



SAR EVALUATION REPORT

Applicant Name:
 LG Electronics MobileComm U.S.A., Inc.
 1000 Sylvan Avenue
 Englewood Cliffs, NJ 07632
 USA

Date of Testing:
 01/10/13 - 01/21/13
Test Site/Location:
 PCTEST Lab, Columbia, MD, USA
Document Serial No.:
 0Y1301150087.ZNF

FCC ID: ZNFVS870

APPLICANT: LG ELECTRONICS MOBILECOMM U.S.A., INC.


DUT Type: Portable Handset
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model(s): LG-VS870, LGVS870, VS870, LG-AS870, LGAS870, AS870
Permissive Change(s): See FCC Change Document
Date of Original Certification: 01/22/2013

Equipment Class	Band & Mode	Tx Frequency	Measured Conducted Power [dBm]	SAR		
				1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	Cell. CDMA/EVDO	824.70 - 848.31 MHz	24.60	0.59	0.99	1.12
PCE	PCS CDMA/EVDO	1851.25 - 1908.75 MHz	24.50	0.45	0.88	0.88
PCE	LTE Band 13	782 MHz	23.55	0.14	0.37	0.37
DTS	2.4 GHz WLAN	2412 - 2462 MHz	16.24	0.47	0.21	0.21
DTS	5.8 GHz WLAN	5745 - 5825 MHz	13.19	< 0.1	< 0.1	
UNII	5.2 GHz WLAN	5180 - 5240 MHz	12.99	0.20	0.21	
UNII	5.3 GHz WLAN	5260 - 5320 MHz	13.19	0.17	0.17	
UNII	5.5 GHz WLAN	5500 - 5700 MHz	13.26	< 0.1	< 0.1	
DSS/DTS	Bluetooth	2402 - 2480 MHz	11.07	N/A		
Simultaneous SAR per KDB 690783 D01v01r02:				1.13	1.44	1.34



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 Section 1.8 of this report; 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.




 Randy Ortanez
 President



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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
LTE Band 13	Data	782 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz



1.2 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05.

Mode / Band		Modulated Average (dBm)	
Cell. CDMA/EVDO	Maximum	24.7	
	Nominal	24.2	
PCS CDMA/EVDO	Maximum	24.7	
	Nominal	24.2	

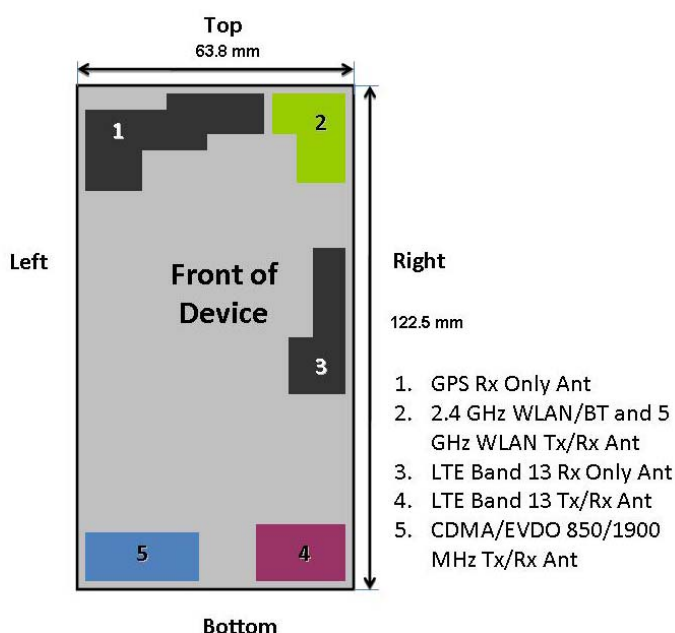
Mode / Band			Modulated Average (dBm)
Cell. CDMA	SVLTE threshold	Maximum	19.2
	LTE is not reducing	Nominal	18.7
PCS CDMA	SVLTE threshold	Maximum	19.2
	LTE is not reducing	Nominal	18.7

Mode / Band	Power Reduction	Modulated Average (dBm)	
LTE Band 13	Inactive	Maximum	23.7
		Nominal	23.2
	Active	Maximum	19.7
		Nominal	19.2

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Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	17.0
	Nominal	16.3
IEEE 802.11g (2.4 GHz)	Maximum	14.0
	Nominal	13.3
IEEE 802.11n (2.4 GHz)	Maximum	13.0
	Nominal	12.3
IEEE 802.11a (5 GHz)	Maximum	14.0
	Nominal	13.3
IEEE 802.11n (5 GHz)	Maximum	13.0
	Nominal	12.3
Bluetooth	Maximum	11.7
	Nominal	11.0

1.3 DUT Antenna Locations



Note: Specific antenna dimensions and separation distances are shown in the antenna distance document.

Figure 1-1
DUT Antenna Locations

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
Cell. EVDO	Yes	Yes	No	Yes	No	Yes
PCS EVDO	Yes	Yes	No	Yes	No	Yes
LTE Band 13	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 D06v01 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.

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1.4 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-2 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.



Figure 1-2
Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v05 3) procedures.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable TX Configuration	Head SAR	Body SAR	Hotspot SAR	Power Reduction (LTE)	Note
1	CDMA BC0 Voice + 2.4GHz WiFi data	Yes	Yes	No	No	
2	CDMA BC0 Voice + 5GHz WiFi data	Yes	Yes	No	No	
3	CDMA BC1 Voice + 2.4GHz WiFi data	Yes	Yes	No	No	
4	CDMA BC1 Voice + 5GHz WiFi data	Yes	Yes	No	No	
5	CDMA BC0 1X Data/EVDO + 2.4GHz WiFi data	Yes	Yes	Yes	No	CDMA Hotspot
6	CDMA BC0 1X Data/EVDO + 5GHz WiFi data	Yes	Yes	No	No	WiFi Direct
7	CDMA BC1 1X Data/EVDO + 2.4GHz WiFi data	Yes	Yes	Yes	No	CDMA Hotspot
8	CDMA BC1 1X Data/EVDO + 5GHz WiFi data	Yes	Yes	No	No	WiFi Direct
9	LTE B13 + 2.4GHz WiFi data	Yes	Yes	Yes	No	LTE Hotspot
10	LTE B13 + 5GHz WiFi data	Yes	Yes	No	No	WiFi Direct
11	CDMA BC0 Voice + LTE B13	Yes	Yes	No	Yes	SVLTE
12	CDMA BC1 Voice + LTE B13	Yes	Yes	No	Yes	SVLTE
13	CDMA BC0 Voice + LTE B13 + 2.4GHz WLAN	Yes	Yes	Yes	Yes	WiFi Hotspot (SVLTE)
14	CDMA BC1 Voice + LTE B13 + 2.4GHz WLAN	Yes	Yes	Yes	Yes	WiFi Hotspot (SVLTE)
15	CDMA BC0 Voice + LTE B13 + 5GHz WLAN	Yes	Yes	No	Yes	WiFi Direct (SVLTE)
16	CDMA BC1 Voice + LTE B13 + 5GHz WLAN	Yes	Yes	No	Yes	WiFi Direct (SVLTE)
17	CDMA BC0 Voice + 2.4 GHz Bluetooth	No	Yes	No	No	
18	CDMA BC1 Voice + 2.4 GHz Bluetooth	No	Yes	No	No	
19	LTE B13 + 2.4 GHz Bluetooth	No	Yes	No	No	
20	CDMA BC0 Voice + LTE B13 + 2.4 GHz Bluetooth	No	Yes	No	Yes	
21	CDMA BC1 Voice + LTE B13 + 2.4 GHz Bluetooth	No	Yes	No	Yes	

* BT and WLAN are not simultaneous transmission.
 * CDMA EVDO and LTE are not simultaneous transmission.
 * CDMA BC0/BC1 EVDO is supported.
 * VoLTE is supported.
 * SVLTE is supported.
 * Power reduction for SVLTE mode is supported.
 * EVDO VoIP is supported.

1.5 Power Reduction for SAR

This device uses power reduction mechanisms for LTE during SVLTE operation (1x-RTT CDMA voice + LTE data) for SAR compliance. See Section 10 for more details.

1.6 Wireless Charging Battery Cover

This DUT may be used with a standard battery cover or with an optional wireless charging battery cover. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover and then repeated with the wireless charging battery cover for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. Since reported SAR did not exceed 1.2 W/kg, additional testing with the wireless charging battery cover was not required.

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1.7 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 according to FCC KDB 941225 D06v01.

Per FCC KDB 447498 D01 v05, the SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Dist (mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 3.0$$

Based on the maximum average conducted power of Bluetooth and the antenna to use separation distance, Bluetooth SAR was not required; $[(15/10) * \sqrt{2.441}] = 2.3 < 3.0$.

This device supports 20 MHz and 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only. IEEE 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 IEEE 802.11a.

(B) Licensed Transmitter(s)

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02.



1.8 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D04 (Wireless Charging Battery Covers)

1.9 Device Serial Numbers

Several samples were used with identical hardware to support SAR testing.



	Serial Number
Cell. CDMA/EVDO Nominal	6457
PCS CDMA/EVDO Nominal	6457
Cell. CDMA/EVDO SVLTE Threshold	6473
PCS CDMA/EVDO SVLTE Threshold	6473
LTE Band 13 Power Reduction Inactive	6465
LTE Band 13 Power Reduction Active	6481
2.4 GHz WLAN	6556
5 GHz WLAN	6556

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LTE INFORMATION

LTE Information				
	FCC ID	ZNFVS870		
	Form Factor	Portable Handset		
1)	Frequency Range of each LTE transmission band	LTE Band 13 (782 MHz)		
2)	Channel Bandwidths	LTE Band 13: 10 MHz		
3)	Channel Numbers and Frequencies (MHz)	Low	Mid	High
	LTE Band 13: 10 MHz		782 (23230)	
4)(a)	UE Category	3		
(b)	Modulations Supported in UL	QPSK, 16QAM		
	LTE Transmitter and Antenna Implementation	CDMA has one Tx/Rx antenna and LTE has one Tx/ Rx antenna and one Rx only antenna		
5)	Description of LTE Tx and Ant. Implementation	CDMA/LTE operate on separate transmission paths		
6)	Hotspot with LTE+WIFI	YES		
	Hotspot with LTE+WIFI active with 1XVoice sessions?	YES		
7)	LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
	A-MPR (Additional MPR) disabled for SAR Testing?	YES		
8)	Conducted power Table provided for 1RB (low, mid, and high offset), 50% RB (low, mid, and high offset), 100% RB	YES		

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3 INTRODUCTION

The FCC and Industry Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 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.

3.1 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 3-1).

**Equation 3-1
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/m³)
- 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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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 and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1).
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 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASYS 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.

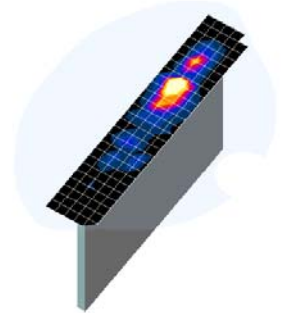


Figure 4-1
Sample SAR Area Scan

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01

Frequency	Maximum Area Scan Resolution (mm) ($\Delta x_{area}, \Delta y_{area}$)	Maximum Zoom Scan Resolution (mm) ($\Delta x_{zoom}, \Delta y_{zoom}$)	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x, y, z)
			Uniform Grid		Graded Grid	
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)^*$		
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 22

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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 5-1). 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].

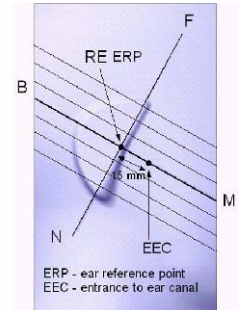


Figure 5-1
Close-Up Side view of ERP

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). The “test device reference point” was then 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 its 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

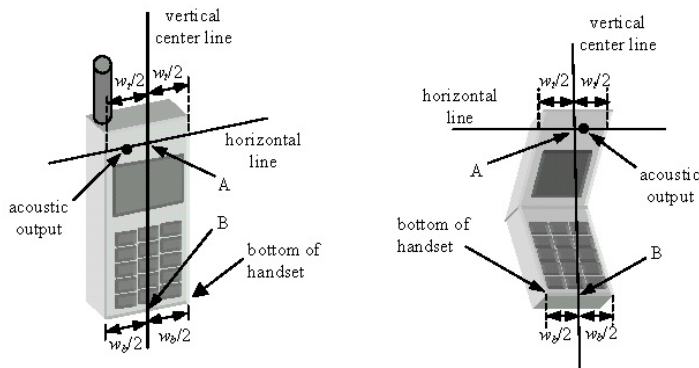


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$.

6.2 Positioning for Cheek

1. The test device was positioned with the device 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.

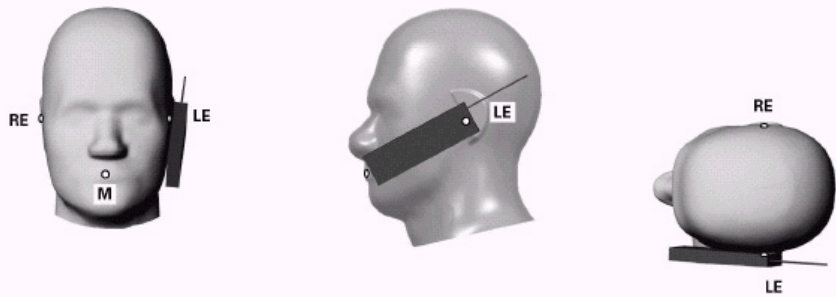




Figure 6-1 Front, Side and Top View of Cheek Position

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 with 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 device contact with the ear, the device was rotated about the NF line 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 / 15° Tilt

With the test device aligned in the “Cheek 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 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched 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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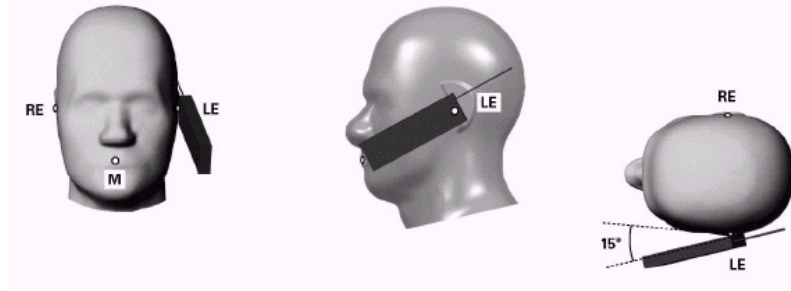


Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position

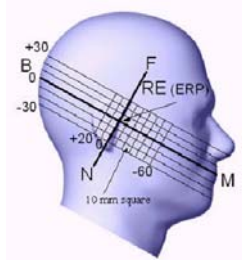


Figure 6-3 Side view w/ relevant markings

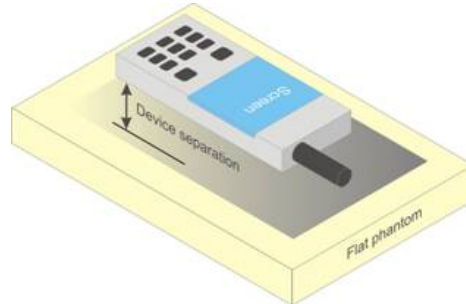


Figure 6-4 Sample Body-Worn Diagram

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 FCC KDB Publication 648474 D04_v01. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

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.

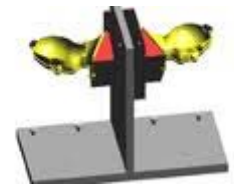




Figure 6-5 Twin SAM Chin20

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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). Per FCC KDB Publication 648474 D04_v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01_v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.



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 user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v01 where SAR test considerations for handsets ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, 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 due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

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7 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 <i>General Population</i> (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT <i>Occupational</i> (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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Power measurements were performed using a base station simulator under digital average power.

8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r02.

8.2 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.



8.3 SAR Measurement Conditions for CDMA2000

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

8.3.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in the "All Up" condition.

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 8-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH₀ and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH₀ data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 8-2 was applied.

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**Table 8-1
Parameters for Max. Power for RC1**

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

**Table 8-2
Parameters for Max. Power for RC3**

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

5. FCHs were configured at full rate for maximum SAR with “All Up” power control bits.

8.3.2 Head SAR Measurements

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

Head SAR was additionally evaluated using EVDO Rev. A to support compliance for VoIP operations. See Section 8.3.4 for EVDO Rev. A configuration parameters.



8.3.3 Body SAR Measurements

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

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

8.3.4 Handsets with EVDO

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

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8.3.5 Body SAR Measurements for EVDO Hotspot

Hotspot Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 per KDB Publication 941225 D01 procedures for “1x Ev-Do data Devices”. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations.

SAR is not required for 1x RTT for Ev-Do devices that also support 1x RTT voice and/or data operations, when the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0. Otherwise, CDMA “Body-SAR Measurement” procedures for “CDMA 2000 1x Handsets” were applied.

8.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

8.4.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

8.4.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.



8.4.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

8.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02:

- a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
 - i. The required channel and offset combination with the highest maximum output power is required for SAR.
 - ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
 - iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.

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- b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
- c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
- d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

8.5 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 D01v01r02 for more details.

8.5.1 General Device Setup



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

8.5.2 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 than 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 CDMA Conducted Powers

Band	Channel	Frequency	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC	MHz	RC1	RC3	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	1013	824.7	24.47	24.40	24.52	24.42	24.53	24.48
	384	836.52	24.40	24.45	24.39	24.53	24.52	24.45
	777	848.31	24.57	24.51	24.55	24.54	24.60	24.53
PCS	25	1851.25	24.24	24.33	24.28	24.32	24.36	24.30
	600	1880	24.29	24.35	24.34	24.35	24.50	24.48
	1175	1908.75	24.34	24.39	24.38	24.38	24.44	24.37

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

Per KDB Publication 941225 D01v02:

1. Head SAR was tested with SO55 RC3. SO55 RC1 was not required since the average output power was not more than 0.25 dB than the SO55 RC3 powers.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. Ev-Do and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers.
3. Hotspot SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. If the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, then Rev. A SAR is not required. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rev. 0.
4. CDMA 1x-RTT SAR was additionally required to be evaluated for Hotspot exposure conditions to support simultaneous transmission capabilities.
5. Head SAR was additionally evaluated with EVDO Rev. A to determine compliance for held-to-ear VoIP operations.

