.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE 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 in applicable Industry Canada Radio Standards Specifications (RSS); for North American frequency bands only.

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 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Tx Frequency
GSM/GPRS/EDGE 850	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz
UMTS 1900	1852.4 - 1907.6 MHz
2.4 GHz WLAN	2412 - 2462 MHz
5.8 GHz WLAN	5745 - 5825 MHz
5.2 GHz WLAN	5180 - 5240 MHz
5.3 GHz WLAN	5260 - 5320 MHz
5.5 GHz WLAN	5500 - 5700 MHz
Bluetooth	2402 - 2480 MHz
NFC	13.56 MHz

1.2 Near Field Communication (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the standard battery and will be the only battery available from the manufacturer for this model. The device restricts the battery used to battery model: EB-L1M7FLU.

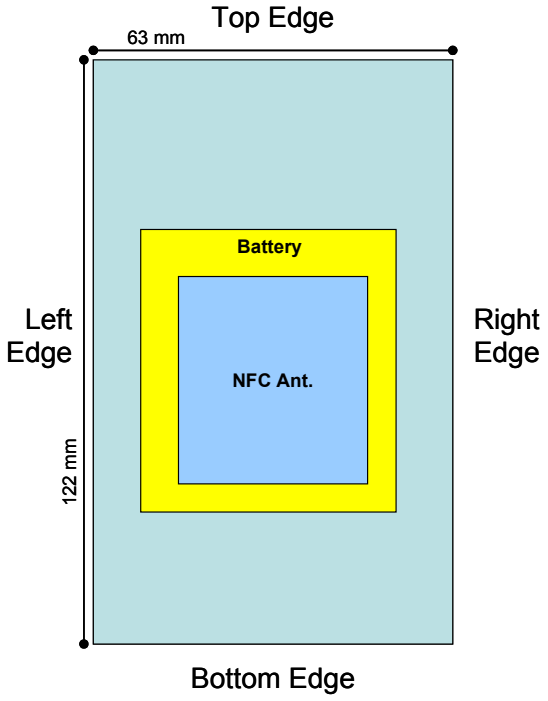

Figure 1-1
NFC Antenna Locations

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1.3 DUT Antenna Locations

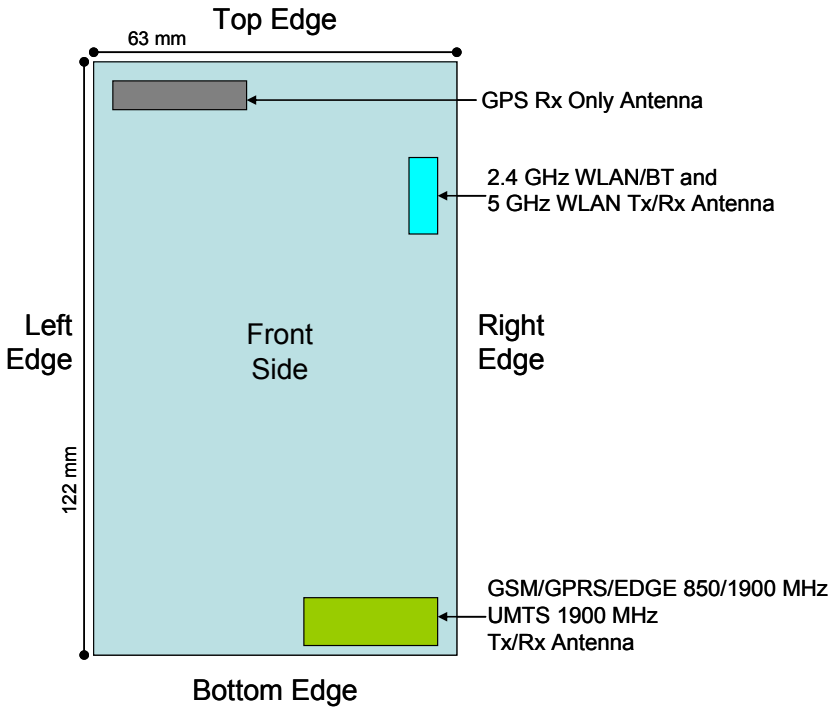

Figure 1-2
DUT Antenna Locations

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mobile Hotspot Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	No
GPRS 1900	Yes	Yes	No	Yes	Yes	No
WCDMA 1900	Yes	Yes	No	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06 guidance, page 2. The antenna document shows the distances between the transmit antennas and the edges of the device. When the wireless router mode is enabled, all 5 GHz bands are disabled. Therefore 5 GHz WIFI is not considered in this section.

1.4 SAR Test Exclusions Applied

(A) WIFI/BT

Since Wireless Router operations are not allowed by the chipset firmware using 5 GHz WIFI, only 2.4 GHz WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations in KDB 941225 D06.

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The separation between the main antenna and the Bluetooth/WLAN antenna is 65 mm.
RF Conducted Power of Bluetooth Tx is 11.246 mW (Please refer to the EMC DSS Report for a full set of Bluetooth conducted powers).

2.4 GHz and 5 GHz WIFI and Bluetooth share the same antenna path and cannot transmit simultaneously.

Per KDB Publication 648474, **Bluetooth SAR was not required** based on the maximum conducted power, the Bluetooth/WLAN to main antenna separation distance and Body-SAR of the main antenna.

This device supports 20 MHz and 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only. 802.11n was not evaluated for SAR since the average output power of 20 MHz and 40 MHz bandwidths was not more than 0.25 dB higher than the average output power of 802.11a.

The wireless portable device has been shown to be electrically equivalent to the device FCC ID A3LGTI8190 with respect to 2.4GHz WLAN, 5GHz WLAN, and Bluetooth modes. Previous SAR test data and Conducted Powers for these modes have been incorporated in current application.

(B) Licensed Transmitter(s)

This model does not support Simultaneous Voice and Data for the licensed transmitter in any modes except in UMTS that allows Multi-RAB transmissions that share voice and data operations on a single physical channel.

GSM/GPRS/EDGE DTM is not supported. Therefore GSM Voice cannot transmit simultaneously with GPRS/EDGE Data.

This device is only capable of QPSK HSUPA in the uplink, but is capable of HSPA+ in the downlink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01.

1.5 Power Reduction for SAR

There is no power reduction for any band/mode implemented in this device for SAR purposes.

1.6 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB 941225 (2G/3G and Hotspot)
- FCC KDB 248227 (802.11)
- FCC KDB 648474 (Simultaneous)
- FCC KDB 865664 (5 GHz)

1.7 Samples Used for SAR Testing

The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

Mode	GSM/GPRS 850	GSM/GPRS 1900	WCDMA 1900	2.4 GHz WLAN	5 GHz WLAN
Sample S/N	FJ-296-C	FJ-296-C	FJ-296-C	FJ-260-A	FJ-260-B

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2 INTRODUCTION

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

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 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 Equation 2-1).

Equation 2-1
SAR Mathematical Equation

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

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

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

where:

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

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

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3 SAR MEASUREMENT SETUP

3.1 Automated SAR Measurement System

Measurements are performed using the DASY automated dosimetric SAR assessment system. The DASY 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 www.speag.com for more information about the specification of the SAR assessment system.

Figure 3-1
SAR Measurement System

Figure 3-2
Near-Field Probe

Table 3-1
Composition of the Tissue Equivalent Matter

Frequency (MHz)	835	835	1900	1900	2450	2450	5200-5800	5200-5800
Tissue	Head	Body	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		17.24	
Diethylenglycol monohexylether							17.24	
Polysorbate (Tween) 80								20
Water	40.45	53.06	54.9	70.17	71.88	73.2	65.52	80

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4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR distribution at the exposed side of the head or body 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 device-head interface and the horizontal grid resolution was 15mm and 15mm for frequencies < 3 GHz in the x and y directions respectively. When applicable, for frequencies above 3 GHz, a 10 mm by 10 mm resolution was used.
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 the 1 gram cube evaluation. SAR at this fixed point was measured and used as a reference value.

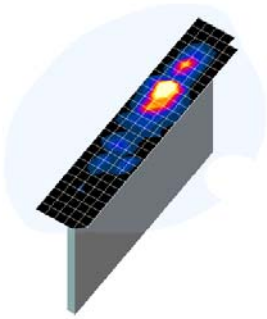

Figure 4-1
Sample SAR Area Scan

3. Based on the area scan data, the peak 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 at least 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 online 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 to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.
5. For testing 5 GHz devices, finer resolution zoom scans were performed as specified by FCC SAR Measurement Requirements for 3 – 6 GHz, KDB 865664 publication. The 5 GHz zoom scan requires a minimum volume of 24mm x 24mm x 20mm and 7 x 7 x 11 points.

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5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

Figure 5-2 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 5-1. 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 5-2). 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].

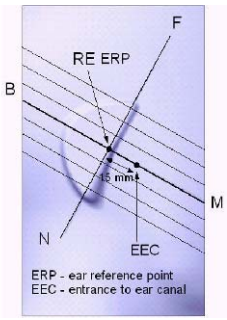

Figure 5-1
Close-Up Side view of ERP

5.2 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 5-3 and Photo 11). 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 5-2
Front, back and side view of SAM Twin Phantom

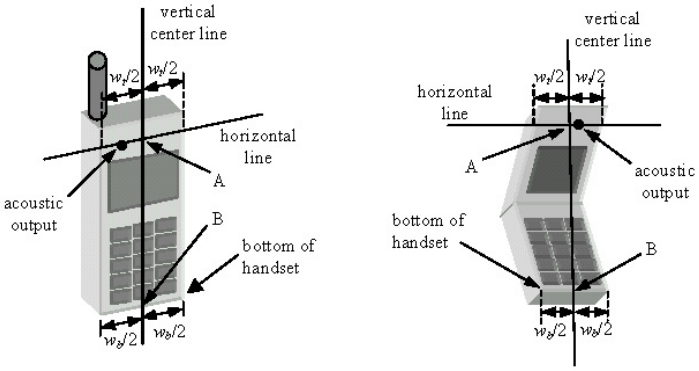

Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 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.

6.2 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 6-1), 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 6-1 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 then 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 6-2).

6.3 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 6-2).

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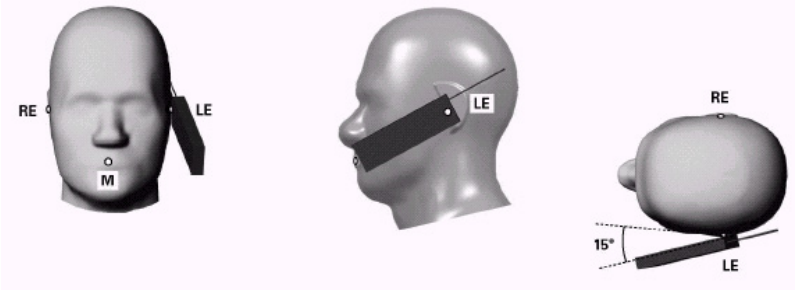

Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

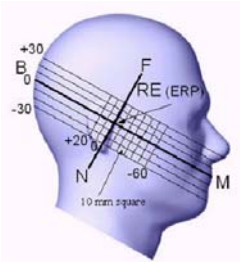

Figure 6-3
Side view w/ relevant markings

Figure 6-4 Body SAR Sample Photo
(Not Actual EUT)

6.4 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.

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 latest IEEE 1528 committee developments propose the usage of a tilted phantom when the antenna of the phone is mounted at the bottom or in all cases the peak absorption is in the chin region. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed individually from the table for emptying and cleaning.

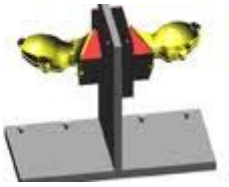

Figure 6-5 Twin SAM Chin20

6.5 Body-Worn Accessory 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 6-4). A device with a headset output is tested with a headset connected to the device.

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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.

6.6 Wireless Router Configurations

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 for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges 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.

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. The "Portable Hotspot" feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

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7 FCC RF EXPOSURE LIMITS

7.1 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.

7.2 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 7-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

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.

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8 FCC MEASUREMENT PROCEDURES

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

8.1 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

8.2 SAR Measurement Conditions for UMTS

8.2.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1s".

8.2.2 Head SAR Measurements for Handsets

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all "1s". SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than 0.25 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signaling radio bearer) using the exposure configuration that resulted in the highest SAR for that RF channel in the 12.2 kbps RMC mode.

8.2.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s".

8.2.4 SAR Measurements for Handsets with Rel 5 HSDPA

Body SAR for HSDPA is not required for handsets with HSDPA capabilities when the maximum average output power of each RF channel with HSDPA active is less than 0.25 dB higher than that measured without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is $\leq$ 75% of the SAR limit. Otherwise, SAR is measured for HSDPA, using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration measured in 12.2 kbps RMC without HSDPA, on the maximum output channel with the body exposure configuration that resulted in the highest SAR in 12.2 kbps RMC mode for that RF channel.

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The H-set used in FRC for HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HSPDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the applicable H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the FRC for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 2 ms to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors of βc=9 and βd=15, and power offset parameters of ΔACK= ΔNACK =5 and ΔCQI=2 is used. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the FRC.

8.2.5 SAR Measurements for Handsets with Rel 6 HSUPA

Body SAR for HSUPA is not required when the maximum average output of each RF channel with HSUPA/HSDPA active is less than 0.25 dB higher than as measured without HSUPA/HSDPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75 % of the SAR limit. Otherwise SAR is measured on the maximum output channel for the body exposure configuration produced highest SAR in 12.2 kbps RMC for that RF channel, using the additional procedures under "Release 6 HSPA data devices"

Head SAR for VOIP operations under HSPA is not required when maximum average output of each RF channel with HSPA is less than 0.25 dB higher than as measured using 12.2 kbps RMC. Otherwise SAR is measured using same HSPA configuration as used for body SAR.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

8.3 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n 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. See KDB Publication 248227 for more details.

8.3.1 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.

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8.3.2 Frequency Channel Configurations [27]

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally evaluated for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

For 5 GHz, the highest average RF output power channel across the default test channels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power then the default channels, these “required channels” were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were evaluated only if the respective mode was 0.25 dB or higher than the 802.11a mode.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg or if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

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9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

		Maximum Burst-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
Cellular	128	32.80	32.80	**32.76**	30.18	28.17	26.62	25.59	24.16	23.00
	190	32.80	32.80	**32.75**	30.20	28.21	26.60	25.63	24.02	23.04
	251	32.85	32.83	**32.81**	30.27	28.30	26.74	25.72	24.21	23.18
PCS	512	30.13	30.14	**30.05**	27.71	25.87	25.85	25.35	23.60	22.58
	661	30.19	30.20	**30.11**	27.78	25.93	25.99	25.43	23.88	22.82
	810	30.16	30.19	**30.10**	27.76	25.90	25.80	25.20	23.76	22.66
		Calculated Maximum Frame-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
Cellular	128	23.77	23.77	**26.74**	25.92	25.16	17.59	19.57	19.90	19.99
	190	23.77	23.77	**26.73**	25.94	25.20	17.57	19.61	19.76	20.03
	251	23.82	23.80	**26.79**	26.01	25.29	17.71	19.70	19.95	20.17
PCS	512	21.10	21.11	**24.03**	23.45	22.86	16.82	19.33	19.34	19.57
	661	21.16	21.17	**24.09**	23.52	22.92	16.96	19.41	19.62	19.81
	810	21.13	21.16	**24.08**	23.50	22.89	16.77	19.18	19.50	19.65

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

2. The bolded GPRS modes were selected according to the highest frame-averaged output power table according to KDB 941225 D03.

3. CS1 coding scheme was used in GPRS output power measurements and SAR testing, as a condition where GMSK modulation was ensured. It was investigated that CS1-CS4 settings do not have any impact on the output power levels in the GPRS modes.

4. MCS7 coding scheme was used to measure the output power for EDGE since it was investigated that choosing MCS7 coding scheme will ensure 8-PSK modulation. MCS levels that produce 8-PSK modulation do not have an impact on output power.

GSM Class: B
GPRS Multislot class: 12 (max 4 Tx Uplink slots)
EDGE Multislot class: 12 (max 4Tx Uplink slots)
DTM Multislot Class: N/A

Figure 9-1
Power Measurement Setup

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9.2 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	PCS Band [dBm]			3GPP MPR [dB]
			9262	9400	9538	
99	WCDMA	12.2 kbps RMC	22.90	22.91	22.93	-
99		12.2 kbps AMR	22.85	22.98	22.99	-
6	HSDPA	Subtest 1	23.02	23.00	23.05	0
6		Subtest 2	22.90	22.90	22.97	0
6		Subtest 3	22.91	22.85	22.87	0.5
6		Subtest 4	22.76	22.86	22.86	0.5
6	HSUPA	Subtest 1	21.76	21.56	21.63	0
6		Subtest 2	20.70	21.01	20.69	2
6		Subtest 3	21.78	21.62	21.66	1
6		Subtest 4	20.89	20.59	20.78	2
6		Subtest 5	21.76	21.89	21.75	0

WCDMA SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

It is expected by the manufacturer that MPR for some HSPA subtests may be as low as 0 dB according to the chipset implementation in this model. Detailed information is included in the operational description explaining how the MPR is applied for this model.

Figure 9-2
Power Measurement Setup

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9.3 WLAN Conducted Powers

Table 9-1
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm] Data Rate [Mbps]			
			1	**2**	**5.5**	**11**
802.11b	2412	1	15.01	15.06	15.10	15.08
802.11b	2437	6	15.34	15.39	15.44	15.45
802.11b	2462	11	**15.51**	15.61	15.67	15.63

Table 9-2
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm] Data Rate [Mbps]							
			6	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11g	2412	1	13.64	13.67	13.59	13.64	13.63	13.66	13.59	13.56
802.11g	2437	6	14.01	13.99	13.97	13.98	13.96	14.03	13.94	13.93
802.11g	2462	11	14.16	14.20	14.17	14.11	14.15	14.09	14.17	14.14

Table 9-3
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm] Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	2412	1	12.56	12.51	12.54	12.53	12.54	12.52	12.55	12.54
802.11n	2437	6	12.92	12.87	12.86	12.91	12.88	12.80	12.79	12.86
802.11n	2462	11	13.12	13.05	13.06	13.08	13.04	13.03	13.04	13.04

Table 9-4
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm] Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	12.30	12.33	12.37	12.36	12.36	12.46	12.48	12.47
802.11a	5200	40	12.37	12.42	12.36	12.43	12.50	12.45	12.53	12.50
802.11a	5220	44	**12.38**	12.33	12.42	12.34	12.46	12.47	12.51	12.57
802.11a	5240	48*	12.32	12.34	12.42	12.40	12.45	12.54	12.51	12.57
802.11a	5260	52*	12.38	12.34	12.42	12.52	12.48	12.56	12.54	12.63
802.11a	5280	56	12.34	12.37	12.42	12.44	12.46	12.46	12.55	12.57
802.11a	5300	60	**12.40**	12.39	12.42	12.47	12.46	12.45	12.48	12.55
802.11a	5320	64*	12.33	12.40	12.36	12.33	12.40	12.40	12.48	12.50
802.11a	5500	100	12.47	12.48	12.54	12.60	12.55	12.57	12.60	12.64
802.11a	5520	104*	**12.47**	12.44	12.47	12.50	12.48	12.54	12.64	12.59
802.11a	5540	108	12.42	12.41	12.41	12.47	12.52	12.50	12.53	12.46
802.11a	5560	112	12.35	12.34	12.41	12.42	12.43	12.49	12.52	12.50
802.11a	5580	116*	12.32	12.38	12.38	12.43	12.43	12.44	12.46	12.43
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	12.28	12.29	12.31	12.33	12.40	12.38	12.38	12.41
802.11a	5680	136*	12.25	12.22	12.31	12.35	12.34	12.42	12.37	12.43
802.11a	5700	140	12.24	12.23	12.24	12.32	12.28	12.35	12.43	12.38
802.11a	5745	149*	13.33	13.35	13.36	13.38	13.48	13.43	13.50	13.48
802.11a	5765	153	13.33	13.39	13.36	13.47	13.40	13.41	13.47	13.42
802.11a	5785	157*	13.32	13.39	13.34	13.36	13.43	13.39	13.41	13.46
802.11a	5805	161*	**13.33**	13.28	13.31	13.27	13.32	13.39	13.41	13.38
802.11a	5825	165	13.30	13.36	13.30	13.35	13.35	13.38	13.42	13.36

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band. (*) – indicates default channels per KDB Publication 248227. When the adjacent channels are higher in power then the default channels, these “required channels” are considered instead of the default channels for SAR testing.

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Table 9-5
IEEE 802.11n (20 MHz Bandwidth) Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm] Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	5180	36*	12.28	12.34	12.25	12.35	12.34	12.42	12.33	12.45
802.11n	5200	40	12.32	12.35	12.35	12.30	12.34	12.49	12.44	12.43
802.11n	5220	44	12.30	12.33	12.46	12.36	12.39	12.40	12.44	12.47
802.11n	5240	48*	12.29	12.42	12.37	12.37	12.45	12.39	12.52	12.44
802.11n	5260	52*	12.32	12.31	12.32	12.39	12.44	12.46	12.45	12.57
802.11n	5280	56	12.31	12.27	12.40	12.42	12.43	12.42	12.41	12.47
802.11n	5300	60	12.30	12.31	12.37	12.44	12.36	12.44	12.40	12.49
802.11n	5320	64*	12.28	12.35	12.34	12.34	12.47	12.40	12.48	12.51
802.11n	5500	100	12.48	12.47	12.52	12.49	12.49	12.51	12.57	12.61
802.11n	5520	104*	12.41	12.41	12.51	12.47	12.39	12.54	12.48	12.53
802.11n	5540	108	12.36	12.41	12.40	12.43	12.49	12.51	12.49	12.49
802.11n	5560	112	12.30	12.35	12.34	12.41	12.41	12.44	12.40	12.43
802.11n	5580	116*	12.31	12.35	12.32	12.38	12.37	12.47	12.40	12.39
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	12.24	12.24	12.27	12.28	12.35	12.34	12.33	12.38
802.11n	5680	136*	12.22	12.20	12.22	12.24	12.27	12.26	12.33	12.29
802.11n	5700	140	12.24	12.25	12.24	12.27	12.29	12.27	12.26	12.34
802.11n	5745	149*	13.24	13.30	13.34	13.31	13.36	13.42	13.38	13.45
802.11n	5765	153	13.25	13.27	13.34	13.31	13.32	13.39	13.40	13.41
802.11n	5785	157*	13.25	13.23	13.31	13.24	13.31	13.39	13.34	13.36
802.11n	5805	161*	13.16	13.24	13.24	13.26	13.34	13.34	13.37	13.34
802.11n	5825	165	13.18	13.13	13.23	13.24	13.29	13.26	13.32	13.29

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Bands. (*) – indicates default channels per KDB Publication 248227. When the adjacent channels are higher in power then the default channels, these “required channels” are considered instead of the default channels for SAR testing.

Table 9-6
IEEE 802.11n (40 MHz Bandwidth) Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm] Data Rate [Mbps]							
			13.5/15	27/30	40.5/45	54/60	81/90	108/120	121.5/135	135/150
802.11n	5190	38	12.51	12.48	12.48	12.43	12.54	12.55	12.63	12.60
802.11n	5230	46	12.56	12.49	12.62	12.53	12.59	12.55	12.63	12.54
802.11n	5270	54	12.54	12.53	12.35	12.59	12.45	12.51	12.61	12.52
802.11n	5310	62	12.48	12.52	12.55	12.47	12.47	12.57	12.58	12.67
802.11n	5510	102	12.08	12.01	12.01	11.99	12.00	11.96	12.13	12.03
802.11n	5550	110	11.85	11.74	11.86	11.71	11.71	11.65	11.96	11.81
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	12.02	11.99	11.90	11.87	11.96	11.95	12.11	11.99
802.11n	5755	151	12.96	13.05	13.12	13.05	13.04	13.15	13.27	13.17
802.11n	5795	159	12.86	12.92	13.02	12.86	12.94	12.92	13.07	13.07

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Bands.

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Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz bandwidth and 802.11n 40 MHz bandwidth) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The data rate and channel of the bolded powers above were tested for SAR.

Figure 9-3
Power Measurement Setup

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C˚)	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
11/8/2012	835H	20.9	820	0.899	43.30	0.898	41.571	0.11%	4.16%
			835	0.918	42.71	0.900	41.500	2.00%	2.92%
			850	0.925	42.65	0.916	41.500	0.98%	2.77%
11/8/2012	1900H	22.8	1850	1.428	40.43	1.400	40.000	2.00%	1.08%
			1880	1.452	40.27	1.400	40.000	3.71%	0.68%
			1910	1.465	40.23	1.400	40.000	4.64%	0.57%
10/2/2012	2450H	24.1	2401	1.822	40.55	1.758	39.298	3.64%	3.19%
			2450	1.874	40.38	1.800	39.200	4.11%	3.01%
			2499	1.931	40.18	1.852	39.135	4.27%	2.67%
09/28/2012	5200H-5800H	24.7	5200	4.523	35.56	4.660	36.000	-2.94%	-1.22%
			5220	4.551	35.57	4.680	35.980	-2.76%	-1.14%
			5300	4.624	35.44	4.760	35.900	-2.86%	-1.28%
			5500	4.795	35.18	4.965	35.650	-3.42%	-1.32%
			5520	4.820	35.13	4.986	35.620	-3.33%	-1.38%
			5800	5.097	34.68	5.270	35.300	-3.28%	-1.76%
			5805	5.099	34.67	5.275	35.295	-3.34%	-1.77%
11/7/2012	835B	20.3	820	0.945	54.70	0.969	55.284	-2.48%	-1.06%
			835	0.958	54.54	0.970	55.200	-1.24%	-1.20%
			850	0.974	54.40	0.988	55.154	-1.42%	-1.37%
11/7/2012	1900B	21.0	1850	1.554	51.43	1.520	53.300	2.24%	-3.51%
			1880	1.566	51.42	1.520	53.300	3.03%	-3.53%
			1910	1.588	51.39	1.520	53.300	4.47%	-3.58%
10/1/2012	2450B	21.3	2401	1.911	51.32	1.903	52.765	0.42%	-2.74%
			2450	2.021	51.34	1.950	52.700	3.64%	-2.58%
			2499	2.084	51.18	2.019	52.638	3.22%	-2.77%
10/01/2012	5200B-5800B	23.3	5200	5.286	47.63	5.299	49.014	-0.25%	-2.82%
			5220	5.321	47.58	5.323	48.987	-0.04%	-2.87%
			5300	5.440	47.41	5.416	48.851	0.44%	-2.95%
			5500	5.732	46.86	5.650	48.580	1.45%	-3.54%
			5520	5.760	46.84	5.673	48.553	1.53%	-3.53%
			5800	6.211	46.13	6.000	48.200	3.52%	-4.29%
			5805	6.217	46.14	6.005	48.166	3.53%	-4.21%

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

The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies (per IEEE 1528 6.6.1.2). The SAR test plots may slightly differ from the table above since the DASY software rounds to three significant digits.

Probe calibration used within ±100 MHz of the test frequency in either 5.725 - 5.85 or 5.47-5.725 GHz is acceptable per KDB Publication 865664 since the design of the SAR probe supports the extended frequency, provided the DASY software version recommended is used for the tests, and the expanded calibration uncertainty (k=2) is less than or equal to 15% (See SAR probe calibration certificate for this information).

10.2 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

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4) The complex relative permittivity $\varepsilon_r^{'}$ can be calculated from the below equation (Pournaropoulos and Misra):

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

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 $j = \sqrt{-1}$.

10.3 Test System Verification

Prior to assessment, the system is verified to ±10% of the manufacturer SAR measurement on the reference dipole at the time of calibration.

Table 10-2
System Verification Results

System Verification TARGET & MEASURED											
Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	Deviation (%)
835	Head	11/08/2012	24.1	22.0	0.100	4d132	3213	0.992	9.450	9.920	4.97%
1900	Head	11/08/2012	23.6	21.2	0.100	5d149	3288	4.05	39.300	40.500	3.05%
2450	Head	10/02/2012	24.6	23.9	0.100	882	3213	5.47	53.500	54.700	2.24%
5200	Head	09/28/2012	24.2	23.6	0.100	1057	3589	8.27	79.100	82.700	4.55%
5500	Head	09/28/2012	24.4	23.7	0.100	1057	3589	8.38	84.900	83.800	-1.30%
5800	Head	09/28/2012	24.2	23.7	0.100	1057	3589	7.99	79.500	79.900	0.50%
835	Body	11/07/2012	24.4	22.1	0.100	4d026	3209	0.943	9.580	9.430	-1.57%
1900	Body	11/07/2012	24.8	22.5	0.100	5d148	3213	4.23	39.100	42.300	8.18%
2450	Body	10/01/2012	21.8	21.2	0.100	882	3287	5.34	50.300	53.400	6.16%
5200	Body	10/01/2012	22.3	21.7	0.100	1057	3589	7.61	73.400	76.100	3.68%
5500	Body	10/01/2012	22.4	21.8	0.100	1057	3589	8.30	78.900	83.000	5.20%
5800	Body	10/01/2012	22.8	21.8	0.100	1057	3589	7.42	74.300	74.200	-0.13%

Note: Per KDB Publication 865664, when a reference dipole is not defined within ±100MHz of the test frequency, the system verification may be conducted within ± 200 MHz of the center frequency of the measurement frequencies if the SAR probe calibration is valid and the same tissue-equivalent matter is used for verification and test measurements.

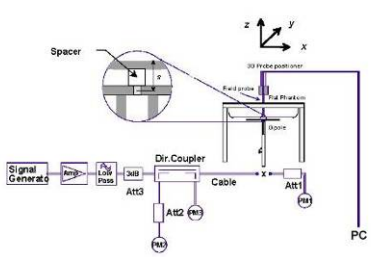

Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

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11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
GSM 850 Head SAR Results

MEASUREMENT RESULTS								
FREQUENCY		Mode/Band	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	SAR (1g)
MHz	Ch.							(W/kg)
836.60	190	GSM 850	32.80	0.08	Right	Cheek	FJ-296-C	**0.098**
836.60	190	GSM 850	32.80	0.05	Right	Tilt	FJ-296-C	0.066
836.60	190	GSM 850	32.80	0.07	Left	Cheek	FJ-296-C	0.080
836.60	190	GSM 850	32.80	0.04	Left	Tilt	FJ-296-C	0.059
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**Head 1.6 W/kg (mW/g)** averaged over 1 gram			

Table 11-2
GSM 1900 Head SAR Results

MEASUREMENT RESULTS								
FREQUENCY		Mode/Band	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	SAR (1g)
MHz	Ch.							(W/kg)
1880.00	661	GSM 1900	30.19	0.03	Right	Cheek	FJ-296-C	**0.274**
1880.00	661	GSM 1900	30.19	0.04	Right	Tilt	FJ-296-C	0.138
1880.00	661	GSM 1900	30.19	-0.04	Left	Cheek	FJ-296-C	0.133
1880.00	661	GSM 1900	30.19	0.04	Left	Tilt	FJ-296-C	0.123
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**Head 1.6 W/kg (mW/g)** averaged over 1 gram			

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Table 11-3
WCDMA 1900 Head SAR Results

MEASUREMENT RESULTS								
FREQUENCY		Mode/Band	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	SAR (1g)
MHz	Ch.							(W/kg)
1880.00	9400	WCDMA 1900	22.91	0.09	Right	Cheek	FJ-296-C	**0.510**
1880.00	9400	WCDMA 1900	22.91	-0.04	Right	Tilt	FJ-296-C	0.201
1880.00	9400	WCDMA 1900	22.91	0.01	Left	Cheek	FJ-296-C	0.265
1880.00	9400	WCDMA 1900	22.91	0.06	Left	Tilt	FJ-296-C	0.237
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**Head 1.6 W/kg (mW/g)** averaged over 1 gram			

Table 11-4
2.4 GHz WLAN Head SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	SAR (1g)
MHz	Ch.									(W/kg)
2462	11	IEEE 802.11b	DSSS	15.51	0.12	Right	Cheek	FJ-260-A	1	0.002
2462	11	IEEE 802.11b	DSSS	15.51	0.00	Right	Tilt	FJ-260-A	1	0.000
2462	11	IEEE 802.11b	DSSS	15.51	0.04	Left	Cheek	FJ-260-A	1	**0.004**
2462	11	IEEE 802.11b	DSSS	15.51	0.10	Left	Tilt	FJ-260-A	1	0.000
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**Head 1.6 W/kg (mW/g)** averaged over 1 gram				

Table 11-5
5.8 GHz WLAN Head SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	SAR (1g)
MHz	Ch.									(W/kg)
5805	161	IEEE 802.11a	OFDM	13.33	0.00	Right	Cheek	FJ-260-B	6	0.005
5805	161	IEEE 802.11a	OFDM	13.33	0.00	Right	Tilt	FJ-260-B	6	0.003
5805	161	IEEE 802.11a	OFDM	13.33	-0.13	Left	Cheek	FJ-260-B	6	**0.028**
5805	161	IEEE 802.11a	OFDM	13.33	0.04	Left	Tilt	FJ-260-B	6	0.011
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**Head 1.6 W/kg (mW/g)** averaged over 1 gram				

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Table 11-6
5.2 GHz WLAN Head SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	SAR (1g)
MHz	Ch.									(W/kg)
5220	44	IEEE 802.11a	OFDM	12.38	-0.05	Right	Cheek	FJ-260-B	6	0.010
5220	44	IEEE 802.11a	OFDM	12.38	0.00	Right	Tilt	FJ-260-B	6	0.015
5220	44	IEEE 802.11a	OFDM	12.38	-0.02	Left	Cheek	FJ-260-B	6	**0.085**
5220	44	IEEE 802.11a	OFDM	12.38	0.04	Left	Tilt	FJ-260-B	6	0.031
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Head 1.6 W/kg (mW/g) averaged over 1 gram				

Table 11-7
5.3 GHz WLAN Head SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	SAR (1g)
MHz	Ch.									(W/kg)
5300	60	IEEE 802.11a	OFDM	12.40	-0.21	Right	Cheek	FJ-260-B	6	0.018
5300	60	IEEE 802.11a	OFDM	12.40	-0.07	Right	Tilt	FJ-260-B	6	0.009
5300	60	IEEE 802.11a	OFDM	12.40	0.02	Left	Cheek	FJ-260-B	6	**0.098**
5300	60	IEEE 802.11a	OFDM	12.40	0.04	Left	Tilt	FJ-260-B	6	0.032
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Head 1.6 W/kg (mW/g) averaged over 1 gram				

Table 11-8
5.5 - 5.7 GHz WLAN Head SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	SAR (1g)
MHz	Ch.									(W/kg)
5520	104	IEEE 802.11a	OFDM	12.47	0.00	Right	Cheek	FJ-260-B	6	0.004
5520	104	IEEE 802.11a	OFDM	12.47	0.00	Right	Tilt	FJ-260-B	6	0.003
5520	104	IEEE 802.11a	OFDM	12.47	-0.08	Left	Cheek	FJ-260-B	6	**0.040**
5520	104	IEEE 802.11a	OFDM	12.47	0.04	Left	Tilt	FJ-260-B	6	0.014
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Head 1.6 W/kg (mW/g) averaged over 1 gram				

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11.2 Standalone Body-Worn SAR Data

Table 11-9
Licensed Transmitter Body-Worn SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Side	SAR (1g)
MHz	Ch.									(W/kg)
836.60	190	GSM 850	GSM	32.80	-0.02	1.0 cm	FJ-296-C	1	back	0.264
836.60	190	GSM 850	GPRS	32.75	-0.03	1.0 cm	FJ-296-C	2	back	**0.503**
1880.00	661	GSM 1900	GSM	30.19	-0.09	1.0 cm	FJ-296-C	1	back	0.527
1850.20	512	GSM 1900	GPRS	30.05	0.02	1.0 cm	FJ-296-C	2	back	0.920
1880.00	661	GSM 1900	GPRS	30.11	-0.04	1.0 cm	FJ-296-C	2	back	0.939
1909.80	810	GSM 1900	GPRS	30.10	-0.08	1.0 cm	FJ-296-C	2	back	**0.987**
1852.40	9262	WCDMA 1900	RMC	22.90	-0.03	1.0 cm	FJ-296-C	N/A	back	0.843
1880.00	9400	WCDMA 1900	RMC	22.91	-0.03	1.0 cm	FJ-296-C	N/A	back	0.883
1907.60	9538	WCDMA 1900	RMC	22.93	-0.04	1.0 cm	FJ-296-C	N/A	back	**0.912**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**Body 1.6 W/kg (mW/g)** averaged over 1 gram				

Note: When the reported SAR measured for 1 cm air-gap without headset cable is >1.2 W/kg, the highest reported SAR configuration for the mode and band should be repeated with headset attached, per past FCC guidance. Since the measured SAR was not >1.2 W/kg, GPRS hotspot data for the back side configuration additionally shows body-worn compliance. GSM voice SAR tests were performed with headset cable connected.

Table 11-10
WLAN Body-Worn SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	SAR (1g)
MHz	Ch.									(W/kg)
2462	11	IEEE 802.11b	DSSS	15.51	0.03	1.0 cm	FJ-260-A	1	back	**0.016**
5805	161	IEEE 802.11a	OFDM	13.33	-0.12	1.0 cm	FJ-260-B	6	back	0.178
5220	44	IEEE 802.11a	OFDM	12.38	0.21	1.0 cm	FJ-260-B	6	back	0.363
5300	60	IEEE 802.11a	OFDM	12.40	0.09	1.0 cm	FJ-260-B	6	back	**0.385**
5520	104	IEEE 802.11a	OFDM	12.47	-0.04	1.0 cm	FJ-260-B	6	back	0.235
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**Body 1.6 W/kg (mW/g)** averaged over 1 gram				

Note: When the reported SAR measured for 1 cm air-gap without headset cable is >1.2 W/kg, the highest reported SAR configuration for the mode and band should be repeated with headset attached, per past FCC guidance. Since the measured SAR was not >1.2 W/kg, IEEE 802.11b hotspot data for the back side configuration additionally shows body-worn compliance. IEEE 802.11a SAR tests were performed with headset cable connected.

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11.3 Standalone Wireless Router SAR Data

Table 11-11
Licensed Transmitter Hotspot SAR Data

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Side	SAR (1g)
MHz	Ch.									(W/kg)
836.60	190	GSM 850	GPRS	32.75	-0.03	1.0 cm	FJ-296-C	2	back	**0.503**
836.60	190	GSM 850	GPRS	32.75	-0.07	1.0 cm	FJ-296-C	2	front	0.228
836.60	190	GSM 850	GPRS	32.75	-0.15	1.0 cm	FJ-296-C	2	bottom	0.071
836.60	190	GSM 850	GPRS	32.75	0.09	1.0 cm	FJ-296-C	2	right	0.298
1850.20	512	GSM 1900	GPRS	30.05	0.02	1.0 cm	FJ-296-C	2	back	0.920
1880.00	661	GSM 1900	GPRS	30.11	-0.04	1.0 cm	FJ-296-C	2	back	0.939
1909.80	810	GSM 1900	GPRS	30.10	-0.08	1.0 cm	FJ-296-C	2	back	**0.987**
1880.00	661	GSM 1900	GPRS	30.11	0.02	1.0 cm	FJ-296-C	2	front	0.604
1880.00	661	GSM 1900	GPRS	30.11	-0.03	1.0 cm	FJ-296-C	2	bottom	0.528
1880.00	661	GSM 1900	GPRS	30.11	-0.05	1.0 cm	FJ-296-C	2	right	0.296
1852.40	9262	WCDMA 1900	RMC	22.90	-0.03	1.0 cm	FJ-296-C	N/A	back	0.843
1880.00	9400	WCDMA 1900	RMC	22.91	-0.03	1.0 cm	FJ-296-C	N/A	back	0.883
1907.60	9538	WCDMA 1900	RMC	22.93	-0.04	1.0 cm	FJ-296-C	N/A	back	**0.912**
1880.00	9400	WCDMA 1900	RMC	22.91	-0.02	1.0 cm	FJ-296-C	N/A	front	0.665
1880.00	9400	WCDMA 1900	RMC	22.91	0.02	1.0 cm	FJ-296-C	N/A	bottom	0.500
1880.00	9400	WCDMA 1900	RMC	22.91	-0.02	1.0 cm	FJ-296-C	N/A	right	0.315
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**Body 1.6 W/kg (mW/g)** averaged over 1 gram				

Table 11-12
WLAN Hotspot SAR Data

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	SAR (1g)
MHz	Ch.									(W/kg)
2462	11	IEEE 802.11b	DSSS	15.51	0.03	1.0 cm	FJ-260-A	1	back	**0.016**
2462	11	IEEE 802.11b	DSSS	15.51	0.03	1.0 cm	FJ-260-A	1	front	0.001
2462	11	IEEE 802.11b	DSSS	15.51	0.10	1.0 cm	FJ-260-A	1	top	0.001
2462	11	IEEE 802.11b	DSSS	15.51	-0.20	1.0 cm	FJ-260-A	1	right	0.013
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**Body 1.6 W/kg (mW/g)** averaged over 1 gram				

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11.4 SAR Test Notes

General 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 [June 2001].
2. Batteries are fully charged for all readings.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. Liquid tissue depth was at least 15.0 cm. To confirm the proper SAR liquid depth, the z-axis plots from the system verifications were included since the system verifications were performed using the same liquid, probe and DAE as the SAR tests in the same time period.
5. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
6. Per FCC/OET Bulletin 65 Supplement C 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).
7. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR using headphones.
2. Per FCC guidance, GPRS Data Mode is additionally required for body-worn configuration. When the reported SAR measured for 1 cm air-gap without headset cable is >1.2 W/kg, the highest reported SAR configuration for the mode and band should be repeated with headset attached, per past FCC guidance. Since the measured SAR was not >1.2 W/kg, GPRS hotspot data for the back side configuration additionally shows body-worn compliance.
3. Justification for reduced test configurations per KDB Publication 941225 D03: The source-based time-averaged output power was evaluated for all multi-slot operations. The worst-case source-based time-averaged powers were evaluated for SAR.

WCDMA Notes:

1. WCDMA mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. When the reported SAR measured for 1 cm air-gap without headset cable is >1.2 W/kg, the highest reported SAR configuration for the mode and band should be repeated with headset attached, per past FCC guidance. Since the measured SAR was not >1.2 W/kg, WCDMA hotspot data for the back side configuration additionally shows body-worn compliance.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz bandwidth and 802.11n 40 MHz bandwidth) were not investigated

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since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.

3. When Hotspot is enabled, all 5 GHz bands are disabled.
4. WLAN transmission was verified using an uncalibrated spectrum analyzer.
5. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was <1.6 W/kg, SAR testing on the default channels is not required.
6. When the reported SAR measured for 1 cm air-gap without headset cable is >1.2 W/kg, the highest reported SAR configuration for the mode and band should be repeated with headset attached, per past FCC guidance. Since the measured SAR was not >1.2 W/kg, IEEE 802.11b hotspot data for the back side configuration additionally shows body-worn compliance.

Hotspot Notes:

1. Top Edge and Left Edge for the licensed transmitter was not tested since the antenna distance from the edge was greater than 2.5 cm per FCC KDB Publication 941225 D06 guidance (see Section 1.3).
2. Bottom Edge and Left Edge for the WLAN transmitter was not tested since the antenna distance from the edge was greater than 2.5 cm per FCC KDB Publication 941225 D06 (see Section 1.3).
3. During SAR Testing for the Wireless Router conditions per KDB 941225 D06, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.6.)

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12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 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/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

12.2 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 12-1
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 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
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	

Figure 12-2
SAR Evaluation Requirements for Multiple Transmitter Handsets

According to Figure 12-1 and Figure 12-2, simultaneous transmission analysis of SAR may be required for this device for the licensed and unlicensed transmitters. Possible simultaneous transmissions for this device were numerically summed using stand-alone SAR data and are shown in the following tables.

Per KDB Publication 648474, standalone Bluetooth SAR tests were not required. Standalone SAR tests for WLAN were required. See Section 1.4(A) for more information.

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12.3 Head SAR Simultaneous Transmission Analysis

Table 12-1
Simultaneous Transmission Scenario (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.098	0.002	**0.100**
	Right Tilt	0.066	0.000	0.066
	Left Cheek	0.080	0.004	0.084
	Left Tilt	0.059	0.000	0.059

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.274	0.002	**0.276**
	Right Tilt	0.138	0.000	0.138
	Left Cheek	0.133	0.004	0.137
	Left Tilt	0.123	0.000	0.123

Simult Tx	Configuration	WCDMA 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.510	0.002	**0.512**
	Right Tilt	0.201	0.000	0.201
	Left Cheek	0.265	0.004	0.269
	Left Tilt	0.237	0.000	0.237

Table 12-2
Simultaneous Transmission Scenario (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.098	0.018	0.116
	Right Tilt	0.066	0.015	0.081
	Left Cheek	0.080	0.098	**0.178**
	Left Tilt	0.059	0.032	0.091

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.274	0.018	**0.292**
	Right Tilt	0.138	0.015	0.153
	Left Cheek	0.133	0.098	0.231
	Left Tilt	0.123	0.032	0.155

Simult Tx	Configuration	WCDMA 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.510	0.018	**0.528**
	Right Tilt	0.201	0.015	0.216
	Left Cheek	0.265	0.098	0.363
	Left Tilt	0.237	0.032	0.269

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12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-3
Simultaneous Transmission Scenario (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.264	0.016	0.280
Back Side	GSM 1900	0.527	0.016	0.543
Back Side	WCDMA 1900	0.912	0.016	**0.928**

Table 12-4
Simultaneous Transmission Scenario (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.264	0.385	0.649
Back Side	GSM 1900	0.527	0.385	0.912
Back Side	WCDMA 1900	0.912	0.385	**1.297**

12.5 Hotspot SAR Simultaneous Transmission Analysis

Table 12-5
Simultaneous Transmission Scenario (Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.503	0.016	**0.519**
	Front	0.228	0.001	0.229
	Top	-	0.001	0.001
	Bottom	0.071	-	0.071
	Right	0.298	0.013	0.311
	Left	-	-	0.000

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.987	0.016	**1.003**
	Front	0.604	0.001	0.605
	Top	-	0.001	0.001
	Bottom	0.528	-	0.528
	Right	0.296	0.013	0.309
	Left	-	-	0.000

Simult Tx	Configuration	WCDMA 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.912	0.016	**0.928**
	Front	0.665	0.001	0.666
	Top	-	0.001	0.001
	Bottom	0.500	-	0.500
	Right	0.315	0.013	0.328
	Left	-	-	0.000

Note: Per FCC KDB Publication 941225 D06, the edges with antennas more than 2.5 cm are not required to be evaluated for SAR ("-"). The above tables represent a portable hotspot condition.

12.6 Simultaneous Transmission Conclusion

The above numerical summed SAR was below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. No volumetric SAR summation is required per FCC KDB Publication 648474. It was confirmed that all standalone and simultaneous transmission scenarios remain complaint when scaled to the maximum allowed power level.

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13 EQUIPMENT LIST

Equipment List from 09/28/12 – 10/02/12

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	85070E	Dielectric Probe Kit	3/8/2012	Annual	3/8/2013	MY44300633
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	ML2438A	Power Meter	2/14/2012	Annual	2/14/2013	1190013
Anritsu	ML2438A	Power Meter	2/14/2012	Annual	2/14/2013	98150041
Anritsu	MA2481A	Power Sensor	2/14/2012	Annual	2/14/2013	5821
Anritsu	MA2481A	Power Sensor	2/14/2012	Annual	2/14/2013	8013
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231538
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231535
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331322
Control Company	61220-416	Long-Stem Thermometer	10/12/2011	Biennial	10/12/2013	111860820
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014488
Intelligent Weighing	PD-3000	Electronic Balance	6/29/2012	Annual	6/29/2013	120405017
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	NRVD	Dual Channel Power Meter	4/8/2011	Biennial	4/8/2013	101695
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Seekonk	NC-100	Torque Wrench (8" lb)	11/29/2011	Triennial	11/29/2014	21053
SPEAG	D2450V2	2450 MHz SAR Dipole	2/7/2012	Annual	2/7/2013	882
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/19/2012	Annual	1/19/2013	1057
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/20/2012	Annual	2/20/2013	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/18/2012	Annual	1/18/2013	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/7/2012	Annual	5/7/2013	1334
SPEAG	DAK-3.5	Dielectic Assessment Kit	6/19/2012	Annual	6/19/2013	1070
SPEAG	EX3DV4	SAR Probe	1/27/2012	Annual	1/27/2013	3589
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	ES3DV3	SAR Probe	2/7/2012	Annual	2/7/2013	3287
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886430
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859332

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, attenuator, amplifier, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

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Equipment List from 11/07/12 – 11/08/12

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2012	Annual	10/10/2013	3613A00315
Agilent	85070E	Dielectric Probe Kit	3/8/2012	Annual	3/8/2013	MY44300633
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	E5515C	Wireless Communications Test Set	9/24/2012	Annual	9/24/2013	GB46310798
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	ML2438A	Power Meter	10/11/2012	Annual	10/11/2013	1070030
Anritsu	ML2438A	Power Meter	2/14/2012	Annual	2/14/2013	1190013
Anritsu	MA2481A	Power Sensor	4/5/2012	Annual	4/5/2013	5605
Anritsu	MA2481A	Power Sensor	2/14/2012	Annual	2/14/2013	5821
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331323
Control Company	61220-416	Long-Stem Thermometer	7/1/2011	Biennial	7/1/2013	111642834
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/10/2012	Annual	10/10/2013	1833460
Gigatronics	8651A	Universal Power Meter	10/10/2012	Annual	10/10/2013	8650319
Intelligent Weigh	PD-3000	Electronic Balance	3/27/2012	Annual	3/27/2013	11081534
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Seekonk	NC-100	Torque Wrench (8" lb)	11/29/2011	Triennial	11/29/2014	21053
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
SPEAG	D1900V2	1900 MHz SAR Dipole	2/8/2012	Annual	2/8/2013	5d148
SPEAG	D1900V2	1900 MHz SAR Dipole	2/22/2012	Annual	2/22/2013	5d149
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	4d026
SPEAG	D835V2	835 MHz SAR Dipole	2/3/2012	Annual	2/3/2013	4d132
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/20/2012	Annual	2/20/2013	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/19/2012	Annual	4/19/2013	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/19/2012	Annual	9/19/2013	1323
SPEAG	DAK-3.5	Dielectic Assessment Kit	6/19/2012	Annual	6/19/2013	1070
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	ES3DV3	SAR Probe	3/16/2012	Annual	3/16/2013	3209
SPEAG	ES3DV3	SAR Probe	9/20/2012	Annual	9/20/2013	3288
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, attenuator, amplifier, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

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14 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 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	6.0	N	1	1.0	1.0	6.0	6.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.1	11.7	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.2	23.5	

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

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Applicable for frequencies up to 6 GHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

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

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15 CONCLUSION

15.1 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

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PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

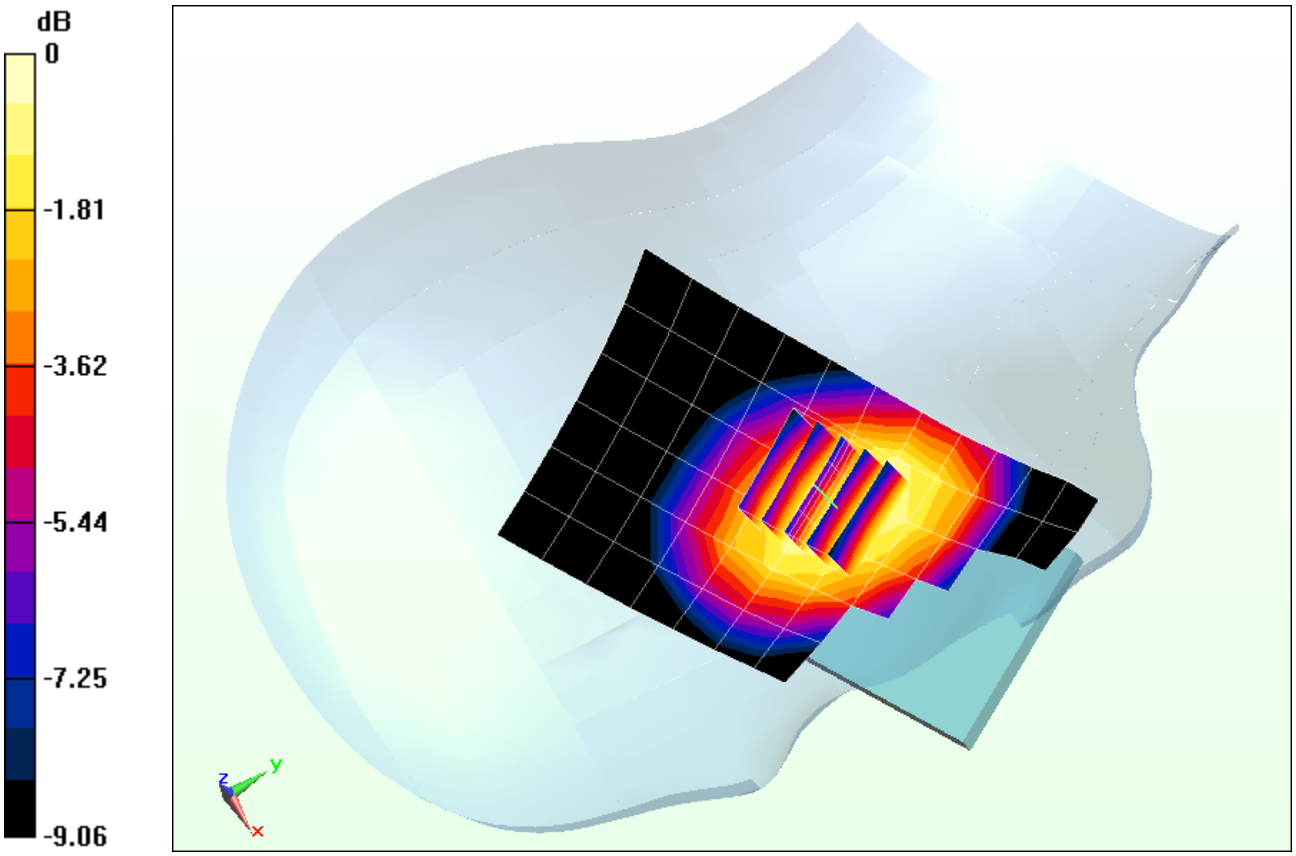
Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.919 mho/m; ε_r = 42.704; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-08-2012; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 850, Right Head, Cheek, 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 = 10.536 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.126 W/kg
SAR(1 g) = 0.098 W/kg



0 dB = 0.104 W/kg = -9.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

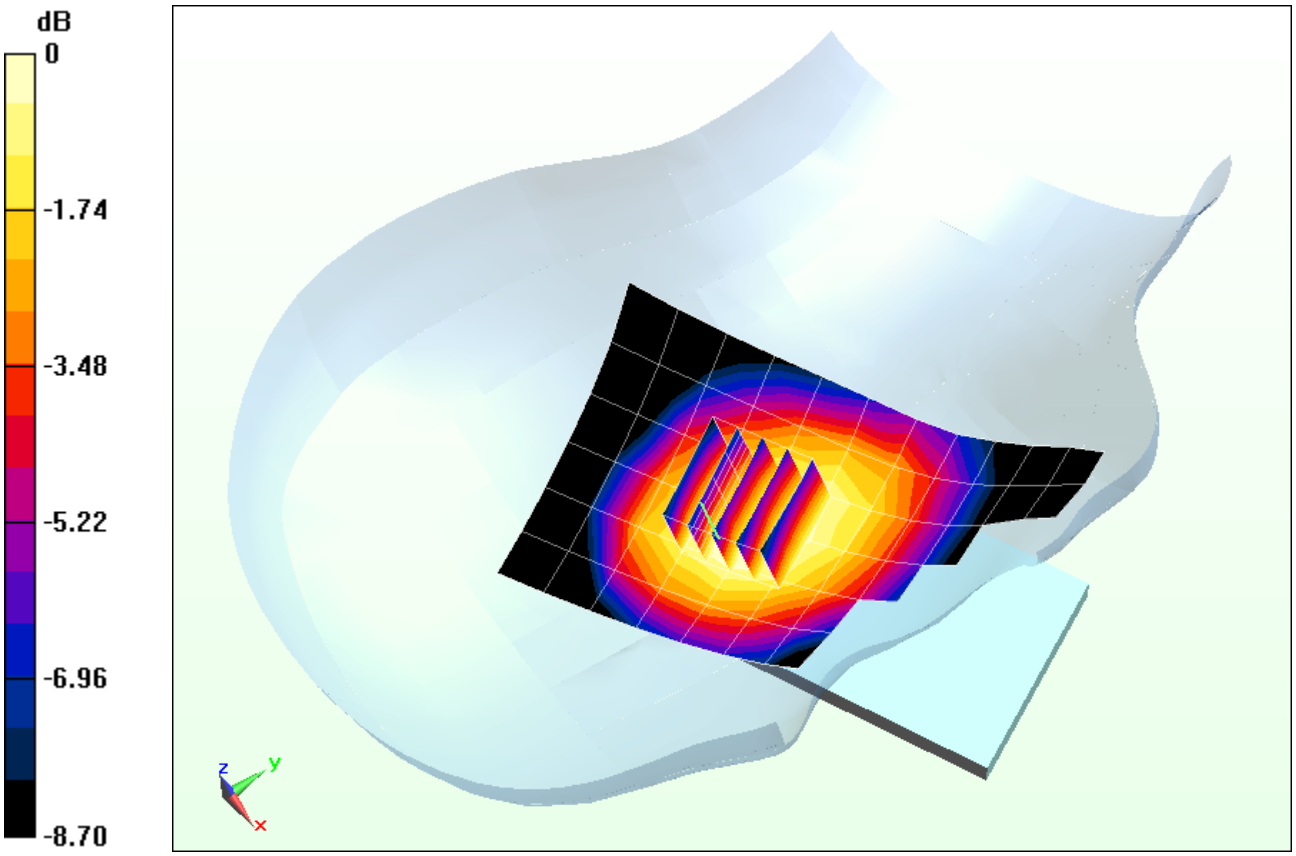
Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.919 mho/m; ε_r = 42.704; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-08-2012; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 850, 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 = 8.794 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.0830 W/kg
SAR(1 g) = 0.066 W/kg



0 dB = 0.0694 W/kg = -11.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

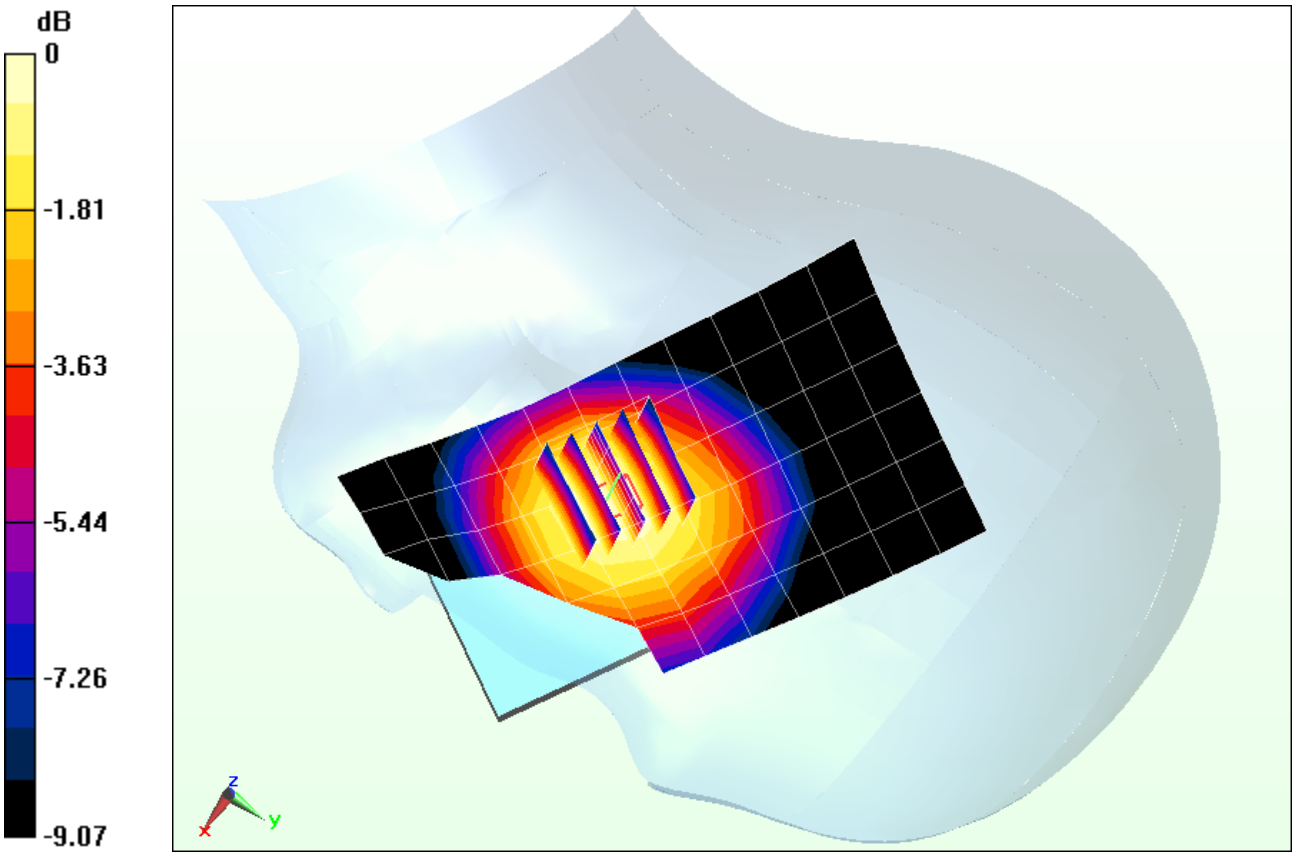
Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.919 mho/m; ε_r = 42.704; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-08-2012; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 850, Left Head, Cheek, 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 = 9.482 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.0970 W/kg
SAR(1 g) = 0.080 W/kg



0 dB = 0.0836 W/kg = -10.78 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

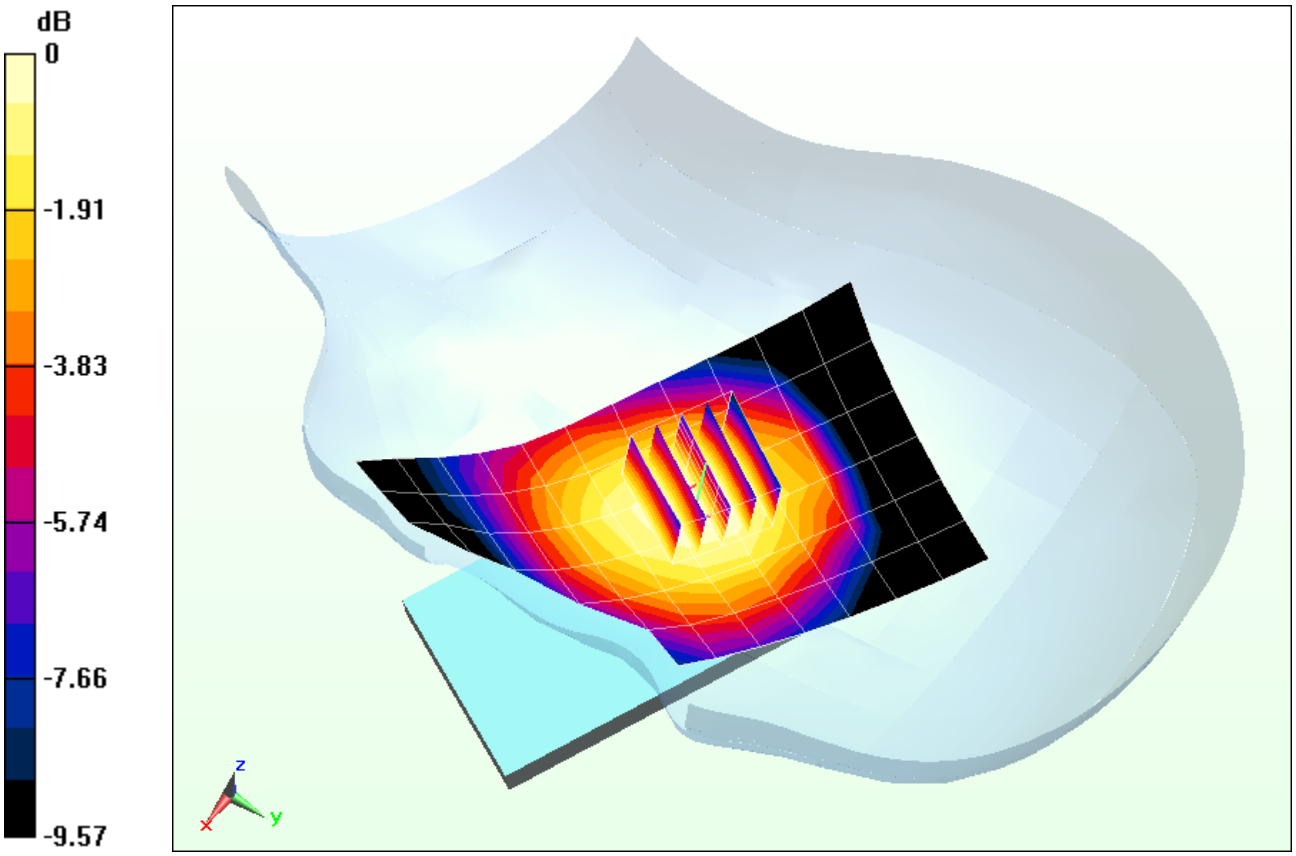
Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.919 mho/m; ε_r = 42.704; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-08-2012; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 850, 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 = 8.139 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.0740 W/kg
SAR(1 g) = 0.059 W/kg



0 dB = 0.0623 W/kg = -12.06 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

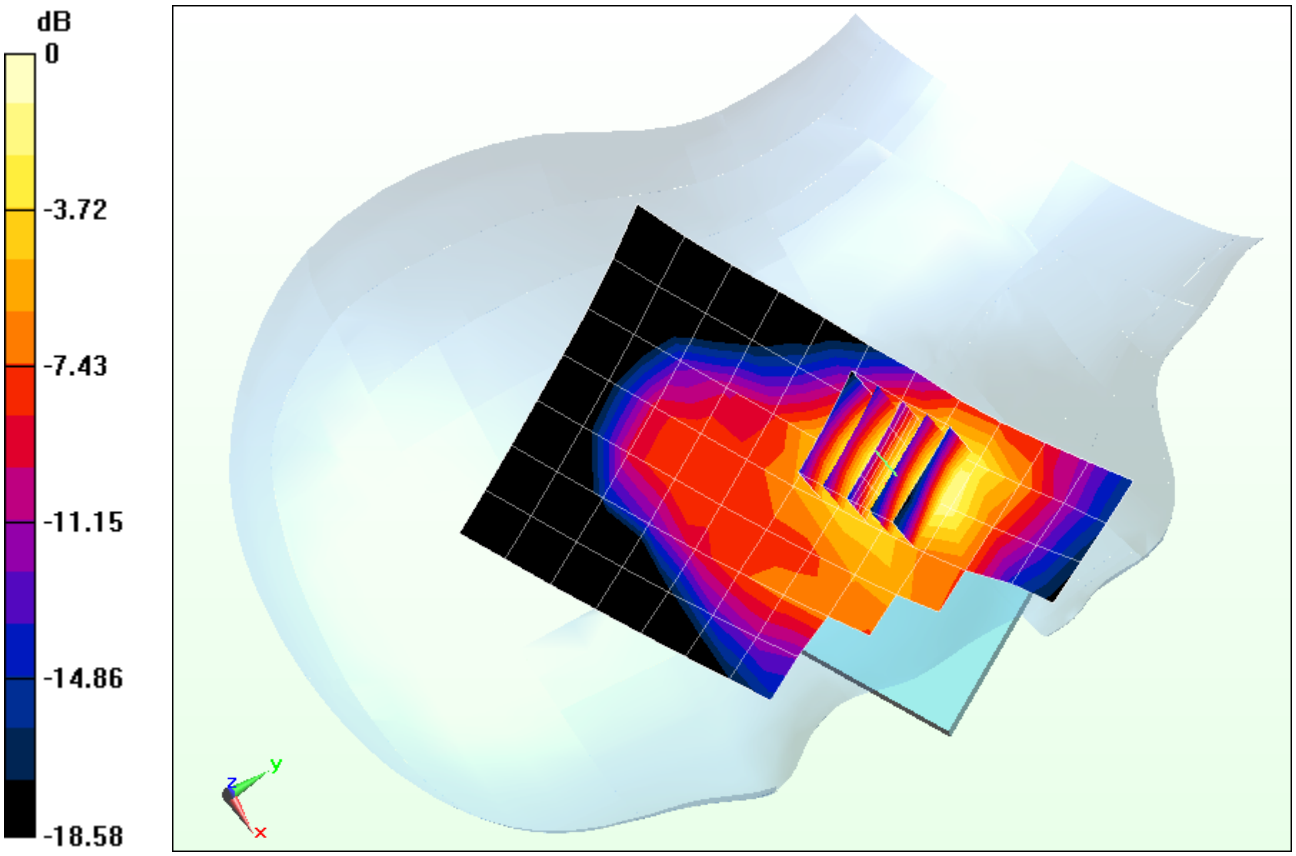
Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 1900, Right Head, Cheek, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.628 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.433 W/kg
SAR(1 g) = 0.274 W/kg



0 dB = 0.298 W/kg = -5.26 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

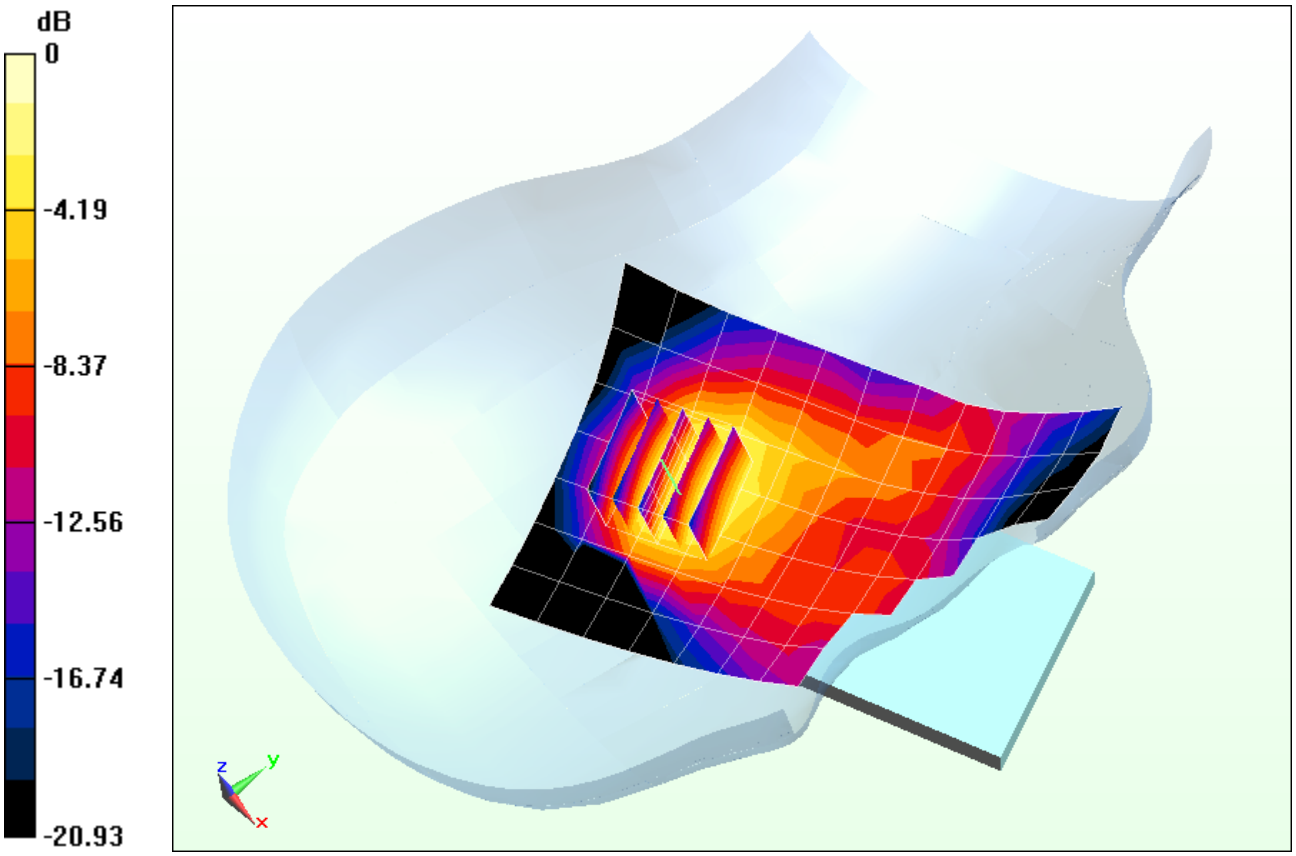
Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 1900, Right Head, Tilt, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.309 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.223 W/kg
SAR(1 g) = 0.138 W/kg



0 dB = 0.150 W/kg = -8.24 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

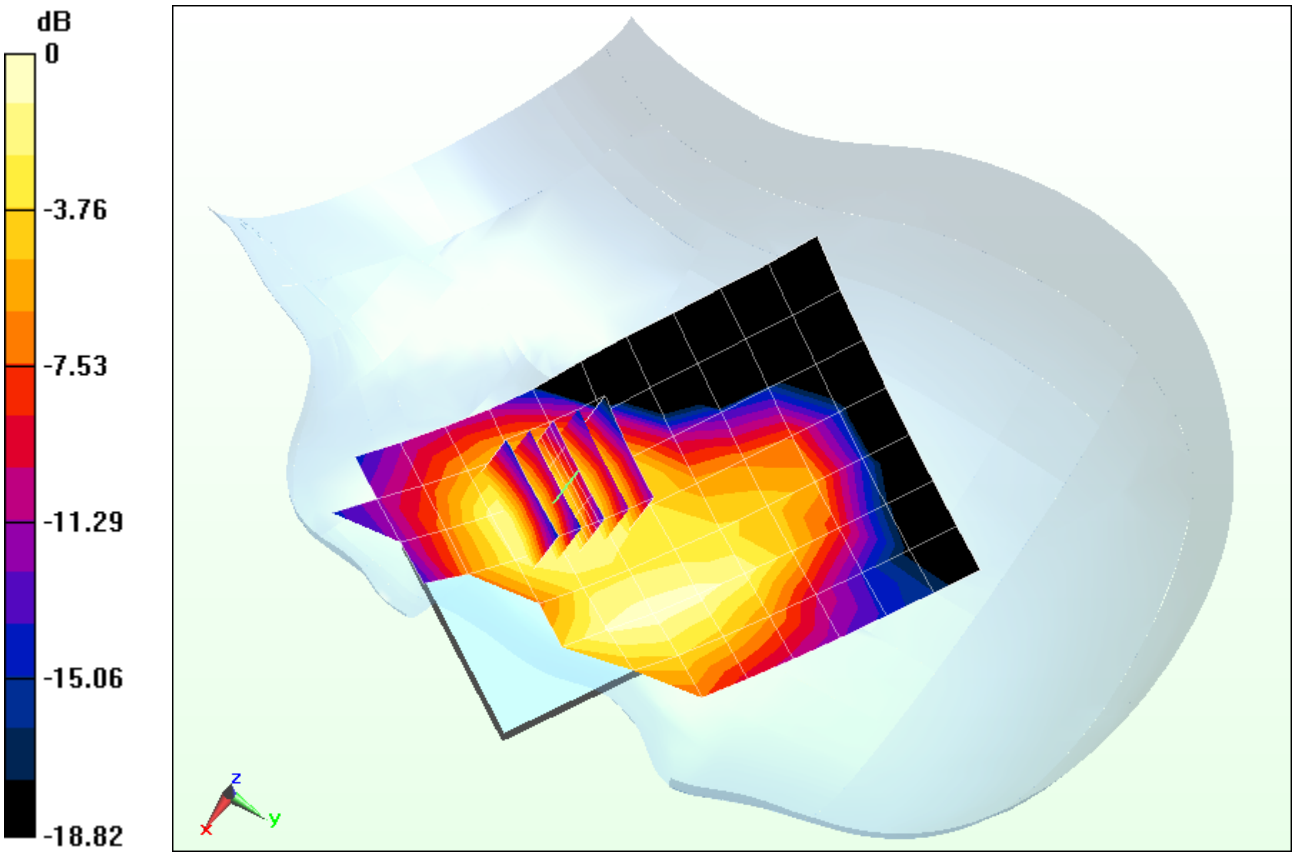
Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 1900, Left Head, Cheek, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.391 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.204 W/kg
SAR(1 g) = 0.133 W/kg



0 dB = 0.146 W/kg = -8.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

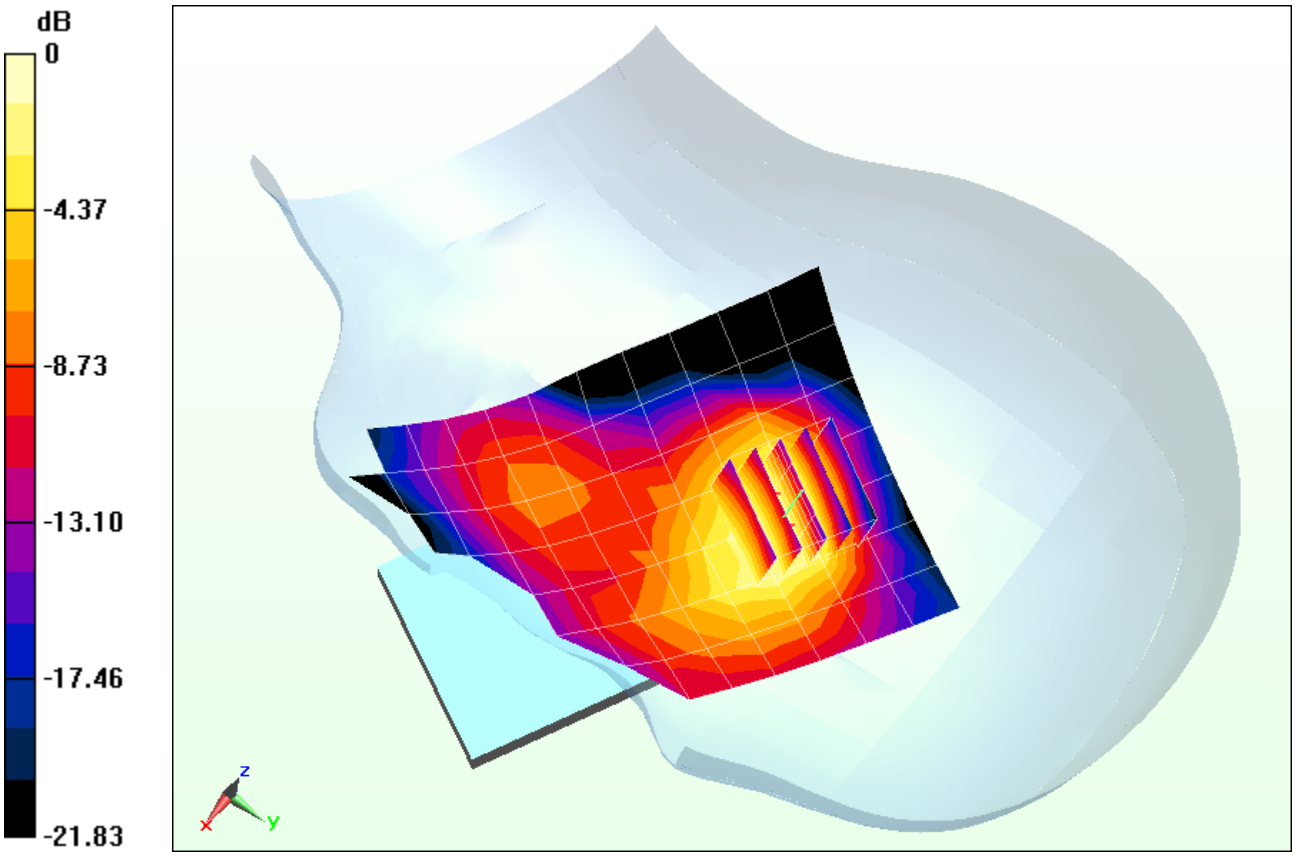
Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GSM 1900, Left Head, Tilt, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.572 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.199 W/kg
SAR(1 g) = 0.123 W/kg