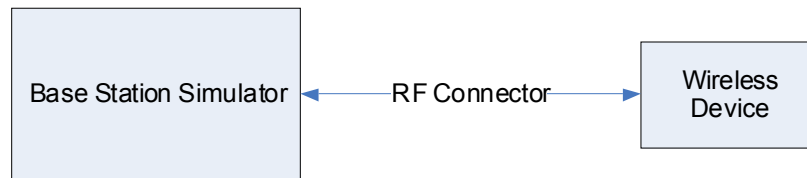


Figure 9-1
Power Measurement Setup

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9.2 LTE Conducted Powers

9.2.1 LTE Band 13

Table 9-1
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
782.0	23230	10	QPSK	1	0	23.50	0	0
782.0	23230	10	QPSK	1	25	23.55	0	0
782.0	23230	10	QPSK	1	49	23.41	0	0
782.0	23230	10	QPSK	25	0	22.51	1	0-1
782.0	23230	10	QPSK	25	12	22.40	1	0-1
782.0	23230	10	QPSK	25	25	22.49	1	0-1
782.0	23230	10	QPSK	50	0	22.37	1	0-1
782.0	23230	10	16QAM	1	0	22.41	1	0-1
782.0	23230	10	16QAM	1	25	22.52	1	0-1
782.0	23230	10	16QAM	1	49	22.49	1	0-1
782.0	23230	10	16QAM	25	0	21.65	2	0-2
782.0	23230	10	16QAM	25	12	21.57	2	0-2
782.0	23230	10	16QAM	25	25	21.56	2	0-2
782.0	23230	10	16QAM	50	0	21.37	2	0-2

9.3 WLAN Conducted Powers

Per the FCC change document for this device, the 2.4 GHz WLAN/Bluetooth and 5 GHz WLAN chipset remains the same as the original certified device. Therefore, conducted powers for IEEE 802.11b/g/n and IEEE 802.11a/n remain the same as the original certification.

Table 9-2
IEEE 802.11b Average RF Power



Mode	Freq [MHz]	Channel	802.11b (2.4 GHz) Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1	16.24	16.16	16.24	16.18
802.11b	2437	6	15.70	15.75	15.82	15.81
802.11b	2462	11	15.30	15.29	15.47	15.44

Table 9-3
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	13.14	12.87	12.82	12.88	13.37	13.43	13.47	13.44
802.11g	2437	6	13.15	13.04	13.10	12.95	13.17	13.13	13.07	
802.11g	2462	11	12.82	12.66	12.78	12.71	12.75	12.78	12.80	12.20

Table 9-4
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	2412	1	12.15	12.21	12.17	12.18	12.17	12.22	12.26	12.24
802.11n	2437	6	11.83	11.81	11.80	11.85	11.80	11.74	11.78	11.78
802.11n	2462	11	11.42	11.46	11.41	11.38	11.42	11.42	11.39	11.42

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**Table 9-5
IEEE 802.11a Average RF Power**

Mode	Freq	Channel	802.11a (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]	6	9	12	18	24	36	48	54	
802.11a	5180	36*	12.84	12.93	12.92	12.86	12.63	12.59	12.60	12.60
802.11a	5200	40	12.95	12.83	12.89	12.85	12.81	12.73	12.78	12.78
802.11a	5220	44	12.99	12.97	12.93	12.96	13.00	12.96	12.93	12.84
802.11a	5240	48*	12.86	13.05	13.07	13.07	12.95	12.99	12.93	12.91
802.11a	5260	52*	13.01	12.63	12.73	12.65	12.57	12.61	12.53	12.52
802.11a	5280	56	13.05	12.71	12.61	12.71	12.69	12.67	12.64	12.55
802.11a	5300	60	13.12	13.17	13.10	13.11	13.08	13.07	13.09	12.99
802.11a	5320	64*	13.19	13.26	13.16	13.08	13.06	13.22	13.26	13.11
802.11a	5500	100	12.81	12.71	12.75	12.74	12.72	12.84	12.64	12.59
802.11a	5520	104*	12.55	12.43	12.40	12.55	12.50	12.55	12.49	12.80
802.11a	5540	108	12.84	12.82	12.86	12.84	12.86	12.75	12.80	12.75
802.11a	5560	112	12.87	12.86	12.81	12.83	12.76	12.78	12.58	12.57
802.11a	5580	116*	12.74	12.67	12.74	12.64	12.62	12.58	12.53	12.54
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	13.21	13.34	13.19	13.16	12.99	13.02	12.98	12.85
802.11a	5680	136*	12.99	13.00	12.93	12.98	12.93	13.05	13.12	13.01
802.11a	5700	140	13.26	13.17	13.34	13.29	13.27	13.37	13.32	13.23
802.11a	5745	149*	12.91	12.93	12.82	12.81	12.77	12.78	12.77	12.64
802.11a	5765	153	12.97	13.00	12.93	12.91	12.92	12.90	12.86	12.95
802.11a	5785	157*	13.02	12.98	12.94	12.88	12.94	12.95	12.92	12.89
802.11a	5805	161*	13.04	13.00	12.97	13.00	12.96	12.91	12.91	12.80
802.11a	5825	165	13.19	13.35	13.29	13.22	13.18	13.12	13.10	13.15

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 D01v01r02. When the adjacent channels are higher in power than the default channels, these “required channels” are considered for SAR testing instead of the default channels.

**Table 9-6
IEEE 802.11n Average RF Power – 20 MHz Bandwidth**

Mode	Freq	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]	6.5	13	20	26	39	52	58	65	
802.11n	5180	36	11.45	11.39	11.50	11.51	11.28	11.36	11.37	11.34
802.11n	5200	40	11.52	11.46	11.41	11.39	11.36	11.32	11.31	11.35
802.11n	5220	44	11.52	11.56	11.56	11.46	11.45	11.43	11.49	11.45
802.11n	5240	48	11.64	11.64	11.65	11.62	11.73	11.69	11.56	11.75
802.11n	5260	52	11.72	11.62	11.63	11.55	11.58	11.54	11.59	11.58
802.11n	5280	56	11.83	11.80	11.75	11.85	11.72	11.71	11.79	11.85
802.11n	5300	60	11.85	11.86	12.03	11.81	11.80	11.79	11.78	11.76
802.11n	5320	64	11.89	11.74	11.75	11.77	11.66	11.67	11.70	11.63
802.11n	5500	100	11.61	11.65	11.57	11.59	11.57	11.61	11.52	11.53
802.11n	5520	104	11.68	11.55	11.57	11.66	11.53	11.44	11.50	11.35
802.11n	5540	108	11.76	11.79	11.69	11.60	11.61	11.56	11.52	11.46
802.11n	5560	112	11.77	11.72	11.73	11.77	11.64	11.70	11.67	11.71
802.11n	5580	116	11.81	11.70	11.76	11.59	11.55	11.51	11.53	11.51
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	11.92	11.89	11.83	11.71	11.78	11.75	11.75	11.69
802.11n	5680	136	12.06	12.05	12.01	11.98	11.92	11.94	11.91	11.81
802.11n	5700	140	12.13	12.14	12.14	12.05	12.05	11.99	12.01	11.97
802.11n	5745	149	11.50	11.47	11.57	11.48	11.40	11.41	11.37	11.40
802.11n	5765	153	11.70	11.75	11.74	11.89	11.69	11.89	11.67	11.73
802.11n	5785	157	11.64	11.51	11.42	11.45	11.40	11.36	11.26	11.30
802.11n	5805	161	11.73	11.78	11.70	11.75	11.62	11.66	11.61	11.50
802.11n	5825	165	11.64	11.61	11.50	11.49	11.45	11.43	11.33	11.37



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Table 9-7
IEEE 802.11n Average RF Power – 40 MHz Bandwidth



Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) 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	12.01	11.89	11.90	11.89	11.93	11.88	11.87	11.73
802.11n	5230	46	12.14	12.11	12.01	12.04	11.95	11.94	11.96	11.93
802.11n	5270	54	12.25	12.15	12.07	12.11	12.09	12.01	12.06	11.93
802.11n	5310	62	12.37	12.29	12.30	12.20	12.17	12.14	12.24	12.09
802.11n	5510	102	12.19	12.09	12.03	12.01	12.03	12.00	12.04	11.91
802.11n	5550	110	12.26	12.17	12.18	12.07	12.10	12.04	12.14	12.06
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	12.61	12.50	12.42	12.41	12.34	12.34	12.41	12.25
802.11n	5755	151	12.20	12.18	12.01	12.11	11.95	11.99	11.91	11.92
802.11n	5795	159	12.24	12.24	12.10	12.21	12.05	12.06	12.11	12.04

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 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 and 40 MHz) 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 reported 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 bolded data rate and channel above were tested for SAR.



Figure 9-2
Power Measurement Setup

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10 LTE POWER REDUCTION

10.1 Introduction to LTE Power Reduction

This device is capable of Simultaneous Voice and LTE (SVLTE) calls, with the voice call supported by a CDMA 1x-RTT transmitter and the data connection supported by a separate LTE transmitter. A LTE power reduction scheme is applied during a LTE connection operating simultaneously with 1x-RTT voice calls. The maximum transmit power of LTE is limited depending on the CDMA 1x voice transmit power level. When CDMA 1x Voice is operating at a certain range of high power levels, the maximum LTE transmit power is limited. When CDMA 1x Voice transmit power is below a certain threshold transmit power level, LTE can transmit at the maximum power. Target levels of power reduction and CDMA voice threshold levels are provided in Table 10-1.

**Table 10-1
SVLTE Power Reduction Scheme**

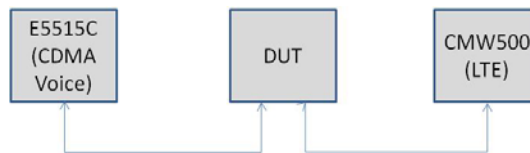
Mode	CDMA Current Voice Power for BC0 & BC1 (in dBm)	LTE Max Power for B13 (in dBm)
SVLTE	$P < 18.7$	23.2
	$P \geq 18.7$	19.2

10.2 Output Power Verification



Per KDB Publication 941225 D05v02 Section 4.4, output powers were measured in SVLTE mode to determine that the power reduction mechanism was operating reliably and consistently. The power reduction was investigated by simultaneously connecting the device to both LTE and CDMA base station simulators. LTE output powers were measured through conducted RF connections by first connecting the device in a LTE data call and subsequently a CDMA 1x-RTT call. CDMA powers were controlled by configuring the CDMA base station simulator to active bits. The LTE output power was monitored while changing the cell output power level.

The power reduction targets and threshold level described in **Table 10-1** were confirmed. Please see results in **Table 10-2**.

Per the FCC change document for this device, the mechanism for SVLTE power reduction remains the same as the original certified device. Therefore, the output power verification remains the same as the original device certification.



**Figure 10-1
SVLTE Conducted Test Setup Diagram**



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**Table 10-2
SVLTE Power Reduction Verification Results**

BC0 1x-RTT CDMA Voice Channel	BC0 1x-RTT CDMA Voice Tx(dBm)	LTE Band 13 Conducted Power (dBm)											
		QPSK 1 RB 0 RB Offset	QPSK 1 RB 25 RB Offset	QPSK 1 RB 49 RB Offset	QPSK 25 RB 0 RB Offset	QPSK 25 RB 12 RB Offset	QPSK 50 RB 0 RB Offset	16QAM 1 RB 0 RB Offset	16QAM 1 RB 25 RB Offset	16QAM 1 RB 49 RB Offset	16QAM 25 RB 0 RB Offset	16QAM 25 RB 12 RB Offset	16QAM 50 RB 0 RB Offset
1013 (Low)	24.7	19.50	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	20	19.50	19.60	19.60	19.30	19.30	19.33	19.22	19.50	19.50	19.30	19.30	19.30
	19.5	19.50	19.60	19.60	19.30	19.30	19.33	19.22	19.50	19.50	19.30	19.30	19.30
	18	23.50	23.60	23.60	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	17	23.50	23.60	23.60	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	11	23.50	23.60	23.60	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
384 (Mid)	24.7	19.50	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	20	19.50	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	19.5	19.50	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	18	23.50	23.60	23.60	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	17	23.50	23.60	23.60	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	11	23.50	23.60	23.60	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
777 (High)	24.7	19.63	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	20	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	19.5	19.50	19.60	19.60	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	18	23.50	23.60	23.61	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	17	23.50	23.60	23.61	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	11	23.50	23.60	23.61	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
25 (Low)	24.7	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	20	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	19.5	19.60	19.60	19.60	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	18	23.60	23.60	23.65	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	17	23.60	23.60	23.65	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	11	23.60	23.60	23.68	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
600 (Mid)	24.7	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	20	19.57	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	19.5	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	18	23.60	23.60	23.66	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	17	23.60	23.60	23.66	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	11	23.60	23.60	23.70	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
1175 (High)	24.7	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	20	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	19.5	19.60	19.60	19.70	19.30	19.30	19.30	19.22	19.50	19.50	19.30	19.30	19.30
	18	23.65	23.60	23.65	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	17	23.65	23.60	23.65	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70
	11	23.66	23.60	23.68	22.50	22.50	22.60	22.50	22.50	22.50	21.60	21.70	21.70

10.3 SVLTE SAR Testing Procedures

Per KDB 941225 D05v02 Section 4.4 B), SAR testing was additionally performed at the reduced CDMA and LTE power levels with respect to the simultaneous transmission scenarios. Additional samples were tuned to fixed reduced power levels to represent the SVLTE condition in a standalone environment. While the power reduction mechanism is activated at the CDMA Voice power level of 18.7 dBm, simultaneous SAR summations of maximum power LTE were evaluated at this reduced fixed CDMA voice power level. SAR was additionally evaluated at reduced power LTE levels to perform simultaneous SAR analysis when CDMA voice is at maximum power.

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10.3.1 Reduced LTE Band 13 Conducted Powers

Table 10-3
Reduced LTE Band 13 Conducted Powers – 10 MHz Bandwidth



	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	782.0	23230	10	QPSK	1	0	19.34	0	0
	782.0	23230	10	QPSK	1	25	19.60	0	0
	782.0	23230	10	QPSK	1	49	19.56	0	0
	782.0	23230	10	QPSK	25	0	19.56	0	0-1
	782.0	23230	10	QPSK	25	12	19.47	0	0-1
	782.0	23230	10	QPSK	25	25	19.39	0	0-1
	782.0	23230	10	QPSK	50	0	19.38	0	0-1
	782.0	23230	10	16QAM	1	0	19.18	0	0-1
	782.0	23230	10	16QAM	1	25	19.45	0	0-1
	782.0	23230	10	16QAM	1	49	19.54	0	0-1
	782.0	23230	10	16QAM	25	0	19.64	0	0-2
	782.0	23230	10	16QAM	25	12	19.49	0	0-2
	782.0	23230	10	16QAM	25	25	19.41	0	0-2
	782.0	23230	10	16QAM	50	0	19.28	0	0-2

LTE Notes:

1. Please refer to Section 8.4.4 for LTE testing requirements per FCC KDB 941225 D05.
2. The bolded powers were tested for SAR.



Figure 10-2
Power Measurement Setup

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10.3.2 Fixed CDMA Conducted Powers

**Table 10-4
Fixed CDMA Conducted Powers**

Band	Channel	Rule Part	Frequency	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	RC1	RC3	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	1013	22H	824.7	18.74	18.90	18.86	18.85	N/A	N/A
	384	22H	836.52	18.89	18.93	18.84	18.87	N/A	N/A
	777	22H	848.31	18.81	18.85	18.91	18.84	N/A	N/A
PCS	25	24E	1851.25	18.68	18.64	18.64	18.70	N/A	N/A
	600	24E	1880	18.58	18.59	18.60	18.71	N/A	N/A
	1175	24E	1908.75	18.66	18.67	18.62	18.62	N/A	N/A

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

Note: There is no power reduction applied to the CDMA Voice modes, however the device with output powers represented in the table above was tuned down (for SAR Test purposes only) to analyze simultaneous SAR scenarios in the SVLTE condition where LTE is operating at maximum output power in conjunction with a lower CDMA voice level (see Table 10-1).

Per KDB Publication 941225 D01v02:

1. Head SAR was tested with SO55 RC3. SO55 RC1 was not required since the average output power was not more than 0.25 dB than the SO55 RC3 powers.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers.
3. CDMA 1x-RTT SAR was required to be evaluated for Hotspot exposure conditions to support simultaneous transmission capabilities.