0 dB = 0.136 W/kg = -8.66 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

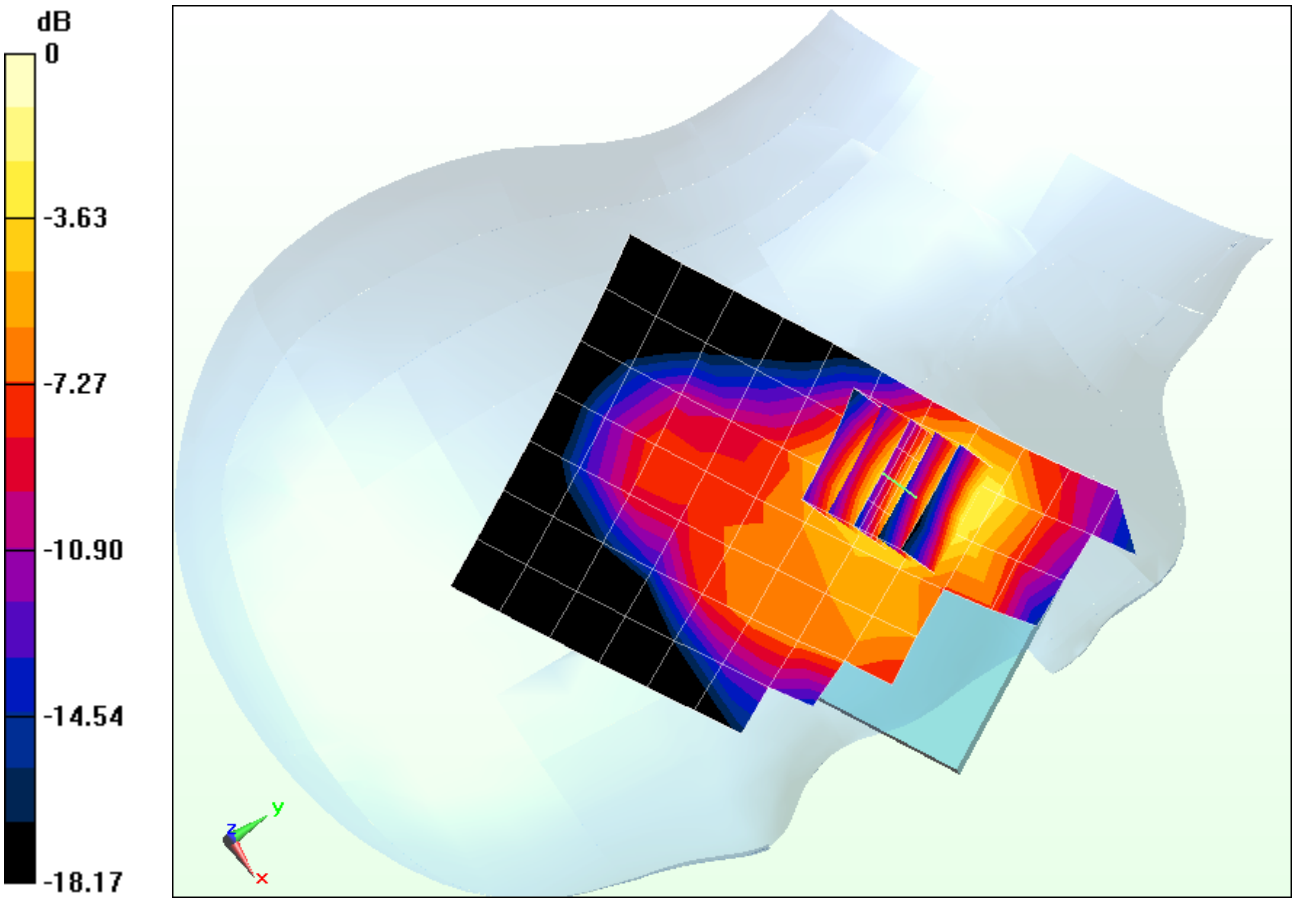
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Right Head, Cheek, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.850 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.807 W/kg
SAR(1 g) = 0.510 W/kg



0 dB = 0.564 W/kg = -2.49 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

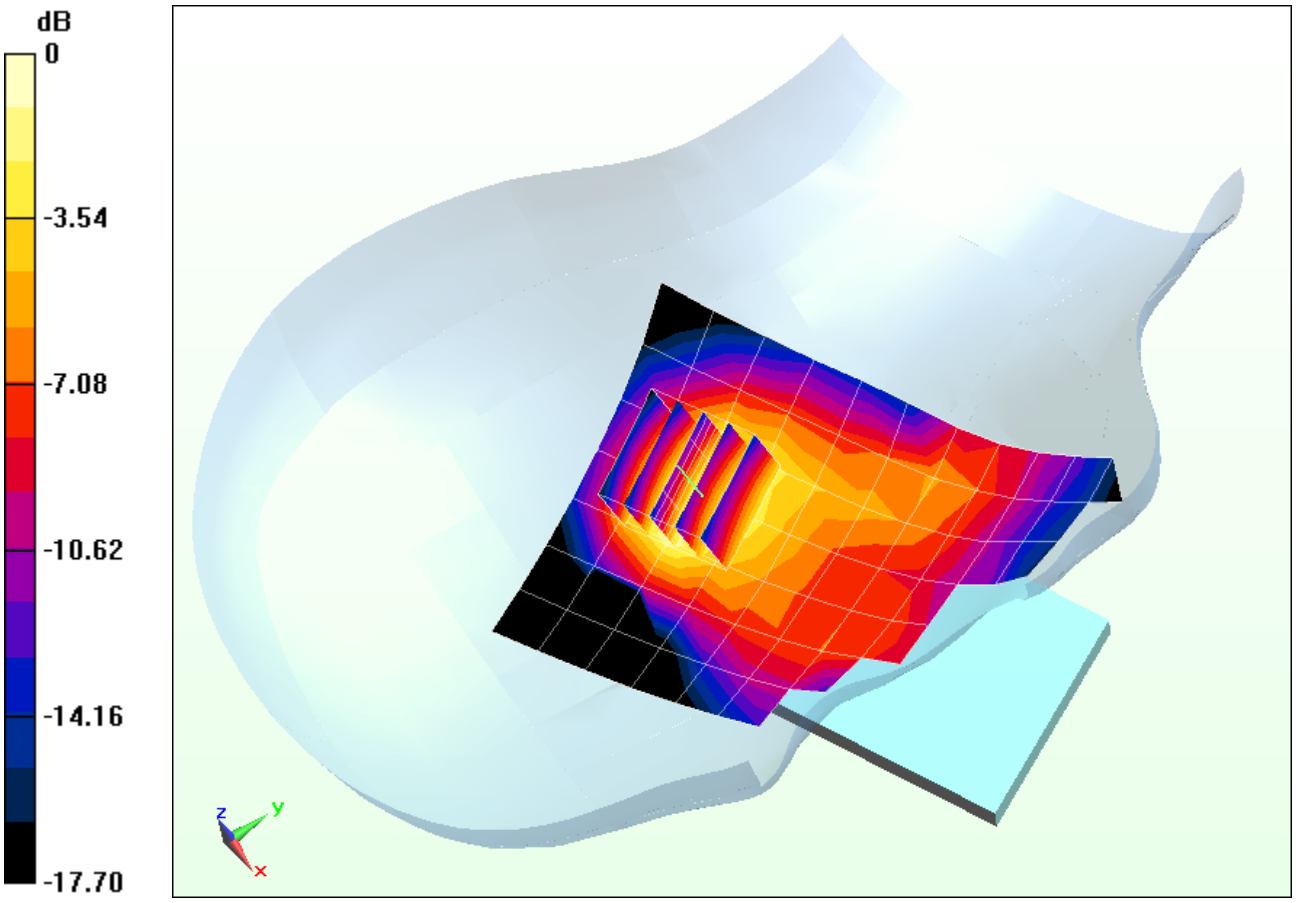
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Right Head, Tilt, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.437 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.320 W/kg
SAR(1 g) = 0.201 W/kg



0 dB = 0.215 W/kg = -6.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

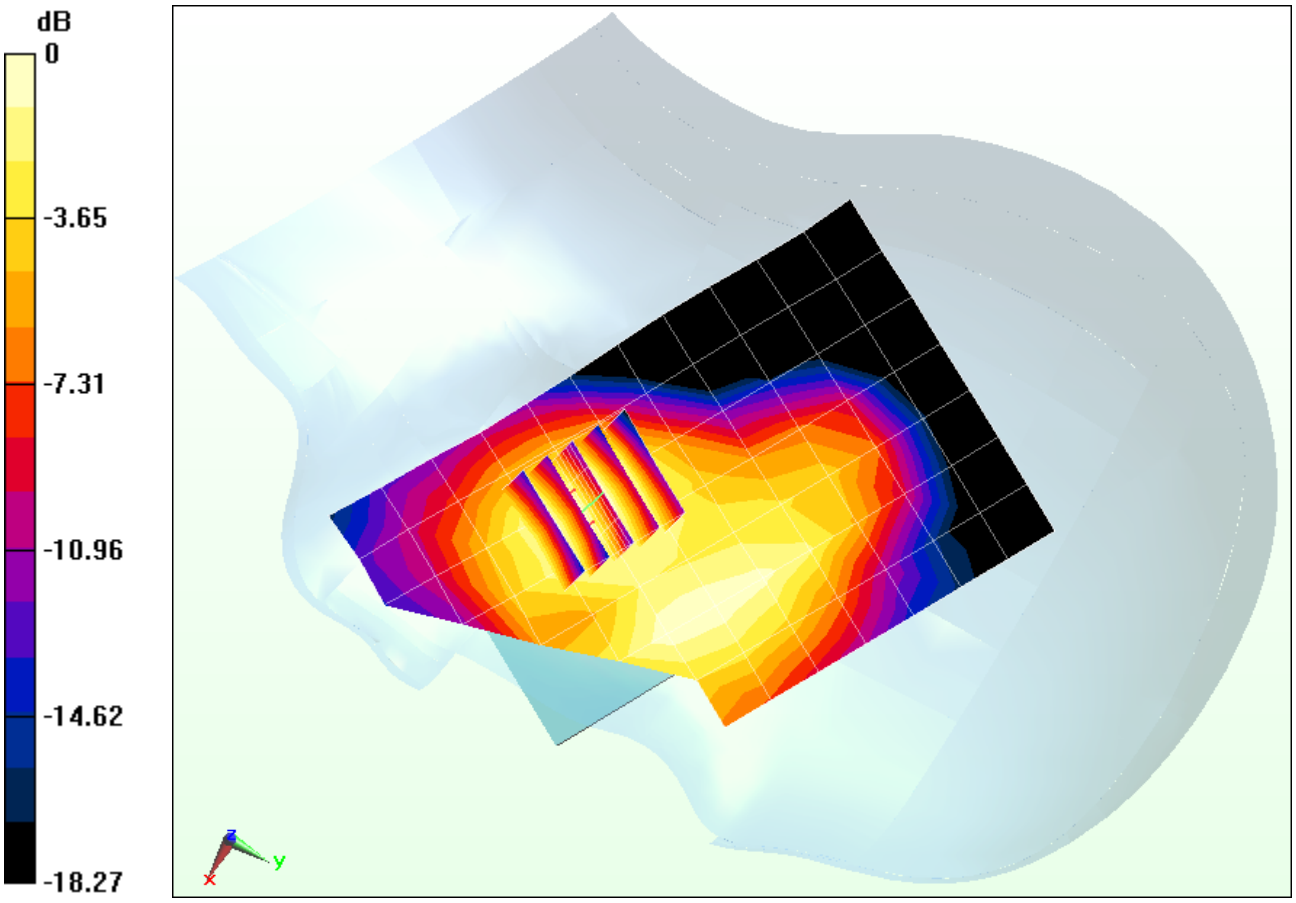
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Left Head, Cheek, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.771 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.405 W/kg
SAR(1 g) = 0.265 W/kg



0 dB = 0.286 W/kg = -5.44 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

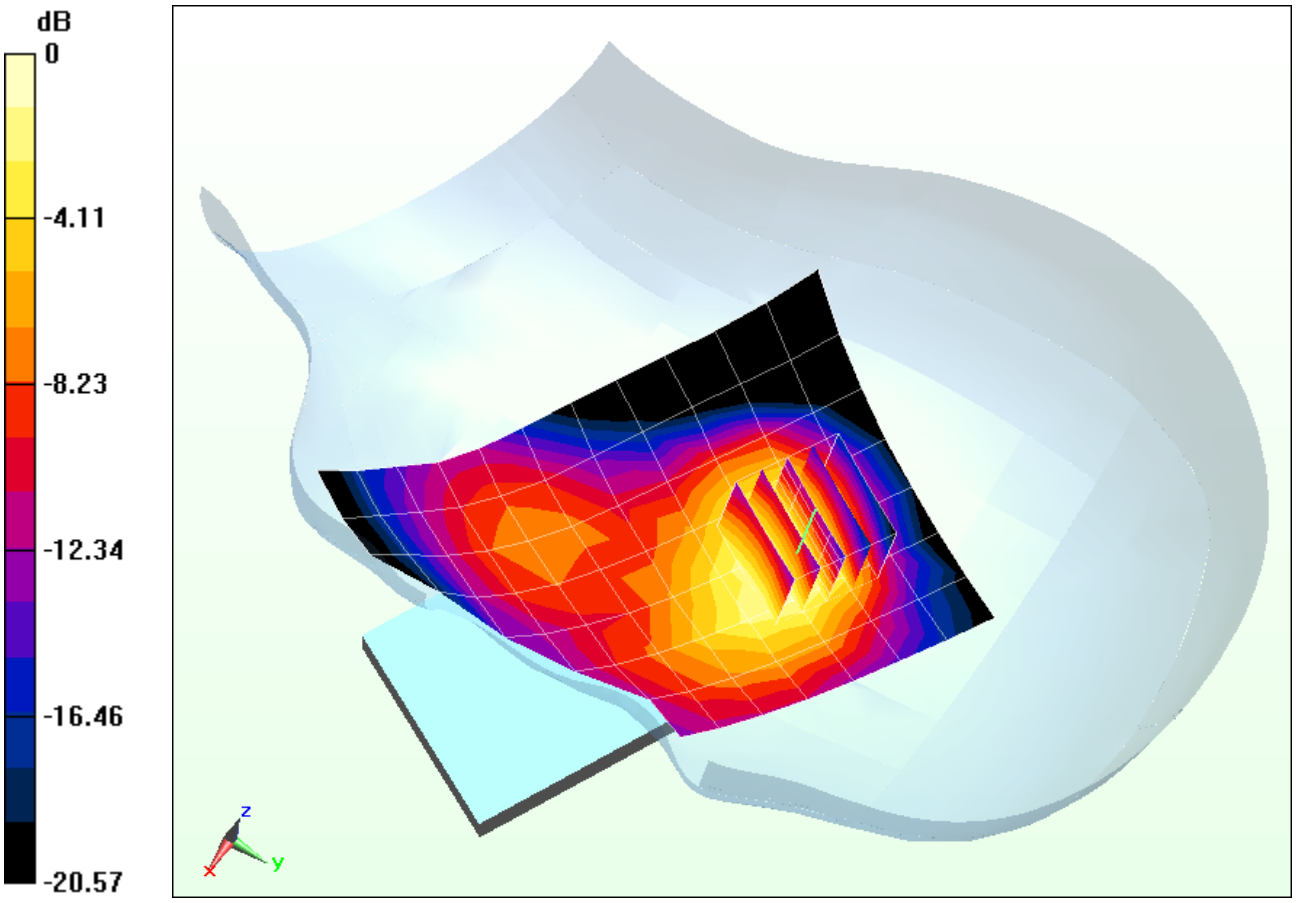
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.452 mho/m; ε_r = 40.27; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Left Head, Tilt, Mid.ch

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.604 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.384 W/kg
SAR(1 g) = 0.237 W/kg



0 dB = 0.257 W/kg = -5.90 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

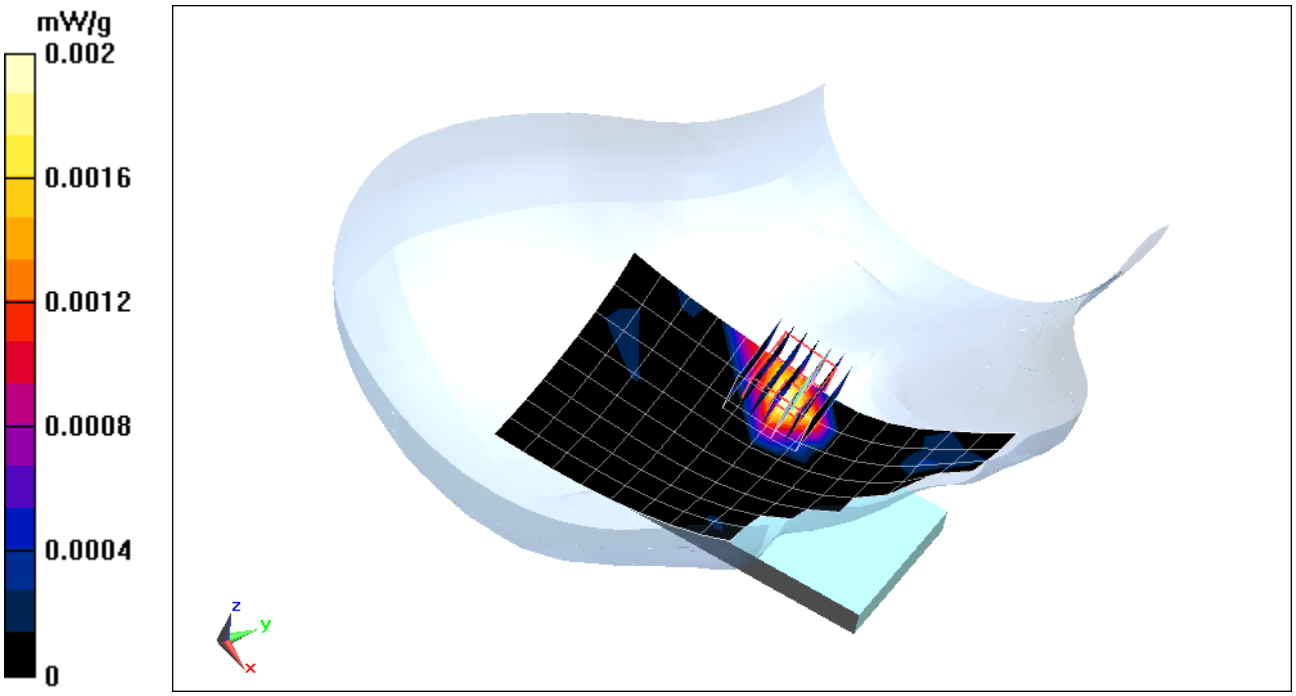
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.888 mho/m; ε_r = 40.331; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 10-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3213; ConvF(4.43, 4.43, 4.43); Calibrated: 4/24/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Right Head, Cheek, Ch 11, 1 Mbps

Area Scan (9x14x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.867 V/m; Power Drift = 0.122 dB
Peak SAR (extrapolated) = 0.007850 W/kg
SAR(1 g) = 0.00171 mW/g; SAR(10 g) = 0.000532 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

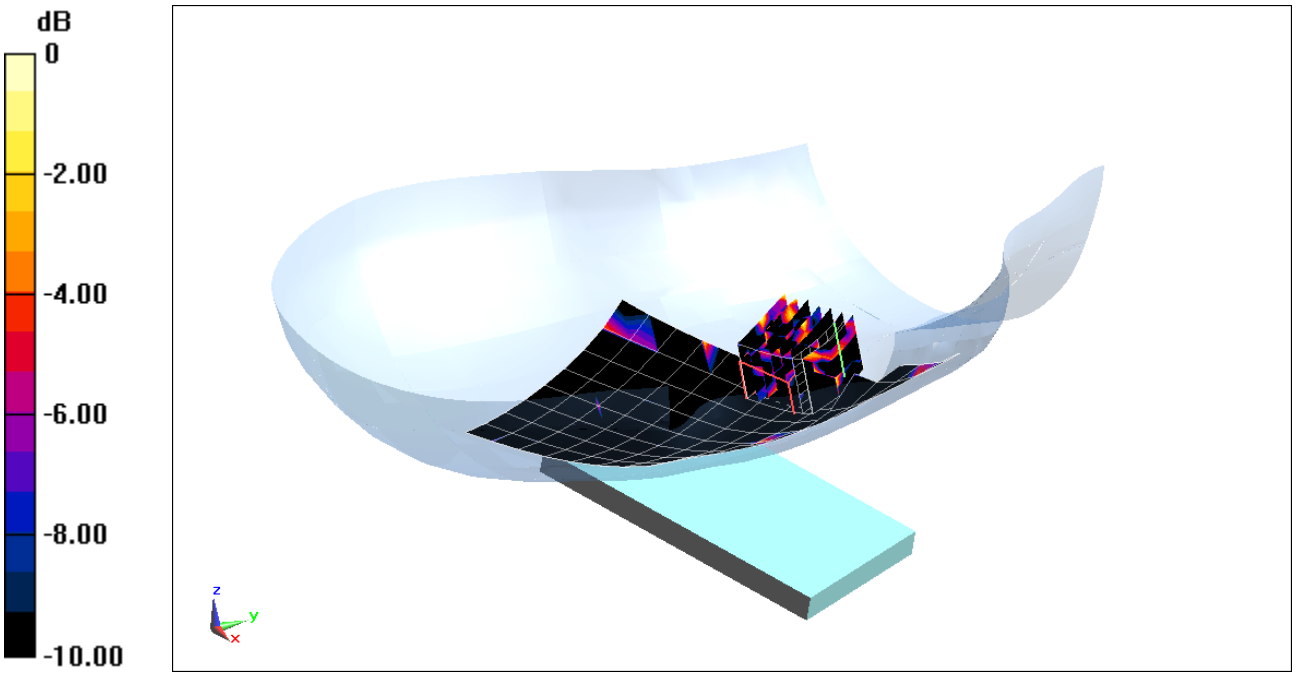
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.888 mho/m; ε_r = 40.331; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 10-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3213; ConvF(4.43, 4.43, 4.43); Calibrated: 4/24/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Right Head, Tilt, Ch 11, 1 Mbps

Area Scan (9x14x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.000320 W/kg
SAR(1 g) = 2.78e-005 mW/g; SAR(10 g) = 3.1e-006 mW/g



0 dB = 0.00082mW/g = -61.72 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

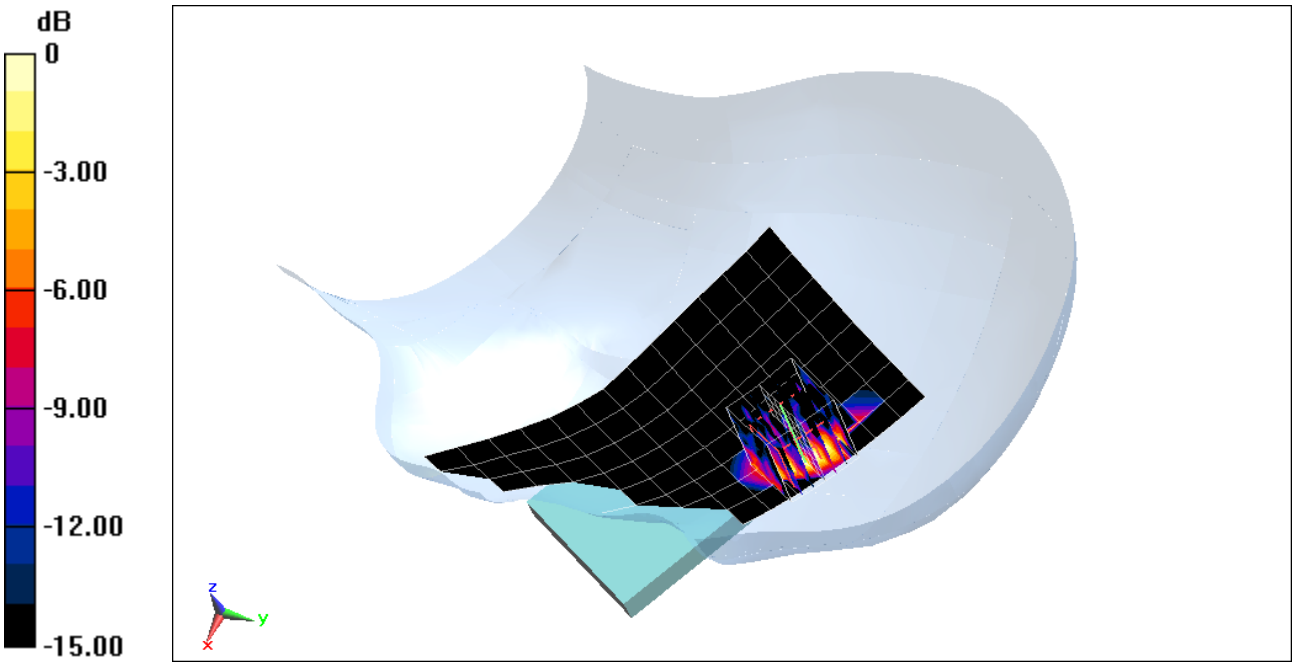
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.888 mho/m; ε_r = 40.331; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 10-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3213; ConvF(4.43, 4.43, 4.43); Calibrated: 4/24/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Left Head, Cheek, Ch 11, 1 Mbps

Area Scan (9x14x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.670 V/m; Power Drift = 0.039 dB
Peak SAR (extrapolated) = 0.0140 W/kg
SAR(1 g) = 0.00369 mW/g; SAR(10 g) = 0.0011 mW/g



0 dB = 0.0056mW/g = -45.04 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

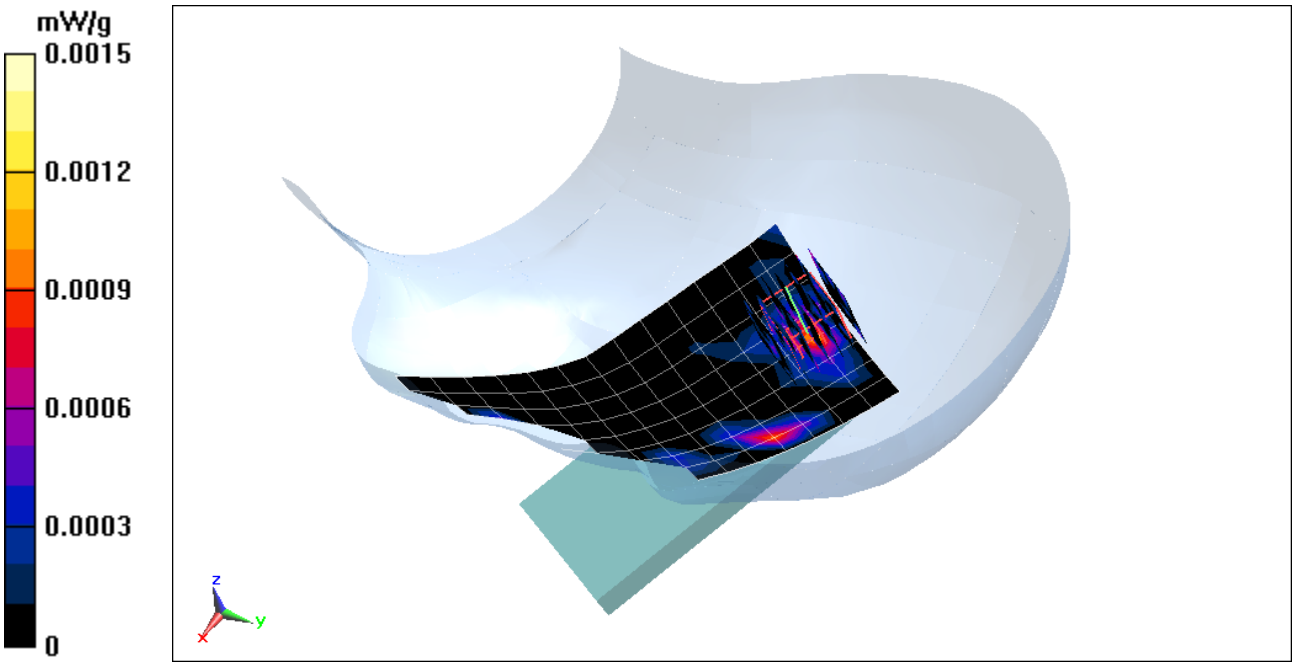
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.888 mho/m; ε_r = 40.331; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 10-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3213; ConvF(4.43, 4.43, 4.43); Calibrated: 4/24/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Left Head, Tilt, Ch 11, 1 Mbps

Area Scan (9x14x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.781 V/m; Power Drift = 0.104 dB
Peak SAR (extrapolated) = 0.003380 W/kg
SAR(1 g) = 0.00043 mW/g; SAR(10 g) = 6.45e-005 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-B

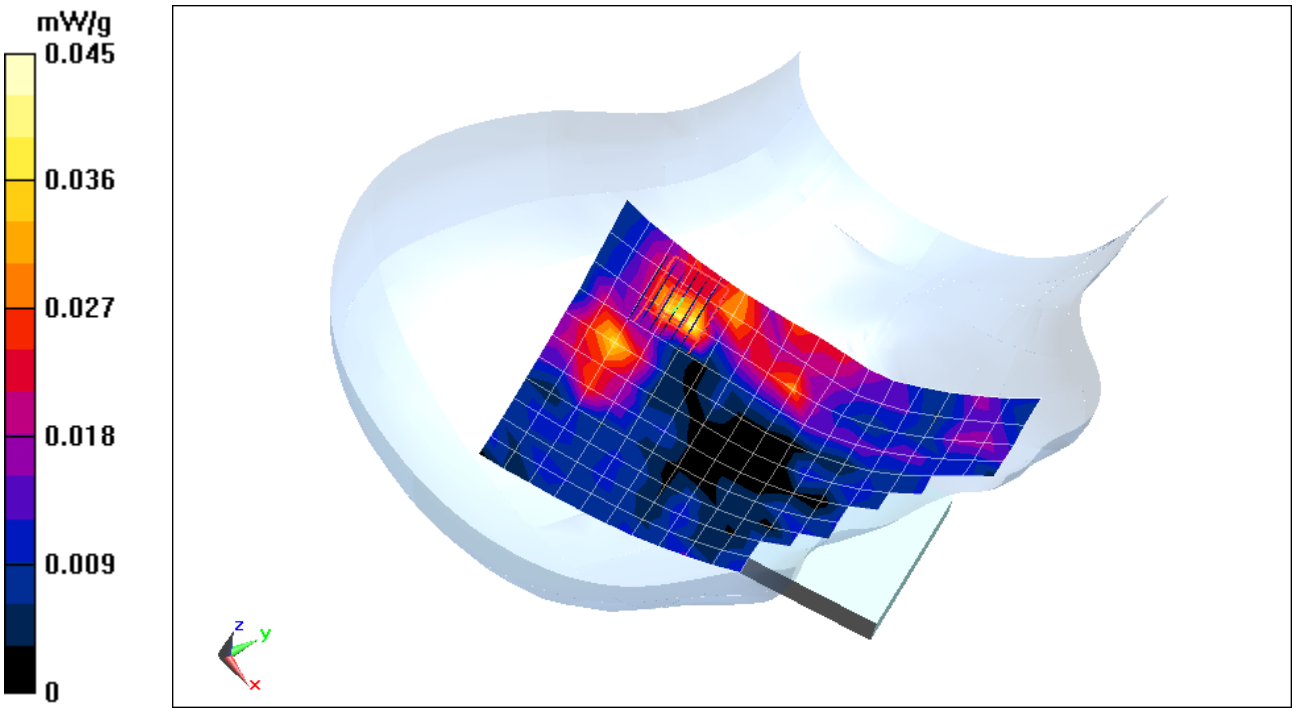
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5300 MHz; σ = 4.624 mho/m; ε_r = 35.44; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.36, 4.36, 4.36); Calibrated: 1/27/2012
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11a 5.3 GHz, Right Head, Cheek, Ch 60, 6 Mbps

Area Scan (12x17x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.261 V/m; Power Drift = -0.21 dB
Peak SAR (extrapolated) = 0.2270W/kg
SAR(1 g) = 0.018 mW/g; SAR(10 g) = 0.00553 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-B

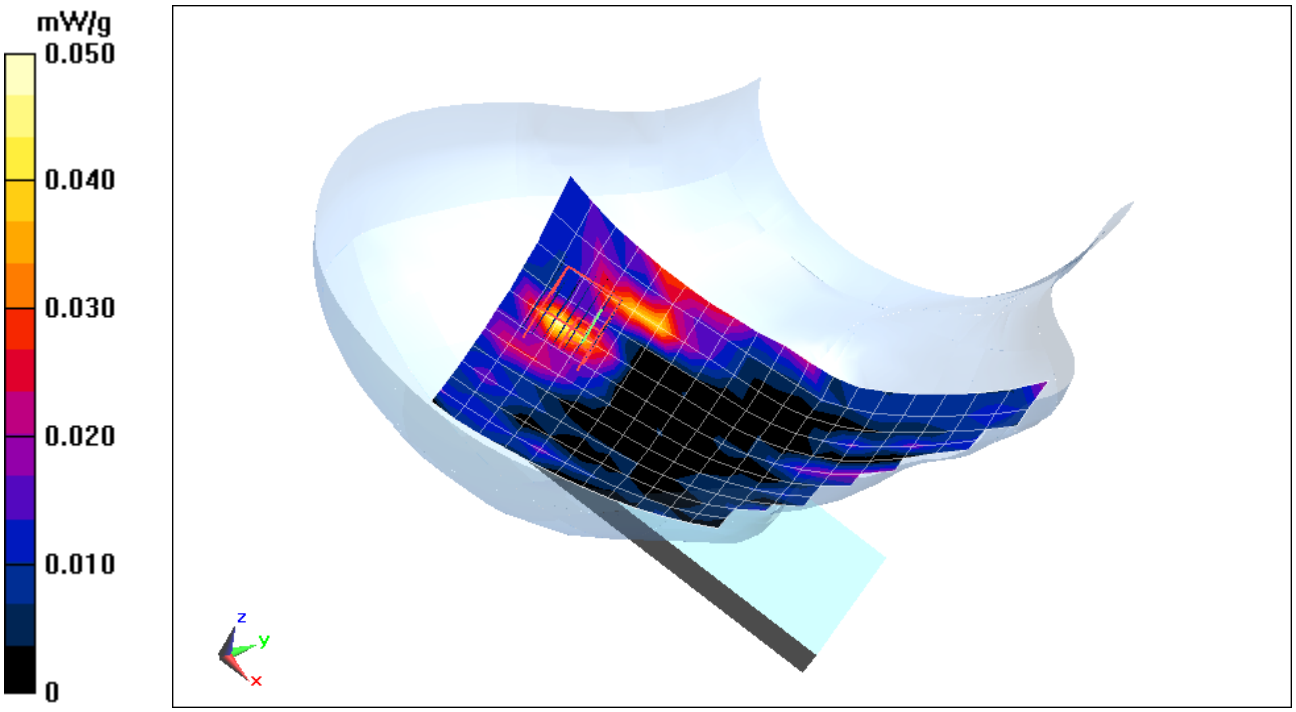
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5220 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5220 MHz; σ = 4.551 mho/m; ε_r = 35.57; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.59, 4.59, 4.59); Calibrated: 1/27/2012
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11a 5.2 GHz, Right Head, Tilt, Ch 44, 6 Mbps

Area Scan (12x19x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.501 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.1330 W/kg
SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.00535 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-B

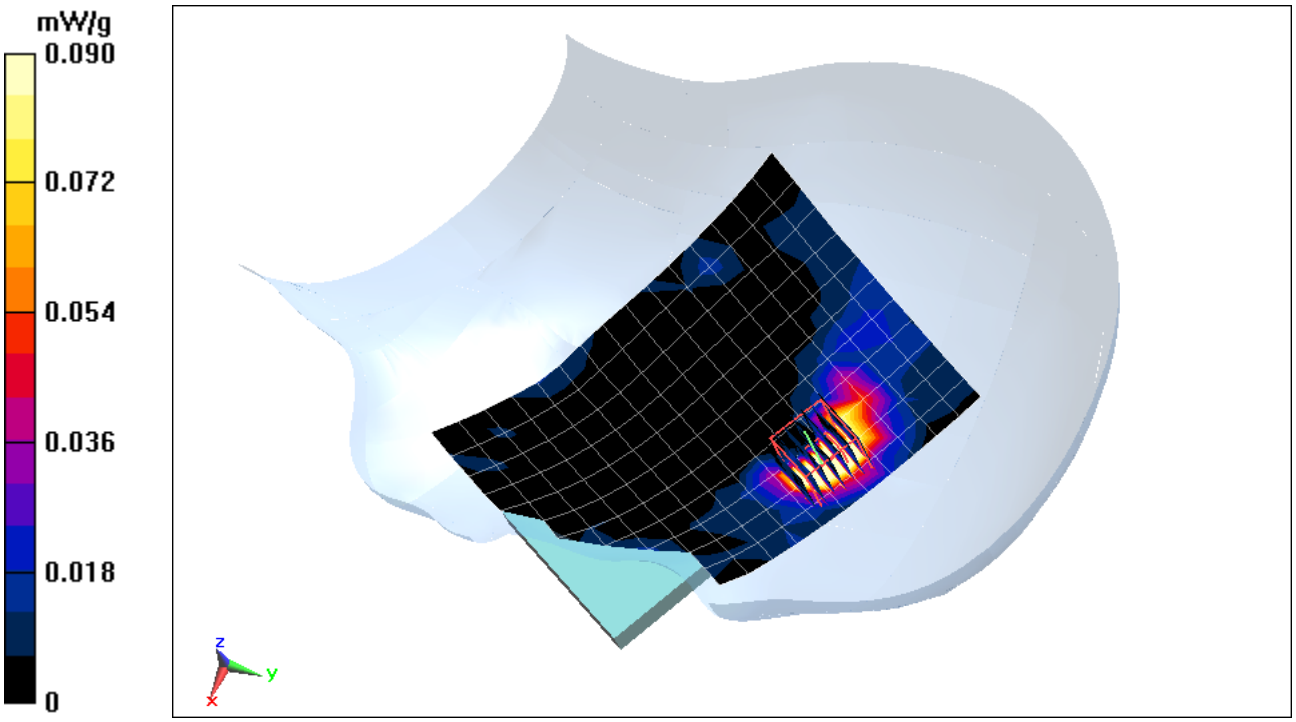
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5300 MHz; σ = 4.624 mho/m; ε_r = 35.44; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.36, 4.36, 4.36); Calibrated: 1/27/2012
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11a, 5.3 GHz Left Head, Cheek, Ch 60, 6 Mbps

Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.792 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.4790 W/kg
SAR(1 g) = 0.098 mW/g; SAR(10 g) = 0.026 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-B