**Figure 10-3
Power Measurement Setup**

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11 SYSTEM VERIFICATION

11.1 Tissue Verification

**Table 11-1
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
1/16/2013	740H	22.7	725	0.848	40.97	0.888	42.033	-4.50%	-2.53%
			740	0.851	40.45	0.889	41.953	-4.27%	-3.58%
			755	0.881	40.47	0.891	41.876	-1.12%	-3.36%
			770	0.863	40.35	0.892	41.806	-3.25%	-3.48%
			785	0.896	40.36	0.894	41.735	0.22%	-3.29%
1/15/2013	835H	23.1	820	0.904	41.42	0.898	41.571	0.67%	-0.36%
			835	0.917	41.31	0.900	41.500	1.89%	-0.46%
			850	0.934	41.11	0.916	41.500	1.97%	-0.94%
1/17/2013	1900H	21.9	1850	1.331	38.56	1.400	40.000	-4.93%	-3.60%
			1880	1.353	38.33	1.400	40.000	-3.36%	-4.18%
			1910	1.391	38.24	1.400	40.000	-0.64%	-4.40%
1/14/2013	2450H	23.7	2401	1.743	39.81	1.758	39.298	-0.85%	1.30%
			2450	1.800	39.73	1.800	39.200	0.00%	1.35%
			2499	1.851	39.45	1.852	39.135	-0.05%	0.80%
1/10/2013	5200H-5800H	23.5	5200	4.651	35.86	4.660	36.000	-0.19%	-0.39%
			5220	4.668	35.71	4.680	35.980	-0.26%	-0.75%
			5300	4.869	35.42	4.760	35.900	2.29%	-1.34%
			5320	4.837	35.51	4.780	35.880	1.19%	-1.03%
			5600	5.117	34.82	5.070	35.500	0.93%	-1.92%
			5700	5.316	34.52	5.170	35.400	2.82%	-2.49%
			5800	5.447	34.09	5.270	35.300	3.36%	-3.43%
			5825	5.477	34.24	5.296	35.275	3.42%	-2.93%
1/15/2013	740B	23.8	725	0.937	56.66	0.961	55.629	-2.50%	1.85%
			740	0.950	56.44	0.963	55.570	-1.35%	1.57%
			755	0.975	56.12	0.964	55.512	1.14%	1.10%
			770	0.972	56.29	0.965	55.453	0.73%	1.51%
			785	0.997	55.87	0.966	55.395	3.21%	0.86%
1/10/2013	835B	23.8	820	0.940	53.31	0.969	55.258	-2.99%	-3.53%
			835	0.955	53.15	0.970	55.200	-1.55%	-3.71%
			850	0.969	53.00	0.988	55.154	-1.92%	-3.91%
1/21/2013	835B	22.2	820	0.979	55.46	0.969	55.258	1.03%	0.37%
			835	0.984	55.10	0.970	55.200	1.44%	-0.18%
			850	0.991	54.85	0.988	55.154	0.30%	-0.55%
1/10/2013	1900B	20.9	1850	1.520	51.98	1.520	53.300	0.00%	-2.48%
			1880	1.575	51.88	1.520	53.300	3.62%	-2.66%
			1910	1.594	51.64	1.520	53.300	4.87%	-3.11%
1/17/2013	1900B	22.8	1850	1.478	53.24	1.520	53.300	-2.76%	-0.11%
			1880	1.492	53.20	1.520	53.300	-1.84%	-0.19%
			1910	1.509	53.07	1.520	53.300	-0.72%	-0.43%
1/15/2013	2450B	22.9	2401	1.950	50.45	1.903	52.765	2.47%	-4.39%
			2450	2.016	50.37	1.950	52.700	3.38%	-4.42%
			2499	2.072	50.10	2.019	52.638	2.63%	-4.82%
1/14/2013	5200B-5800B	23.4	5200	5.248	47.65	5.299	49.014	-0.96%	-2.78%
			5220	5.304	47.62	5.323	48.987	-0.36%	-2.79%
			5300	5.414	47.40	5.416	48.851	-0.04%	-2.97%
			5320	5.431	47.34	5.439	48.607	-0.15%	-2.61%
			5600	5.862	46.64	5.766	48.444	1.66%	-3.72%
			5700	6.016	46.43	5.880	48.275	2.31%	-3.82%
			5800	6.170	46.20	6.000	48.200	2.83%	-4.15%
			5825	6.204	46.13	6.029	48.132	2.90%	-4.16%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per IEEE 1528 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

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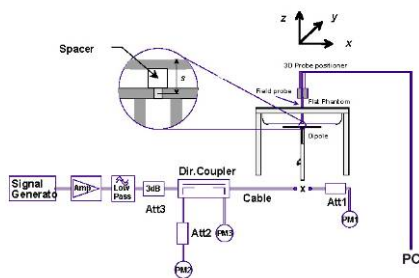
11.2 Test System Verification

Prior to SAR assessment, the system is verified to $\pm 10\%$ of the SAR measurement on the reference dipole at the time of calibration by the calibration facility.

**Table 11-2
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 (%)
750	HEAD	01/16/2013	23.8	23.4	0.060	1054	3288	0.475	8.520	7.917	-7.08%
835	HEAD	01/15/2013	23.7	23.3	0.100	4d026	3209	0.937	9.390	9.370	-0.21%
1900	HEAD	01/17/2013	23.3	22.7	0.100	5d148	3213	3.910	40.500	39.100	-3.46%
2450	HEAD	01/14/2013	24.7	24.2	0.040	719	3022	2.260	52.700	56.500	7.21%
5200	HEAD	01/10/2013	23.3	22.3	0.100	1007	3561	8.120	79.800	81.200	1.75%
5300	HEAD	01/10/2013	23.4	22.3	0.100	1007	3561	7.890	83.100	78.900	-5.05%
5600	HEAD	01/10/2013	23.5	22.4	0.100	1007	3561	7.940	84.500	79.400	-6.04%
5800	HEAD	01/10/2013	23.6	22.8	0.100	1007	3561	7.760	79.800	77.600	-2.76%
750	BODY	01/15/2013	24.3	23.8	0.060	1054	3288	0.501	8.840	8.350	-5.54%
835	BODY	01/10/2013	23.8	23.3	0.100	4d026	3209	0.994	9.580	9.940	3.76%
835	BODY	01/21/2013	23.3	20.3	0.100	4d047	3288	0.971	9.410	9.710	3.19%
1900	BODY	01/10/2013	21.5	20.8	0.100	5d148	3213	4.210	39.100	42.100	7.67%
1900	BODY	01/17/2013	24.6	23.7	0.100	5d149	3263	4.080	39.300	40.800	3.82%
2450	BODY	01/15/2013	24.2	22.7	0.0398	719	3022	2.170	51.600	54.523	5.66%
5200	BODY	01/14/2013	24.2	22.5	0.100	1007	3561	7.210	73.300	72.100	-1.64%
5300	BODY	01/14/2013	24.3	22.6	0.100	1007	3561	7.870	75.600	78.700	4.10%
5600	BODY	01/14/2013	24.3	22.9	0.100	1007	3561	8.180	80.000	81.800	2.25%
5800	BODY	01/14/2013	24.5	22.9	0.100	1007	3561	7.290	74.300	72.900	-1.88%

Note: Full system validation status and results can be found in Appendix E.



**Figure 11-1
System Verification Setup Diagram**



**Figure 11-2
System Verification Setup Photo**

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12 SAR DATA SUMMARY



12.1 Standalone Head SAR Data

**Table 12-1
Cell. CDMA/EVDO Head SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.52	384	Cell. CDMA	RC3 / SO55	24.7	24.45	-0.15	Right	Cheek	Standard	6457	1:1	0.374	1.059	0.396	
836.52	384	Cell. CDMA	RC3 / SO55	24.7	24.45	0.00	Right	Tilt	Standard	6457	1:1	0.300	1.059	0.318	
836.52	384	Cell. CDMA	RC3 / SO55	24.7	24.45	-0.14	Left	Cheek	Standard	6457	1:1	0.511	1.059	0.541	
836.52	384	Cell. CDMA	RC3 / SO55	24.7	24.45	-0.07	Left	Cheek	Wireless Charging	6457	1:1	0.552	1.059	0.585	A2
836.52	384	Cell. CDMA	RC3 / SO55	24.7	24.45	-0.01	Left	Tilt	Standard	6457	1:1	0.260	1.059	0.275	
836.52	384	Cell. CDMA	RC3 / SO55	19.2	18.93	-0.21	Right	Cheek	Standard	6473	1:1	0.116	1.064	0.123	
836.52	384	Cell. CDMA	RC3 / SO55	19.2	18.93	-0.01	Right	Tilt	Standard	6473	1:1	0.095	1.064	0.101	
836.52	384	Cell. CDMA	RC3 / SO55	19.2	18.93	0.01	Left	Cheek	Standard	6473	1:1	0.174	1.064	0.185	
836.52	384	Cell. CDMA	RC3 / SO55	19.2	18.93	0.03	Left	Cheek	Wireless Charging	6473	1:1	0.171	1.064	0.182	
836.52	384	Cell. CDMA	RC3 / SO55	19.2	18.93	-0.03	Left	Tilt	Standard	6473	1:1	0.097	1.064	0.104	
836.52	384	Cell. CDMA	EVDO Rev. A	24.7	24.45	0.09	Right	Cheek	Standard	6457	1:1	0.303	1.059	0.321	
836.52	384	Cell. CDMA	EVDO Rev. A	24.7	24.45	0.07	Right	Tilt	Standard	6457	1:1	0.241	1.059	0.255	
836.52	384	Cell. CDMA	EVDO Rev. A	24.7	24.45	0.10	Left	Cheek	Standard	6457	1:1	0.389	1.059	0.412	
836.52	384	Cell. CDMA	EVDO Rev. A	24.7	24.45	0.04	Left	Cheek	Wireless Charging	6457	1:1	0.538	1.059	0.570	
836.52	384	Cell. CDMA	EVDO Rev. A	24.7	24.45	0.09	Left	Tilt	Standard	6457	1:1	0.206	1.059	0.218	
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 12-2
PCS CDMA/EVDO Head SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.35	0.10	Right	Cheek	Standard	6457	1:1	0.270	1.084	0.293	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.35	0.10	Right	Tilt	Standard	6457	1:1	0.202	1.084	0.219	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.35	0.05	Left	Cheek	Standard	6457	1:1	0.395	1.084	0.428	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.35	0.00	Left	Cheek	Wireless Charging	6457	1:1	0.326	1.084	0.353	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.35	-0.03	Left	Tilt	Standard	6457	1:1	0.208	1.084	0.225	
1880.00	600	PCS CDMA	RC3 / SO55	19.2	18.59	-0.05	Right	Cheek	Standard	6473	1:1	0.119	1.151	0.137	
1880.00	600	PCS CDMA	RC3 / SO55	19.2	18.59	0.19	Right	Tilt	Standard	6473	1:1	0.090	1.151	0.103	
1880.00	600	PCS CDMA	RC3 / SO55	19.2	18.59	0.01	Left	Cheek	Standard	6473	1:1	0.168	1.151	0.193	
1880.00	600	PCS CDMA	RC3 / SO55	19.2	18.59	0.00	Left	Cheek	Wireless Charging	6473	1:1	0.186	1.151	0.214	
1880.00	600	PCS CDMA	RC3 / SO55	19.2	18.59	0.18	Left	Tilt	Standard	6473	1:1	0.091	1.151	0.105	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.48	0.11	Right	Cheek	Standard	6457	1:1	0.246	1.052	0.259	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.48	0.01	Right	Tilt	Standard	6457	1:1	0.200	1.052	0.210	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.48	0.04	Left	Cheek	Standard	6457	1:1	0.423	1.052	0.445	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.48	-0.02	Left	Cheek	Wireless Charging	6457	1:1	0.431	1.052	0.453	A3
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.48	-0.03	Left	Tilt	Standard	6457	1:1	0.225	1.052	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								



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**Table 12-3
LTE Band 13 Head SAR**

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	0.07	0	Right	Cheek	QPSK	1	25	6465	1:1	0.124	1.035	0.128	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	0.20	1	Right	Cheek	QPSK	25	0	6465	1:1	0.107	1.045	0.112	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	0.03	0	Right	Tilt	QPSK	1	25	6465	1:1	0.081	1.035	0.084	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	0.17	1	Right	Tilt	QPSK	25	0	6465	1:1	0.084	1.045	0.087	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	0.14	0	Left	Cheek	QPSK	1	25	6465	1:1	0.131	1.035	0.136	A1
782.00	23230	Mid	LTE Band 13	10	Wireless Charging	23.7	23.55	0.16	0	Left	Cheek	QPSK	1	25	6465	1:1	0.107	1.035	0.111	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	0.07	1	Left	Cheek	QPSK	25	0	6465	1:1	0.108	1.045	0.113	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	-0.15	0	Left	Tilt	QPSK	1	25	6465	1:1	0.085	1.035	0.087	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	0.13	1	Left	Tilt	QPSK	25	0	6465	1:1	0.072	1.045	0.076	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.13	0	Right	Cheek	QPSK	1	25	6481	1:1	0.077	1.023	0.079	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.09	0	Right	Cheek	QPSK	25	0	6481	1:1	0.082	1.033	0.085	
782.00	23230	Mid	LTE Band 13	10	Wireless Charging	19.7	19.56	0.13	0	Right	Cheek	QPSK	25	0	6481	1:1	0.096	1.033	0.100	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.17	0	Right	Tilt	QPSK	1	25	6481	1:1	0.051	1.023	0.052	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.07	0	Right	Tilt	QPSK	25	0	6481	1:1	0.056	1.033	0.058	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.14	0	Left	Cheek	QPSK	1	25	6481	1:1	0.069	1.023	0.071	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.13	0	Left	Cheek	QPSK	25	0	6481	1:1	0.071	1.033	0.073	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.16	0	Left	Tilt	QPSK	1	25	6481	1:1	0.046	1.023	0.047	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.11	0	Left	Tilt	QPSK	25	0	6481	1:1	0.048	1.033	0.049	
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 12-4
DTS Head SAR**

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.												(W/kg)		(W/kg)		
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.02	Right	Cheek	Standard	6556	1	1:1	0.232	1.191	0.276		
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.00	Right	Tilt	Standard	6556	1	1:1	0.193	1.191	0.230		
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.03	Left	Cheek	Standard	6556	1	1:1	0.356	1.191	0.424		
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.03	Left	Cheek	Wireless Charging	6556	1	1:1	0.393	1.191	0.468	A4	
2412	1	IEEE 802.11b	DSSS	17.0	16.24	-0.02	Left	Tilt	Standard	6556	1	1:1	0.249	1.191	0.297		
5825	165	IEEE 802.11a	OFDM	14.0	13.19	0.13	Right	Cheek	Standard	6556	6	1:1	0.003	1.205	0.003		
5825	165	IEEE 802.11a	OFDM	14.0	13.19	0.17	Right	Tilt	Standard	6556	6	1:1	0.006	1.205	0.008		
5825	165	IEEE 802.11a	OFDM	14.0	13.19	0.05	Left	Cheek	Standard	6556	6	1:1	0.023	1.205	0.027	A6	
5825	165	IEEE 802.11a	OFDM	14.0	13.19	0.03	Left	Tilt	Standard	6556	6	1:1	0.015	1.205	0.018		
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 12-5
NII Head SAR**



MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	14.0	12.99	0.21	Right	Cheek	Standard	6556	6	1:1	0.086	1.262	0.108	
5220	44	IEEE 802.11a	OFDM	14.0	12.99	0.06	Right	Tilt	Standard	6556	6	1:1	0.080	1.262	0.101	
5220	44	IEEE 802.11a	OFDM	14.0	12.99	0.17	Left	Cheek	Standard	6556	6	1:1	0.159	1.262	0.201	A5
5220	44	IEEE 802.11a	OFDM	14.0	12.99	0.14	Left	Cheek	Wireless Charging	6556	6	1:1	0.124	1.262	0.156	
5220	44	IEEE 802.11a	OFDM	14.0	12.99	0.17	Left	Tilt	Standard	6556	6	1:1	0.128	1.262	0.162	
5320	64	IEEE 802.11a	OFDM	14.0	13.19	0.07	Right	Cheek	Standard	6556	6	1:1	0.075	1.205	0.090	
5320	64	IEEE 802.11a	OFDM	14.0	13.19	0.12	Right	Tilt	Standard	6556	6	1:1	0.072	1.205	0.087	
5320	64	IEEE 802.11a	OFDM	14.0	13.19	0.08	Left	Cheek	Standard	6556	6	1:1	0.137	1.205	0.165	
5320	64	IEEE 802.11a	OFDM	14.0	13.19	0.16	Left	Tilt	Standard	6556	6	1:1	0.107	1.205	0.129	
5700	140	IEEE 802.11a	OFDM	14.0	13.26	0.06	Right	Cheek	Standard	6556	6	1:1	0.022	1.186	0.025	
5700	140	IEEE 802.11a	OFDM	14.0	13.26	0.12	Right	Tilt	Standard	6556	6	1:1	0.022	1.186	0.025	
5700	140	IEEE 802.11a	OFDM	14.0	13.26	0.17	Left	Cheek	Standard	6556	6	1:1	0.036	1.186	0.042	
5700	140	IEEE 802.11a	OFDM	14.0	13.26	0.04	Left	Tilt	Standard	6556	6	1:1	0.027	1.186	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								

12.2 Standalone Body-Worn SAR Data

**Table 12-6
CDMA/EVDO Body-Worn SAR Data**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
824.70	1013	Cell. CDMA	TDSO / SO32	24.7	24.42	-0.04	10 mm	Standard	6457	1:1	back	0.924	1.067	0.986	A8
836.52	384	Cell. CDMA	TDSO / SO32	24.7	24.53	0.03	10 mm	Standard	6457	1:1	back	0.864	1.040	0.899	
848.31	777	Cell. CDMA	TDSO / SO32	24.7	24.54	-0.11	10 mm	Standard	6457	1:1	back	0.804	1.038	0.835	
824.70	1013	Cell. CDMA	TDSO / SO32	24.7	24.42	-0.01	10 mm	Wireless Charging	6457	1:1	back	0.573	1.067	0.611	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	-0.04	10 mm	Standard	6473	1:1	back	0.192	1.079	0.207	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	0.01	10 mm	Wireless Charging	6473	1:1	back	0.174	1.079	0.188	
1851.25	25	PCS CDMA	TDSO / SO32	24.7	24.32	0.00	10 mm	Standard	6457	1:1	back	0.810	1.091	0.884	A10
1880.00	600	PCS CDMA	TDSO / SO32	24.7	24.35	-0.01	10 mm	Standard	6457	1:1	back	0.784	1.084	0.850	
1908.75	1175	PCS CDMA	TDSO / SO32	24.7	24.38	0.02	10 mm	Standard	6457	1:1	back	0.651	1.076	0.700	
1851.25	25	PCS CDMA	TDSO / SO32	24.7	24.32	-0.04	10 mm	Wireless Charging	6457	1:1	back	0.521	1.091	0.568	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	0.04	10 mm	Standard	6473	1:1	back	0.326	1.119	0.365	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	0.05	10 mm	Wireless Charging	6473	1:1	back	0.263	1.119	0.294	
1851.25	25	PCS CDMA	TDSO / SO32	24.7	24.32	0.01	10 mm	Standard	6457	1:1	back	0.745	1.091	0.813	
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: Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. The repeated SAR measurement for PCS back side is highlighted in blue in the table above. Please see Section 14 for variability analysis.

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**Table 12-7
LTE Body-Worn SAR**



MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #	
MHz	Ch.																			
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	-0.18	0	6465	QPSK	1	25	10 mm	back	1:1	0.356	1.035	0.368	A7
782.00	23230	Mid	LTE Band 13	10	Wireless Charging	23.7	23.55	-0.07	0	6465	QPSK	1	25	10 mm	back	1:1	0.222	1.035	0.230	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	-0.10	1	6465	QPSK	25	0	10 mm	back	1:1	0.308	1.045	0.322	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.18	0	6481	QPSK	1	25	10 mm	back	1:1	0.143	1.023	0.146	
782.00	23230	Mid	LTE Band 13	10	Wireless Charging	19.7	19.60	0.05	0	6481	QPSK	1	25	10 mm	back	1:1	0.085	1.023	0.087	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	-0.03	0	6481	QPSK	25	0	10 mm	back	1:1	0.140	1.033	0.145	
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 12-8
DTS Body-Worn SAR**

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #	
MHz	Ch.																
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.16	10 mm	Standard	6556	1	back	1:1	0.174	1.191	0.207	A11	
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.16	10 mm	Wireless Charging	6556	1	back	1:1	0.102	1.191	0.121		
5825	165	IEEE 802.11a	OFDM	14.0	13.19	0.12	10 mm	Standard	6556	6	back	1:1	0.032	1.205	0.038	A13	
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 12-9
NII Body-Worn SAR**

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #	
MHz	Ch.																
5220	44	IEEE 802.11a	OFDM	14.0	12.99	0.05	10 mm	Standard	6556	6	back	1:1	0.163	1.262	0.206	A12	
5220	44	IEEE 802.11a	OFDM	14.0	12.99	-0.12	10 mm	Wireless Charging	6556	6	back	1:1	0.101	1.262	0.127		
5320	64	IEEE 802.11a	OFDM	14.0	13.19	-0.03	10 mm	Standard	6556	6	back	1:1	0.139	1.205	0.167		
5700	140	IEEE 802.11a	OFDM	14.0	13.26	0.12	10 mm	Standard	6556	6	back	1:1	0.052	1.186	0.062		
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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12.3 Standalone Wireless Router SAR Data

Table 12-10
CDMA Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)	Factor	(W/kg)	
824.70	1013	Cell. CDMA	TDSO / SO32	24.7	24.42	-0.04	10 mm	Standard	6457	1:1	back	0.924	1.067	0.986	
836.52	384	Cell. CDMA	TDSO / SO32	24.7	24.53	0.03	10 mm	Standard	6457	1:1	back	0.864	1.040	0.899	
848.31	777	Cell. CDMA	TDSO / SO32	24.7	24.54	-0.11	10 mm	Standard	6457	1:1	back	0.804	1.038	0.835	
824.70	1013	Cell. CDMA	TDSO / SO32	24.7	24.42	-0.01	10 mm	Wireless Charging	6457	1:1	back	0.573	1.067	0.611	
836.52	384	Cell. CDMA	TDSO / SO32	24.7	24.53	-0.06	10 mm	Standard	6457	1:1	front	0.506	1.040	0.526	
836.52	384	Cell. CDMA	TDSO / SO32	24.7	24.53	0.05	10 mm	Standard	6457	1:1	bottom	0.129	1.040	0.134	
836.52	384	Cell. CDMA	TDSO / SO32	24.7	24.53	-0.12	10 mm	Standard	6457	1:1	left	0.680	1.040	0.707	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	-0.04	10 mm	Standard	6473	1:1	back	0.192	1.079	0.207	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	0.01	10 mm	Wireless Charging	6473	1:1	back	0.174	1.079	0.188	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	0.04	10 mm	Standard	6473	1:1	front	0.131	1.079	0.141	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	0.05	10 mm	Standard	6473	1:1	bottom	0.035	1.079	0.038	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	0.01	10 mm	Standard	6473	1:1	left	0.192	1.079	0.207	
836.52	384	Cell. CDMA	TDSO / SO32	19.2	18.87	0.14	10 mm	Wireless Charging	6473	1:1	left	0.189	1.079	0.204	
824.70	1013	Cell. CDMA	EVDO Rev. 0	24.7	24.53	-0.03	10 mm	Standard	6457	1:1	back	1.080	1.040	1.123	A9
836.52	384	Cell. CDMA	EVDO Rev. 0	24.7	24.52	-0.01	10 mm	Standard	6457	1:1	back	0.977	1.042	1.018	
848.31	777	Cell. CDMA	EVDO Rev. 0	24.7	24.60	0.03	10 mm	Standard	6457	1:1	back	0.866	1.023	0.886	
824.70	1013	Cell. CDMA	EVDO Rev. 0	24.7	24.52	-0.03	10 mm	Wireless Charging	6457	1:1	back	0.733	1.042	0.764	
836.52	384	Cell. CDMA	EVDO Rev. 0	24.7	24.52	-0.01	10 mm	Standard	6457	1:1	front	0.620	1.042	0.646	
836.52	384	Cell. CDMA	EVDO Rev. 0	24.7	24.52	-0.04	10 mm	Standard	6457	1:1	bottom	0.171	1.042	0.178	
836.52	384	Cell. CDMA	EVDO Rev. 0	24.7	24.52	-0.02	10 mm	Standard	6457	1:1	left	0.554	1.042	0.577	
824.70	1013	Cell. CDMA	EVDO Rev. 0	24.7	24.53	0.18	10 mm	Standard	6457	1:1	back	1.030	1.040	1.071	
1851.25	25	PCS CDMA	TDSO / SO32	24.7	24.32	0.00	10 mm	Standard	6457	1:1	back	0.810	1.091	0.884	A10
1880.00	600	PCS CDMA	TDSO / SO32	24.7	24.35	-0.01	10 mm	Standard	6457	1:1	back	0.784	1.084	0.850	
1908.75	1175	PCS CDMA	TDSO / SO32	24.7	24.38	0.02	10 mm	Standard	6457	1:1	back	0.651	1.076	0.700	
1851.25	25	PCS CDMA	TDSO / SO32	24.7	24.32	-0.04	10 mm	Wireless Charging	6457	1:1	back	0.521	1.091	0.568	
1880.00	600	PCS CDMA	TDSO / SO32	24.7	24.35	0.01	10 mm	Standard	6457	1:1	front	0.294	1.084	0.319	
1880.00	600	PCS CDMA	TDSO / SO32	24.7	24.35	-0.06	10 mm	Standard	6457	1:1	bottom	0.325	1.084	0.352	
1880.00	600	PCS CDMA	TDSO / SO32	24.7	24.35	-0.07	10 mm	Standard	6457	1:1	left	0.236	1.084	0.256	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	0.04	10 mm	Standard	6473	1:1	back	0.326	1.119	0.365	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	0.05	10 mm	Wireless Charging	6473	1:1	back	0.263	1.119	0.294	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	0.01	10 mm	Standard	6473	1:1	front	0.165	1.119	0.185	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	-0.08	10 mm	Standard	6473	1:1	bottom	0.157	1.119	0.176	
1880.00	600	PCS CDMA	TDSO / SO32	19.2	18.71	0.12	10 mm	Standard	6473	1:1	left	0.065	1.119	0.073	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.50	-0.02	10 mm	Standard	6457	1:1	back	0.703	1.047	0.736	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.50	-0.08	10 mm	Wireless Charging	6457	1:1	back	0.550	1.047	0.576	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.50	0.01	10 mm	Standard	6457	1:1	front	0.346	1.047	0.362	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.50	-0.07	10 mm	Standard	6457	1:1	bottom	0.261	1.047	0.273	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.50	-0.07	10 mm	Standard	6457	1:1	left	0.235	1.047	0.246	
1851.25	25	PCS CDMA	TDSO / SO32	24.7	24.32	0.01	10 mm	Standard	6457	1:1	back	0.745	1.091	0.813	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Body								
Spatial Peak							1.6 W/kg (mW/g)								
Uncontrolled Exposure/General Population							averaged over 1 gram								

Note: Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements for Cell. EVDO Rev. 0 back side and PCS TDSO / SO32 back side are highlighted in blue in the table above. Please see Section 14 for variability analysis.



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**Table 12-11
LTE Band 13 Hotspot SAR**

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.	High															(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	-0.18	0	6465	QPSK	1	25	10 mm	back	1:1	0.356	1.035	0.368	A7
782.00	23230	Mid	LTE Band 13	10	Wireless Charging	23.7	23.55	-0.07	0	6465	QPSK	1	25	10 mm	back	1:1	0.222	1.035	0.230	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	-0.10	1	6465	QPSK	25	0	10 mm	back	1:1	0.308	1.045	0.322	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	0.00	0	6465	QPSK	1	25	10 mm	front	1:1	0.241	1.035	0.249	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	0.11	1	6465	QPSK	25	0	10 mm	front	1:1	0.224	1.045	0.234	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	0.01	0	6465	QPSK	1	25	10 mm	bottom	1:1	0.137	1.035	0.142	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	-0.01	1	6465	QPSK	25	0	10 mm	bottom	1:1	0.103	1.045	0.108	
782.00	23230	Mid	LTE Band 13	10	Standard	23.7	23.55	0.08	0	6465	QPSK	1	25	10 mm	right	1:1	0.153	1.035	0.158	
782.00	23230	Mid	LTE Band 13	10	Standard	22.7	22.51	0.00	1	6465	QPSK	25	0	10 mm	right	1:1	0.134	1.045	0.140	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.18	0	6481	QPSK	1	25	10 mm	back	1:1	0.143	1.023	0.146	
782.00	23230	Mid	LTE Band 13	10	Wireless Charging	19.7	19.60	0.05	0	6481	QPSK	1	25	10 mm	back	1:1	0.085	1.023	0.087	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	-0.03	0	6481	QPSK	25	0	10 mm	back	1:1	0.140	1.033	0.145	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.09	0	6481	QPSK	1	25	10 mm	front	1:1	0.085	1.023	0.087	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.04	0	6481	QPSK	25	0	10 mm	front	1:1	0.082	1.033	0.085	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.06	0	6481	QPSK	1	25	10 mm	bottom	1:1	0.051	1.023	0.052	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.01	0	6481	QPSK	25	0	10 mm	bottom	1:1	0.048	1.033	0.049	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.60	0.07	0	6481	QPSK	1	25	10 mm	right	1:1	0.108	1.023	0.110	
782.00	23230	Mid	LTE Band 13	10	Standard	19.7	19.56	0.01	0	6481	QPSK	25	0	10 mm	right	1:1	0.108	1.033	0.112	
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 12-12
WLAN Hotspot SAR**

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.16	10 mm	Standard	6556	1	back	1:1	0.174	1.191	0.207	A11
2412	1	IEEE 802.11b	DSSS	17.0	16.24	0.16	10 mm	Wireless Charging	6556	1	back	1:1	0.102	1.191	0.121	
2412	1	IEEE 802.11b	DSSS	17.0	16.24	-0.12	10 mm	Standard	6556	1	front	1:1	0.087	1.191	0.103	
2412	1	IEEE 802.11b	DSSS	17.0	16.24	-0.11	10 mm	Standard	6556	1	top	1:1	0.130	1.191	0.155	
2412	1	IEEE 802.11b	DSSS	17.0	16.24	-0.06	10 mm	Standard	6556	1	right	1:1	0.092	1.191	0.110	
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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12.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC/OET Bulletin 65, Supplement C [June 2001] and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. 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.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. 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.
7. Per FCC KDB Publication 648474 D04v01, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 14 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.6 for more details).
10. This DUT may be used with a standard battery cover or with an optional wireless charging battery cover. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover and then repeated with the wireless charging battery cover for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. Since reported SAR did not exceed 1.2 W/kg, additional testing with the wireless charging battery cover was not required.

CDMA Notes:

1. Head SAR for CDMA2000 mode was tested under RC3/SO55 per FCC KDB Publication 941225 D01v02.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. EVDO and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers, per FCC KDB Publication 941225 D01v02.
3. CDMA Wireless Router SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01 procedures for data devices. If the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, then EVDO Rev. A SAR is not required. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rev. 0. 1x-RTT CDMA hotspot was additionally evaluated for SAR to support simultaneous transmission scenarios.
4. Head SAR was additionally evaluated using EVDO Rev. A to determine compliance for VoIP operations.
5. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output

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power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.



6. CDMA 1x-RTT Hotspot SAR was additionally evaluated for Hotspot exposure to support simultaneous capabilities

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02. Implementation of the general test procedures can be found in Section 8.4.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 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 D01v01r02 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 and 40 MHz bandwidths) 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.
3. When Hotspot is enabled, all 5 GHz bands are disabled. Therefore no 5 GHz WIFI Wireless Router SAR Data was required.
4. WIFI transmission was verified using an uncalibrated spectrum analyzer.
5. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required.

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13 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

13.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 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.

13.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(\text{GHz})}}{7.5} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance, mm}}$$

**Table 13-1
Estimated SAR**

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2441	11.70	10	0.312

Note:



1. Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission.
2. The estimated SAR results were determined according to FCC KDB 447498 D01v05.

13.3 Head SAR Simultaneous Transmission Analysis

**Table 13-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)**

Simult Tx	Configuration	Cell. CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.396	0.276	0.672	Head SAR	Right Cheek	0.293	0.276	0.569
	Right Tilt	0.318	0.230	0.548		Right Tilt	0.219	0.230	0.449
	Left Cheek	0.585	0.468	1.053		Left Cheek	0.428	0.468	0.896
	Left Tilt	0.275	0.297	0.572		Left Tilt	0.225	0.297	0.522

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.128	0.276	0.404
	Right Tilt	0.087	0.230	0.317
	Left Cheek	0.136	0.468	0.604
	Left Tilt	0.087	0.297	0.384

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Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.321	0.276	0.597	Head SAR	Right Cheek	0.259	0.276	0.535
	Right Tilt	0.255	0.230	0.485		Right Tilt	0.210	0.230	0.440
	Left Cheek	0.570	0.468	1.038		Left Cheek	0.453	0.468	0.921
	Left Tilt	0.218	0.297	0.515		Left Tilt	0.237	0.297	0.534

Table 13-3
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	Cell. CDMA SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS CDMA SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.396	0.108	0.504	Head SAR	Right Cheek	0.293	0.108	0.401
	Right Tilt	0.318	0.101	0.419		Right Tilt	0.219	0.101	0.320
	Left Cheek	0.585	0.201	0.786		Left Cheek	0.428	0.201	0.629
	Left Tilt	0.275	0.162	0.437		Left Tilt	0.225	0.162	0.387

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.128	0.108	0.236
	Right Tilt	0.087	0.101	0.188
	Left Cheek	0.136	0.201	0.337
	Left Tilt	0.087	0.162	0.249

Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.321	0.108	0.429	Head SAR	Right Cheek	0.259	0.108	0.367
	Right Tilt	0.255	0.101	0.356		Right Tilt	0.210	0.101	0.311
	Left Cheek	0.570	0.201	0.771		Left Cheek	0.453	0.201	0.654
	Left Tilt	0.218	0.162	0.380		Left Tilt	0.237	0.162	0.399

Note: The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Direct capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

13.4 Body-Worn Simultaneous Transmission Analysis

Table 13-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	CDMA/LTE SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.986	0.207	1.193
Back Side	PCS CDMA	0.884	0.207	1.091
Back Side	LTE Band 13	0.368	0.207	0.575

Note: Per KDB 941225, when the maximum output power of each channel in EVDO is less than 0.25 dB higher than measured in TDSO, body SAR for EVDO is not required. Therefore, 1x-RTT CDMA body-worn SAR summations additionally show compliance for EVDO Rev. A VoIP body-worn simultaneous transmission scenarios.



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Table 13-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	CDMA/LTE SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.986	0.206	1.192
Back Side	PCS CDMA	0.884	0.206	1.090
Back Side	LTE Band 13	0.368	0.206	0.574

Note:

1. The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Direct capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.
2. Per KDB 941225, when the maximum output power of each channel in EVDO is less than 0.25 dB higher than measured in TDSO, body SAR for EVDO is not required. Therefore, 1x-RTT CDMA body-worn SAR summations additionally show compliance for EVDO Rev. A VoIP body-worn simultaneous transmission scenarios.

Table 13-6
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 10 mm)

Configuration	Mode	CDMA/LTE SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.986	0.312	1.298
Back Side	PCS CDMA	0.884	0.312	1.196
Back Side	LTE Band 13	0.368	0.312	0.680

Note:



1. Bluetooth SAR was not required to be measured per FCC KDB 447498. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.
2. Per KDB 941225, when the maximum output power of each channel in EVDO is less than 0.25 dB higher than measured in TDSO, body SAR for EVDO is not required. Therefore, 1x-RTT CDMA body-worn SAR summations additionally show compliance for EVDO Rev. A VoIP body-worn simultaneous transmission scenarios.

13.5 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR (“-”).