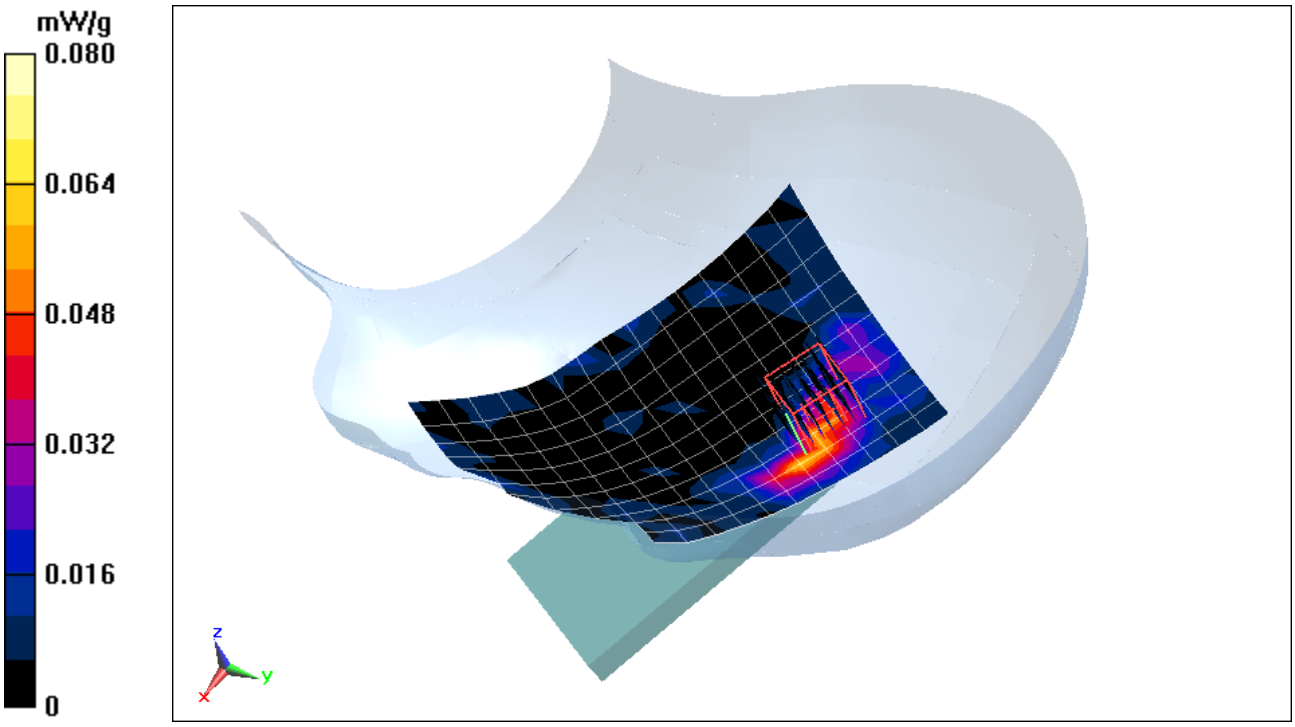
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5300 MHz; σ = 4.624 mho/m; ε_r = 35.44; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.36, 4.36, 4.36); Calibrated: 1/27/2012
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11a, 5.3 GHz Left Head, Tilt, Ch 60, 6 Mbps

Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.972 V/m; Power Drift = 0.041 dB
Peak SAR (extrapolated) = 0.2400 W/kg
SAR(1 g) = 0.032 mW/g; SAR(10 g) = 0.00996 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

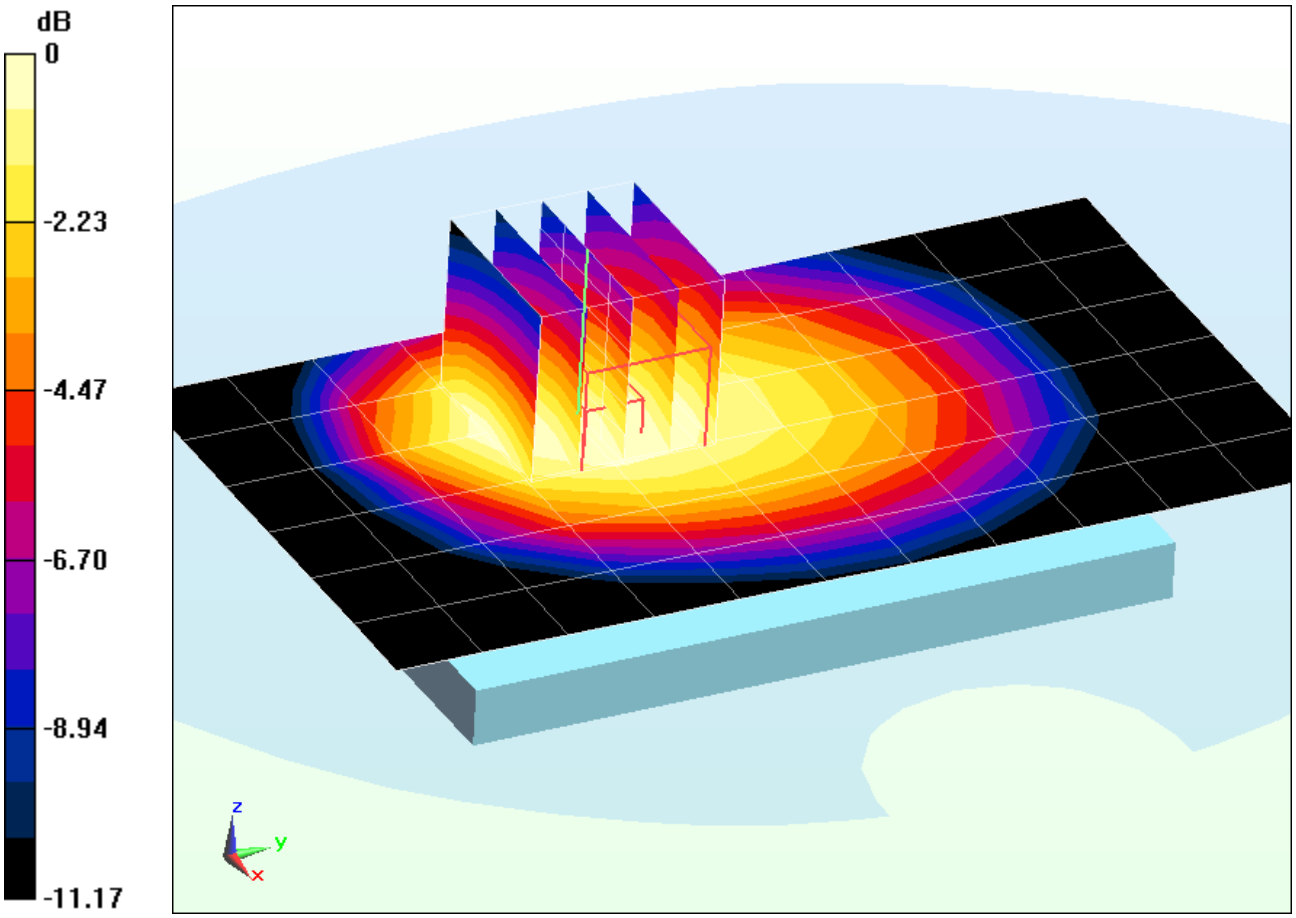
Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 54.525; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.4°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.873 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.669 W/kg
SAR(1 g) = 0.503 W/kg; SAR(10 g) = 0.372 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

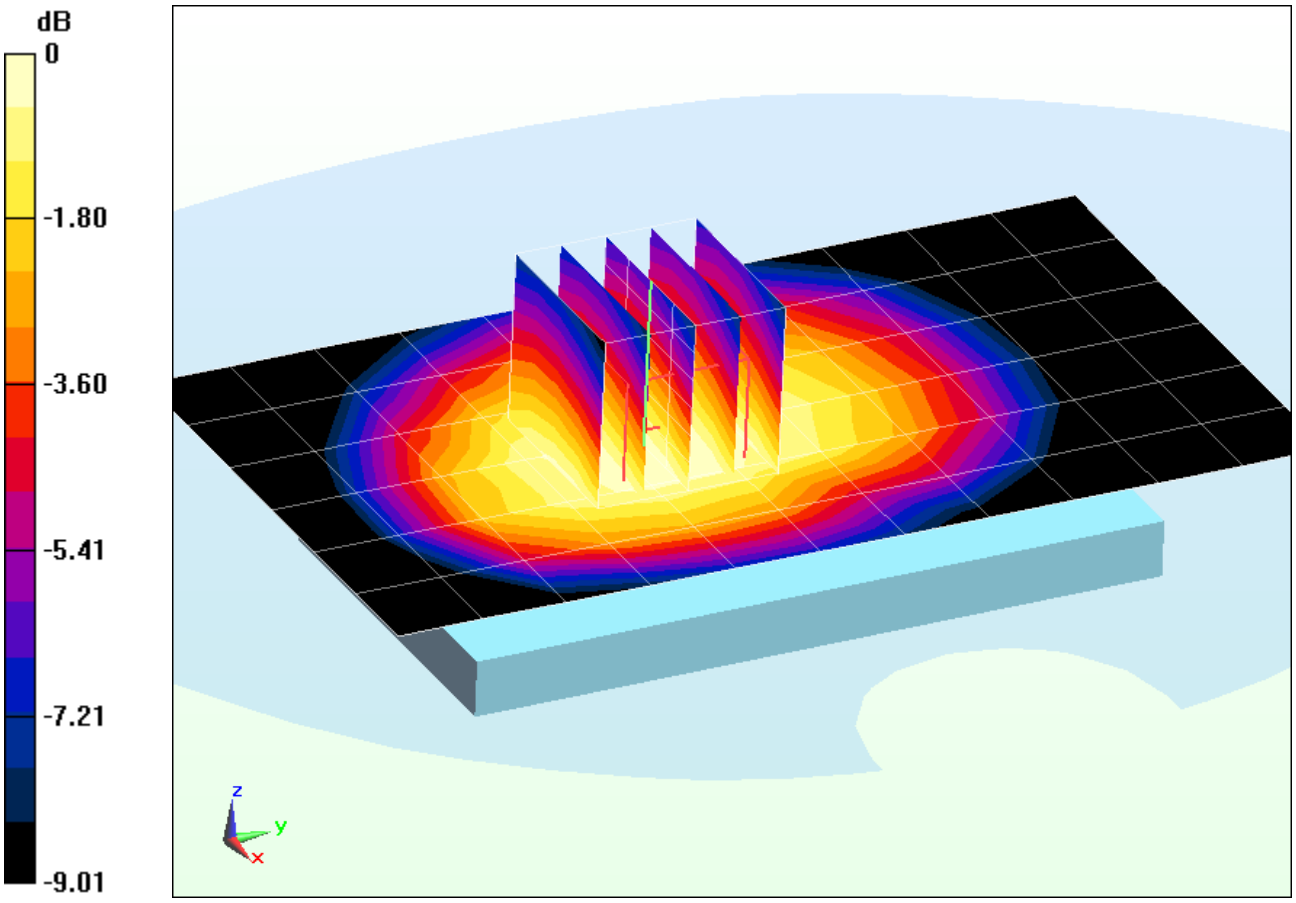
Communication System: GSM 850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 54.525; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.4°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 850, Body SAR, Front side, Mid.ch, 2 Tx Slots

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.012 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.282 W/kg
SAR(1 g) = 0.228 W/kg; SAR(10 g) = 0.175 W/kg



0 dB = 0.240 W/kg = -6.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

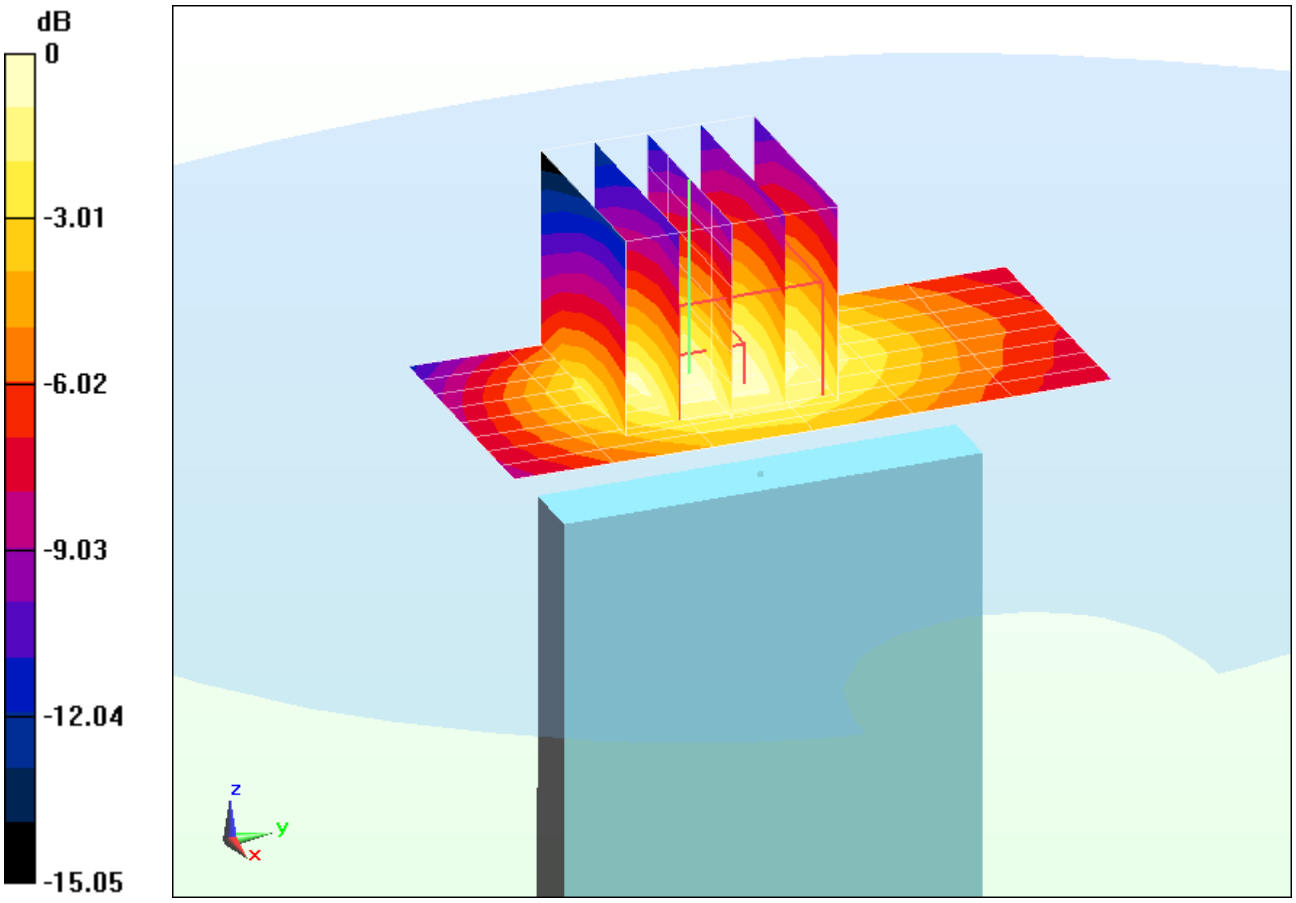
Communication System: GSM 850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 54.525; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.4°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 850, Body SAR, Bottom Edge, Mid.ch, 2 Tx Slots

Area Scan (9x7x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.983 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.110 W/kg
SAR(1 g) = 0.071 W/kg; SAR(10 g) = 0.046 W/kg



0 dB = 0.0775 W/kg = -11.11 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

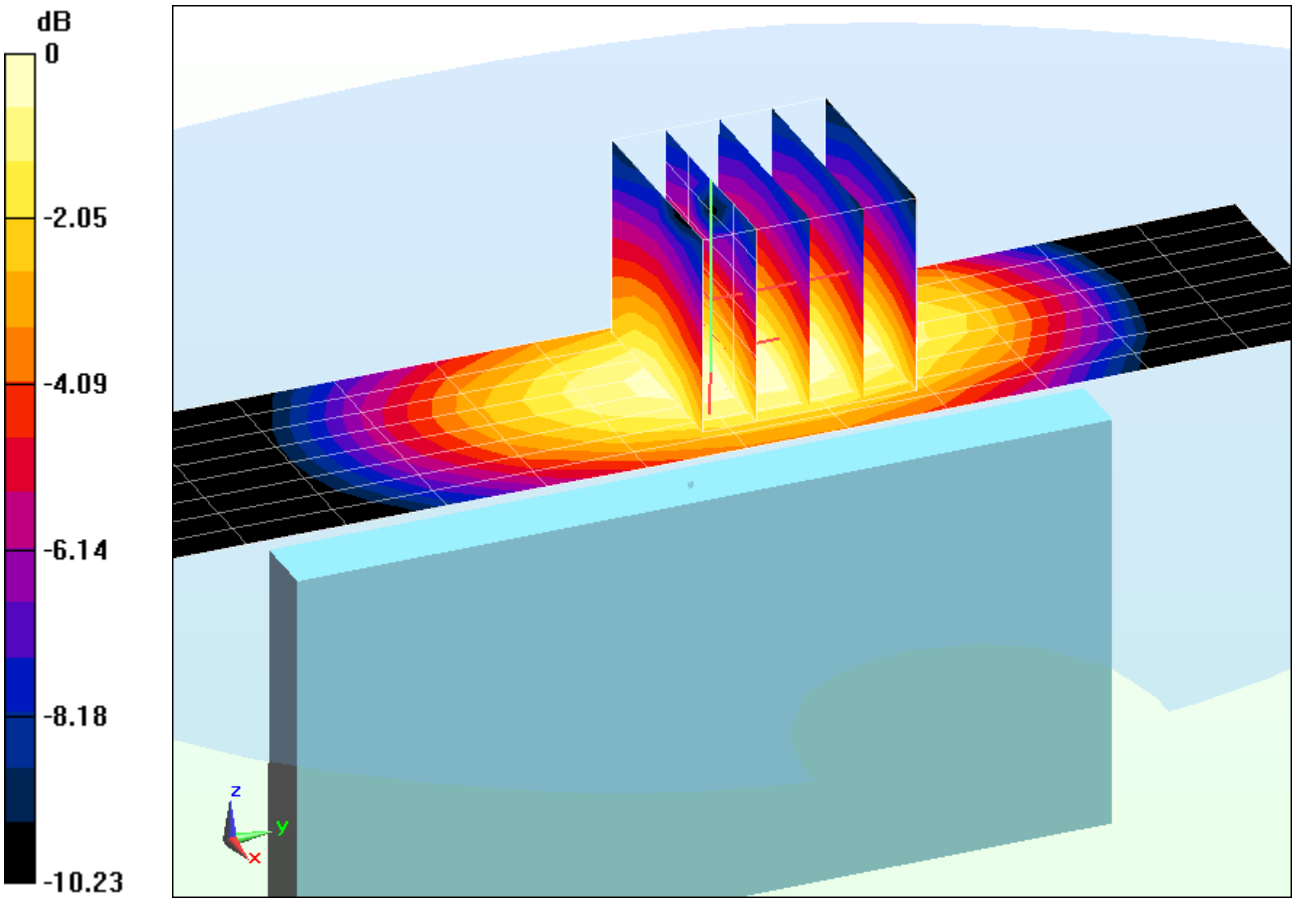
Communication System: GSM 850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 54.525; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.4°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 850, Body SAR, Right Edge, Mid.ch, 2 Tx Slots

Area Scan (9x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.341 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.410 W/kg
SAR(1 g) = 0.298 W/kg; SAR(10 g) = 0.206 W/kg



0 dB = 0.321 W/kg = -4.93 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

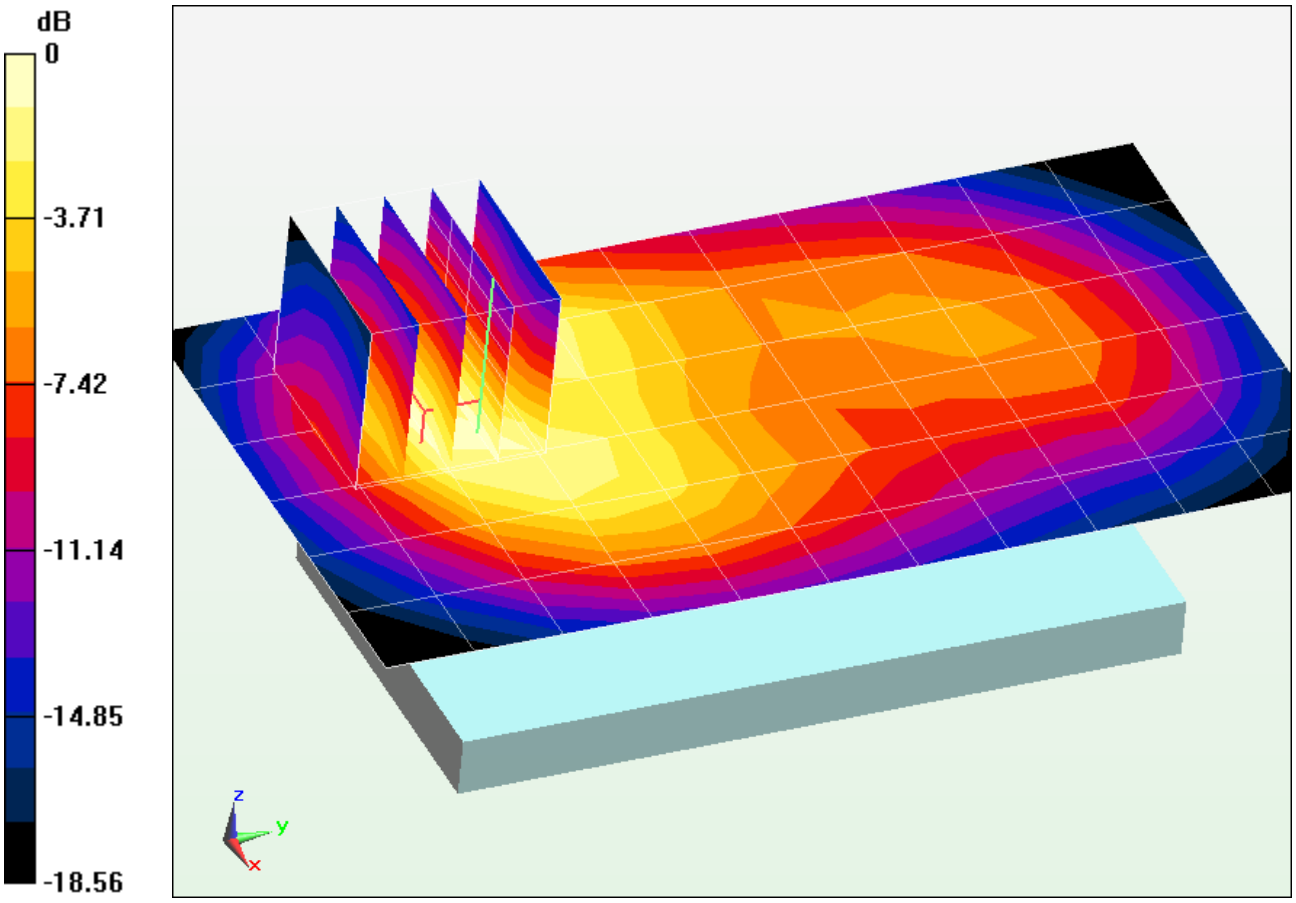
Communication System: GSM GPRS; 2 Tx slots; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15
Medium: 1900 Body; Medium parameters used:
f = 1910 MHz; σ = 1.588 mho/m; ε_r = 51.39; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 1900, Body SAR, Back side, High.ch, 2 Tx Slots

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.848 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.72 W/kg
SAR(1 g) = 0.987 W/kg



0 dB = 1.04 W/kg = 0.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

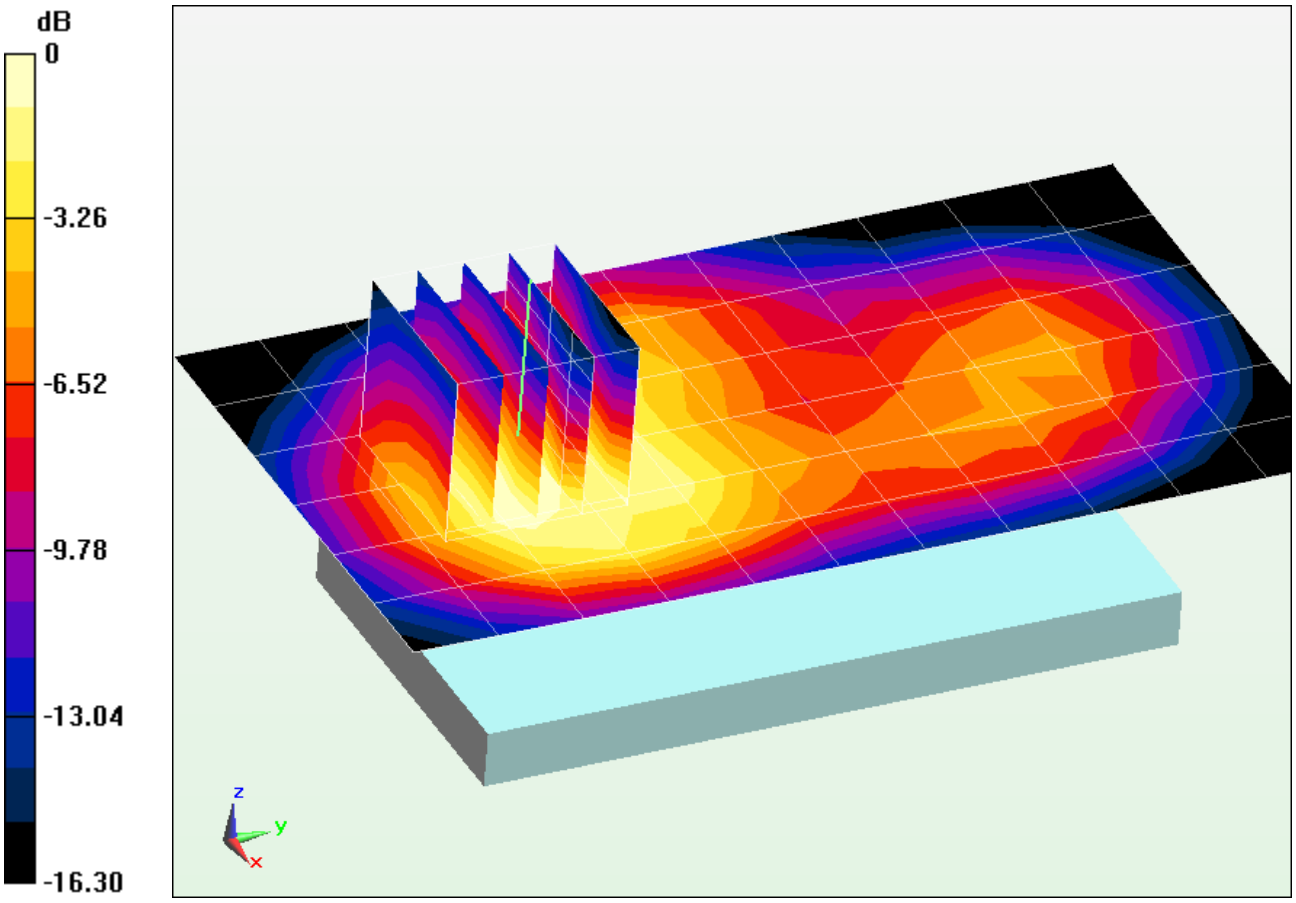
Communication System: GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.566 mho/m; ε_r = 51.42; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 1900, Body SAR, Front side, Mid.ch, 2 Tx Slots

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.977 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.02 W/kg
SAR(1 g) = 0.604 W/kg



0 dB = 0.658 W/kg = -1.82 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

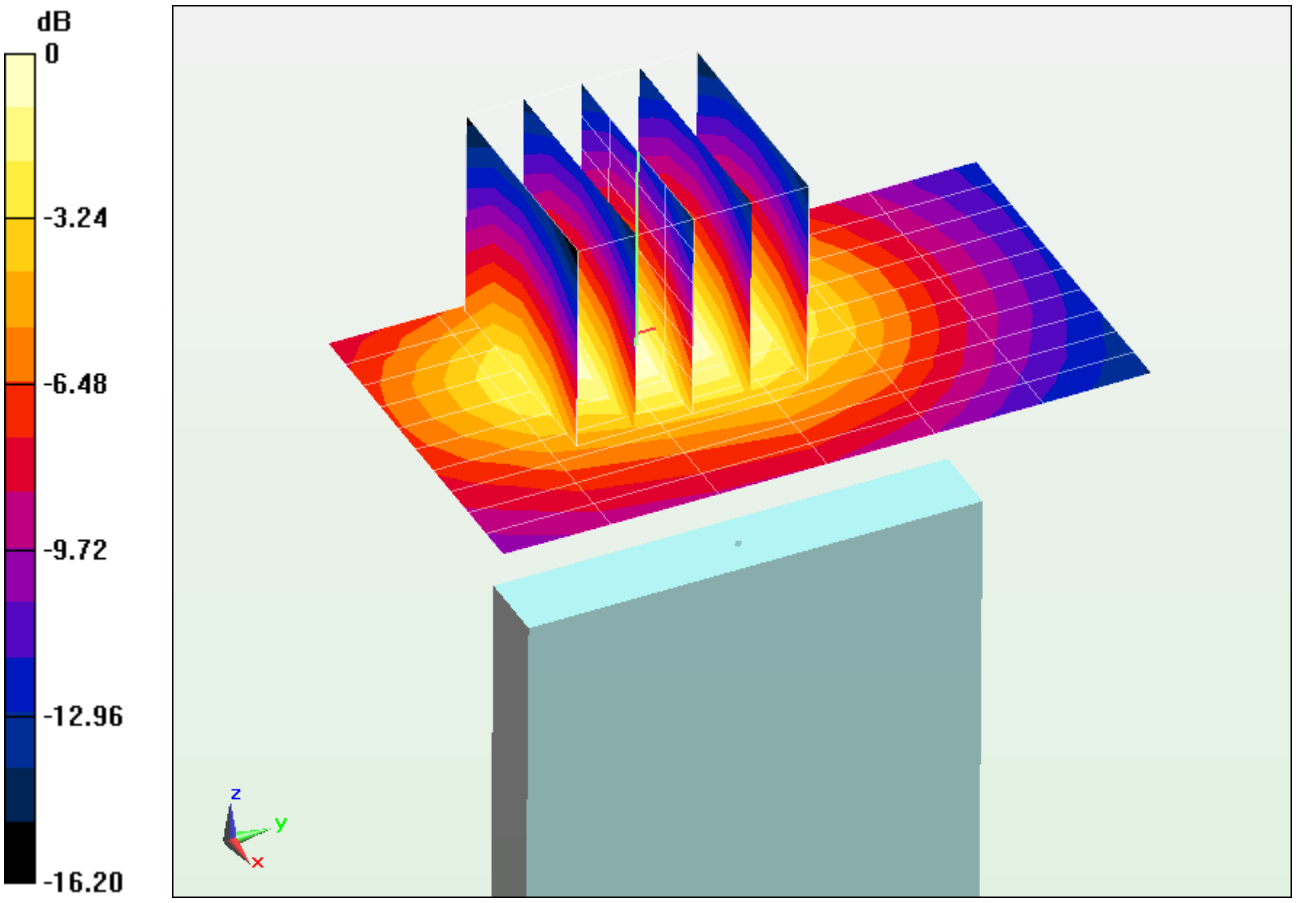
Communication System: GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.566 mho/m; ε_r = 51.42; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 1900, Body SAR, Bottom Edge, Mid.ch, 2 Tx Slots

Area Scan (11x7x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.222 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.874 W/kg
SAR(1 g) = 0.528 W/kg



0 dB = 0.589 W/kg = -2.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

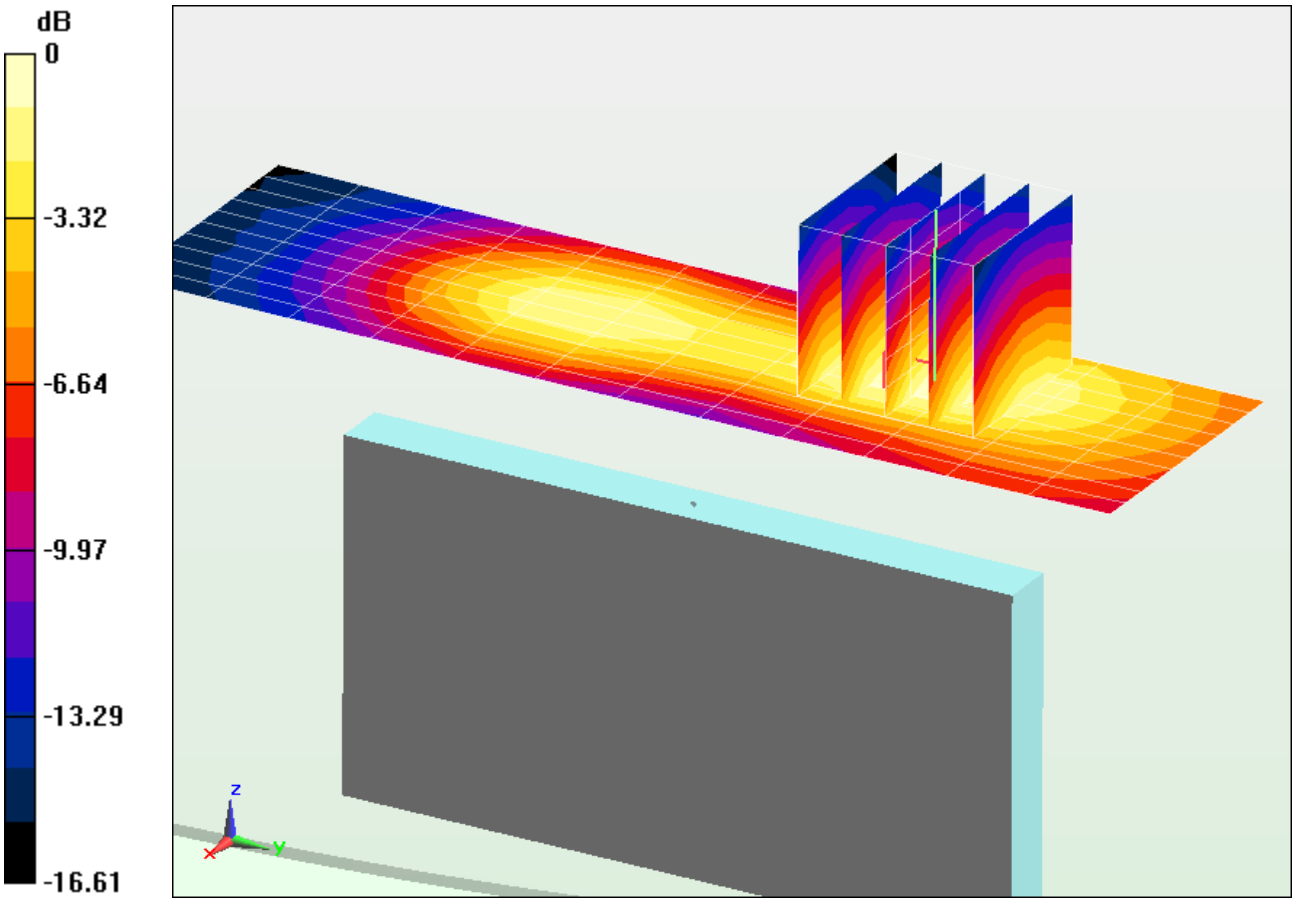
Communication System: GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.566 mho/m; ε_r = 51.42; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 1900, Body SAR, Right Edge, Mid.ch, 2 Tx Slots

Area Scan (11x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.604 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.498 W/kg
SAR(1 g) = 0.296 W/kg



0 dB = 0.328 W/kg = -4.84 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

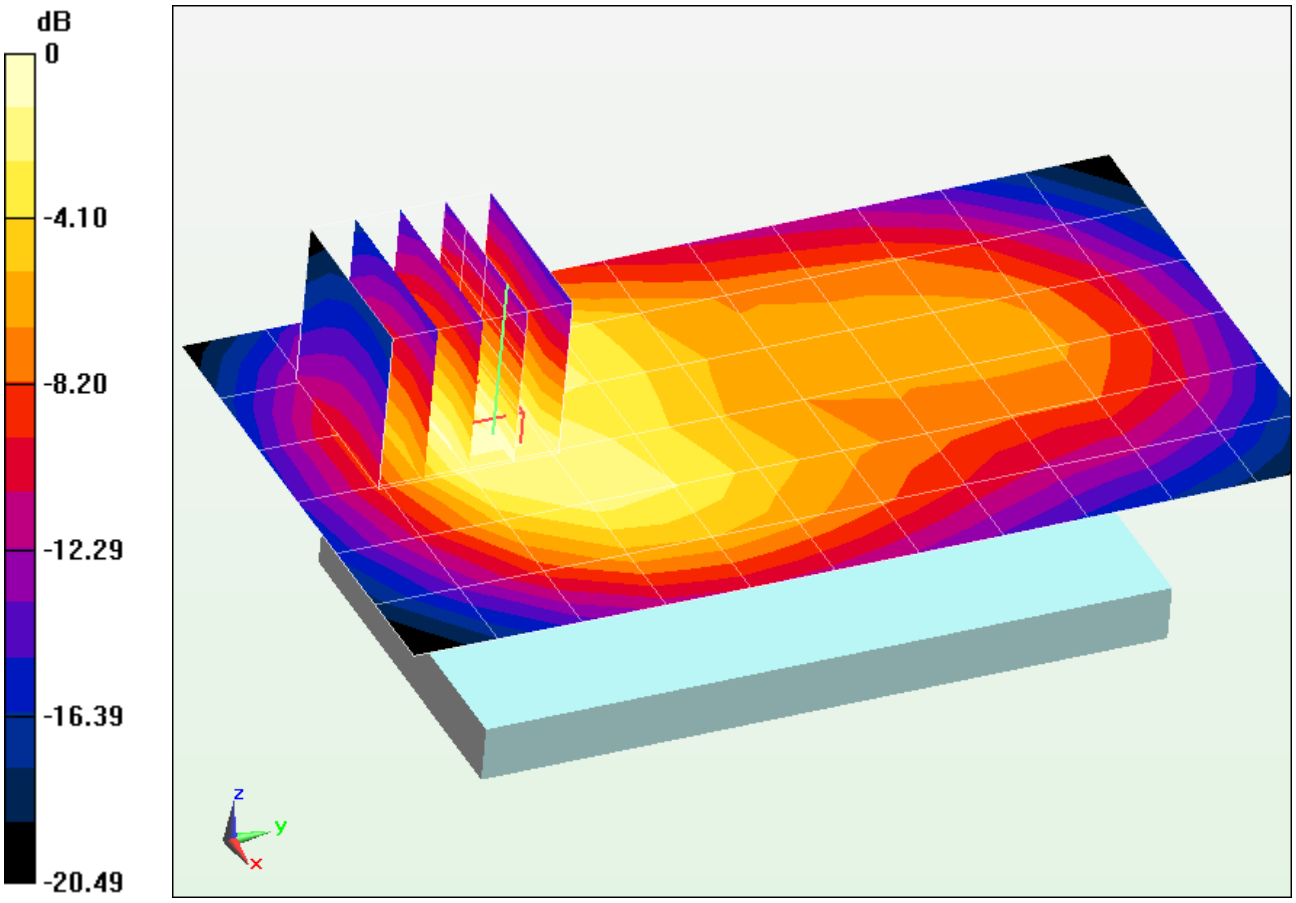
Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1907.6 MHz; σ = 1.586 mho/m; ε_r = 51.392; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Body SAR, Back side, High.ch

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.553 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.57 W/kg
SAR(1 g) = 0.912 W/kg