Table 13-7
Simultaneous Transmission Scenario (Hotspot at 1.0 cm)

Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.123	0.207	1.330	Body SAR	Back	0.736	0.207	0.943
	Front	0.646	0.103	0.749		Front	0.362	0.103	0.465
	Top	-	0.155	0.155		Top	-	0.155	0.155
	Bottom	0.178	-	0.178		Bottom	0.273	-	0.273
	Right	-	0.110	0.110		Right	-	0.110	0.110
	Left	0.577	-	0.577		Left	0.246	-	0.246
	Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)				
Body SAR	Back		0.368	0.207	0.575				
	Front		0.249	0.103	0.352				
	Top		-	0.155	0.155				
	Bottom		0.142	-	0.142				
	Right		0.158	0.110	0.268				
	Left		-	-	0.000				

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13.6 SVLTE Simultaneous Transmission Scenario Analysis

Table 13-8
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3	1+2	1+2+3
Head SAR	P ≥ 18.7	Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	17.0	1+2	1+2+3
		Right Cheek	0.396	0.100	0.276	0.496	0.772
		Right Tilt	0.318	0.058	0.230	0.376	0.606
		Left Cheek	0.585	0.073	0.468	0.658	1.126
	Left Tilt	0.275	0.049	0.297	0.324	0.621	
	P < 18.7	Maximum Allowed Power (dBm)	19.2	23.7	17.0		
		Right Cheek	0.123	0.128	0.276	0.251	0.527
		Right Tilt	0.101	0.087	0.230	0.188	0.418
		Left Cheek	0.185	0.136	0.468	0.321	0.789
Left Tilt		0.104	0.087	0.297	0.191	0.488	
Head SAR	P ≥ 18.7	Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	17.0	1+2	1+2+3
		Right Cheek	0.293	0.100	0.276	0.393	0.669
		Right Tilt	0.219	0.058	0.230	0.277	0.507
		Left Cheek	0.428	0.073	0.468	0.501	0.969
	Left Tilt	0.225	0.049	0.297	0.274	0.571	
	P < 18.7	Maximum Allowed Power (dBm)	19.2	23.7	17.0		
		Right Cheek	0.137	0.128	0.276	0.265	0.541
		Right Tilt	0.103	0.087	0.230	0.190	0.420
		Left Cheek	0.214	0.136	0.468	0.350	0.818
Left Tilt		0.105	0.087	0.297	0.192	0.489	

Table 13-9
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3	1+2	1+2+3
Head SAR	P ≥ 18.7	Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	14.0	1+2	1+2+3
		Right Cheek	0.396	0.100	0.108	0.496	0.604
		Right Tilt	0.318	0.058	0.101	0.376	0.477
		Left Cheek	0.585	0.073	0.201	0.658	0.859
	Left Tilt	0.275	0.049	0.162	0.324	0.486	
	P < 18.7	Maximum Allowed Power (dBm)	19.2	23.7	14.0		
		Right Cheek	0.123	0.128	0.108	0.251	0.359
		Right Tilt	0.101	0.087	0.101	0.188	0.289
		Left Cheek	0.185	0.136	0.201	0.321	0.522
Left Tilt		0.104	0.087	0.162	0.191	0.353	

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Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3	1+2	1+2+3
Head SAR	P ≥ 18.7	Maximum Allowed Power (dBm)	24.7	19.7	14.0	1+2	1+2+3
		Right Cheek	0.293	0.100	0.108	0.393	0.501
		Right Tilt	0.219	0.058	0.101	0.277	0.378
		Left Cheek	0.428	0.073	0.201	0.501	0.702
		Left Tilt	0.225	0.049	0.162	0.274	0.436
	P < 18.7	Maximum Allowed Power (dBm)	19.2	23.7	14.0		
		Right Cheek	0.137	0.128	0.108	0.265	0.373
		Right Tilt	0.103	0.087	0.101	0.190	0.291
		Left Cheek	0.214	0.136	0.201	0.350	0.551
		Left Tilt	0.105	0.087	0.162	0.192	0.354

Note: The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Direct capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

Table 13-10
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

CDMA Power Level (dBm)	Mode	Configuration	CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3	1+2	1+2+3
P ≥ 18.7		Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	17.0	1+2	1+2+3
	Cell. CDMA	Back Side	0.986	0.146	0.207	1.132	1.339
P < 18.7		Maximum Allowed Power (dBm)	19.2	23.7	17.0		
	Cell. CDMA	Back Side	0.207	0.368	0.207	0.575	0.782
	PCS CDMA	Back Side	0.365	0.368	0.207	0.733	0.940

Table 13-11
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 10 mm)

CDMA Power Level (dBm)	Mode	Configuration	CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3	1+2	1+2+3
P ≥ 18.7		Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	14.0	1+2	1+2+3
	Cell. CDMA	Back Side	0.986	0.146	0.206	1.132	1.338
P < 18.7		Maximum Allowed Power (dBm)	19.2	23.7	14.0		
	Cell. CDMA	Back Side	0.207	0.368	0.206	0.575	0.781
	PCS CDMA	Back Side	0.365	0.368	0.206	0.733	0.939

Note: The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Direct capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.



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Table 13-12
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Body-Worn at 10 mm)



CDMA Power Level (dBm)	Mode	Configuration	CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3	1+2	1+2+3
P ≥ 18.7		Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	11.7	1+2	1+2+3
	Cell. CDMA	Back Side	0.986	0.146	0.312	1.132	1.444
	PCS CDMA	Back Side	0.884	0.146	0.312	1.030	1.342
P < 18.7		Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	19.2	23.7	11.7		
	Cell. CDMA	Back Side	0.207	0.368	0.312	0.575	0.887
	PCS CDMA	Back Side	0.365	0.368	0.312	0.733	1.045

Table 13-13
Simultaneous Transmission Scenario (Hotspot at 10 mm)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			1	2	3		
Body SAR	P ≥ 18.7	Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	17.0		1+2+3
		Back	0.986	0.146	0.207		1.339
		Front	0.526	0.087	0.103		0.716
		Top	-	-	0.155		0.155
		Bottom	0.134	0.052	-		0.186
		Right	-	0.112	0.110		0.222
		Left	0.707	-	-		0.707
	P < 18.7	Maximum Allowed Power (dBm)	19.2	23.7	17.0		
		Back	0.207	0.368	0.207		0.782
		Front	0.141	0.249	0.103		0.493
		Top	-	-	0.155		0.155
		Bottom	0.038	0.142	-		0.180
		Right	-	0.158	0.110		0.268
Left		0.207	-	-		0.207	
Body SAR	P ≥ 18.7	Tx Antenna	1	2	3		
		Maximum Allowed Power (dBm)	24.7	19.7	17.0		1+2+3
		Back	0.884	0.146	0.207		1.237
		Front	0.319	0.087	0.103		0.509
		Top	-	-	0.155		0.155
		Bottom	0.352	0.052	-		0.404
		Right	-	0.112	0.110		0.222
		Left	0.256	-	-		0.256
	P < 18.7	Maximum Allowed Power (dBm)	19.2	23.7	17.0		
		Back	0.365	0.368	0.207		0.940
		Front	0.185	0.249	0.103		0.537
		Top	-	-	0.155		0.155
		Bottom	0.176	0.142	-		0.318
		Right	-	0.158	0.110		0.268
Left		0.073	-	-		0.073	

13.7 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01_v05.

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14 SAR MEASUREMENT VARIABILITY

14.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:



- 1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
- 3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
- 4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

**Table 14-1
Body SAR Measurement Variability Results**

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Service	Side	Spacing	Cover Type	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)		(W/kg)	
835 MHz	824.70	1013	Cell. CDMA	EVDO Rev. 0	back	10 mm	Standard	1.080	1.030	1.0	N/A	N/A	N/A	N/A
1900 MHz	1851.25	25	PCS CDMA	TDSO / SO32	back	10 mm	Standard	0.810	0.745	1.1	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

14.2 Measurement Uncertainty



The measured SAR was < 1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

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15 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
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	E5515C	Wireless Communications Test Set	2/9/2012	Annual	2/9/2013	GB43460554
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	E5515C	Wireless Communications Tester	4/4/2012	Annual	4/4/2013	US41140256
Agilent	E5515C	Wireless Communications Test Set	2/12/2012	Annual	2/12/2013	GB45360985
Agilent	E5515C	Wireless Communications Test Set	2/14/2012	Annual	2/14/2013	GB43304447
Agilent	MA24106A	USB Power Sensor	12/6/2012	Annual	12/6/2013	1248508
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244512
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	E5515C	Wireless Communications Test Set	9/24/2012	Annual	9/24/2013	GB43163447
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2012	Annual	10/10/2013	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Amplifier Research	6S1G4	5W, 800MHz-4.2GHz	N/A	N/A	N/A	21910
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	M7820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
Anritsu	MA2411B	Pulse Sensor	9/19/2012	Annual	9/19/2013	1027293
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231535
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231538
Anritsu	ML2495A	Power Meter	10/11/2012	Annual	10/11/2013	1039008
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204343
Anritsu	MA2411B	Pulse Power Sensor	12/4/2012	Annual	12/4/2013	1207364
Anritsu	ML2496A	Power Meter	11/28/2012	Annual	11/28/2013	1138001
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204419
COMTECH	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M155A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122541139
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014497
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014488
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/10/2012	Annual	10/10/2013	1833466
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
Intelligent Weighing	PD-3000	Electronic Balance	6/29/2012	Annual	6/29/2013	120405017
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini-Circuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
Mini-Circuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	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	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
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	SME06	Signal Generator	10/11/2012	Annual	10/11/2013	832026
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	3/5/2012	Annual	3/5/2013	102060
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/7/2011	Biennial	10/7/2013	103962
Rohde & Schwarz	CMU200	Base Station Simulator	5/22/2012	Annual	5/22/2013	109892
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
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	ES3DV2	SAR Probe	8/28/2012	Annual	8/28/2013	3022
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/7/2012	Annual	5/7/2013	1334
SPEAG	EX3DV4	SAR Probe	7/28/2012	Annual	7/28/2013	3561
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	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	D1900V2	1900 MHz SAR Dipole	2/9/2012	Annual	2/9/2013	50148
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	40026
SPEAG	D5GHZV2	5 GHz SAR Dipole	10/30/2012	Annual	10/30/2013	1007
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/24/2012	Annual	8/24/2013	1322
SPEAG	D750V3	750 MHz Dipole	2/9/2012	Annual	2/9/2013	1054
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	ES3DV3	SAR Probe	5/18/2012	Annual	5/18/2013	3263
SPEAG	ES3DV3	SAR Probe	3/16/2012	Annual	3/16/2013	3209
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/19/2012	Annual	9/19/2013	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
SPEAG	D1900V2	1900 MHz SAR Dipole	2/22/2012	Annual	2/22/2013	50149
SPEAG	ES3DV3	SAR Probe	9/20/2012	Annual	9/20/2013	3288
SPEAG	D835V2	835 MHz SAR Dipole	1/25/2012	Annual	1/25/2013	40047
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177
VWR	38934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859332
VWR	23226-658	Long Stem Thermometer	3/30/2012	Biennial	3/30/2014	122179874
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886414
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389330
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389334

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, 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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16 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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17 CONCLUSION

17.1 Measurement Conclusion



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

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



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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6465

Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 770 Head Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.889 \text{ S/m}$; $\epsilon_r = 40.358$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-16-2013; Ambient Temp: 23.8°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3288; ConvF(6.67, 6.67, 6.67); 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 14.6.8 (7028)

**Mode: LTE Band 13, Left Head, Cheek, Mid.ch, 10 MHz Bandwidth,
QPSK, 1 RB, 25 RB Offset, Standard Cover**

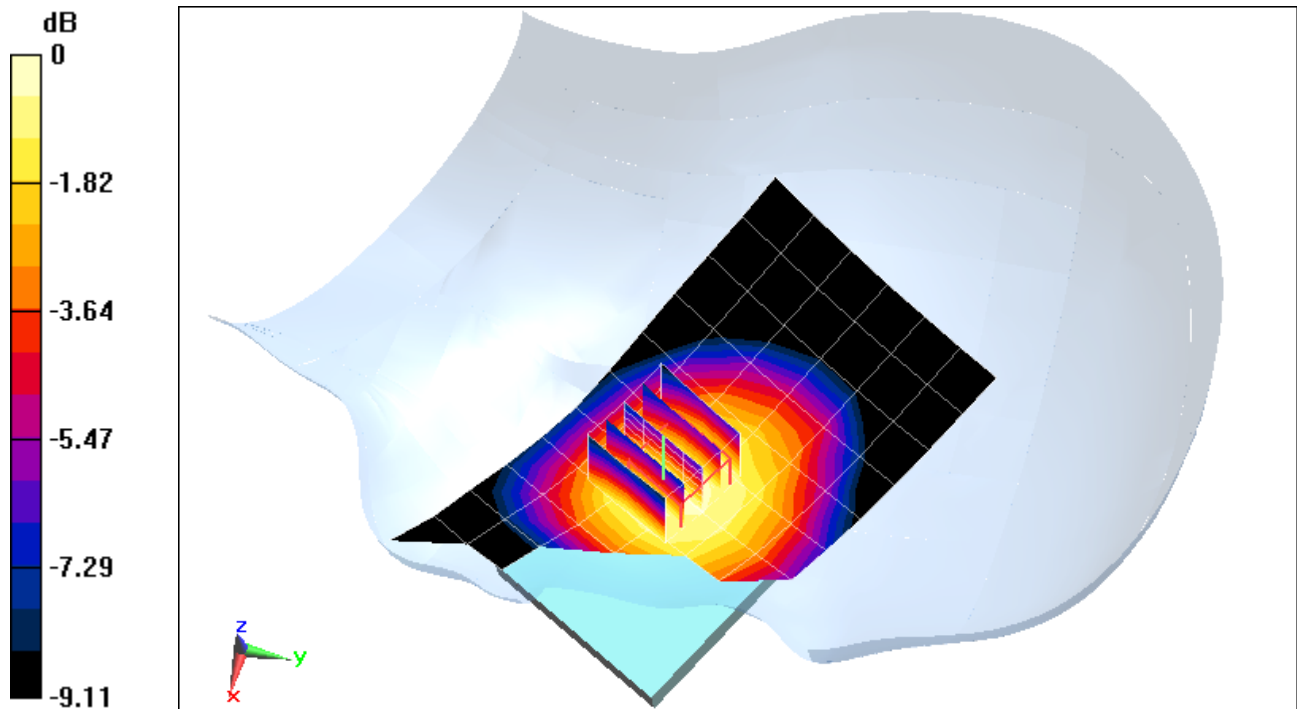
Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.675 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.161 W/kg

SAR(1 g) = 0.131 W/kg; SAR(10 g) = 0.099 W/kg



0 dB = 0.137 W/kg = -8.63 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6457

Communication System: Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$; $\sigma = 0.919 \text{ S/m}$; $\epsilon_r = 41.29$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-15-2013; Ambient Temp: 23.7°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(6.22, 6.22, 6.22); 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 14.6.8 (7028)

**Mode: Cellular CDMA, Left Head, Cheek,
Mid.ch, Wireless Charging Cover**

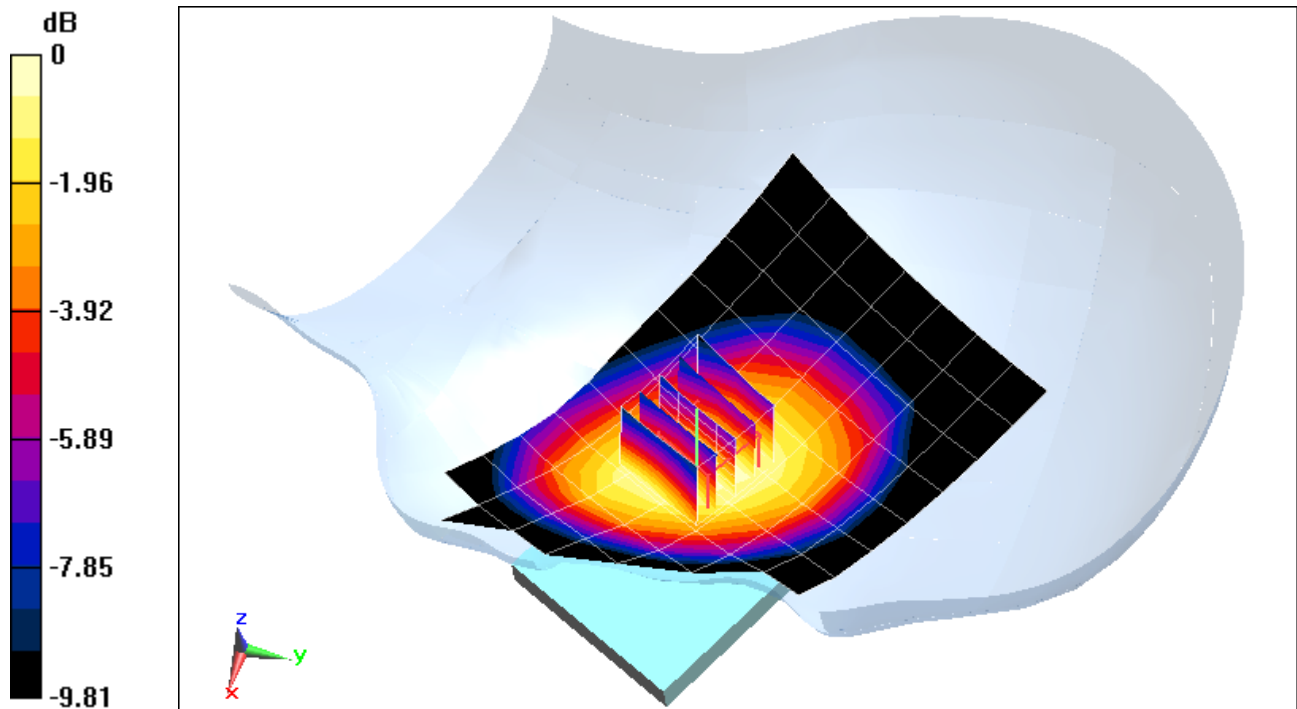
Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.429 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.691 W/kg

SAR(1 g) = 0.552 W/kg; SAR(10 g) = 0.406 W/kg



0 dB = 0.590 W/kg = -2.29 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6457

Communication System: CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.353 \text{ S/m}$; $\epsilon_r = 38.33$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-17-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); 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 14.6.8 (7028)

**Mode: PCS EVDO Rev. A, Left Head, Cheek,
Mid.ch, Wireless Charging Cover**

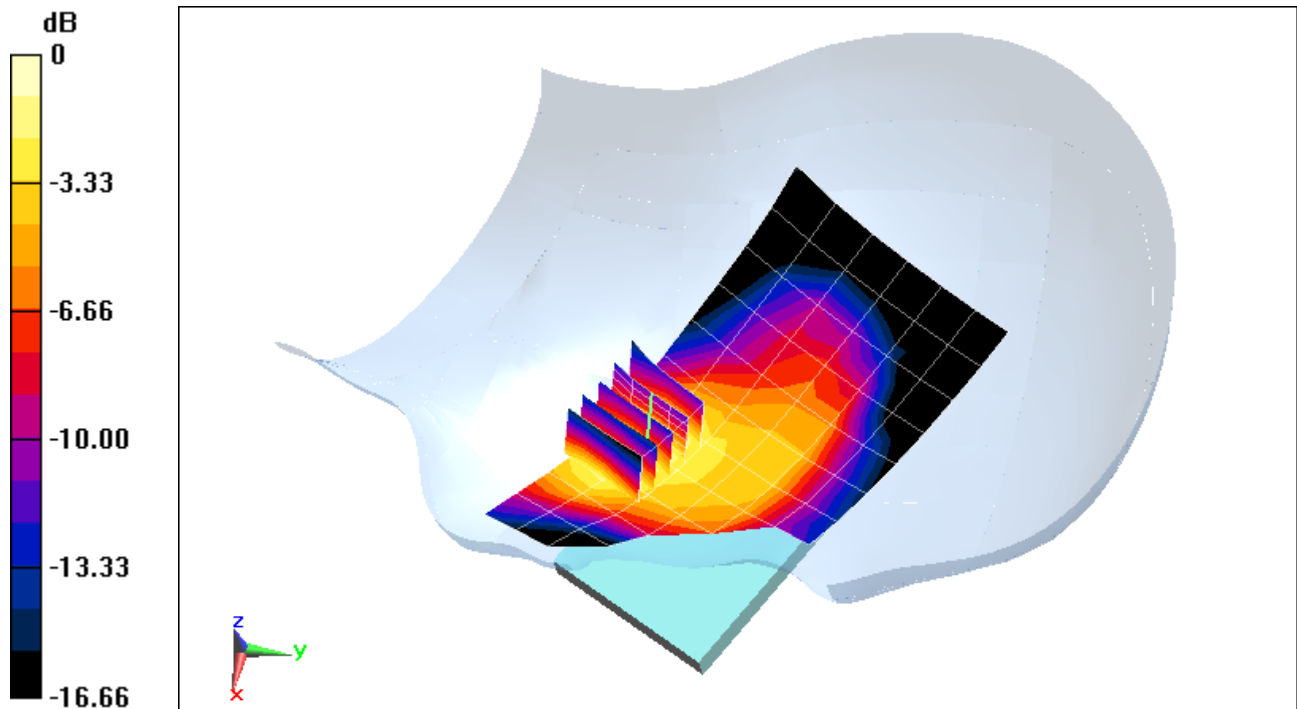
Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.240 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.681 W/kg

SAR(1 g) = 0.431 W/kg



0 dB = 0.468 W/kg = -3.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6556

Communication System: IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.756 \text{ S/m}$; $\epsilon_r = 39.792$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-14-2013; Ambient Temp: 24.7°C; Tissue Temp: 24.2°C

Probe: ES3DV2 - SN3022; ConvF(4.23, 4.23, 4.23); Calibrated: 8/28/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 11/13/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: IEEE 802.11b, Left Head, Cheek, Ch 01,
1 Mbps, Wireless Charging Cover**

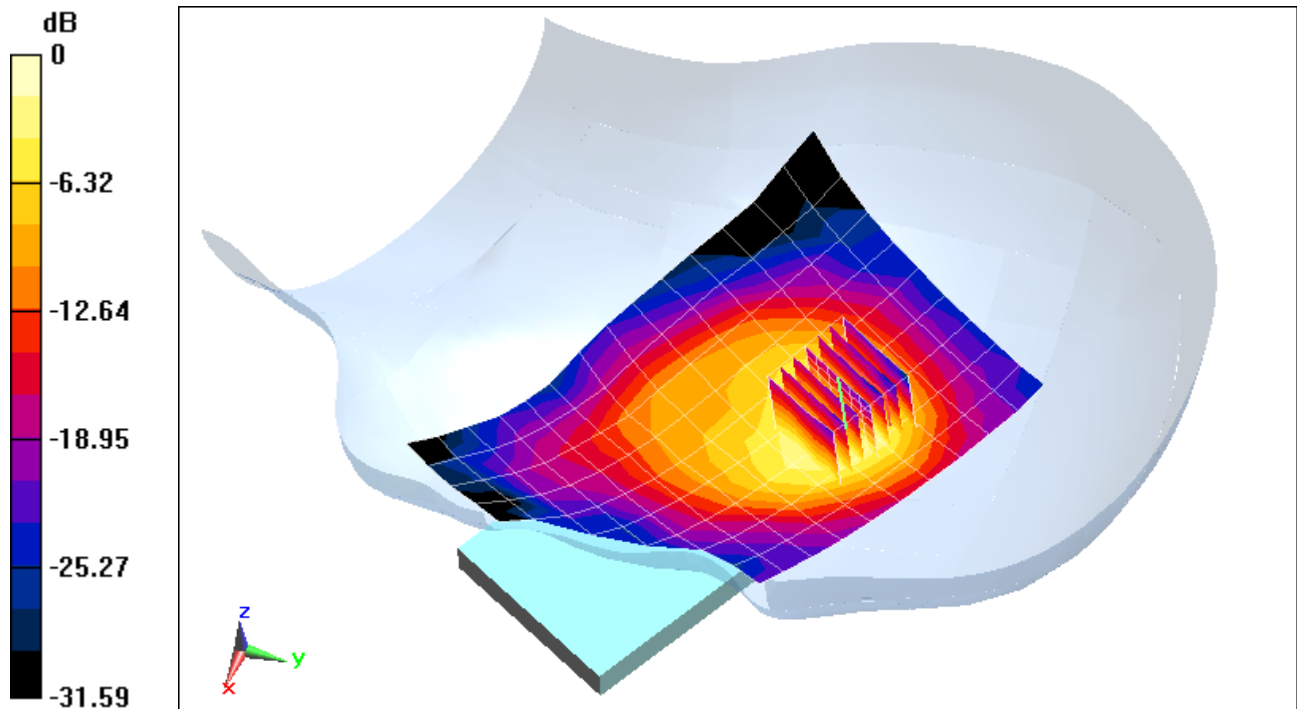
Area Scan (10x15x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.875 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.866 W/kg

SAR(1 g) = 0.393 W/kg; SAR(10 g) = 0.189 W/kg



0 dB = 0.502 W/kg = -2.99 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6556

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:

$$f = 5220 \text{ MHz}; \sigma = 4.668 \text{ S/m}; \epsilon_r = 35.71; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Left Section

Test Date: 01-10-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3561; ConvF(4.45, 4.45, 4.45); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: IEEE 802.11a, 5.2 GHz Left Head, Cheek,
Ch 44, 6 Mbps, Standard Cover**

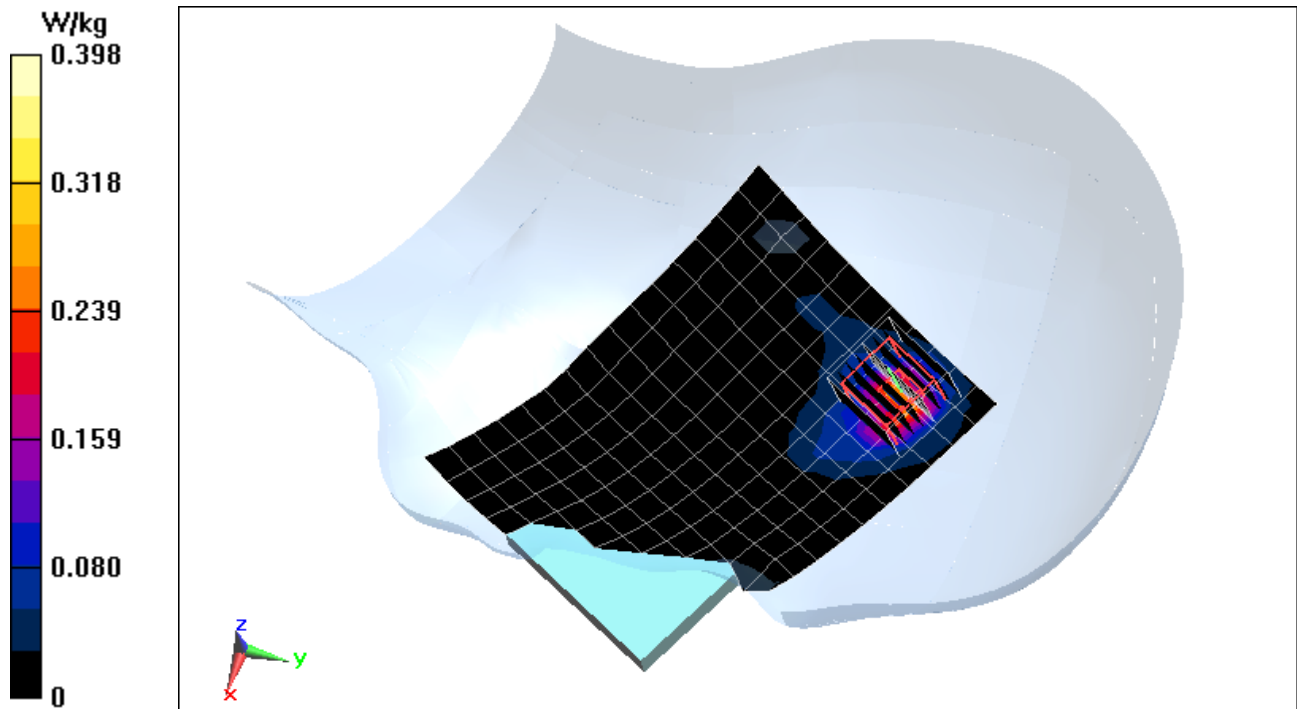
Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 5.941 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.170 W/kg

SAR(1 g) = 0.159 W/kg; SAR(10 g) = 0.051 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6556

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$$f = 5825 \text{ MHz}; \sigma = 5.477 \text{ S/m}; \epsilon_r = 34.24; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Left Section

Test Date: 01-10-2013; Ambient Temp: 23.6°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3561; ConvF(3.92, 3.92, 3.92); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: IEEE 802.11a, 5.8 GHz Left Head, Cheek,
Ch 165, 6 Mbps, Standard Cover**

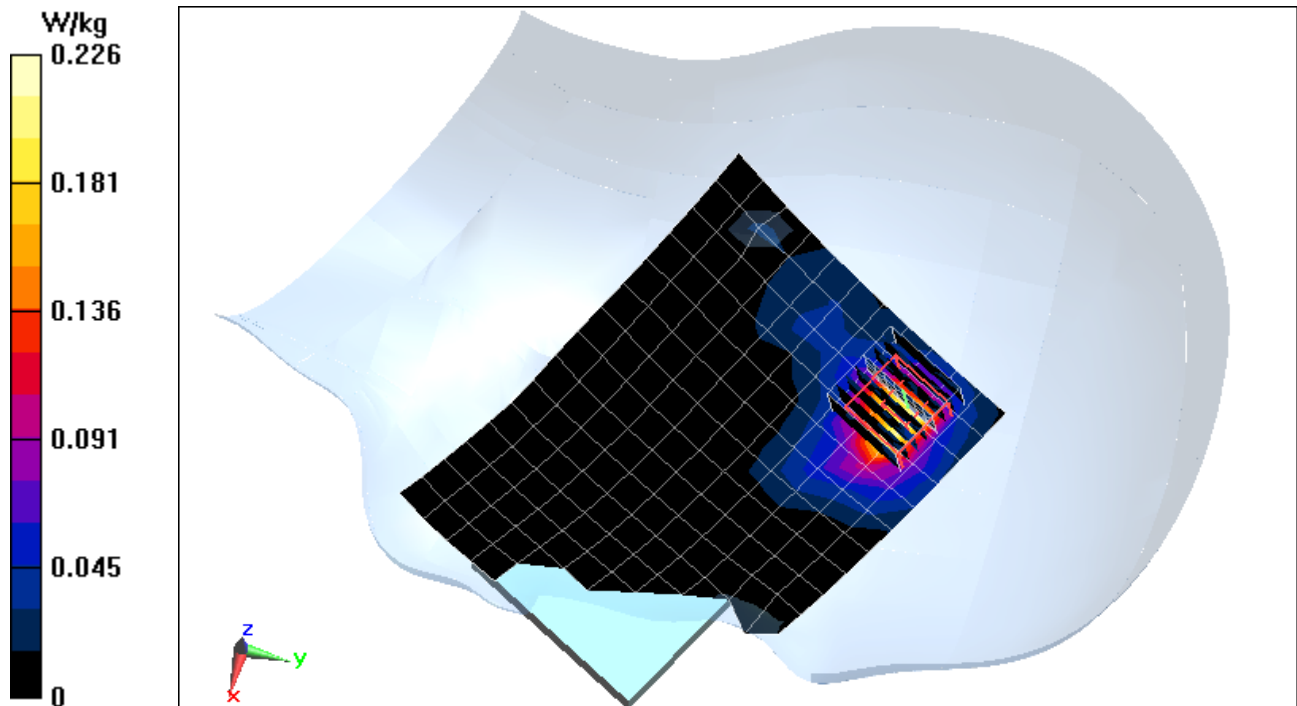
Area Scan (12x16x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 1.759 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.386 W/kg

SAR(1 g) = 0.023 W/kg; SAR(10 g) = 0.0046 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6465

Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 770 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.992 \text{ S/m}$; $\epsilon_r = 55.954$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-15-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.8°C

Probe: ES3DV3 - SN3288; ConvF(6.44, 6.44, 6.44); Calibrated: 9/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.8 (7028)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch, 10 MHz Bandwidth,
QPSK, 1 RB, 25 RB Offset, Standard Cover**

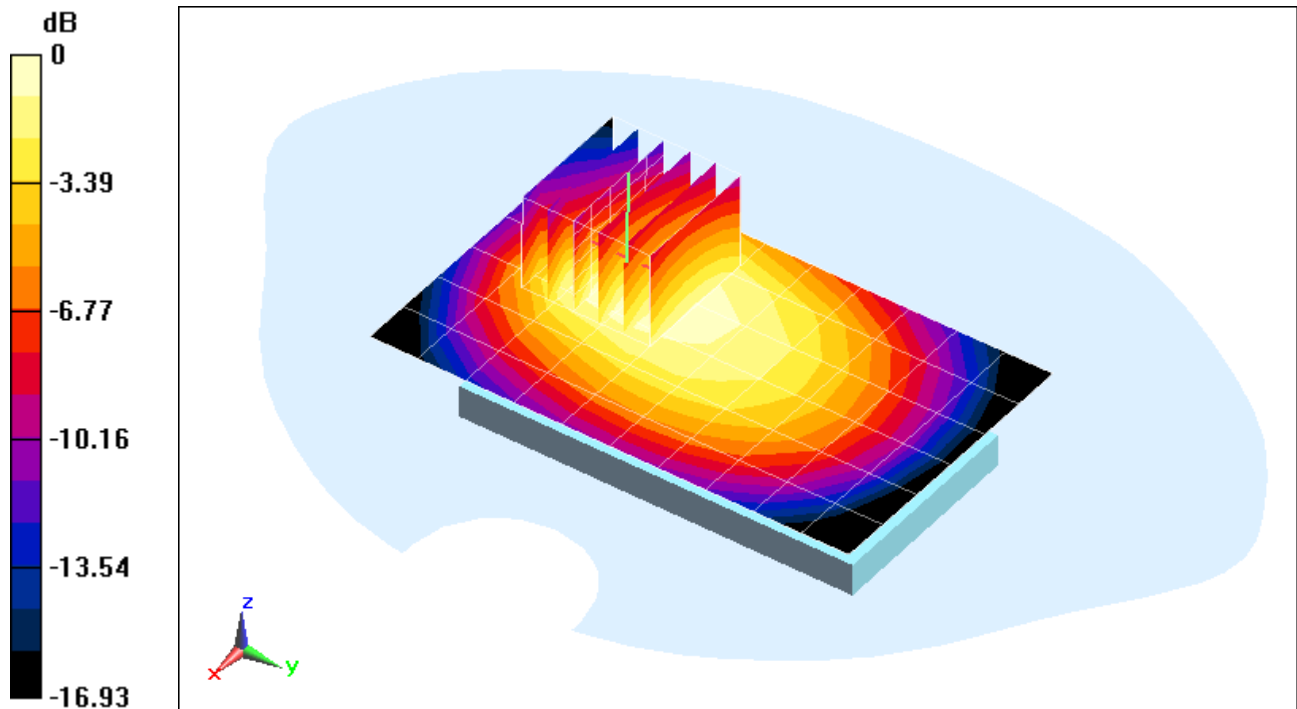
Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.062 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.562 W/kg

SAR(1 g) = 0.356 W/kg; SAR(10 g) = 0.238 W/kg



0 dB = 0.380 W/kg = -4.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6457

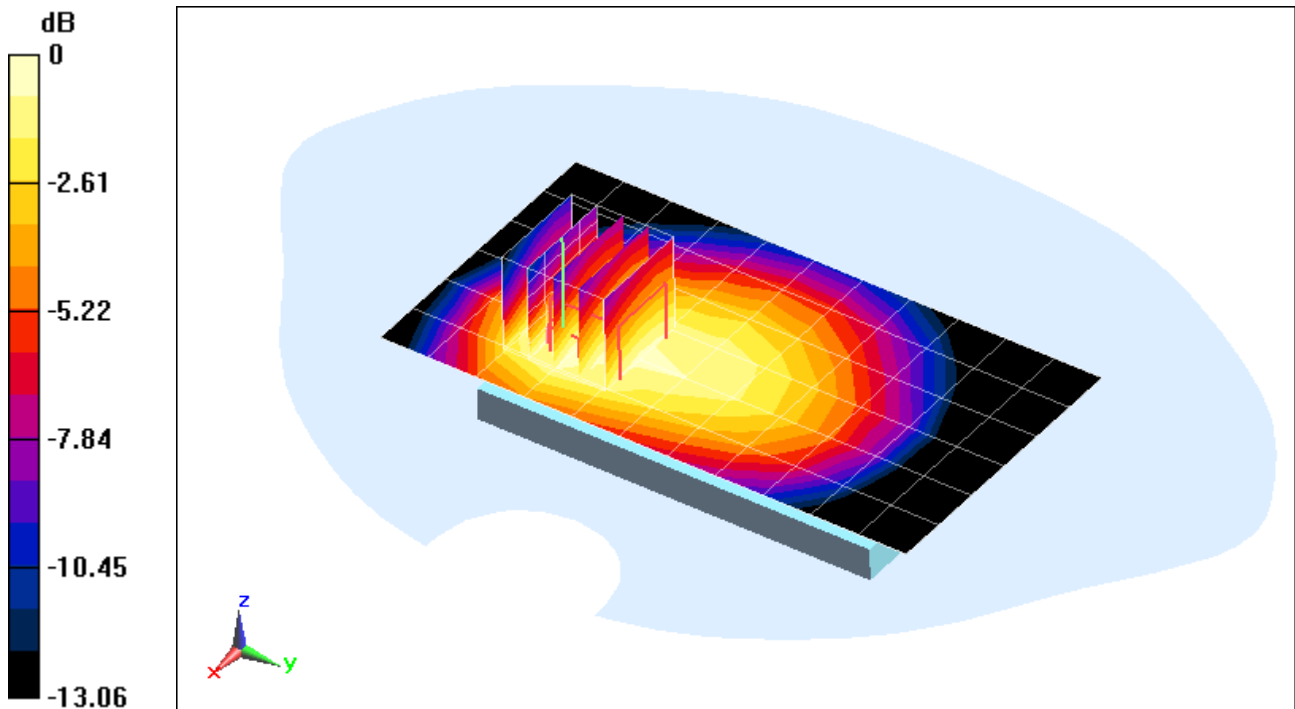
*****Communication System: Cellular CDMA; Frequency: 824.7 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
 $f = 824.7 \text{ MHz}$; $\sigma = 0.945 \text{ S/m}$; $\epsilon_r = 53.26$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 23.8°C; Tissue Temp: 23.3°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 with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: Cellular CDMA, Body SAR, Back side,
Low.ch, Standard Cover**