0 dB = 1.03 W/kg = 0.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

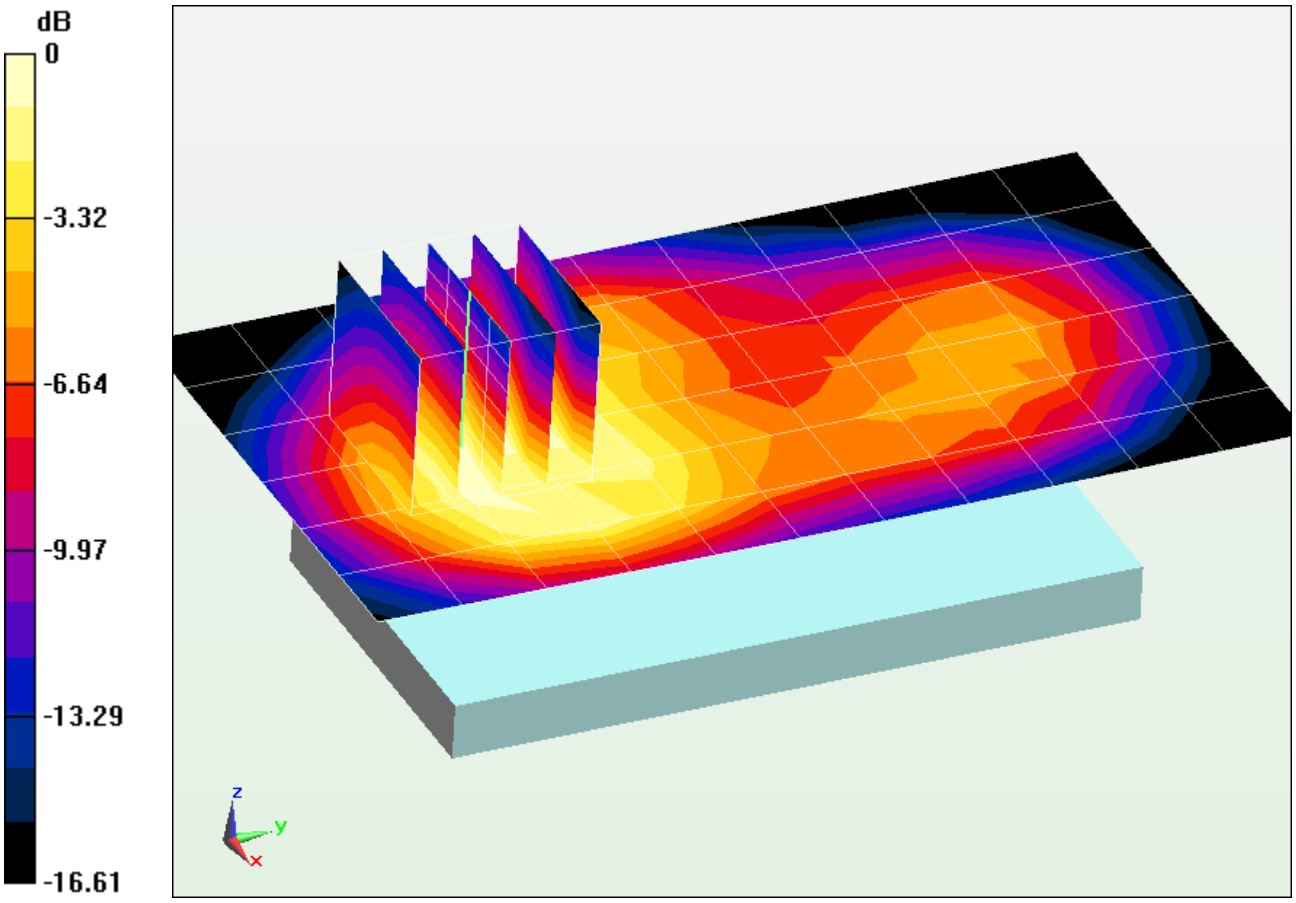
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.566 mho/m; ε_r = 51.42; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Body SAR, Front side, Mid.ch

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.713 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.665 W/kg



0 dB = 0.724 W/kg = -1.40 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

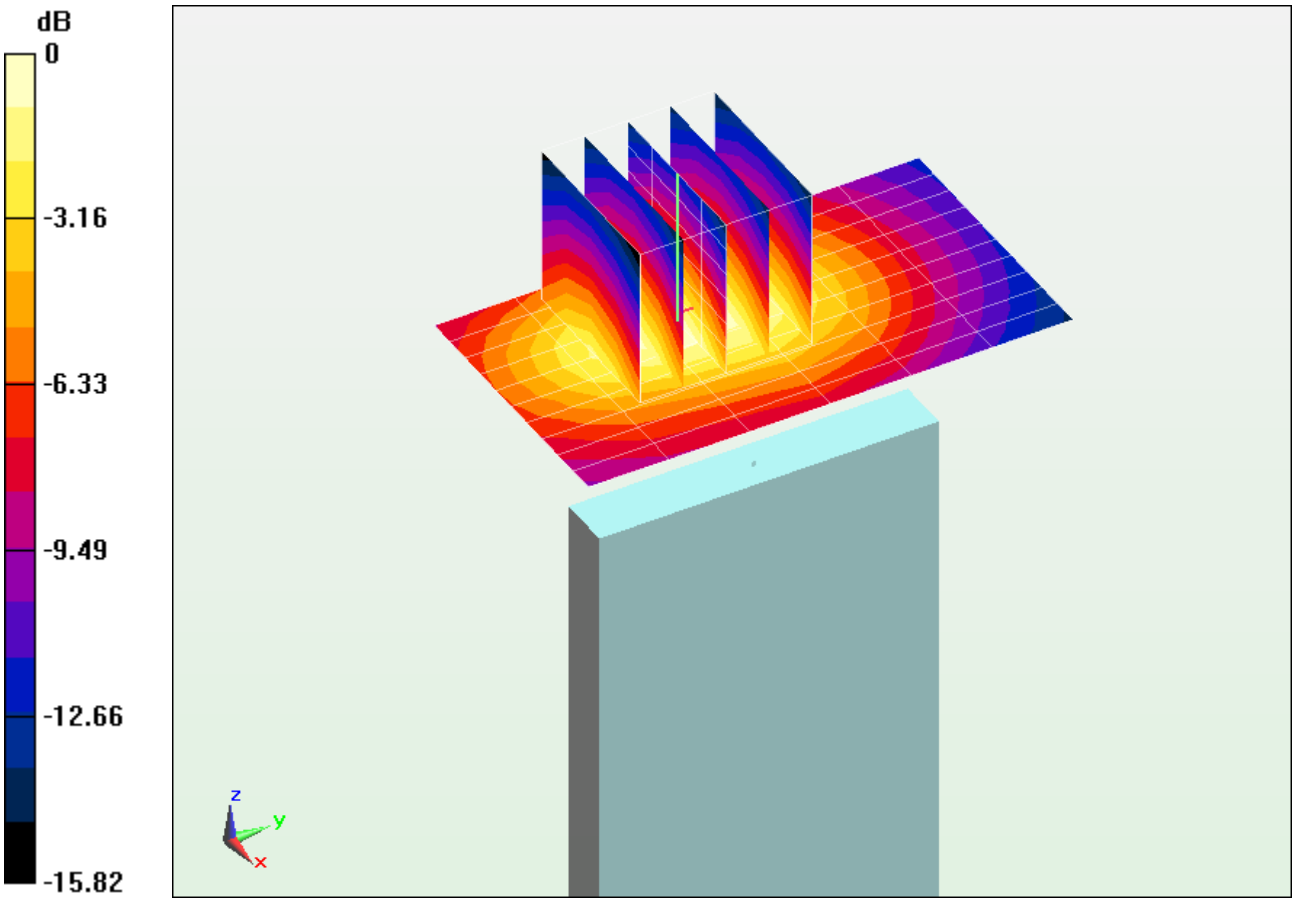
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.566 mho/m; ε_r = 51.42; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Body SAR, Bottom Edge, Mid.ch

Area Scan (11x7x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.861 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.819 W/kg
SAR(1 g) = 0.500 W/kg



0 dB = 0.555 W/kg = -2.56 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-296-C

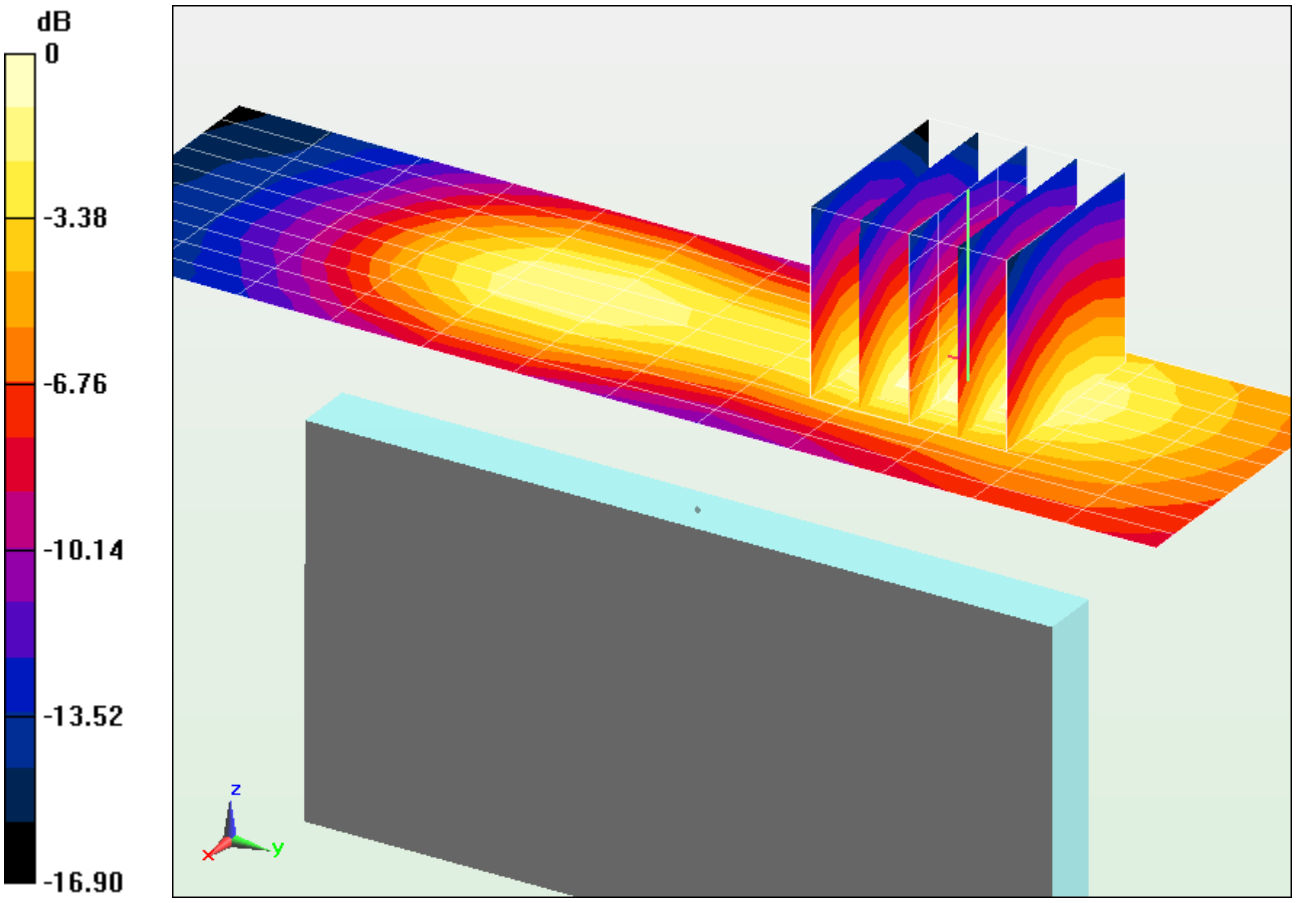
Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.566 mho/m; ε_r = 51.42; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

Mode: WCDMA 1900, Body SAR, Right Edge, Mid.ch

Area Scan (11x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.111 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.533 W/kg
SAR(1 g) = 0.315 W/kg



0 dB = 0.353 W/kg = -4.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

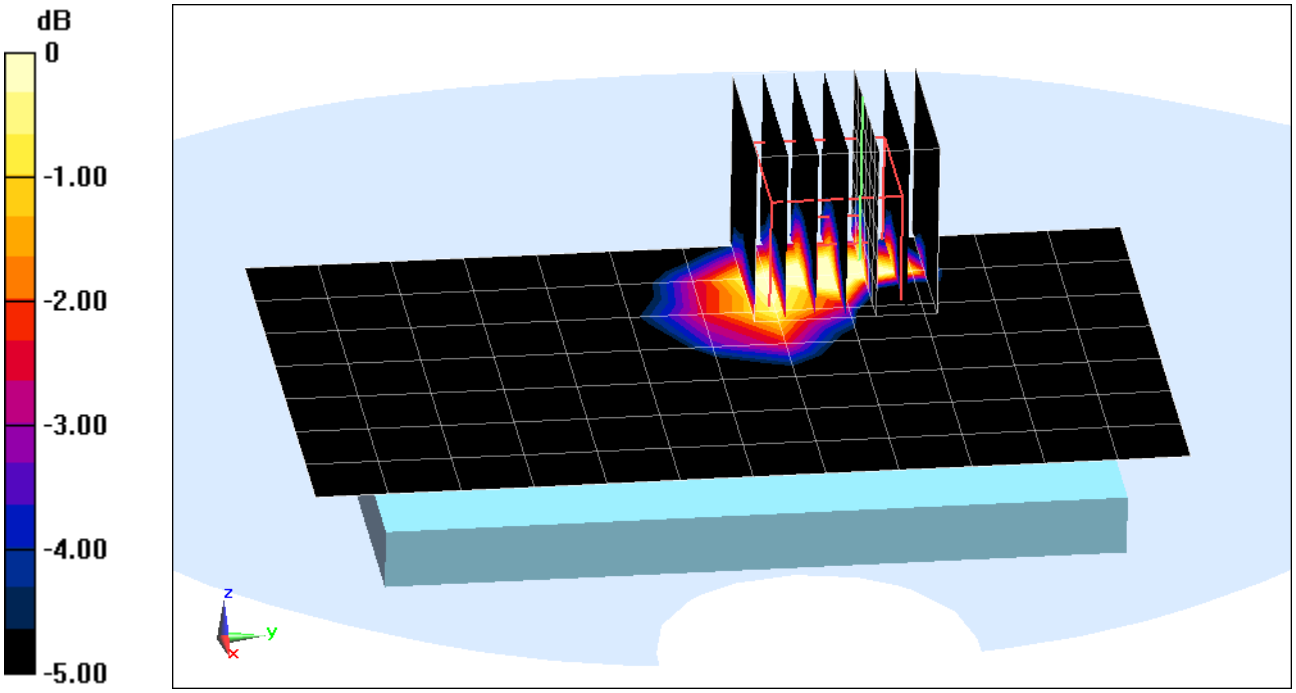
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2462 MHz; σ = 2.036 mho/m; ε_r = 51.301; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 21.8°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3287; ConvF(4.28, 4.28, 4.28); Calibrated: 2/7/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Back Side

Area Scan (8x13x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.942 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 0.0360 W/kg
SAR(1 g) = 0.016 mW/g; SAR(10 g) = 0.00713 mW/g



0 dB = 0.020mW/g = -33.98 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

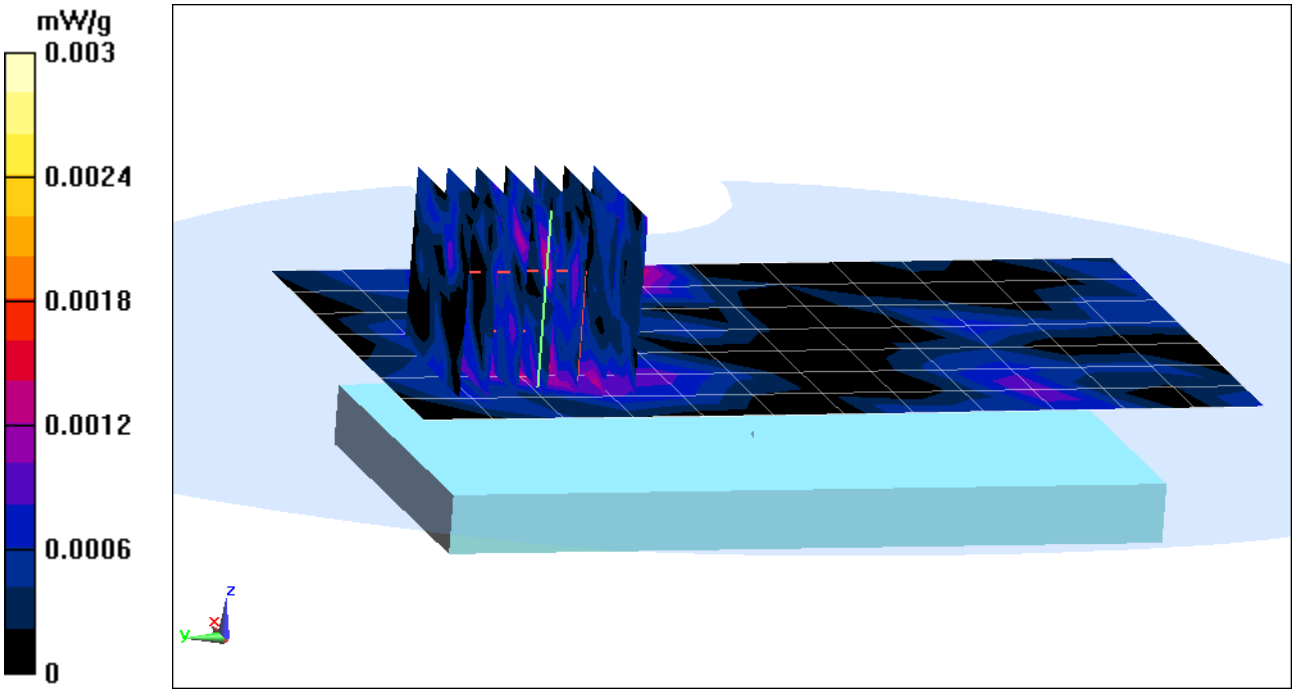
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2462 MHz; σ = 2.036 mho/m; ε_r = 51.301; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 21.8°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3287; ConvF(4.28, 4.28, 4.28); Calibrated: 2/7/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Front Side

Area Scan (8x13x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.539 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.005340 W/kg
SAR(1 g) = 0.000894 mW/g; SAR(10 g) = 0.000328 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

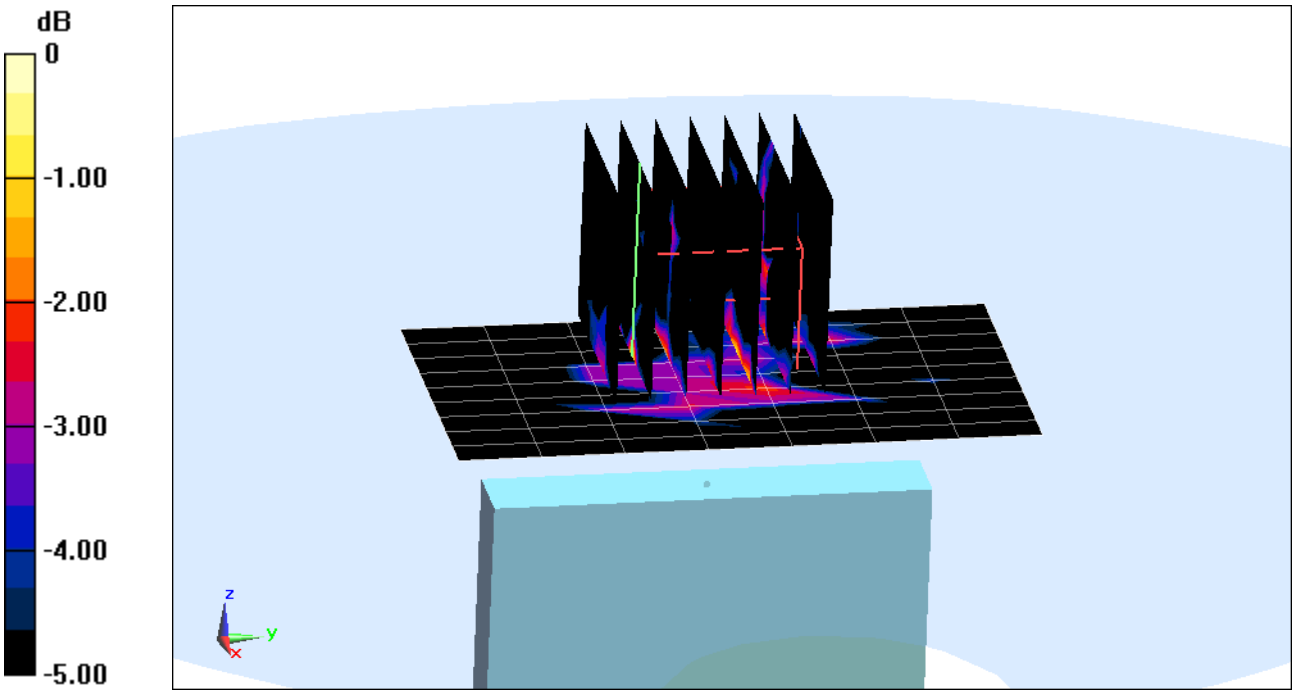
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2462 MHz; σ = 2.036 mho/m; ε_r = 51.301; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 21.8°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3287; ConvF(4.28, 4.28, 4.28); Calibrated: 2/7/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Top Edge

Area Scan (10x8x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.812 V/m; Power Drift = 0.104 dB
Peak SAR (extrapolated) = 0.006430 W/kg
SAR(1 g) = 0.000996 mW/g; SAR(10 g) = 0.000314 mW/g



0 dB = 0.0025mW/g = -52.04 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-A

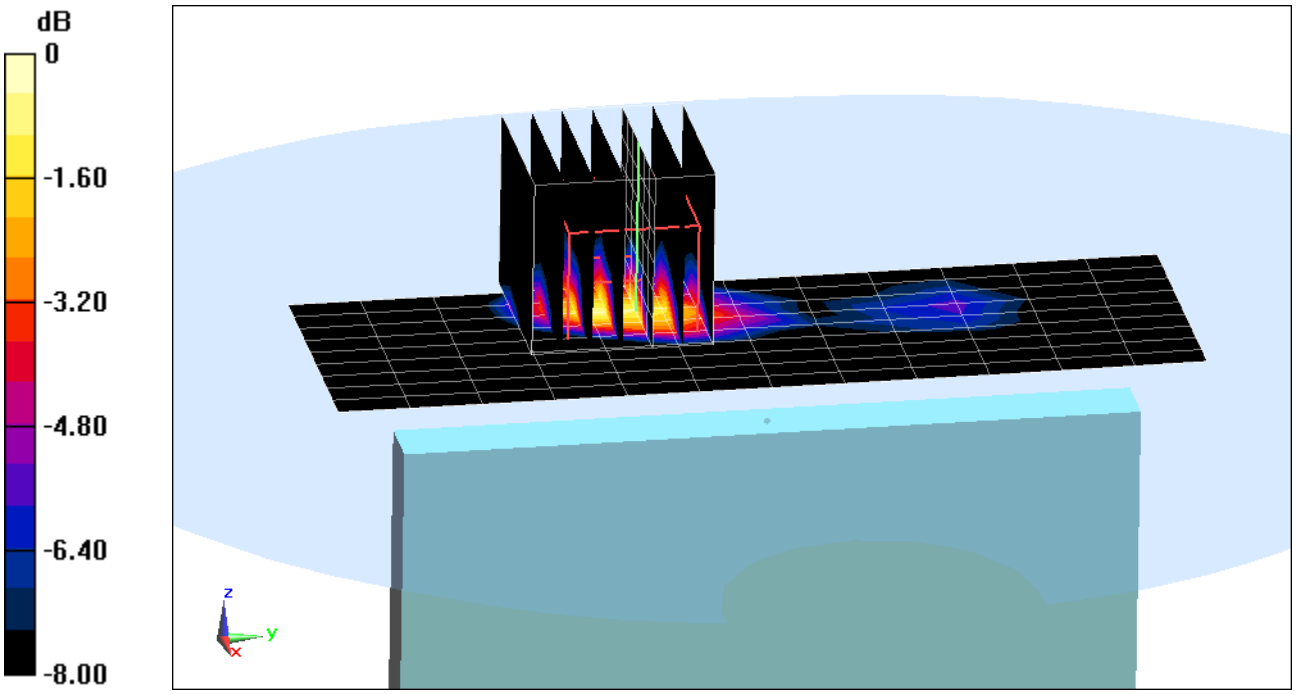
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2462 MHz; σ = 2.036 mho/m; ε_r = 51.301; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 21.8°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3287; ConvF(4.28, 4.28, 4.28); Calibrated: 2/7/2012
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Right Edge

Area Scan (10x13x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.767 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 0.0310 W/kg
SAR(1 g) = 0.013 mW/g; SAR(10 g) = 0.00602 mW/g



0 dB = 0.020mW/g = -33.98 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LGTI8190N; Type: Portable Handset; Serial: FJ-260-B

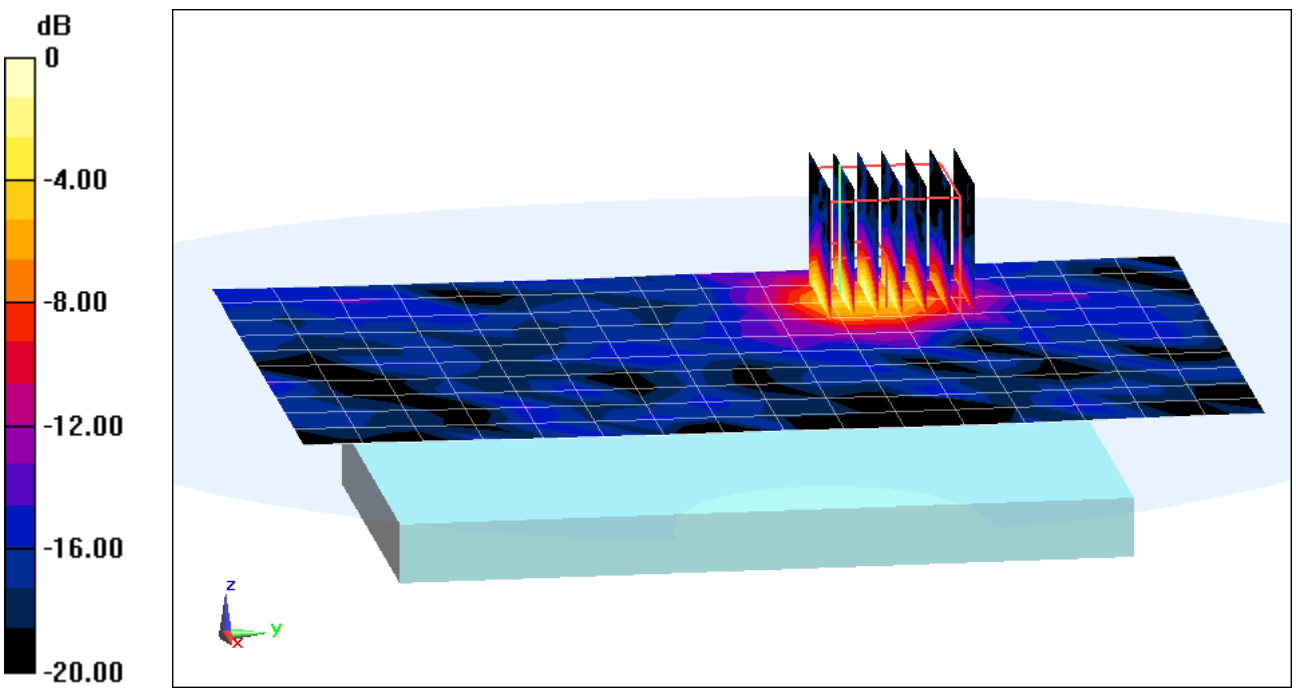
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5GHz Body Medium parameters used:
f = 5300 MHz; σ = 5.44 mho/m; ε_r = 47.41; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.3°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN3589; ConvF(3.72, 3.72, 3.72); Calibrated: 1/27/2012
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Mode: IEEE 802.11a, 5.3 GHz, Body SAR, Ch 60, 6 Mbps, Back Side

Area Scan (11x17x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.572 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.5730 W/kg
SAR(1 g) = 0.385 mW/g; SAR(10 g) = 0.118 mW/g



0 dB = 0.730mW/g = -2.73 dB mW/g

APPENDIX B: SYSTEM VERIFICATION

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PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 835 MHz; Type: D835V2; Serial: 4d132

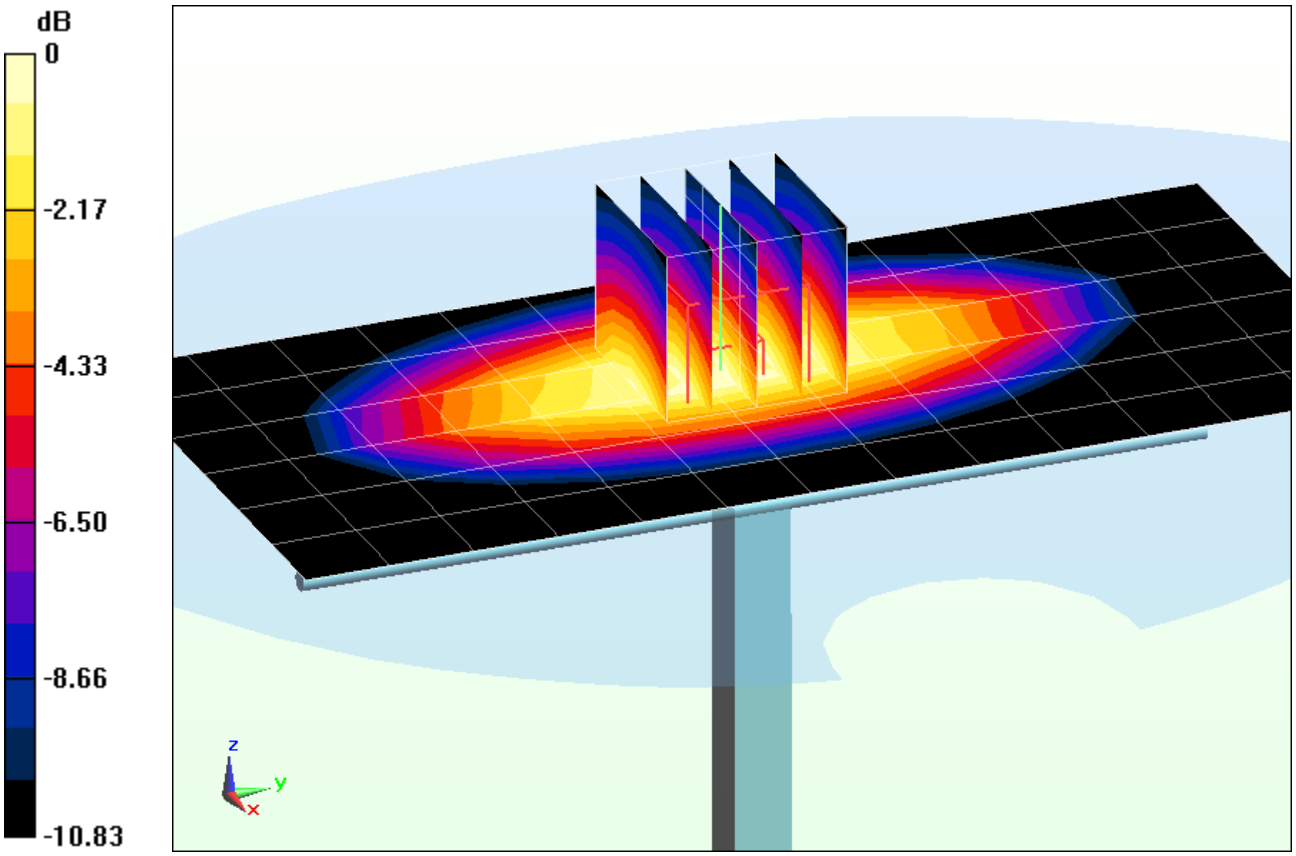
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used:
f = 835 MHz; σ = 0.918 mho/m; ε_r = 42.71; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-08-2012; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.46 W/kg
SAR(1 g) = 0.992 W/kg; SAR(10 g) = 0.644 W/kg
Deviation = 4.97%



0 dB = 1.08 W/kg = 0.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 835 MHz; Type: D835V2; Serial: 4d132

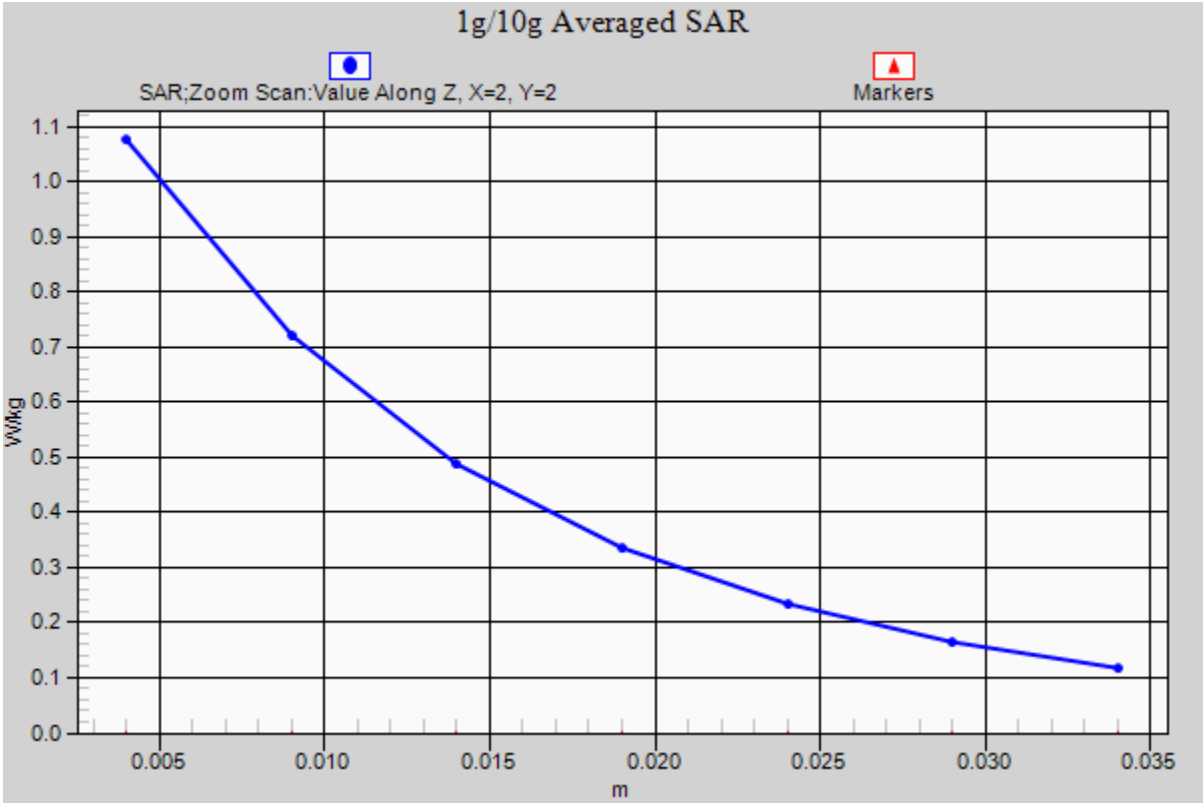
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used:
f = 835 MHz; σ = 0.918 mho/m; ε_r = 42.71; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-08-2012; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.46 W/kg
SAR(1 g) = 0.992 W/kg; SAR(10 g) = 0.644 W/kg
Deviation = 4.97%



PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

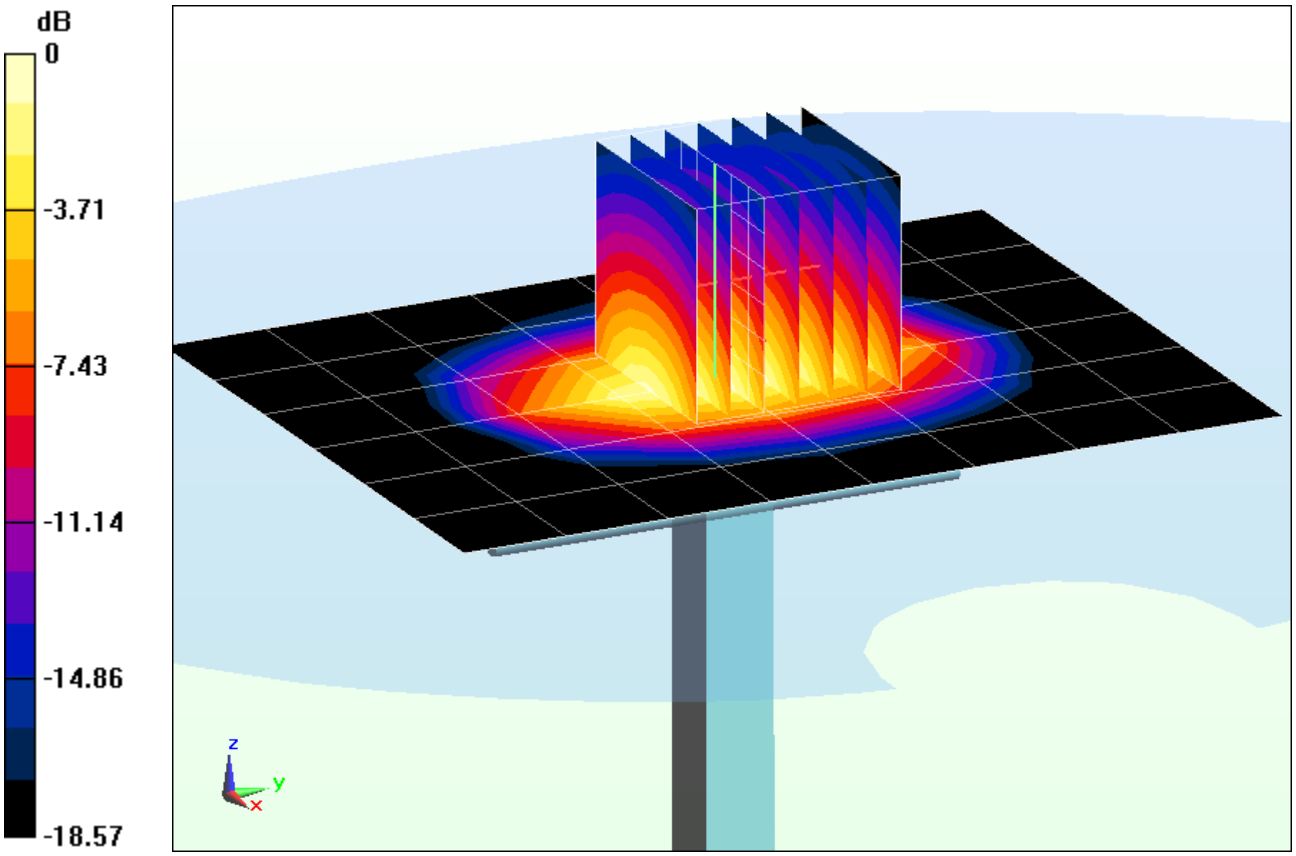
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.461 mho/m; ε_r = 40.243; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.67 W/kg
SAR(1 g) = 4.05 W/kg; SAR(10 g) = 2.08 W/kg
Deviation = 3.05%