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.677 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.34 W/kg
SAR(1 g) = 0.924 W/kg; SAR(10 g) = 0.659 W/kg



0 dB = 0.969 W/kg = -0.14 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6457

Communication System: Cellular CDMA; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 824.7 \text{ MHz}$; $\sigma = 0.945 \text{ S/m}$; $\epsilon_r = 53.26$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 23.8°C; Tissue Temp: 23.3°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 with CRP; Type: SAM 4.0; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: Cellular EVDO Rev. 0, Body SAR, Back side,
Low.ch, Standard Cover**

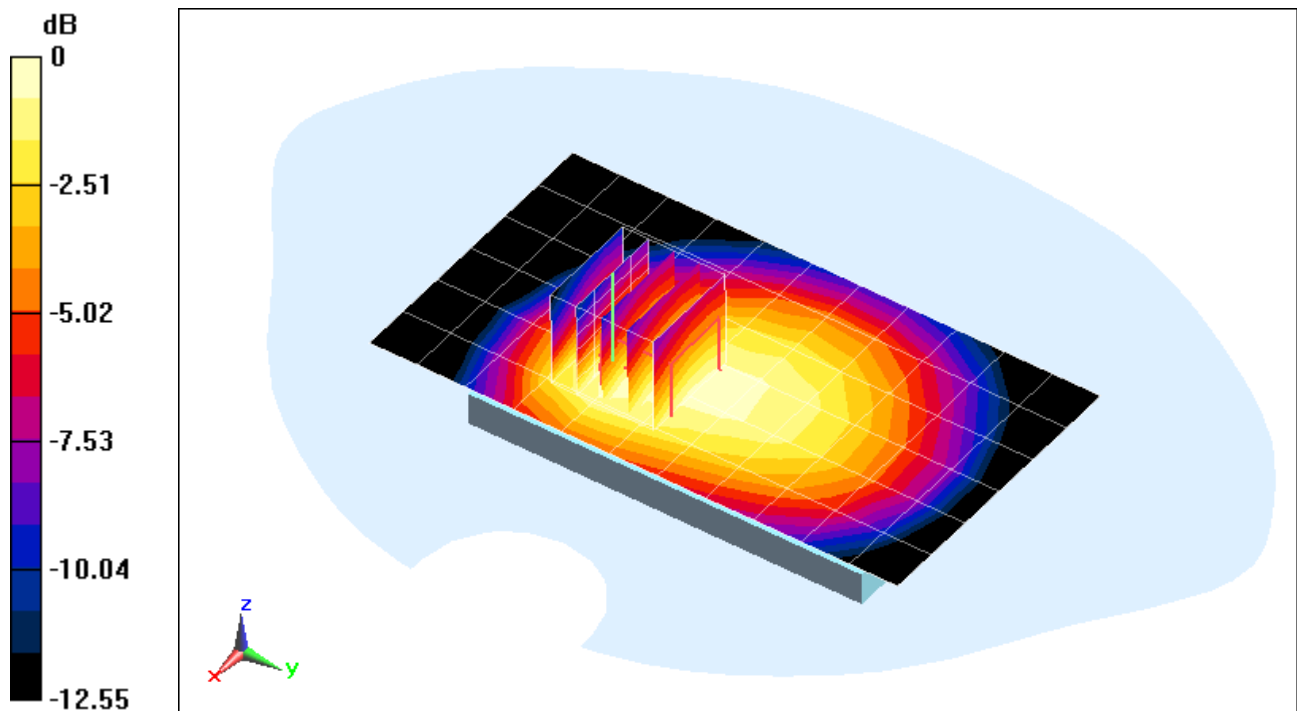
Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 37.668 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.782 W/kg



0 dB = 1.15 W/kg = 0.61 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6457

Communication System: CDMA; Frequency: 1851.25 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1851.25 \text{ MHz}$; $\sigma = 1.522 \text{ S/m}$; $\epsilon_r = 51.976$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 21.5°C; Tissue Temp: 20.8°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: SAM Right; Type: QD000P40CD; Serial: 1686

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.8 (7028)

Mode: PCS CDMA, Body SAR, Back side, Low.ch, Standard Cover

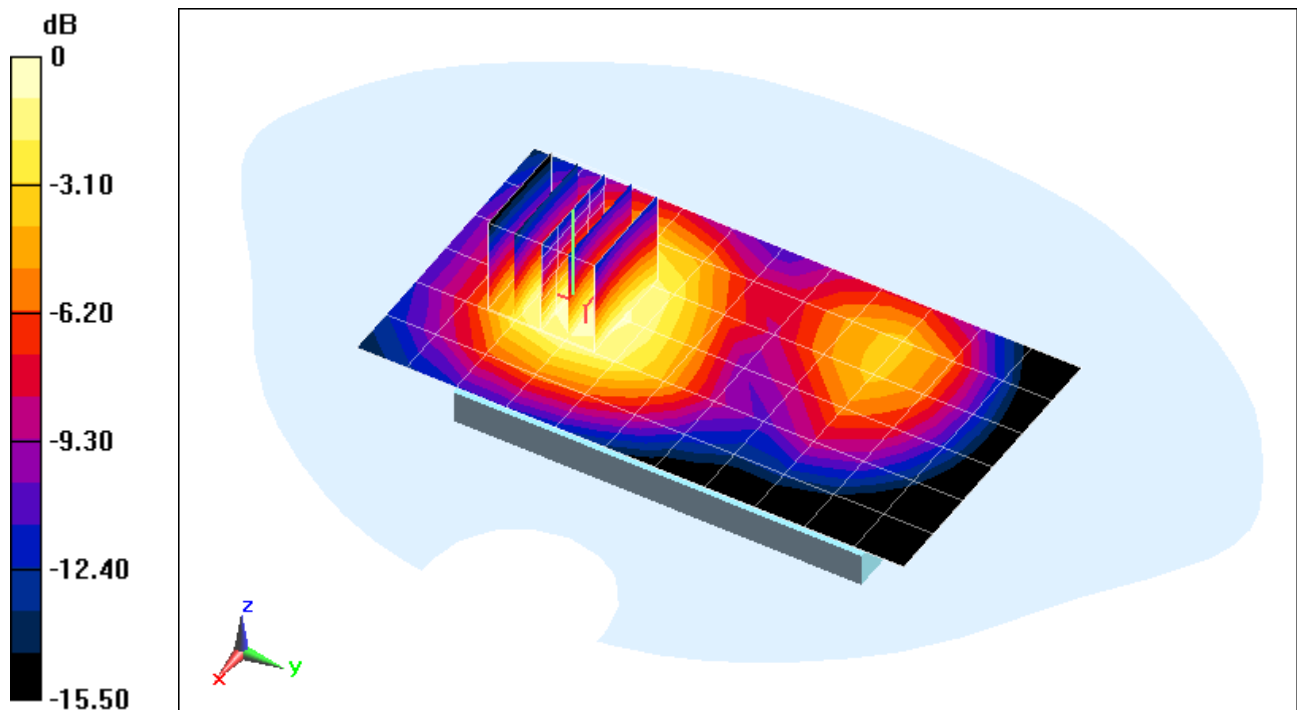
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 24.169 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.29 W/kg

SAR(1 g) = 0.810 W/kg



0 dB = 0.855 W/kg = -0.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6556

Communication System: IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.965 \text{ S/m}$; $\epsilon_r = 50.432$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-15-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.7°C

Probe: ES3DV2 - SN3022; ConvF(3.97, 3.97, 3.97); Calibrated: 8/28/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 11/13/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: IEEE 802.11b, Body SAR, Back Side, Ch 01,
1 Mbps, Standard Cover**

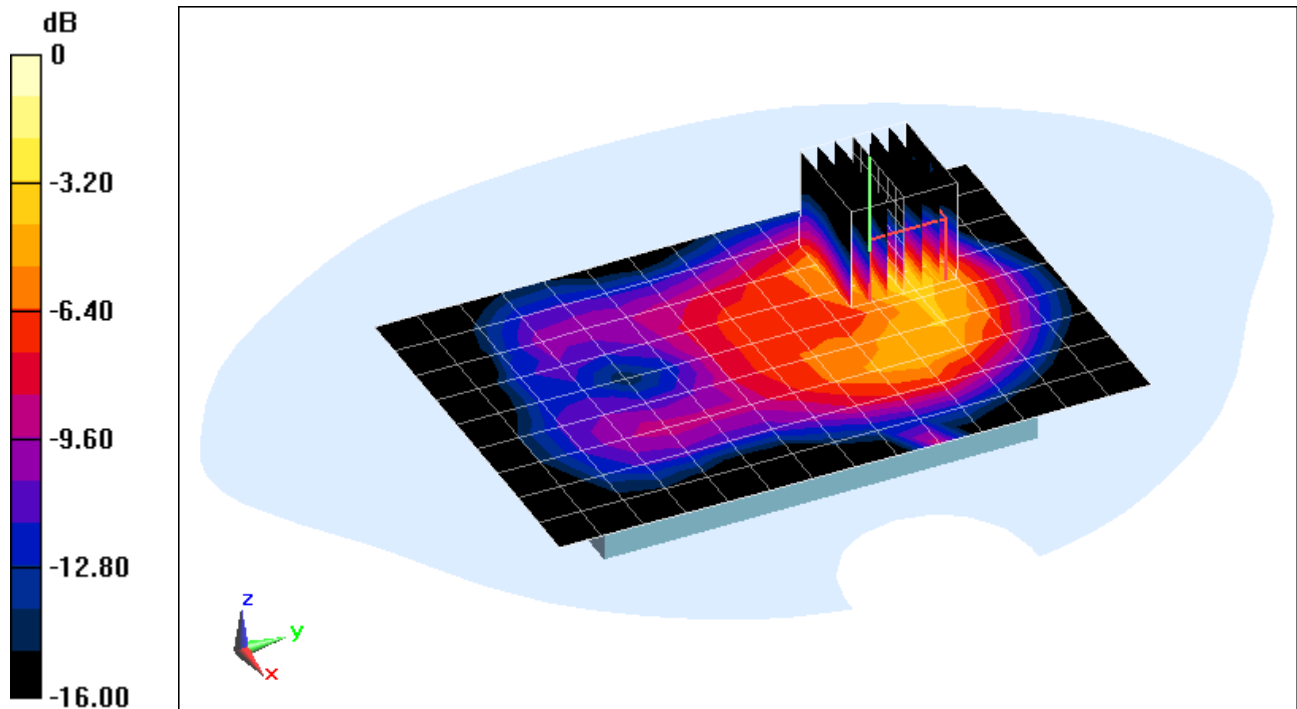
Area Scan (10x15x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.801 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.174 W/kg; SAR(10 g) = 0.081 W/kg



0 dB = 0.363 W/kg = -4.40 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6556

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5220 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$$f = 5220 \text{ MHz}; \sigma = 5.304 \text{ S/m}; \epsilon_r = 47.62; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3561; ConvF(3.76, 3.76, 3.76); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: IEEE 802.11a, 5.2 GHz, Body SAR, Back Side, Ch 44,
6 Mbps, Standard Cover**

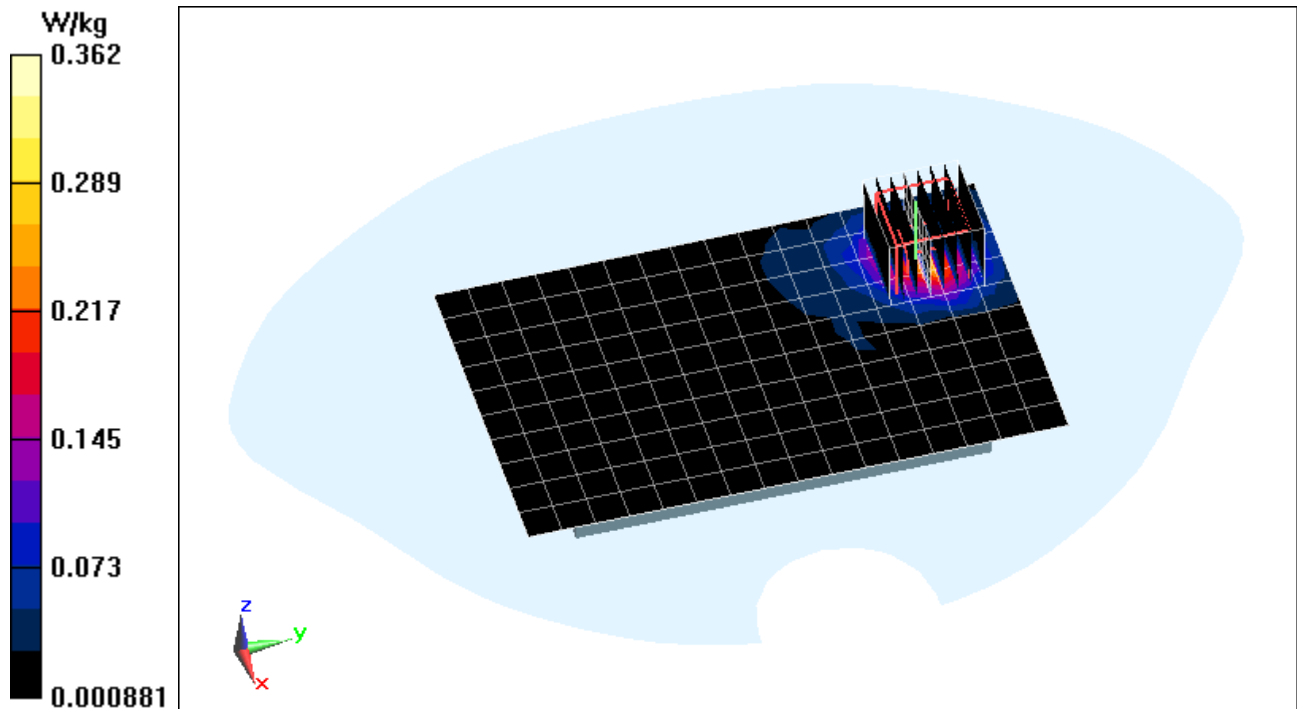
Area Scan (11x17x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 5.552 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.571 W/kg

SAR(1 g) = 0.163 W/kg; SAR(10 g) = 0.063 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFVS870; Type: Portable Handset; Serial: 6556

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$$f = 5825 \text{ MHz}; \sigma = 6.204 \text{ S/m}; \epsilon_r = 46.13; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.5°C; Tissue Temp: 22.9°C

Probe: EX3DV4 - SN3561; ConvF(3.42, 3.42, 3.42); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

**Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Back Side, Ch 165,
6 Mbps, Standard Cover**

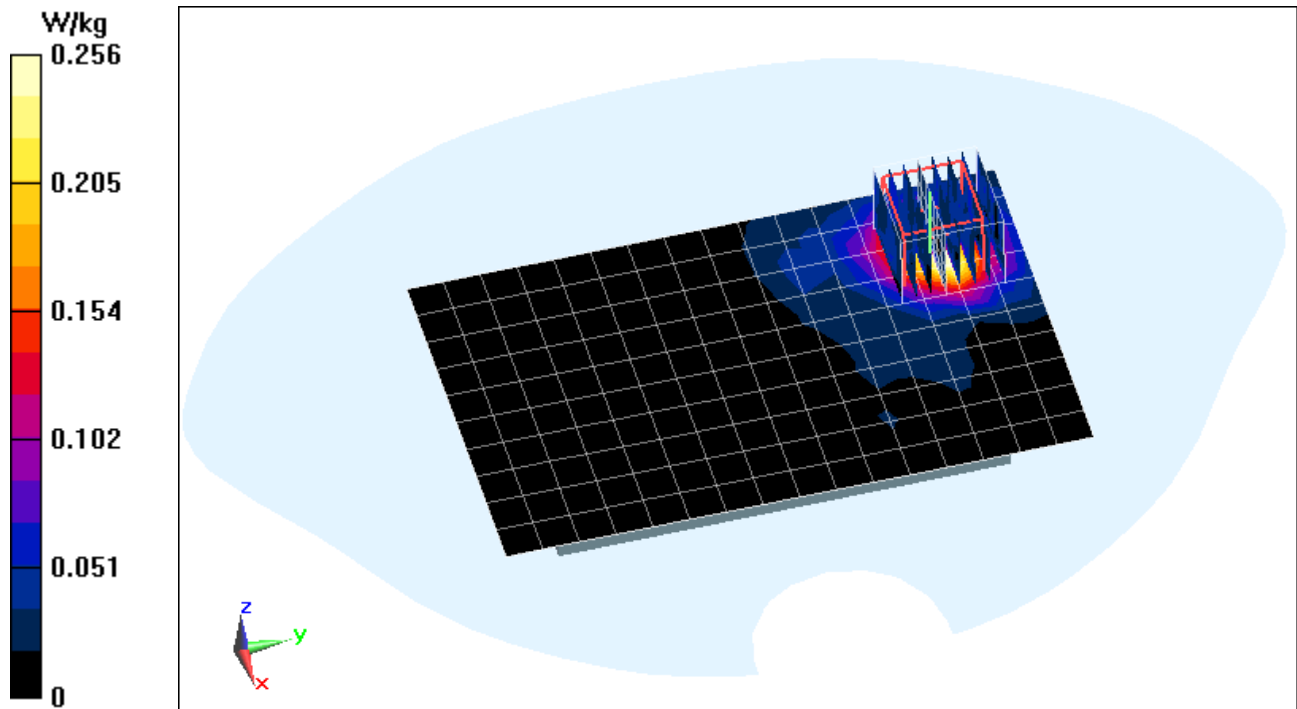
Area Scan (11x17x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 2.096 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.275 W/kg