0 dB = 4.57 W/kg = 6.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

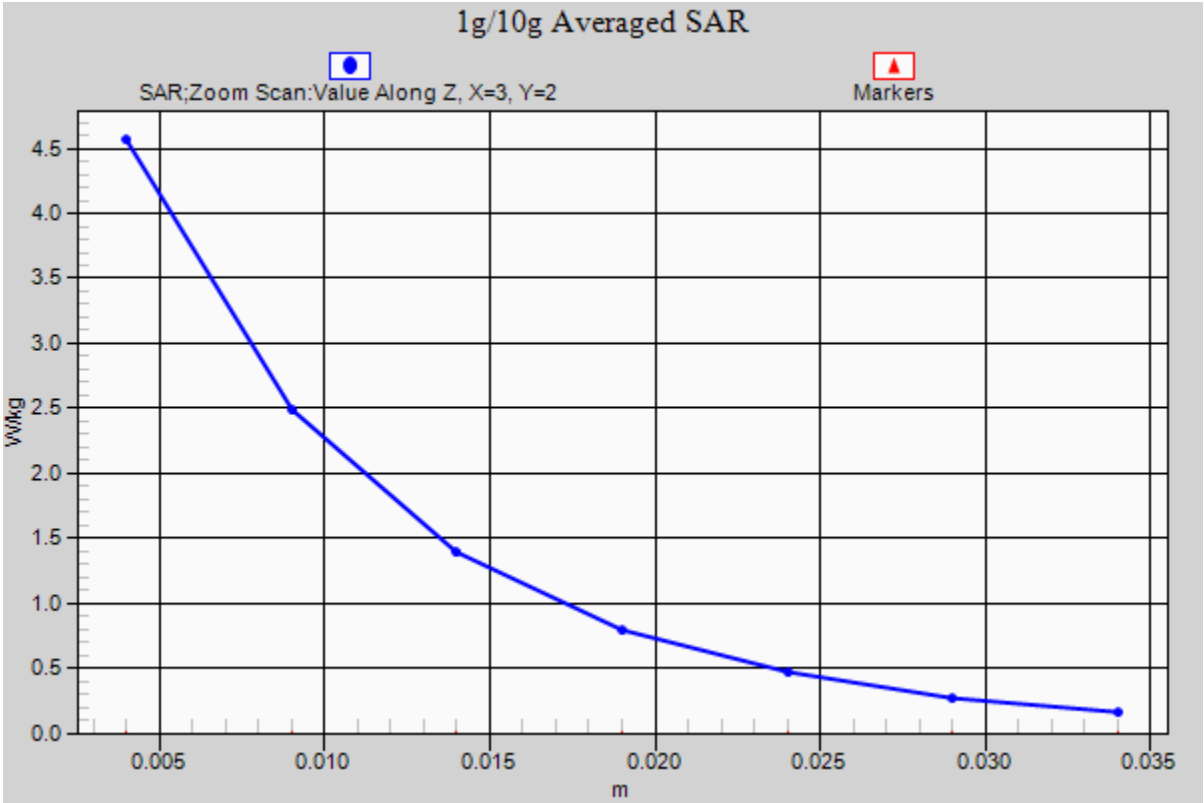
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.461 mho/m; ε_r = 40.243; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-08-2012; Ambient Temp: 23.6°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3288; ConvF(5.28, 5.28, 5.28); Calibrated: 9/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.67 W/kg
SAR(1 g) = 4.05 W/kg; SAR(10 g) = 2.08 W/kg
Deviation = 3.05%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

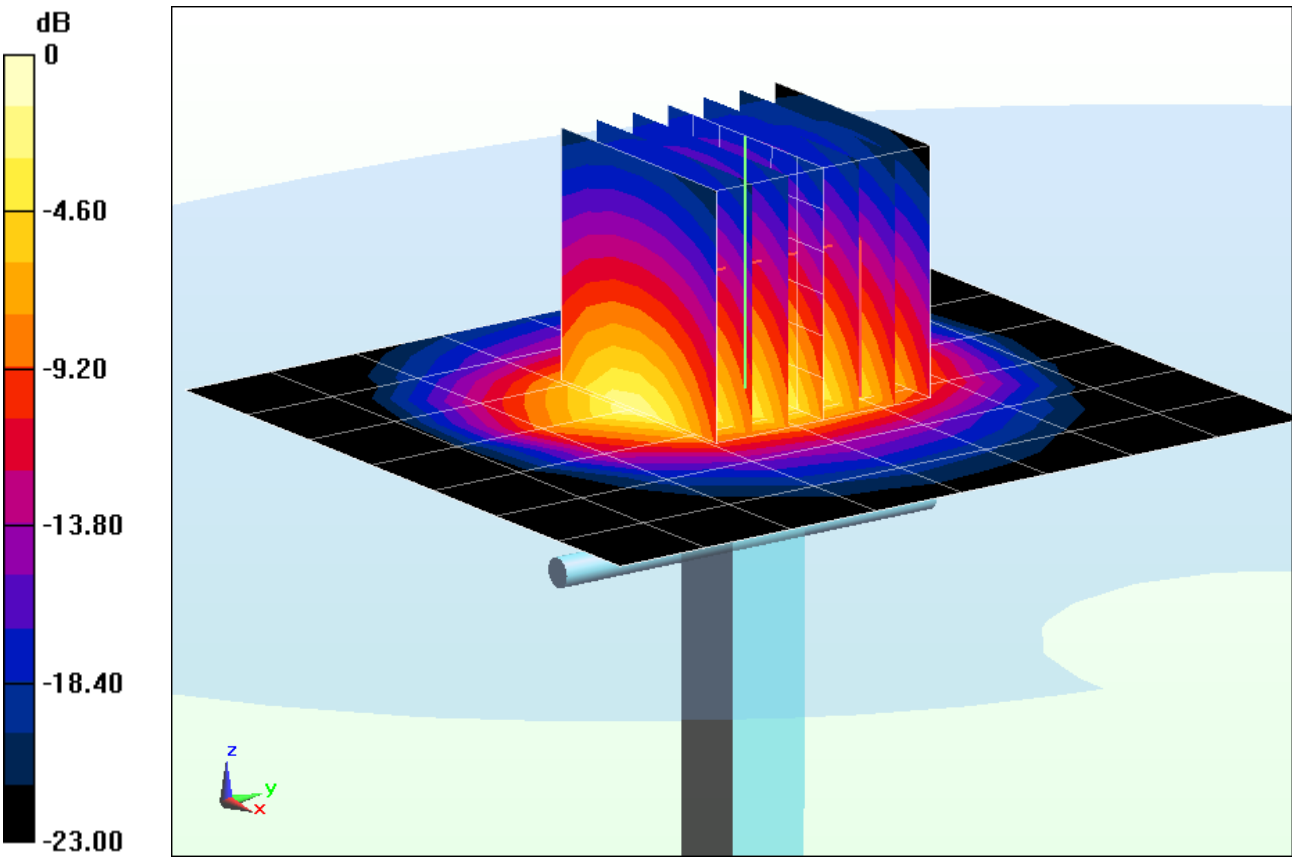
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used:
f = 2450 MHz; σ = 1.874 mho/m; ε_r = 40.38; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3213; ConvF(4.43, 4.43, 4.43); Calibrated: 4/24/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (1);SEMCAD X Version 14.6.5 (6469)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.5 mW/g
SAR(1 g) = 5.47 mW/g; SAR(10 g) = 2.51 mW/g
Deviation = 2.24%



0 dB = 7.12 mW/g = 17.05 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

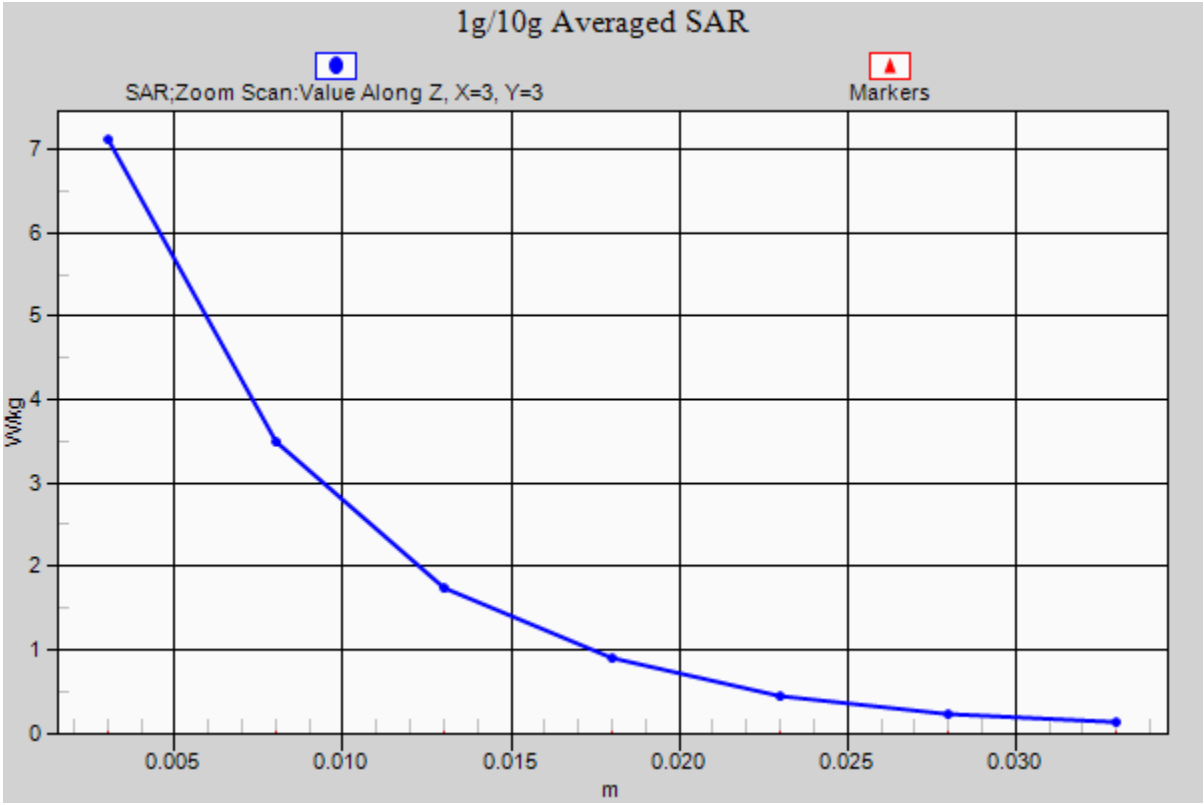
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used:
f = 2450 MHz; σ = 1.874 mho/m; ε_r = 40.38; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3213; ConvF(4.43, 4.43, 4.43); Calibrated: 4/24/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.5 W/kg
SAR(1 g) = 5.47 W/kg; SAR(10 g) = 2.51 W/kg
Deviation = 2.24%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

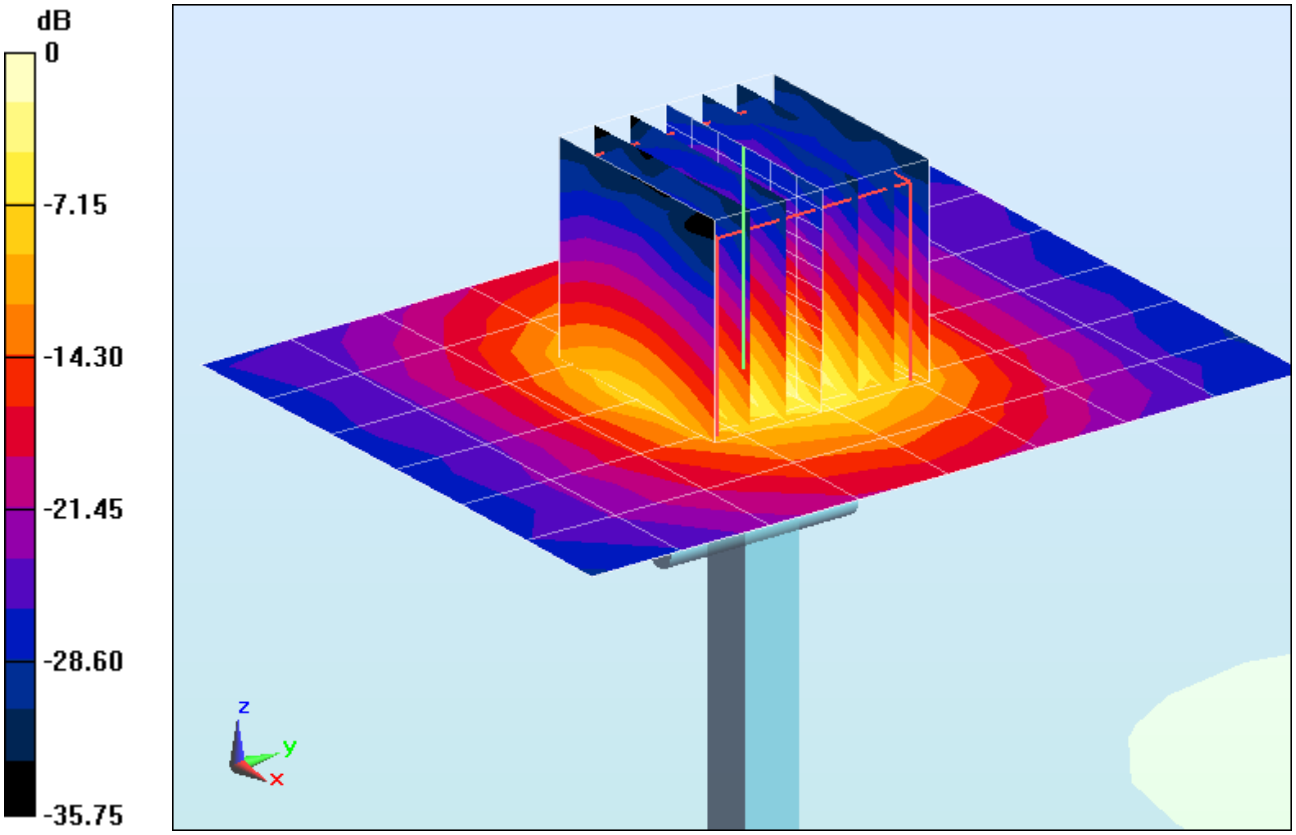
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head; Medium parameters used:
f = 5200 MHz; σ = 4.523 mho/m; ε_r = 35.56; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.59, 4.59, 4.59); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 36.9 W/kg
SAR(1 g) = 8.27 W/kg; SAR(10 g) = 2.38 W/kg
Deviation = 4.55%



0 dB = 16.9 W/kg = 12.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

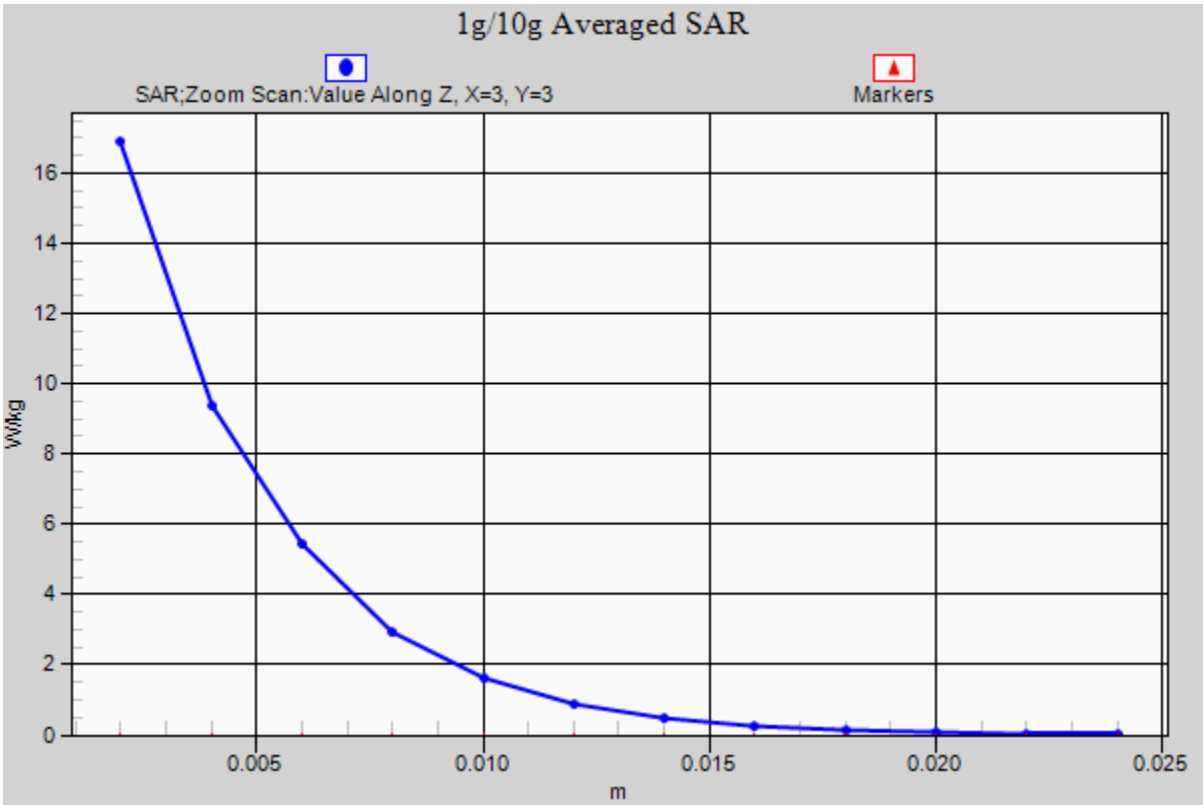
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head; Medium parameters used:
f = 5200 MHz; σ = 4.523 mho/m; ε_r = 35.56; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.59, 4.59, 4.59); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 36.9 W/kg
SAR(1 g) = 8.27 W/kg; SAR(10 g) = 2.38 W/kg
Deviation = 4.55%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

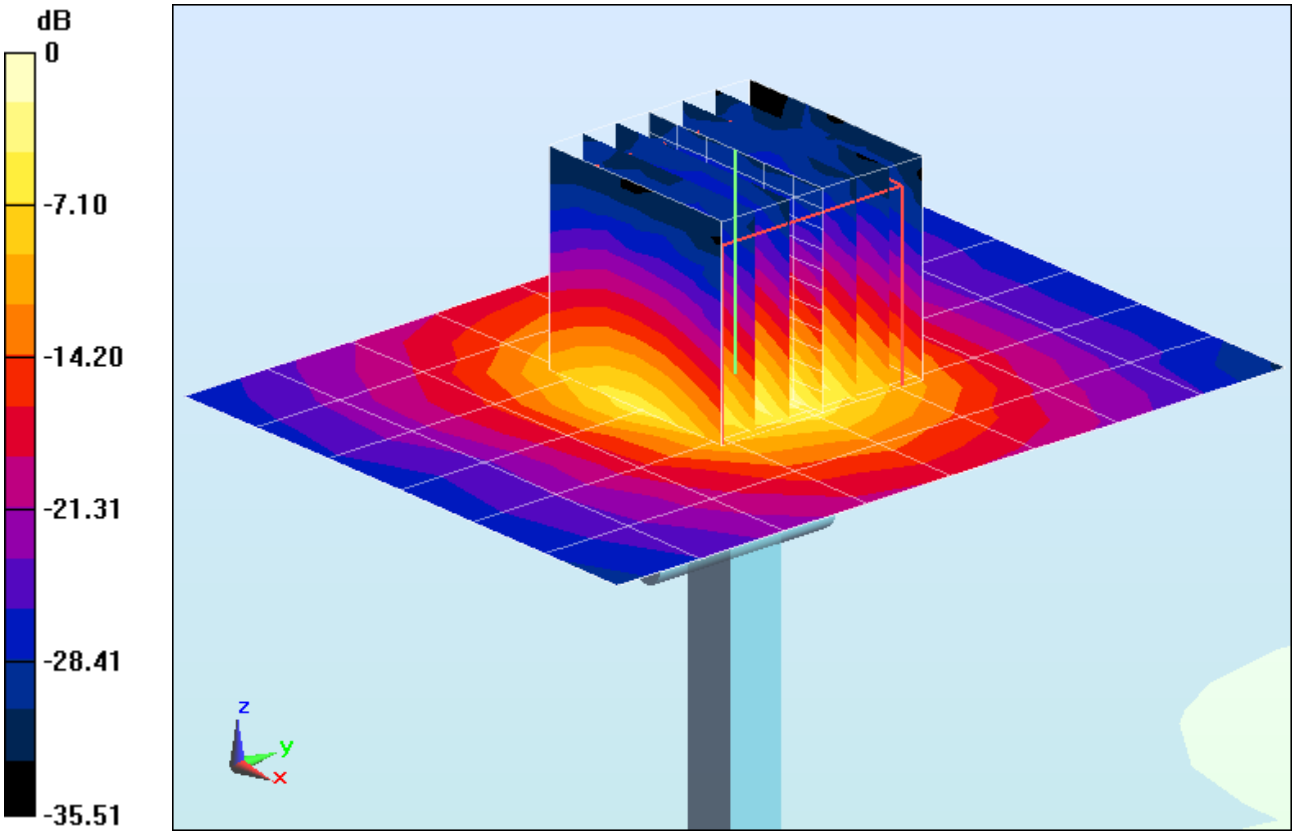
Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head; Medium parameters used:
f = 5500 MHz; σ = 4.795 mho/m; ε_r = 35.18; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-28-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.7°C

Probe: EX3DV4 - SN3589; ConvF(4.33, 4.33, 4.33); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 42.5 W/kg
SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.33 W/kg
Deviation = -1.30%



0 dB = 16.9 W/kg = 12.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

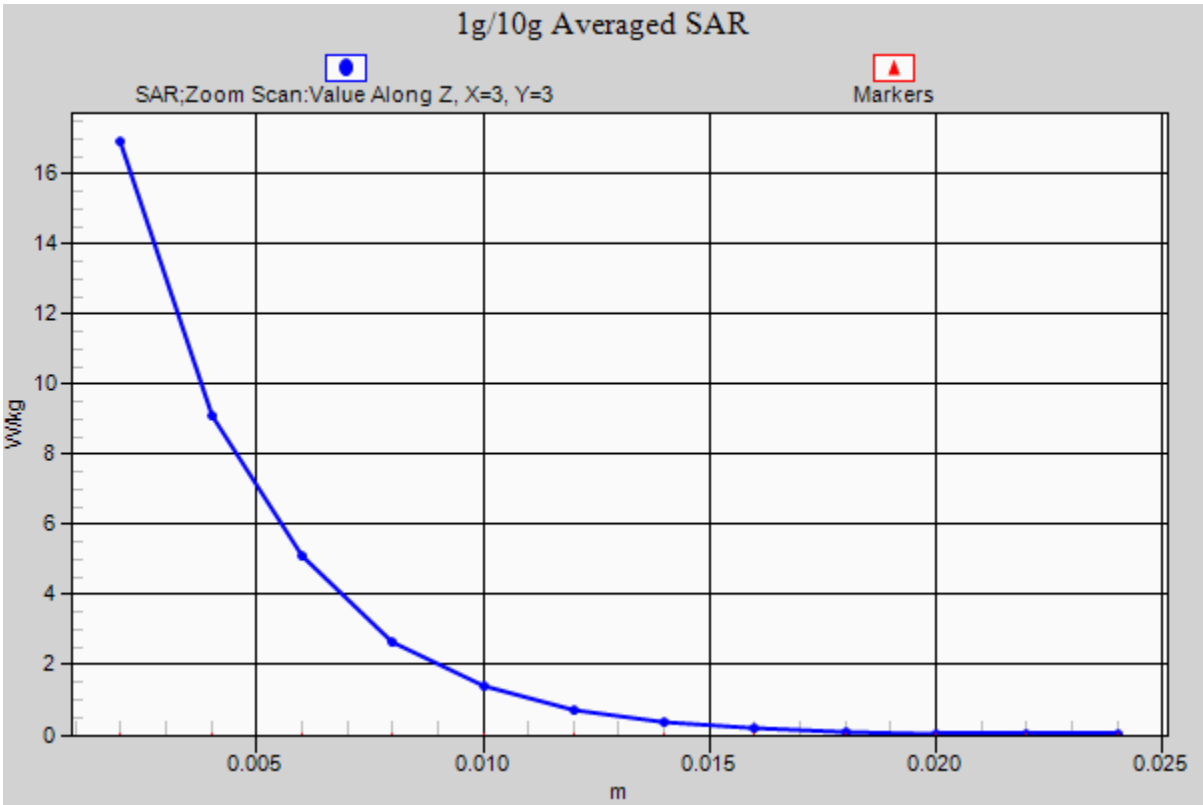
Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head; Medium parameters used:
f = 5500 MHz; σ = 4.795 mho/m; ε_r = 35.18; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-28-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.7°C

Probe: EX3DV4 - SN3589; ConvF(4.33, 4.33, 4.33); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 42.5 W/kg
SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.33 W/kg
Deviation = -1.30%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

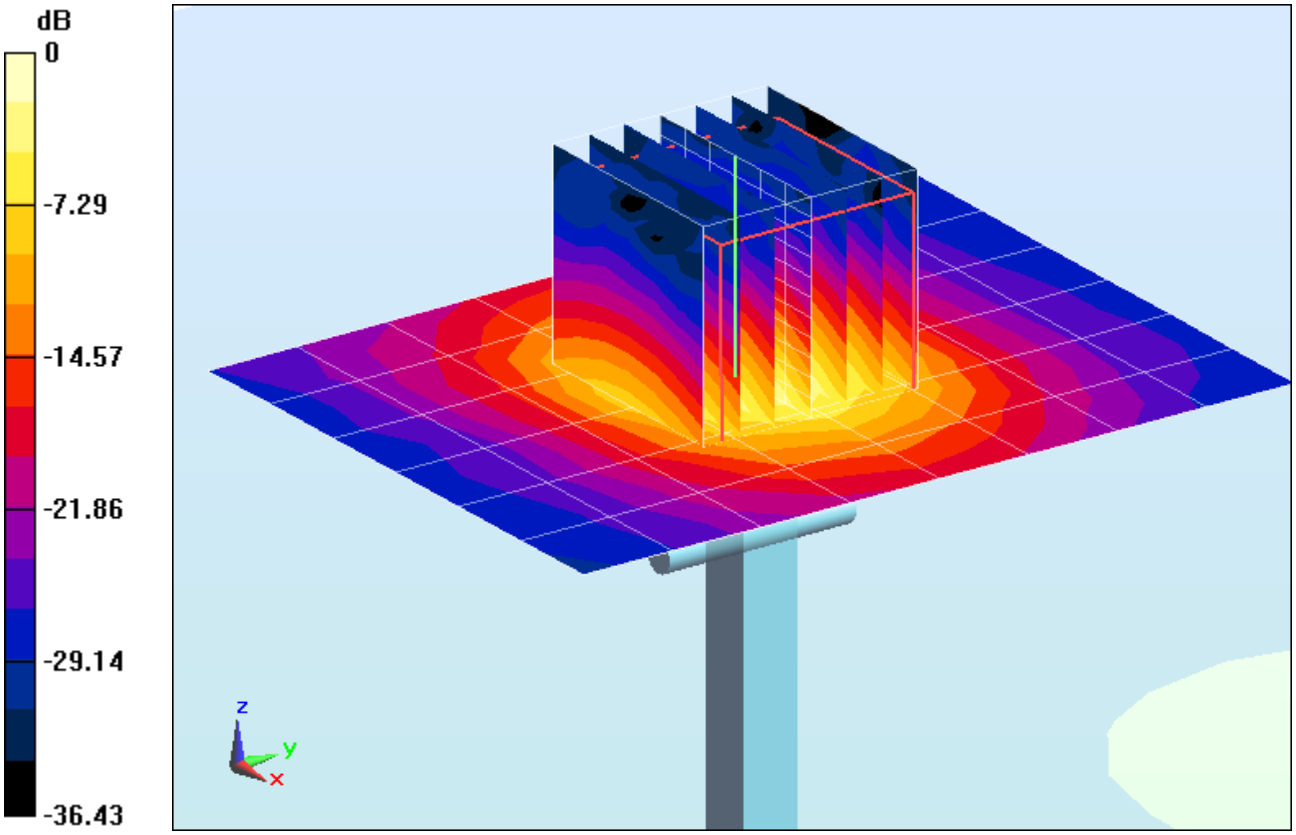
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head; Medium parameters used:
f = 5800 MHz; σ = 5.097 mho/m; ε_r = 34.68; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.7°C

Probe: EX3DV4 - SN3589; ConvF(4.05, 4.05, 4.05); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 39.8 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.23 W/kg
Deviation = 0.50%



0 dB = 16.8 W/kg = 12.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

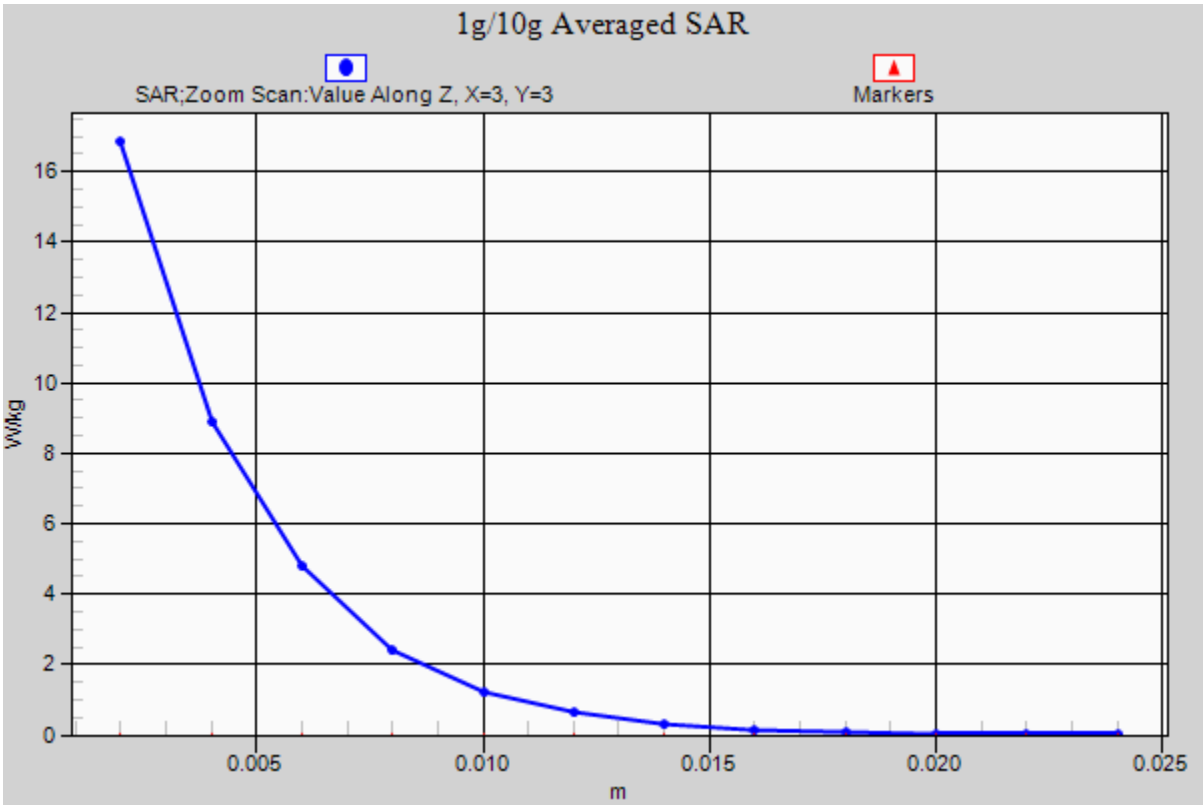
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head; Medium parameters used:
f = 5800 MHz; σ = 5.097 mho/m; ε_r = 34.68; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-28-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.7°C

Probe: EX3DV4 - SN3589; ConvF(4.05, 4.05, 4.05); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 39.8 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.23 W/kg
Deviation = 0.50%



PCTEST ENGINEERING LABORATORY, INC.

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

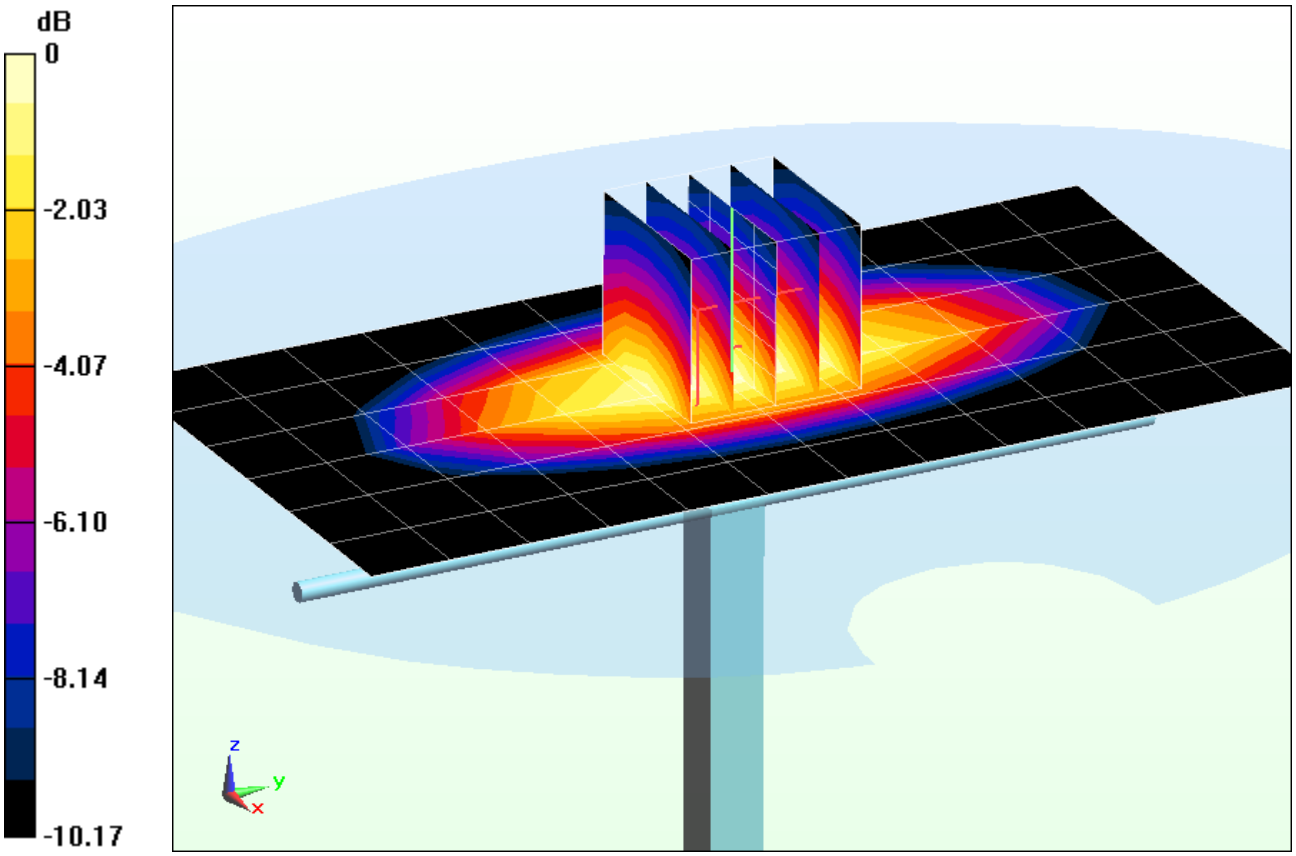
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used:
f = 835 MHz; σ = 0.958 mho/m; ε_r = 54.54; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-07-2012; Ambient Temp: 24.4°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.7 (6848)

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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.34 W/kg
SAR(1 g) = 0.943 W/kg; SAR(10 g) = 0.621 W/kg
Deviation = -1.57%



0 dB = 1.02 W/kg = 0.09 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

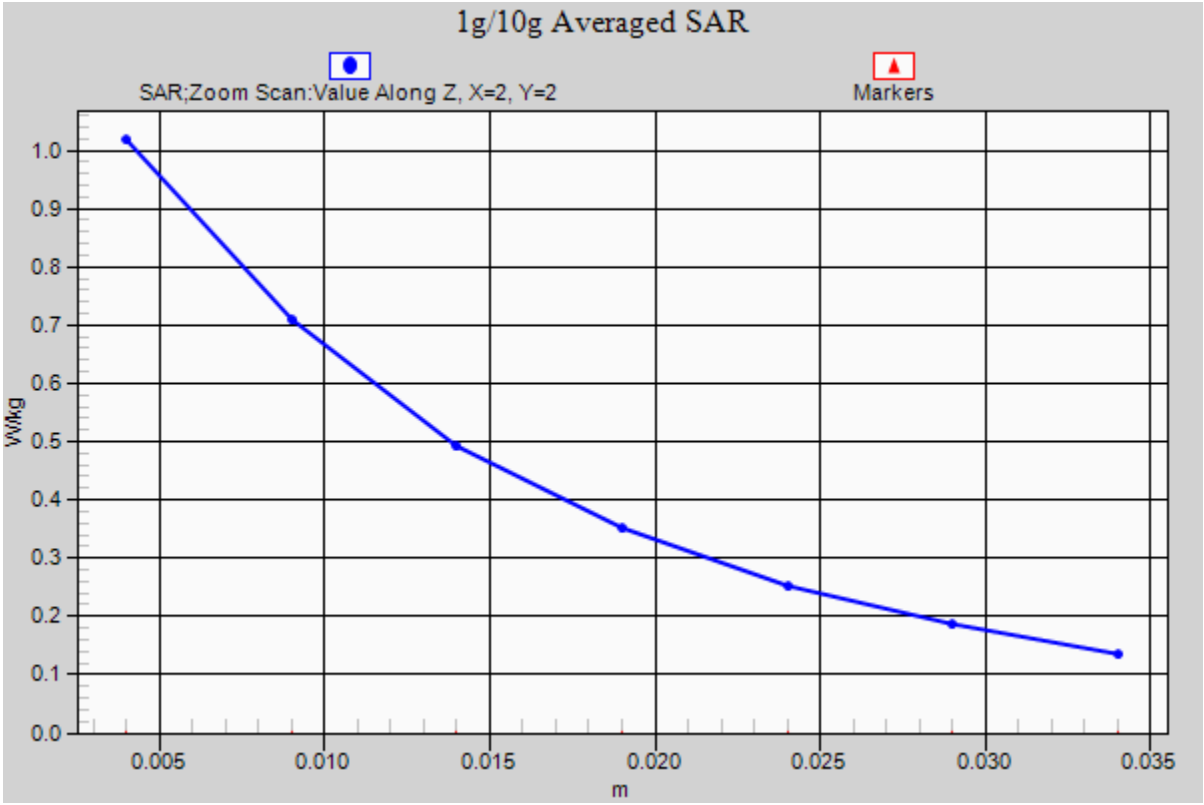
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used:
f = 835 MHz; σ = 0.958 mho/m; ε_r = 54.54; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-07-2012; Ambient Temp: 24.4°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.34 W/kg
SAR(1 g) = 0.943 W/kg; SAR(10 g) = 0.621 W/kg
Deviation = -1.57%



PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

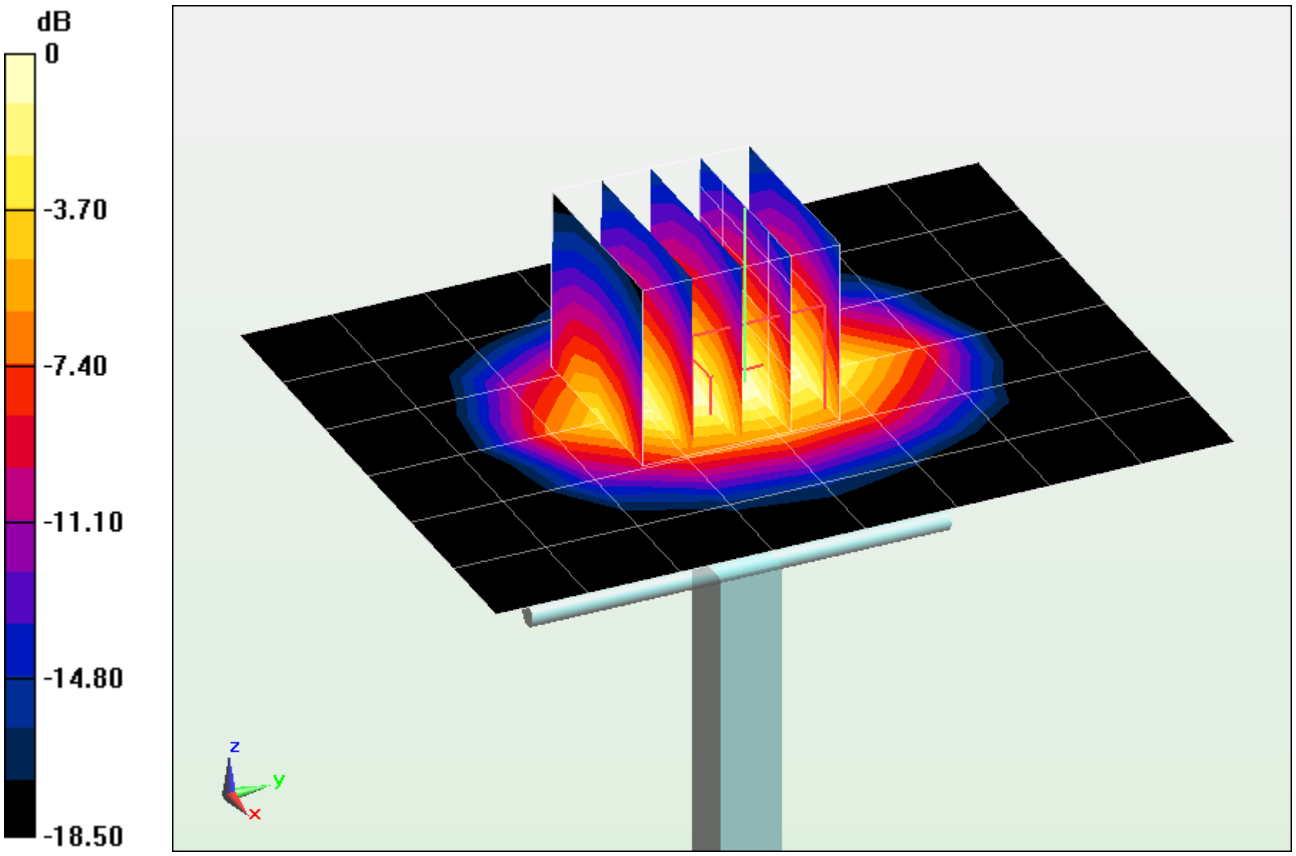
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.581 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.72 W/kg
SAR(1 g) = 4.23 W/kg; SAR(10 g) = 2.2 W/kg
Deviation = 8.18%



0 dB = 4.66 W/kg = 6.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

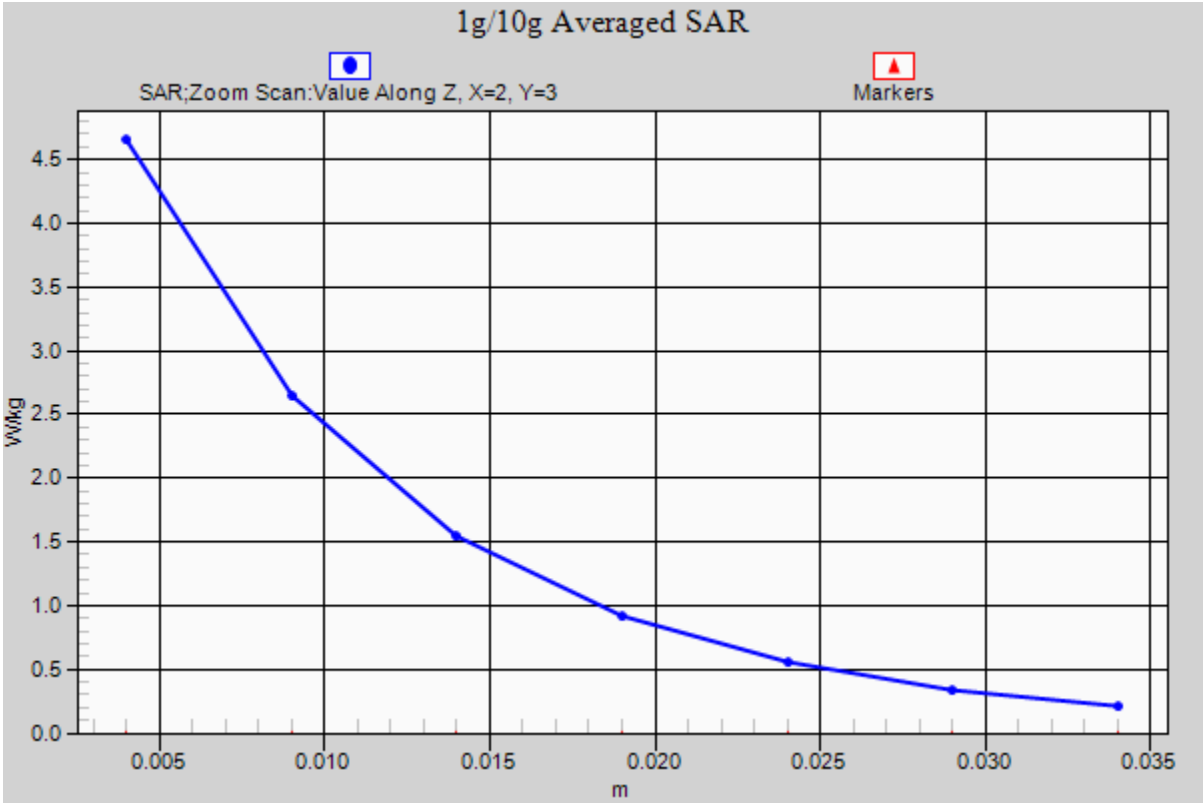
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.581 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-07-2012; Ambient Temp: 24.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.72 W/kg
SAR(1 g) = 4.23 W/kg; SAR(10 g) = 2.2 W/kg
Deviation = 8.18%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

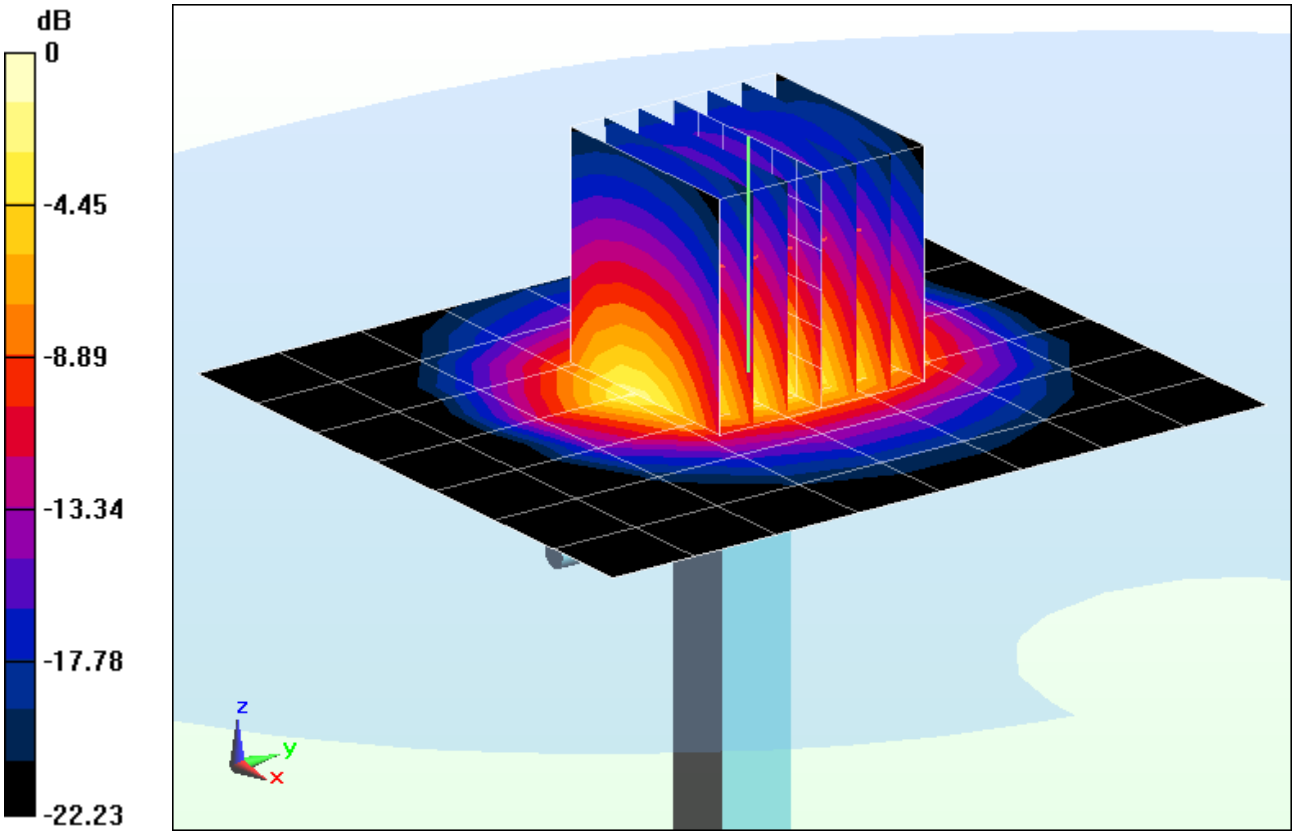
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used:
f = 2450 MHz; σ = 2.021 mho/m; ε_r = 51.34; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 21.8°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3287; ConvF(4.28, 4.28, 4.28); Calibrated: 2/7/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.4 W/kg
SAR(1 g) = 5.34 W/kg; SAR(10 g) = 2.44 W/kg
Deviation = 6.16%



0 dB = 6.93 W/kg = 8.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

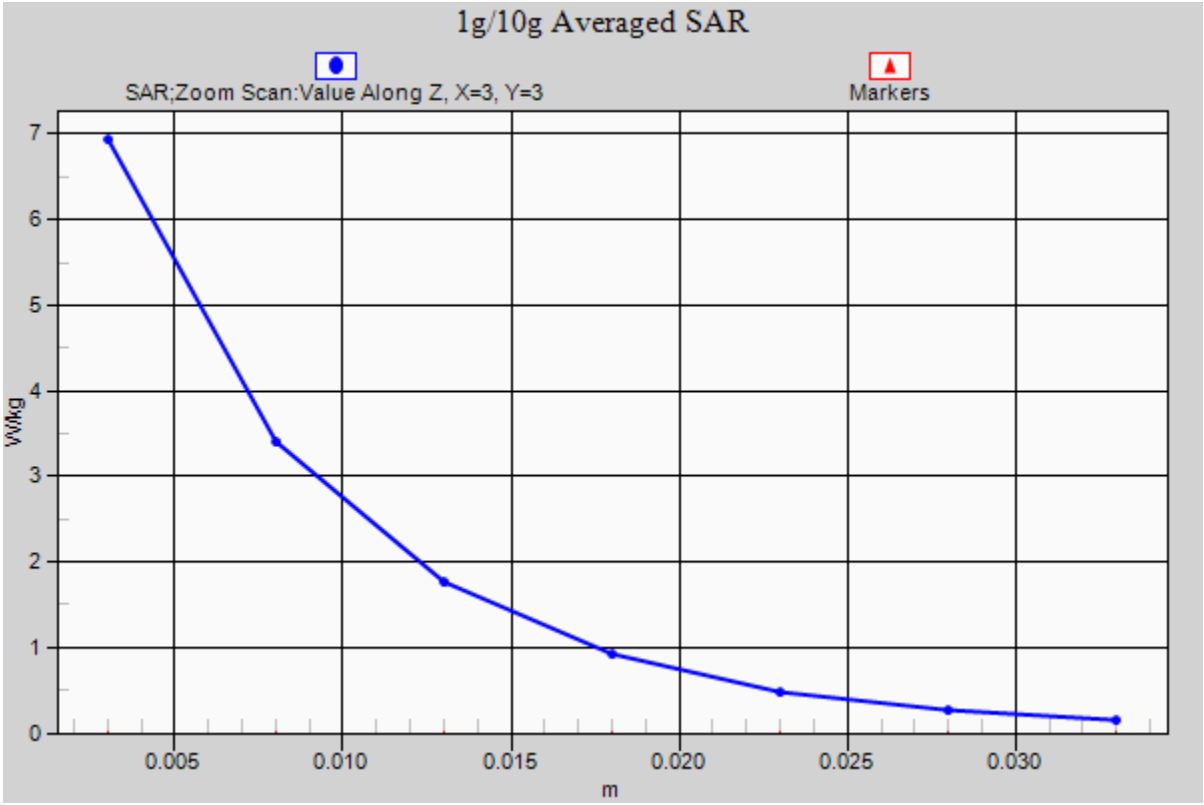
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used:
f = 2450 MHz; σ = 2.021 mho/m; ε_r = 51.34; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 21.8°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3287; ConvF(4.28, 4.28, 4.28); Calibrated: 2/7/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/20/2012
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.4 W/kg
SAR(1 g) = 5.34 W/kg; SAR(10 g) = 2.44 W/kg
Deviation = 6.16%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

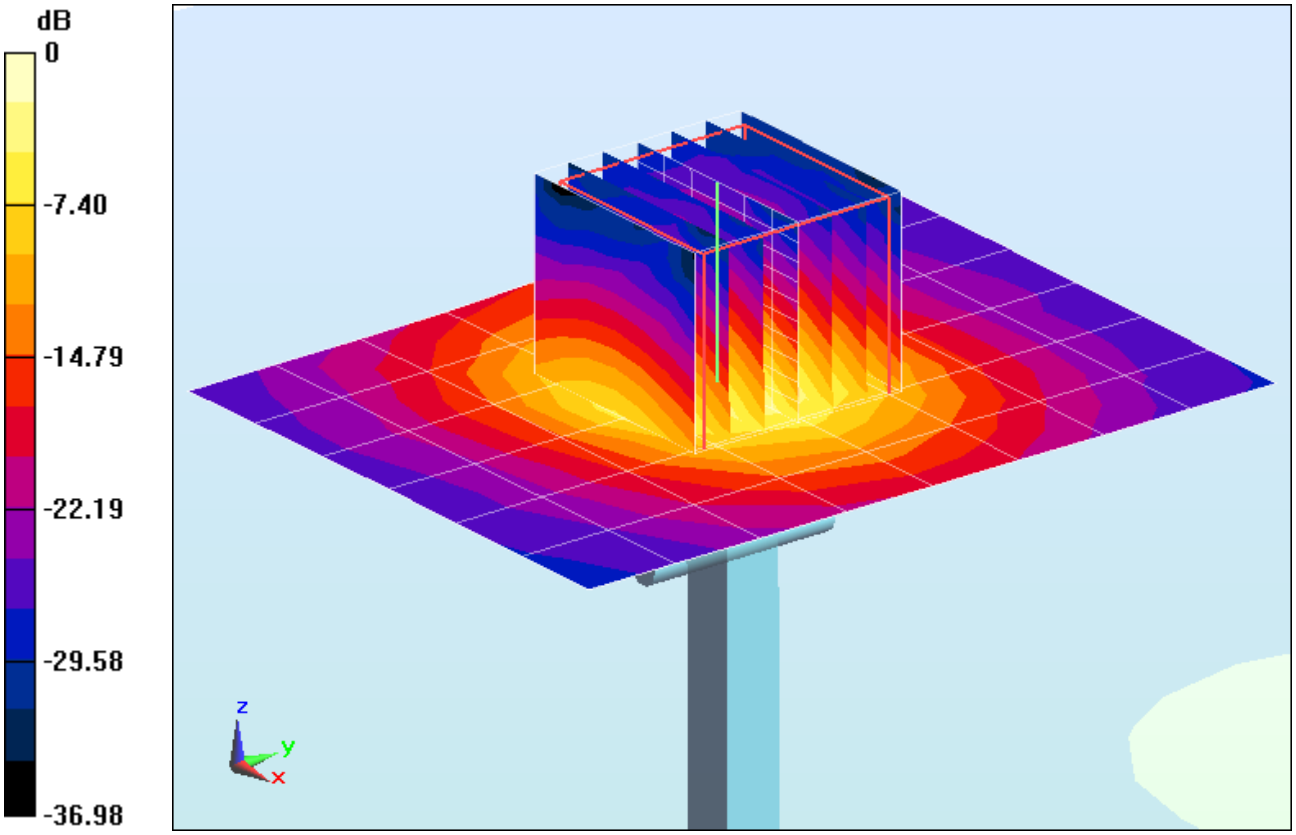
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5GHz Body; Medium parameters used:
f = 5200 MHz; σ = 5.286 mho/m; ε_r = 47.63; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.3°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN3589; ConvF(3.92, 3.92, 3.92); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 35.7 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.1 W/kg
Deviation = 3.68%



0 dB = 16.1 W/kg = 12.07 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

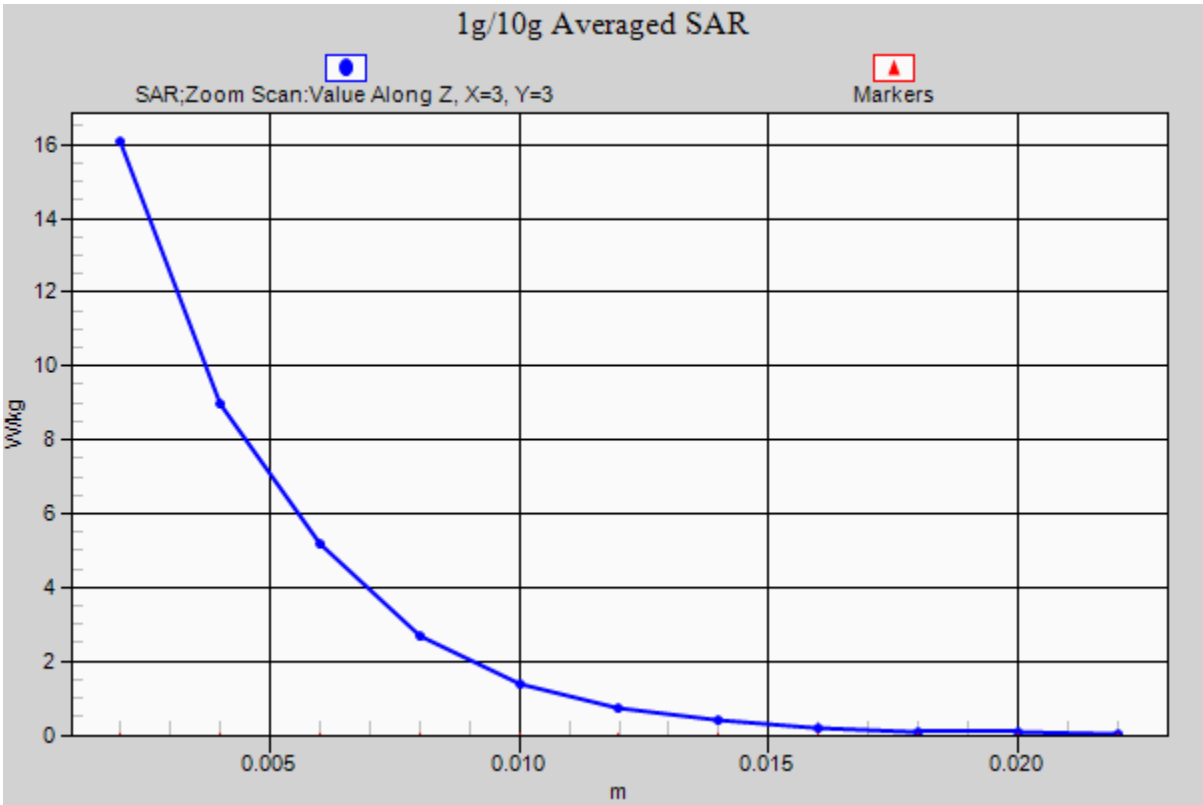
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5GHz Body; Medium parameters used:
f = 5200 MHz; σ = 5.286 mho/m; ε_r = 47.63; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.3°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN3589; ConvF(3.92, 3.92, 3.92); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 35.7 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.1 W/kg
Deviation = 3.68%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

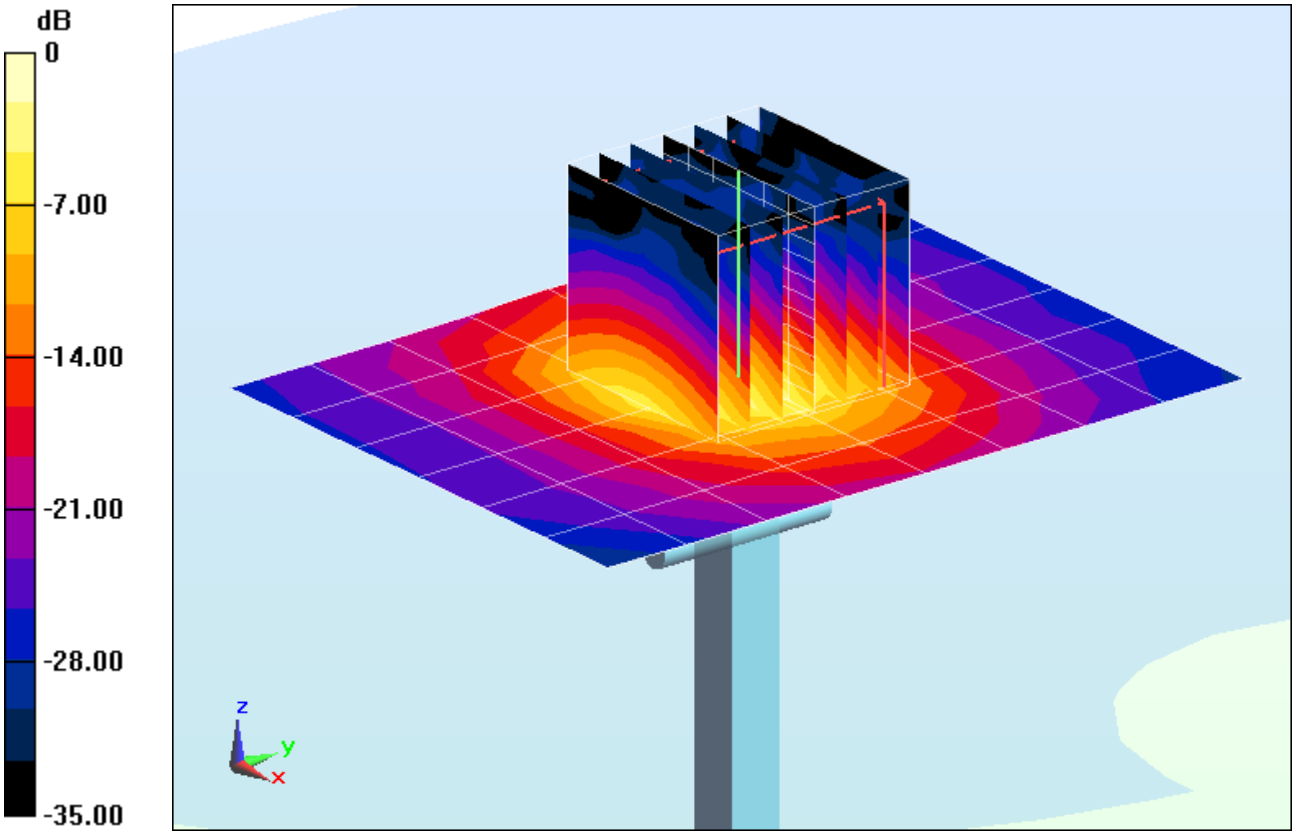
Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5GHz Body; Medium parameters used:
f = 5500 MHz; σ = 5.732 mho/m; ε_r = 46.86; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3589; ConvF(3.4, 3.4, 3.4); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 39.8 W/kg
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.26 W/kg
Deviation = 5.20%



0 dB = 17.2 W/kg = 12.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

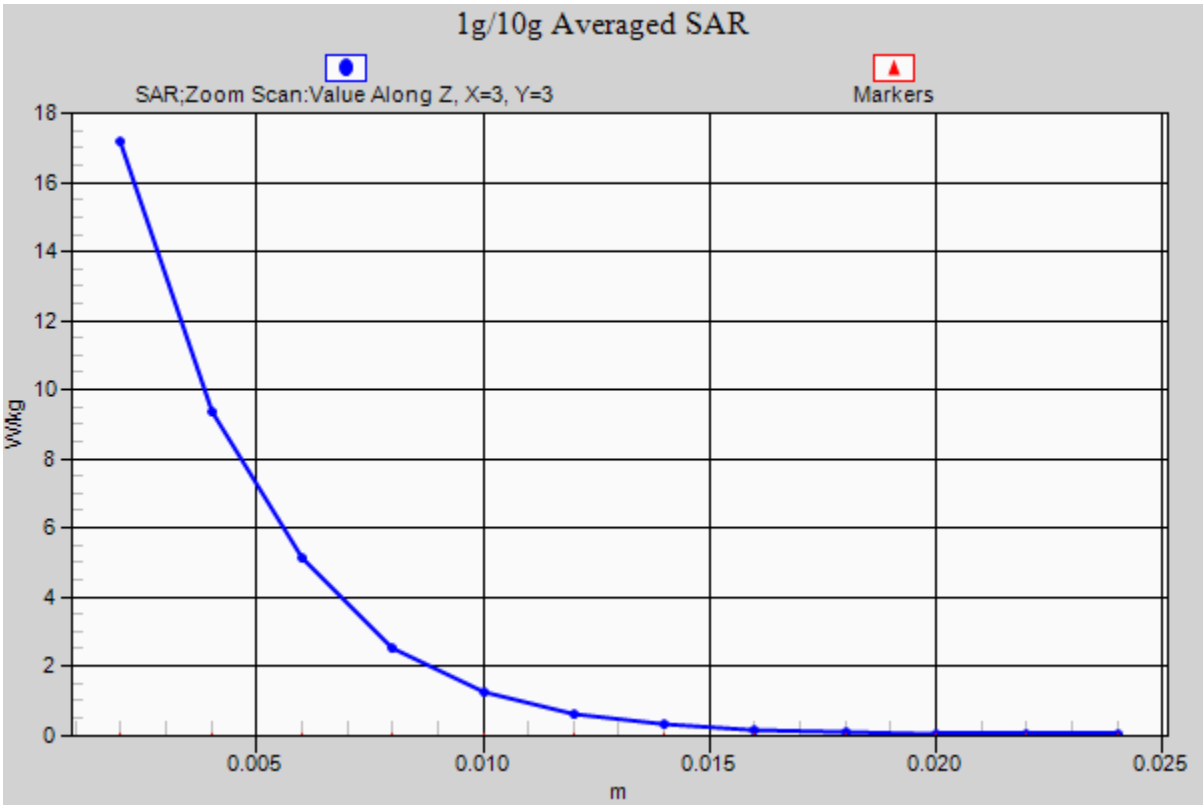
Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5GHz Body; Medium parameters used:
f = 5500 MHz; σ = 5.732 mho/m; ε_r = 46.86; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3589; ConvF(3.4, 3.4, 3.4); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 39.8 W/kg
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.26 W/kg
Deviation = 5.20%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

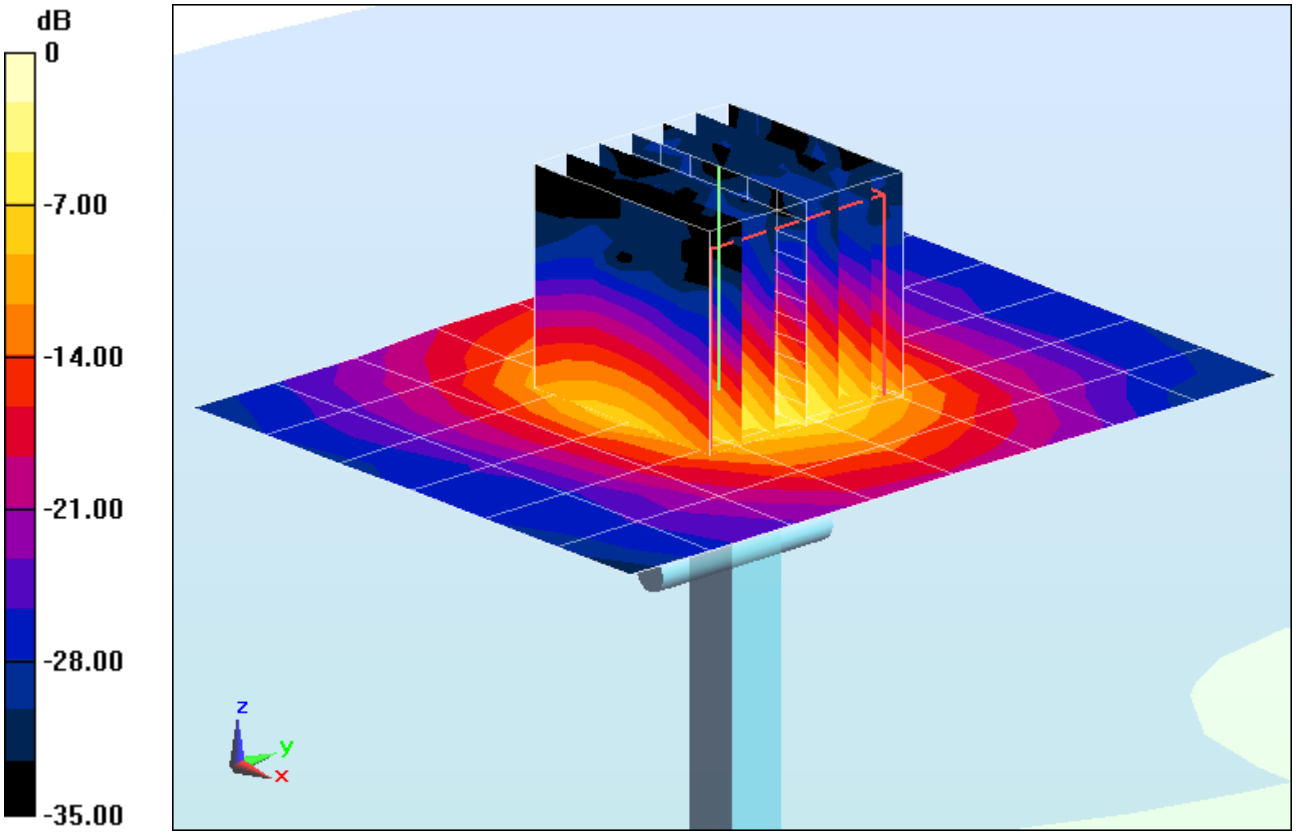
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5GHz Body; Medium parameters used:
f = 5800 MHz; σ = 6.211 mho/m; ε_r = 46.13; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3589; ConvF(3.59, 3.59, 3.59); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.42 W/kg; SAR(10 g) = 2.04 W/kg
Deviation = -0.13%



0 dB = 15.7 W/kg = 11.96 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

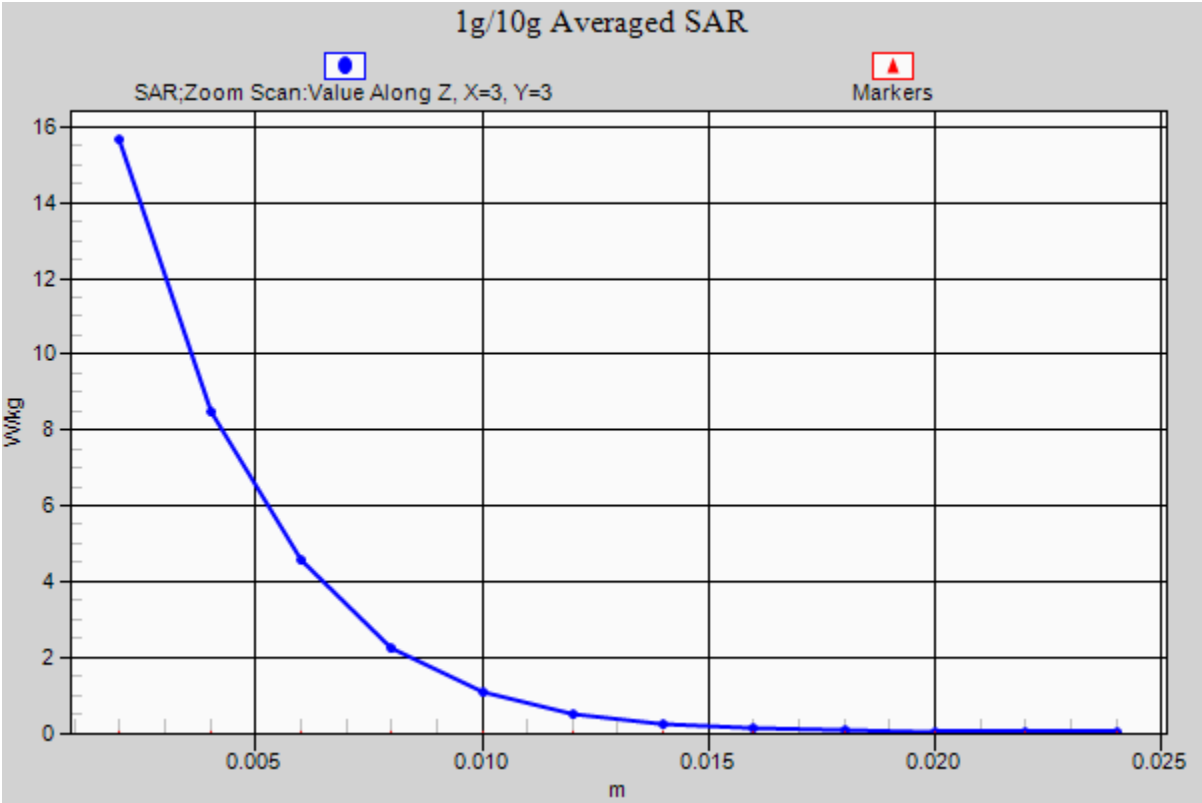
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5GHz Body; Medium parameters used:
f = 5800 MHz; σ = 6.211 mho/m; ε_r = 46.13; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-01-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3589; ConvF(3.59, 3.59, 3.59); Calibrated: 1/27/2012;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/18/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.5 (6469)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.42 W/kg; SAR(10 g) = 2.04 W/kg
Deviation = -0.13%



APPENDIX C: PROBE CALIBRATION

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

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

Accredited by the Swiss 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: ES3-3213_Apr12

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3213
Calibration procedure(s)	QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	April 24, 2012

✓ KOK 5/2/12

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	10-Jan-12 (No. DAE4-660_Jan12)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 25, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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 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, 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:3213

Manufactured: October 14, 2008
Calibrated: April 24, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.48	1.36	1.33	± 10.1 %
DCP (mV)[B]	97.8	101.0	99.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	125.2	±2.5 %
			Y	0.00	0.00	1.00	127.5	
			Z	0.00	0.00	1.00	169.0	

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 max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

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	6.32	6.32	6.32	0.50	1.38	± 12.0 %
835	41.5	0.90	6.07	6.07	6.07	0.41	1.57	± 12.0 %
1640	40.3	1.29	5.36	5.36	5.36	0.64	1.24	± 12.0 %
1750	40.1	1.37	5.22	5.22	5.22	0.57	1.39	± 12.0 %
1900	40.0	1.40	5.02	5.02	5.02	0.63	1.32	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.26	4.26	4.26	0.72	1.36	± 12.0 %

[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: ES3DV3 - SN:3213

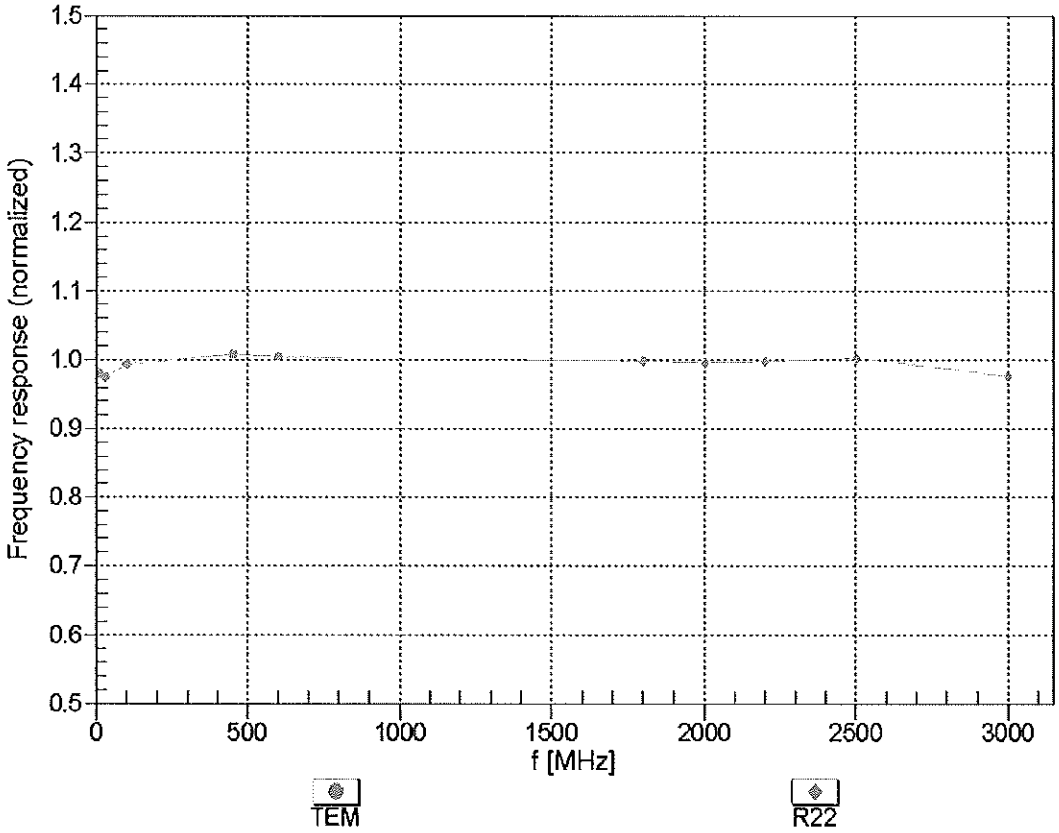
Calibration Parameter Determined in Body Tissue Simulating Media

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	6.19	6.19	6.19	0.31	1.96	± 12.0 %
835	55.2	0.97	6.07	6.07	6.07	0.38	1.73	± 12.0 %
1640	53.8	1.40	5.13	5.13	5.13	0.35	2.07	± 12.0 %
1750	53.4	1.49	4.68	4.68	4.68	0.54	1.56	± 12.0 %
1900	53.3	1.52	4.50	4.50	4.50	0.69	1.37	± 12.0 %
2450	52.7	1.95	4.11	4.11	4.11	0.80	1.04	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	0.63	0.92	± 12.0 %

[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

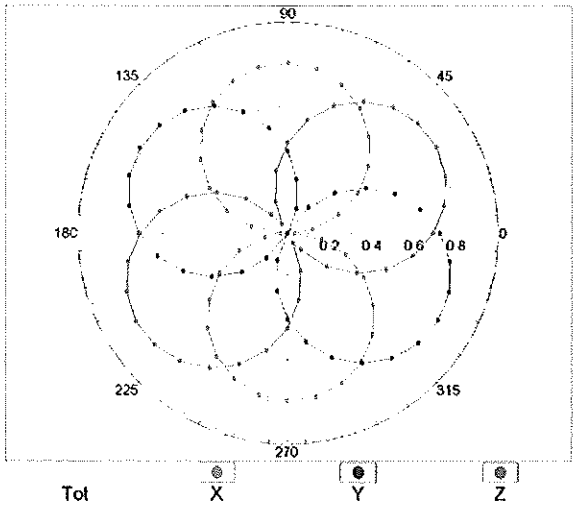
(TEM-Cell:ifi110 EXX, Waveguide: R22)



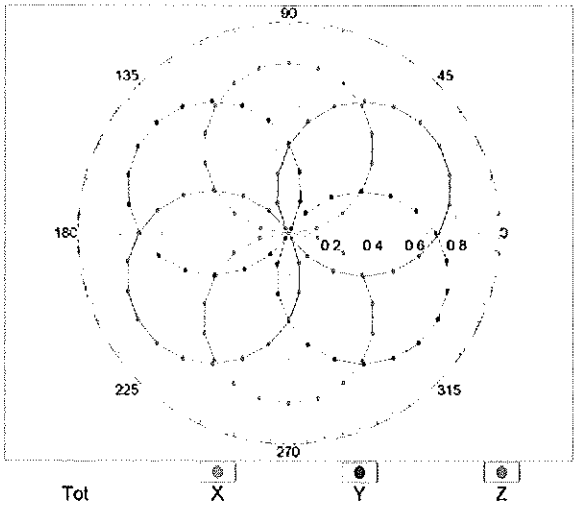
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

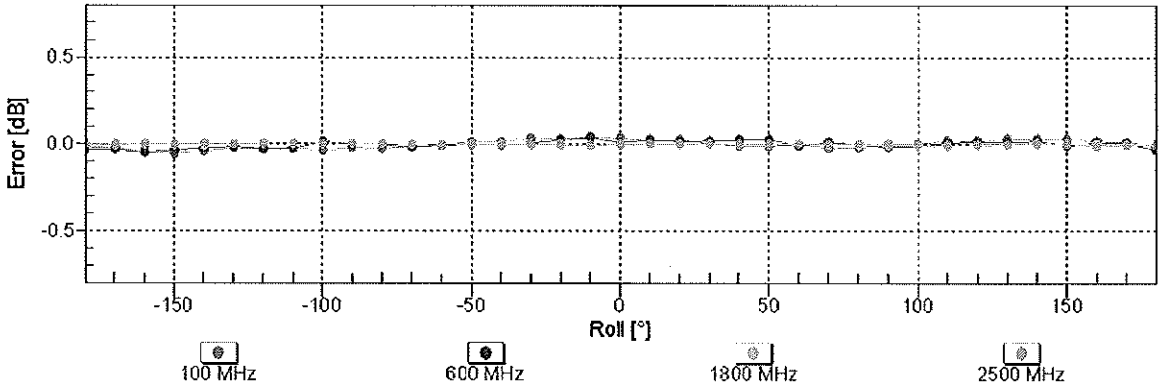
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



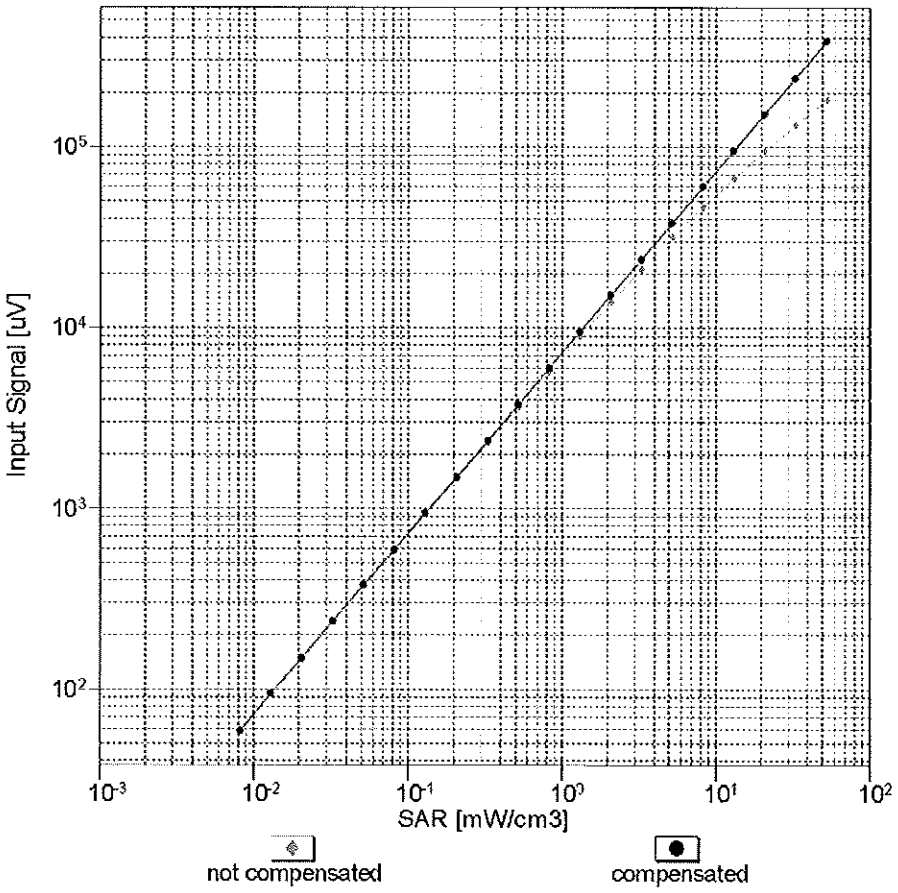
f=1800 MHz,R22

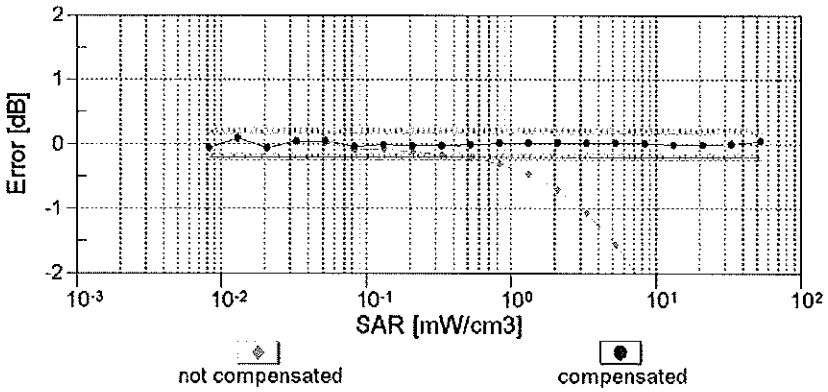




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

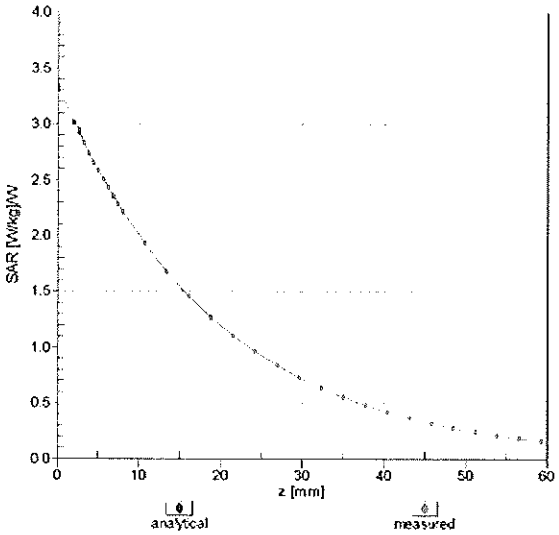




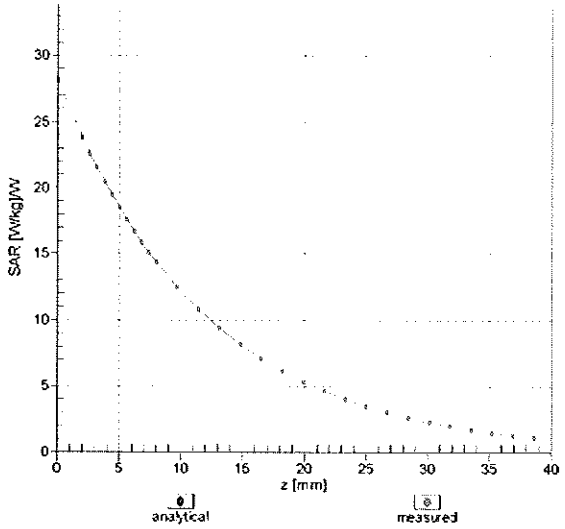
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

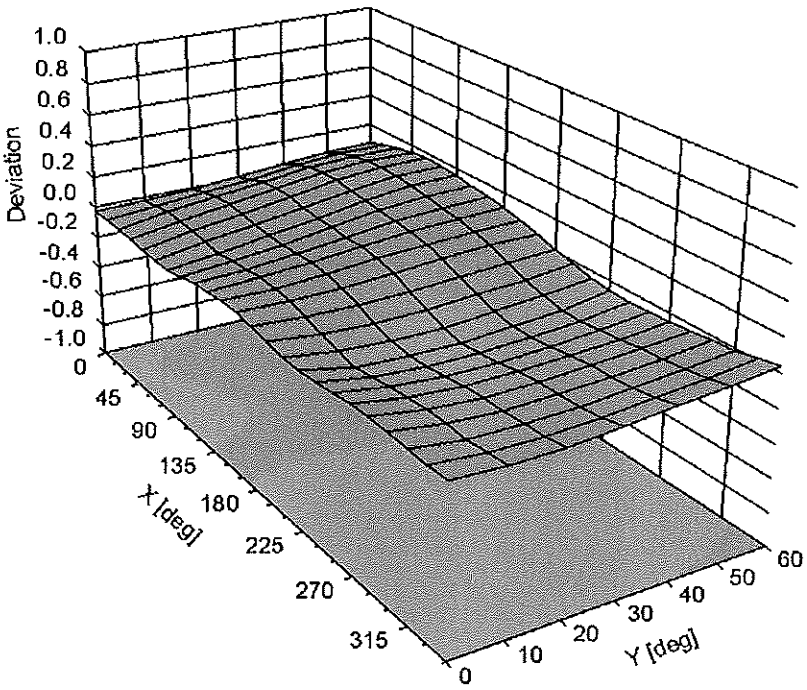


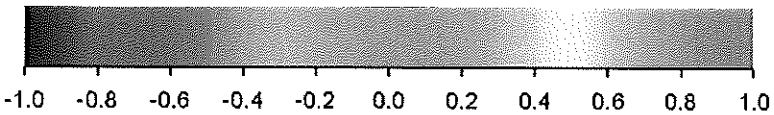
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	140.1
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 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

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

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

Accredited by the Swiss 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: ES3-3288_Sep12

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3288
Calibration procedure(s)	QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	September 20, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: September 20, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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 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, 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:3288

Manufactured: July 6, 2010
Calibrated: September 20, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.87	0.97	0.75	± 10.1 %
DCP (mV)[B]	101.3	102.4	103.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	168.6	±3.3 %
			Y	0.00	0.00	1.00	132.2	
			Z	0.00	0.00	1.00	156.8	

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: ES3DV3 - SN:3288

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	6.67	6.67	6.67	0.80	1.14	± 12.0 %
835	41.5	0.90	6.41	6.41	6.41	0.76	1.18	± 12.0 %
1750	40.1	1.37	5.51	5.51	5.51	0.70	1.28	± 12.0 %
1900	40.0	1.40	5.28	5.28	5.28	0.80	1.22	± 12.0 %
2450	39.2	1.80	4.61	4.61	4.61	0.80	1.26	± 12.0 %
2600	39.0	1.96	4.45	4.45	4.45	0.80	1.31	± 12.0 %

[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: ES3DV3 - SN:3288

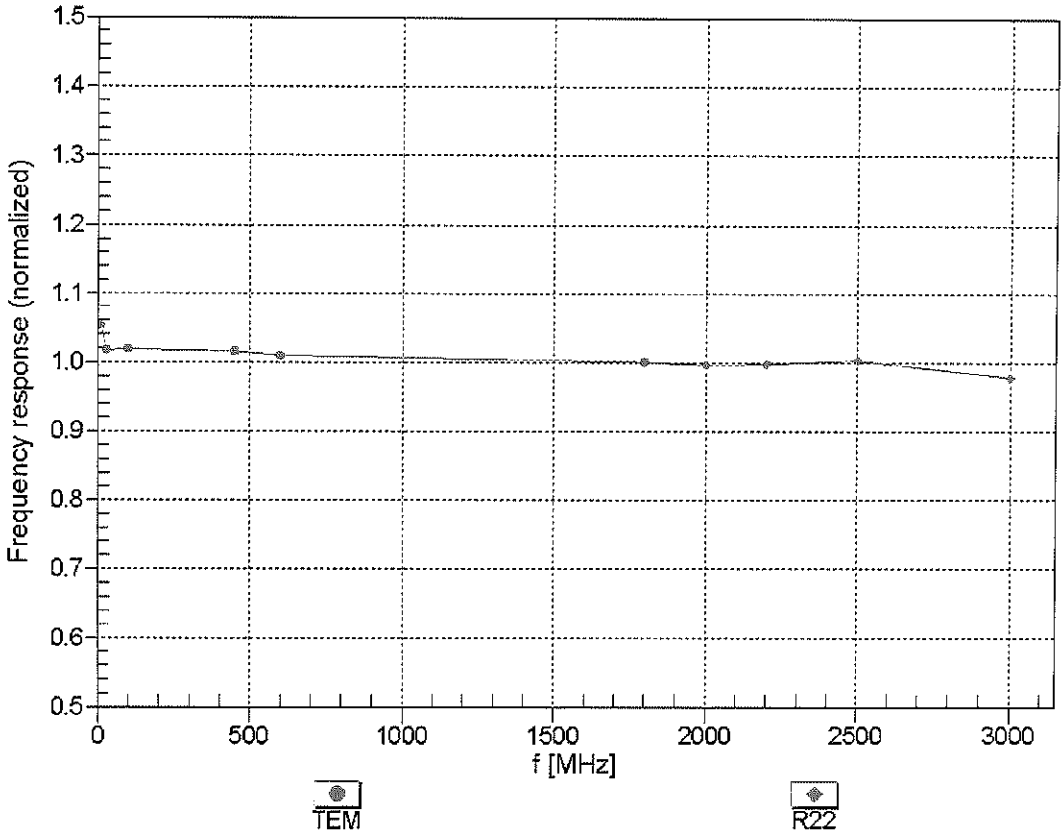
Calibration Parameter Determined in Body Tissue Simulating Media

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	6.44	6.44	6.44	0.62	1.31	± 12.0 %
835	55.2	0.97	6.31	6.31	6.31	0.38	1.78	± 12.0 %
1750	53.4	1.49	5.18	5.18	5.18	0.64	1.43	± 12.0 %
1900	53.3	1.52	4.89	4.89	4.89	0.50	1.64	± 12.0 %
2450	52.7	1.95	4.35	4.35	4.35	0.74	1.23	± 12.0 %
2600	52.5	2.16	4.09	4.09	4.09	0.80	1.07	± 12.0 %

[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

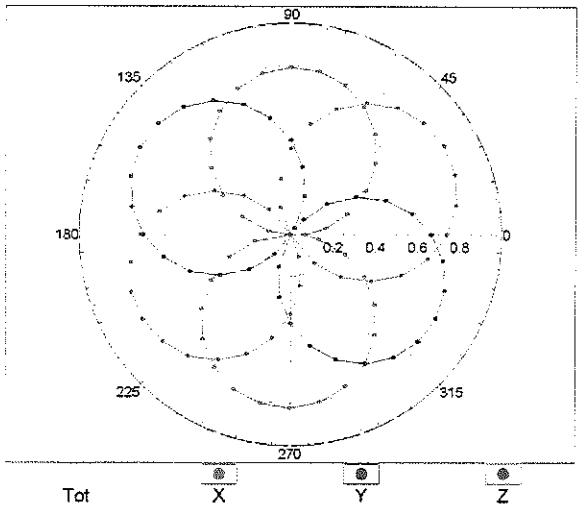
(TEM-Cell:ifi110 EXX, Waveguide: R22)



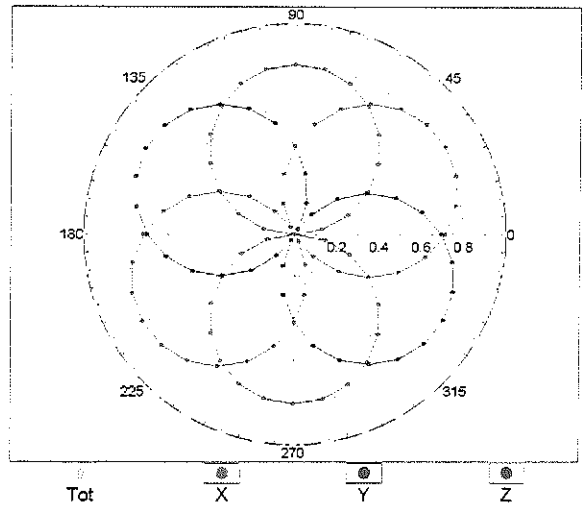
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

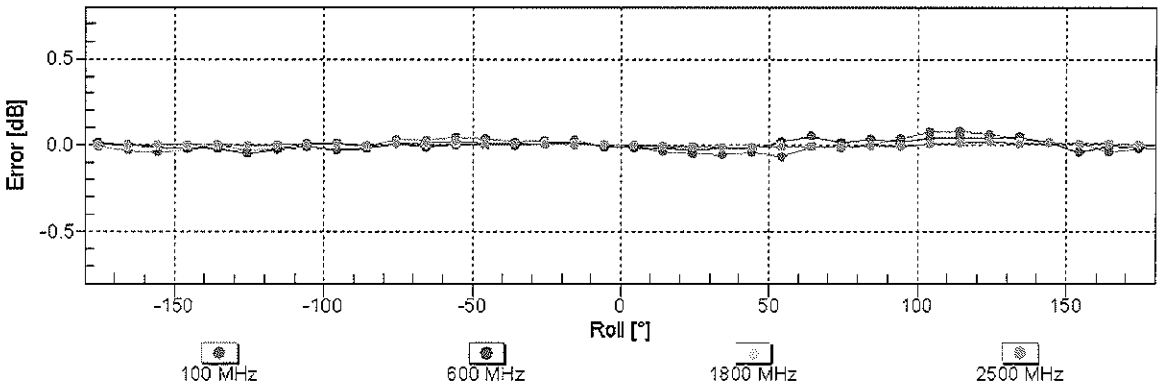
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

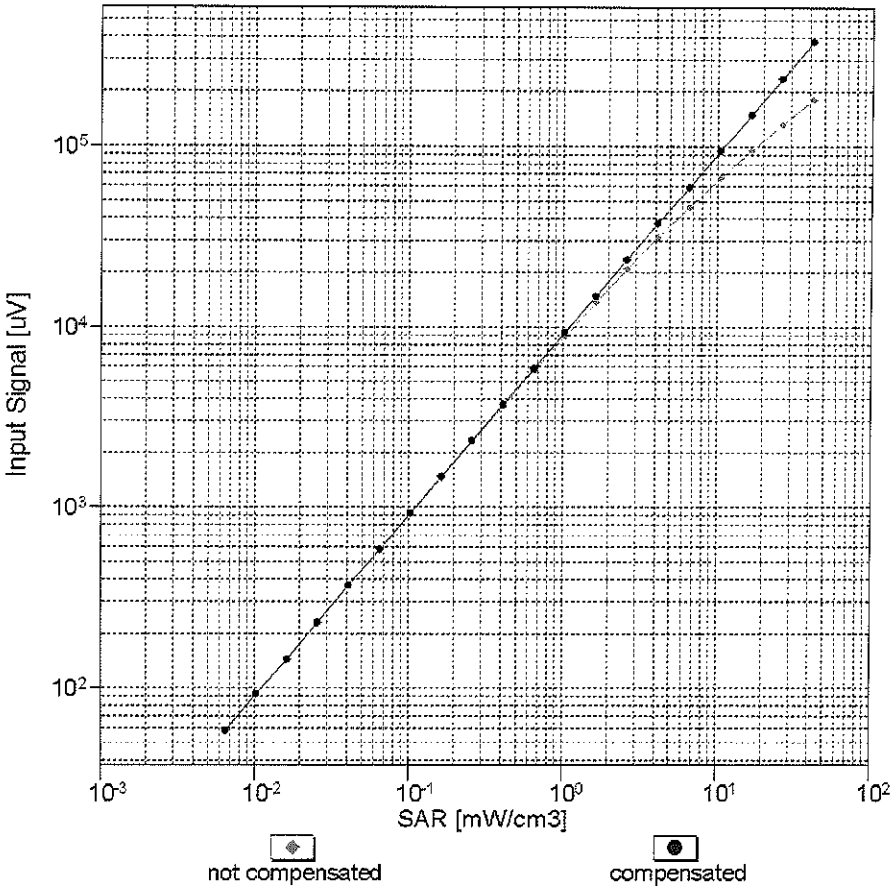


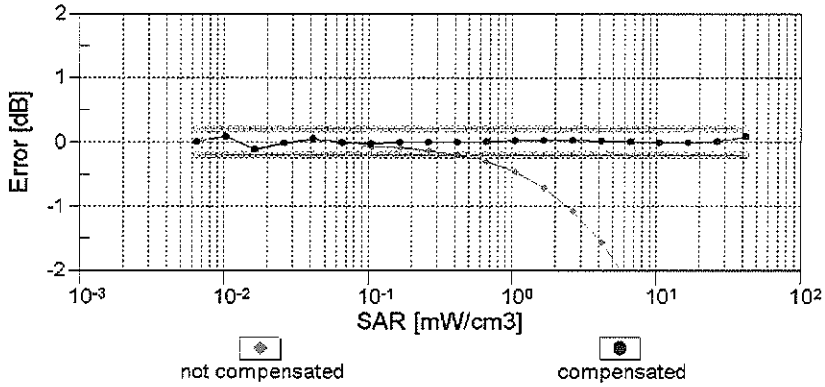


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)

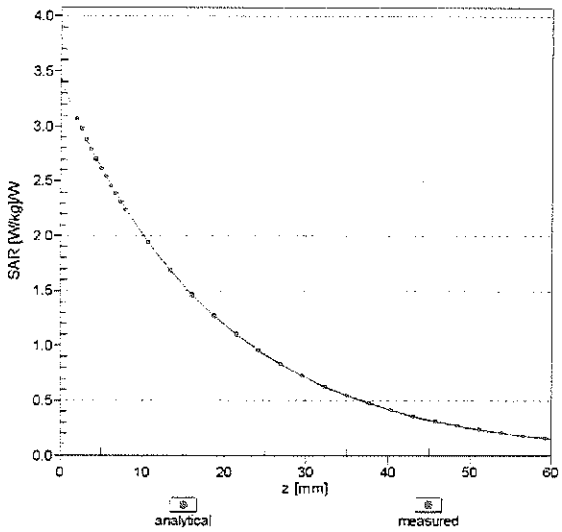




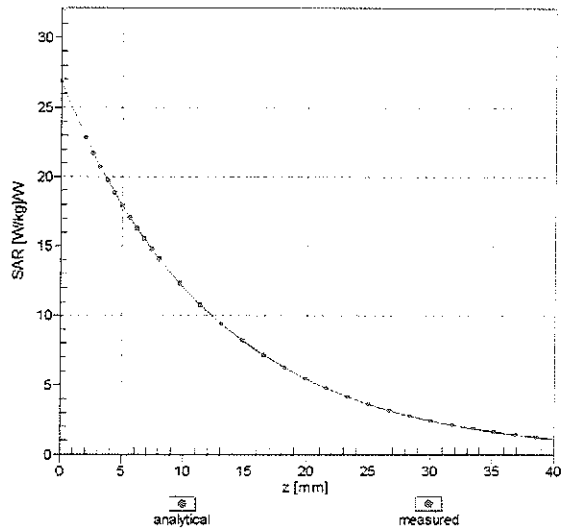
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

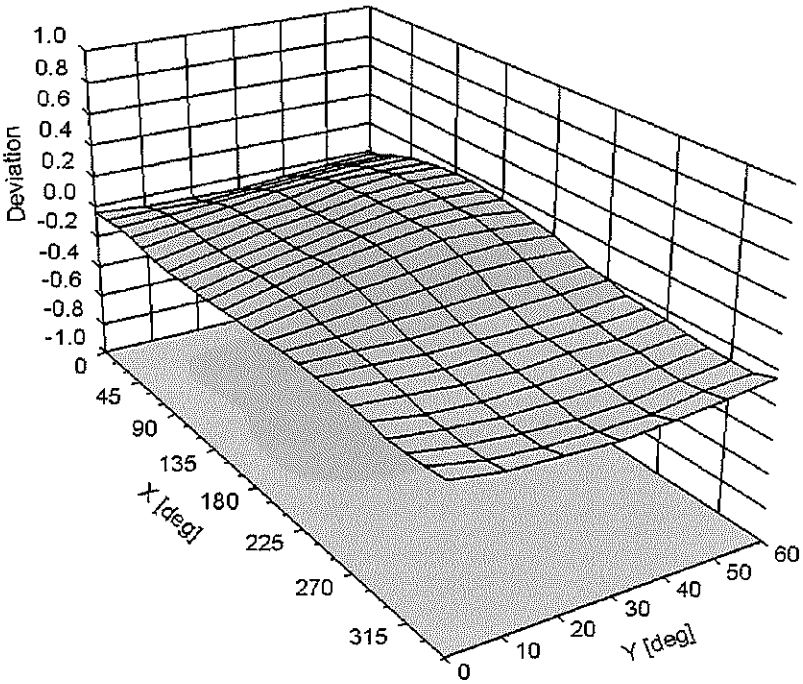


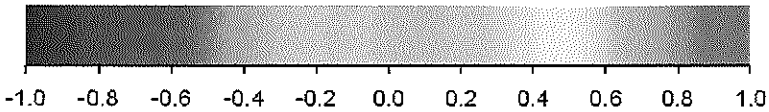
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	54.3
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 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

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3209_Mar12

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3209
Calibration procedure(s)	QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	March 16, 2012

✓ KOK 4/5/12

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	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: March 19, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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., $\vartheta = 0$ 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 ≤ 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, 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
Calibrated: March 16, 2012

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

DASY/EASY - 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]	1.36	1.34	1.15	± 10.1 %
DCP (mV)[B]	98.2	97.4	98.7	

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	119.2	±3.5 %
			Y	0.00	0.00	1.00	89.3	
			Z	0.00	0.00	1.00	111.5	

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: ES3DV3 - SN:3209

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	6.47	6.47	6.47	0.37	1.61	± 12.0 %
835	41.5	0.90	6.22	6.22	6.22	0.24	2.24	± 12.0 %
1640	40.3	1.29	5.38	5.38	5.38	0.41	1.56	± 12.0 %
1750	40.1	1.37	5.26	5.26	5.26	0.41	1.60	± 12.0 %
1900	40.0	1.40	5.15	5.15	5.15	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.46	4.46	4.46	0.64	1.39	± 12.0 %
2600	39.0	1.96	4.30	4.30	4.30	0.69	1.42	± 12.0 %

[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: ES3DV3 - SN:3209

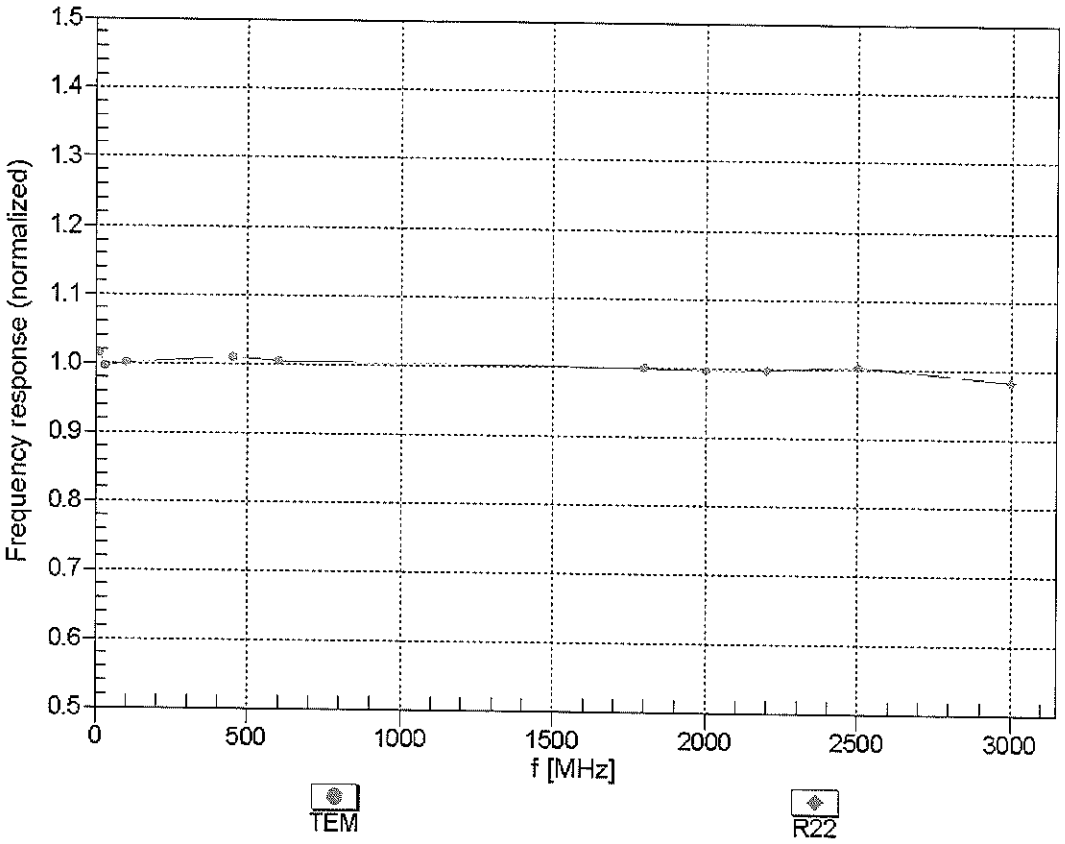
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.11	7.11	7.11	0.07	1.00	± 13.4 %
750	55.5	0.96	6.23	6.23	6.23	0.54	1.40	± 12.0 %
835	55.2	0.97	6.13	6.13	6.13	0.24	2.27	± 12.0 %
1640	53.8	1.40	5.21	5.21	5.21	0.72	1.29	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.59	1.44	± 12.0 %
1900	53.3	1.52	4.63	4.63	4.63	0.57	1.50	± 12.0 %
2450	52.7	1.95	4.23	4.23	4.23	0.80	1.00	± 12.0 %
2600	52.5	2.16	4.02	4.02	4.02	0.62	0.90	± 12.0 %

[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

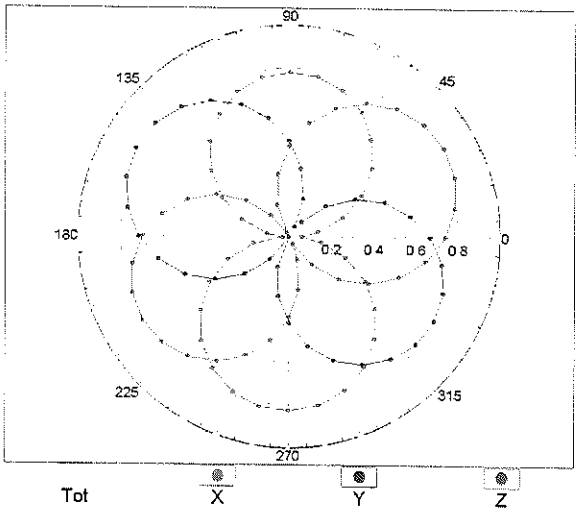
(TEM-Cell:ifi110 EXX, Waveguide: R22)



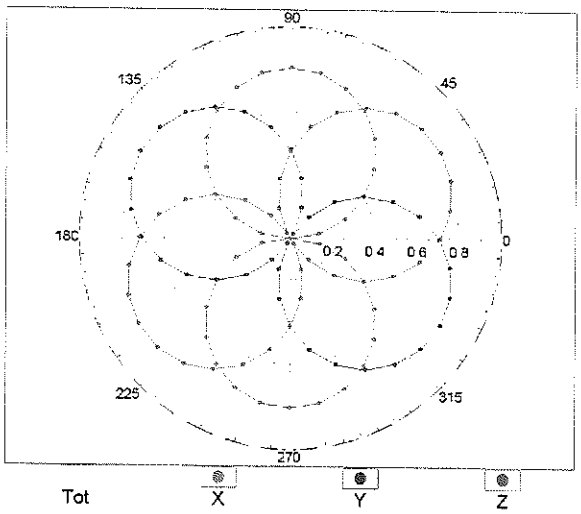
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

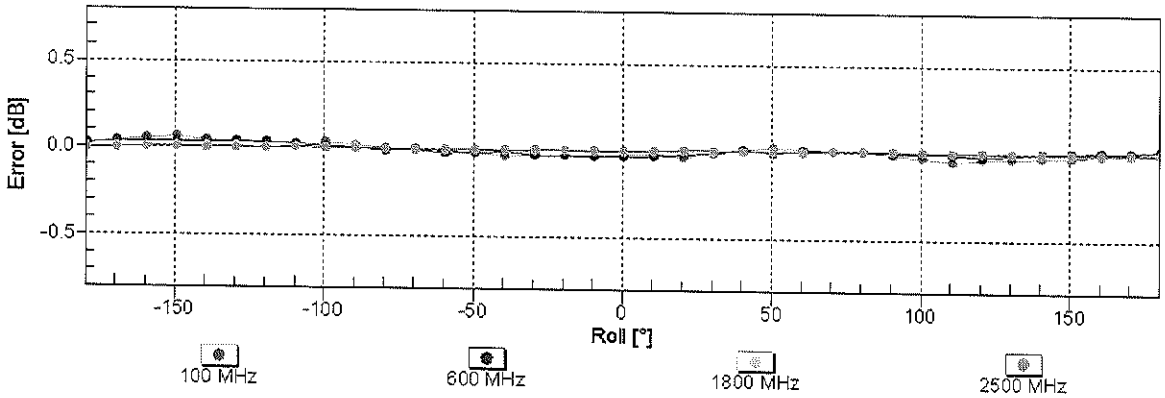
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



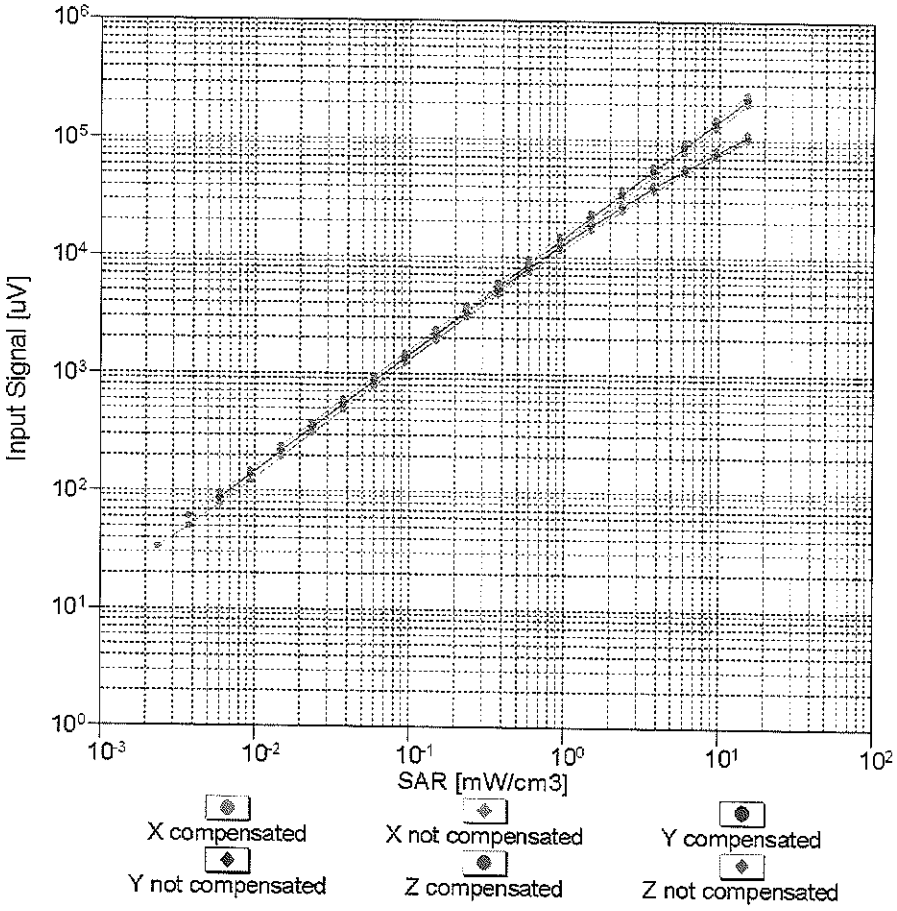
f=1800 MHz,R22

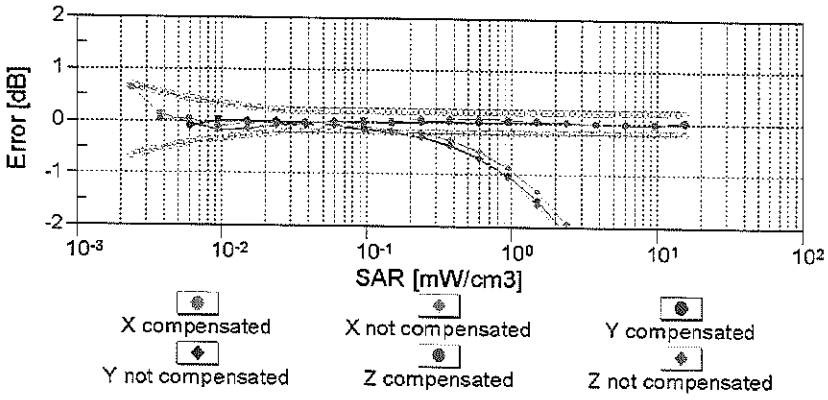




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

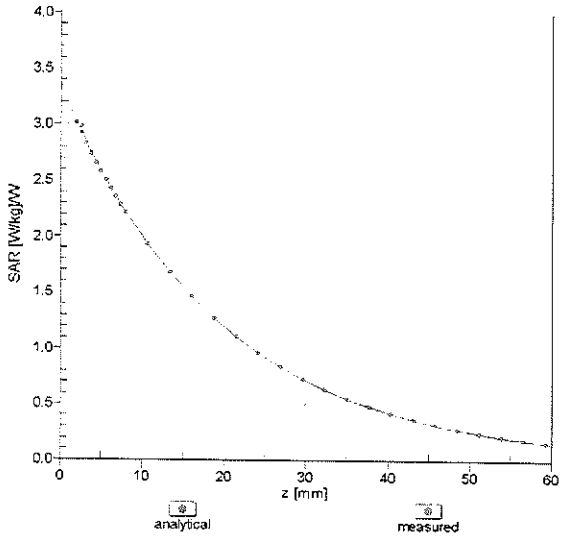




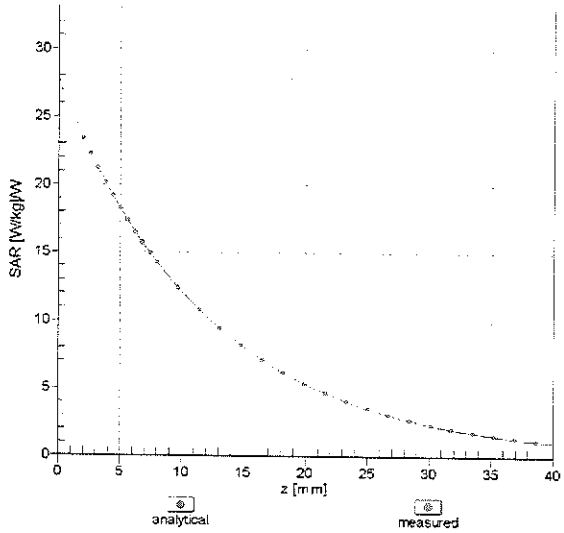
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

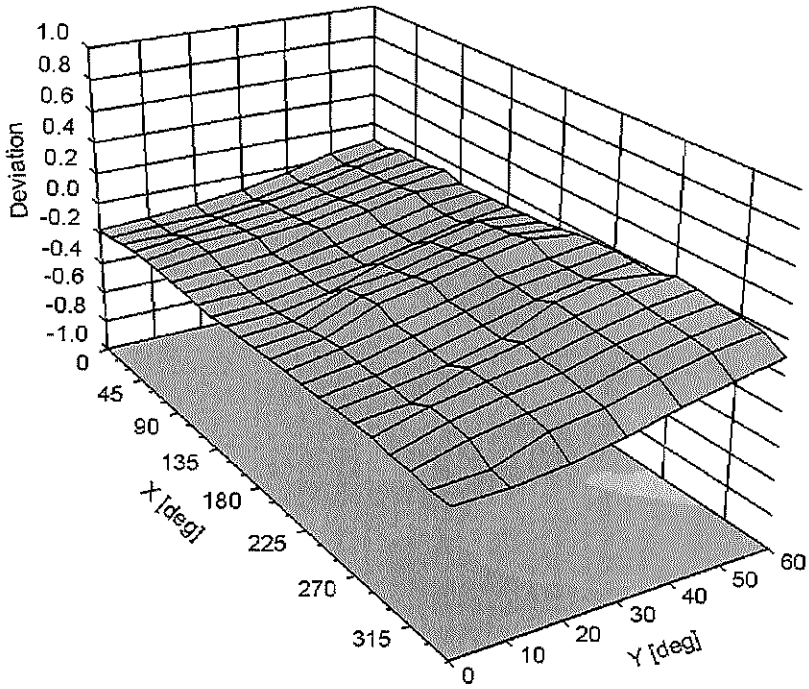


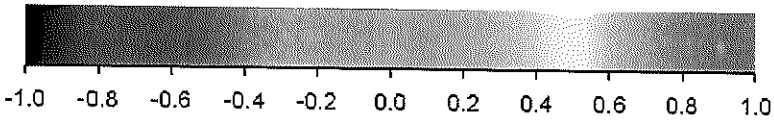
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

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 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