SAR(1 g) = 0.032 W/kg; SAR(10 g) = 0.015 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1054

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 740 Head Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.871 \text{ mho/m}$; $\epsilon_r = 40.463$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 01-16-2013; Ambient Temp: 23.8°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3288; ConvF(6.67, 6.67, 6.67); 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 14.6.8 (7028)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

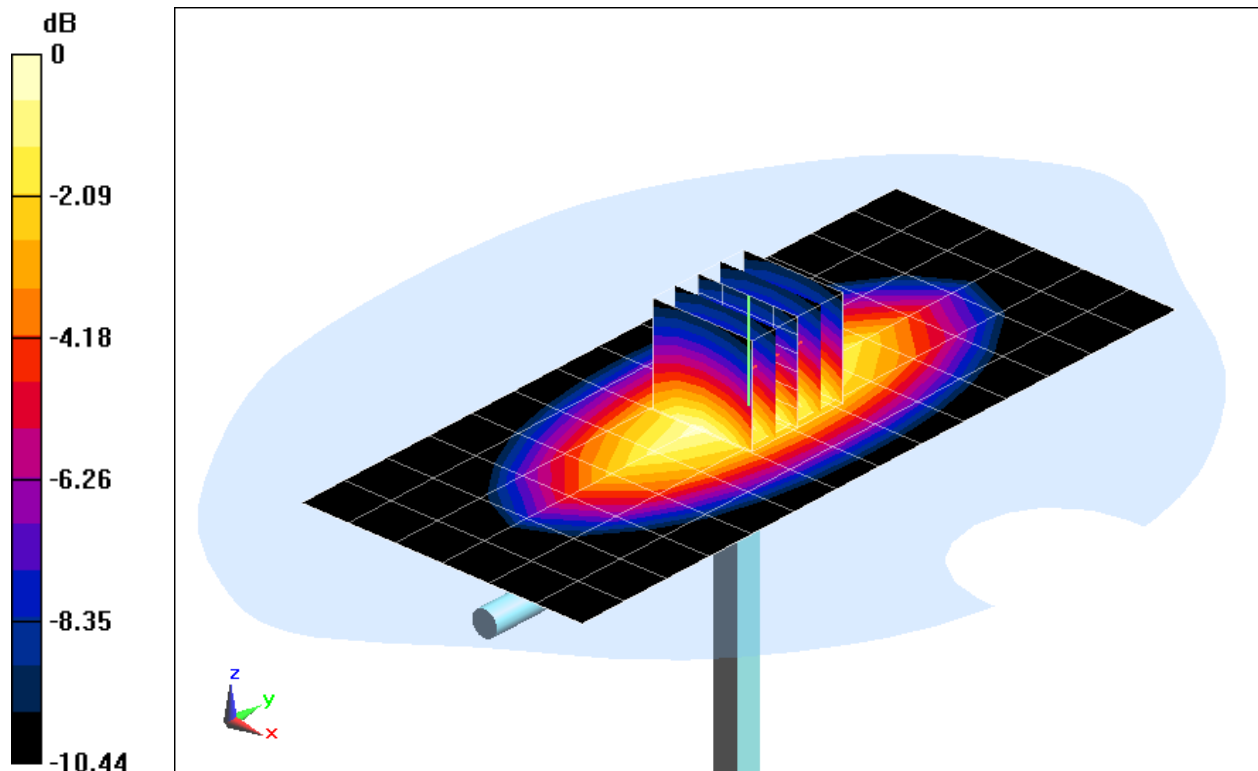
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 17.78 dBm (60 mW)

Peak SAR (extrapolated) = 0.711 W/kg

SAR(1 g) = 0.475 W/kg; SAR(10 g) = 0.311 W/kg

Deviation: -7.08%



0 dB = 0.513 W/kg = -2.90 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 Head Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.917 \text{ S/m}$; $\epsilon_r = 41.31$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 01-15-2013; Ambient Temp: 23.7°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(6.22, 6.22, 6.22); 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 14.6.8 (7028)

835 MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm

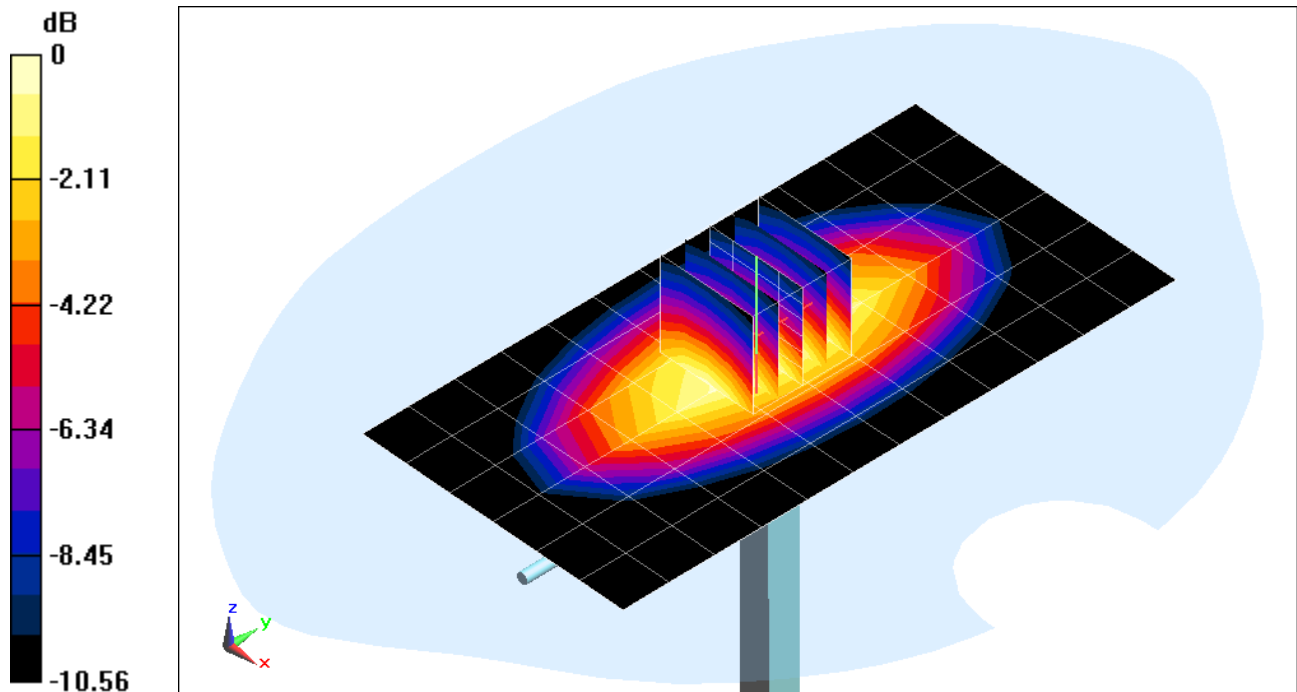
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.34 W/kg

SAR(1 g) = 0.937 W/kg; SAR(10 g) = 0.618 W/kg

Deviation: -0.21%



0 dB = 1.01 W/kg = 0.04 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 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.378 \text{ S/m}$; $\epsilon_r = 38.27$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); 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 14.6.8 (7028)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

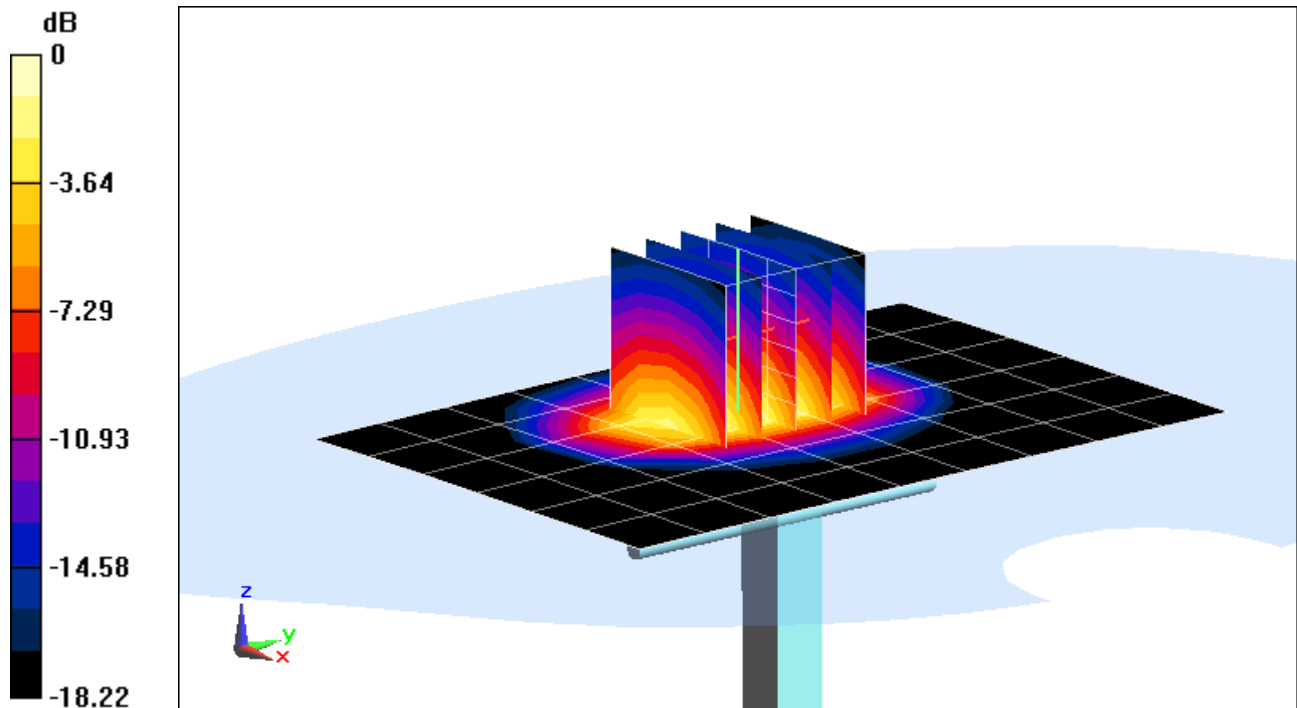
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.36 W/kg

SAR(1 g) = 3.91 W/kg; SAR(10 g) = 2.01 W/kg

Deviation: -3.46%



0 dB = 4.37 W/kg = 6.40 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.8 \text{ S/m}$; $\epsilon_r = 39.73$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.7°C; Tissue Temp: 24.2°C

Probe: ES3DV2 - SN3022; ConvF(4.23, 4.23, 4.23); Calibrated: 8/28/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 11/13/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

2450 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=12mm, dy=12mm

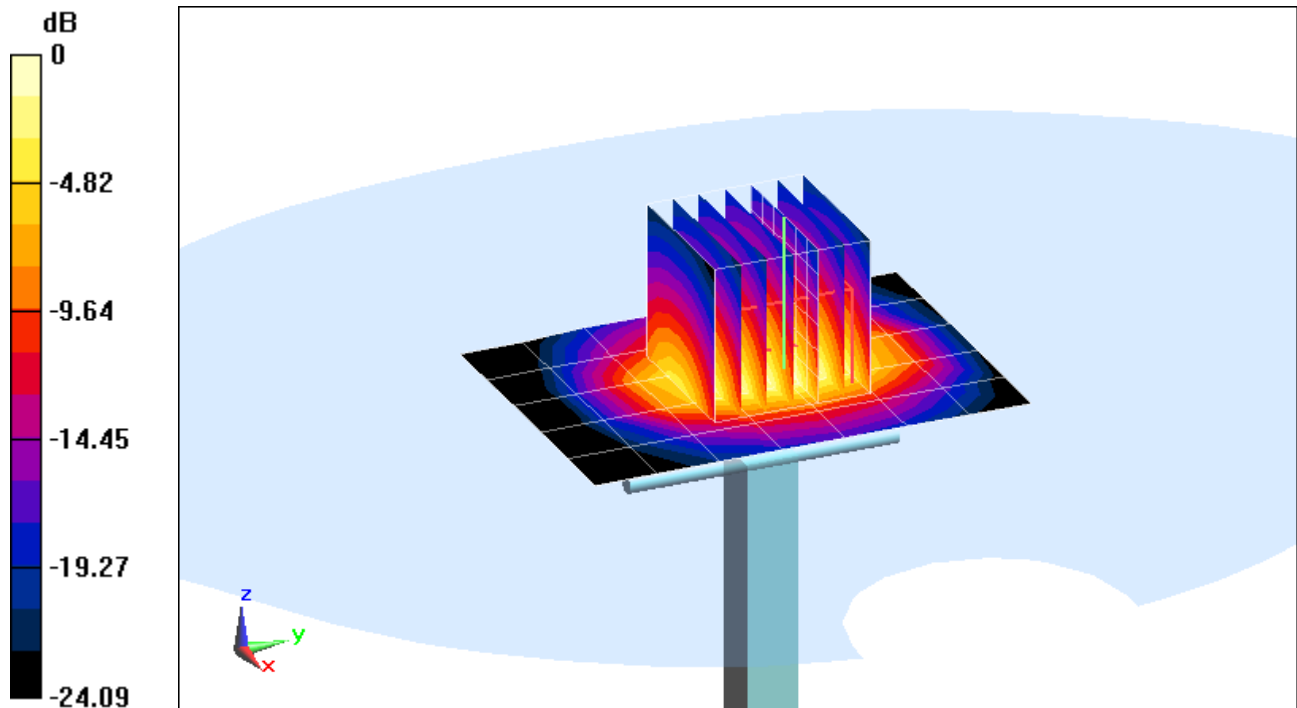
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power: 16.02 dBm (40 mW)

Peak SAR (extrapolated) = 4.84 W/kg

SAR(1 g) = 2.26 W/kg; SAR(10 g) = 1.04 W/kg

Deviation: 7.21%



0 dB = 2.93 W/kg = 4.67 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5200 \text{ MHz}$; $\sigma = 4.651 \text{ S/m}$; $\epsilon_r = 35.86$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3561; ConvF(4.45, 4.45, 4.45); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5200 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

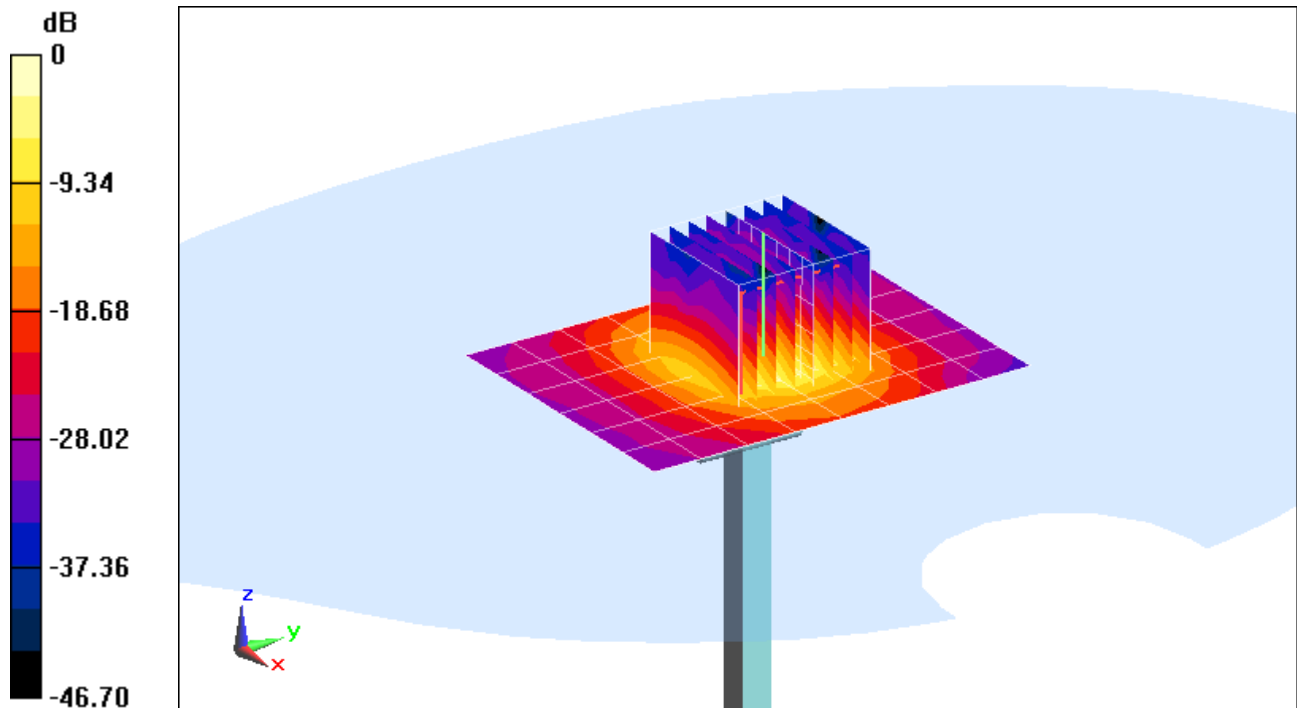
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 33.3 W/kg

SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.35 W/kg

Deviation: 1.75%



0 dB = 18.8 W/kg = 12.74 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 4.869 \text{ S/m}$; $\epsilon_r = 35.42$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3561; ConvF(4.16, 4.16, 4.16); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

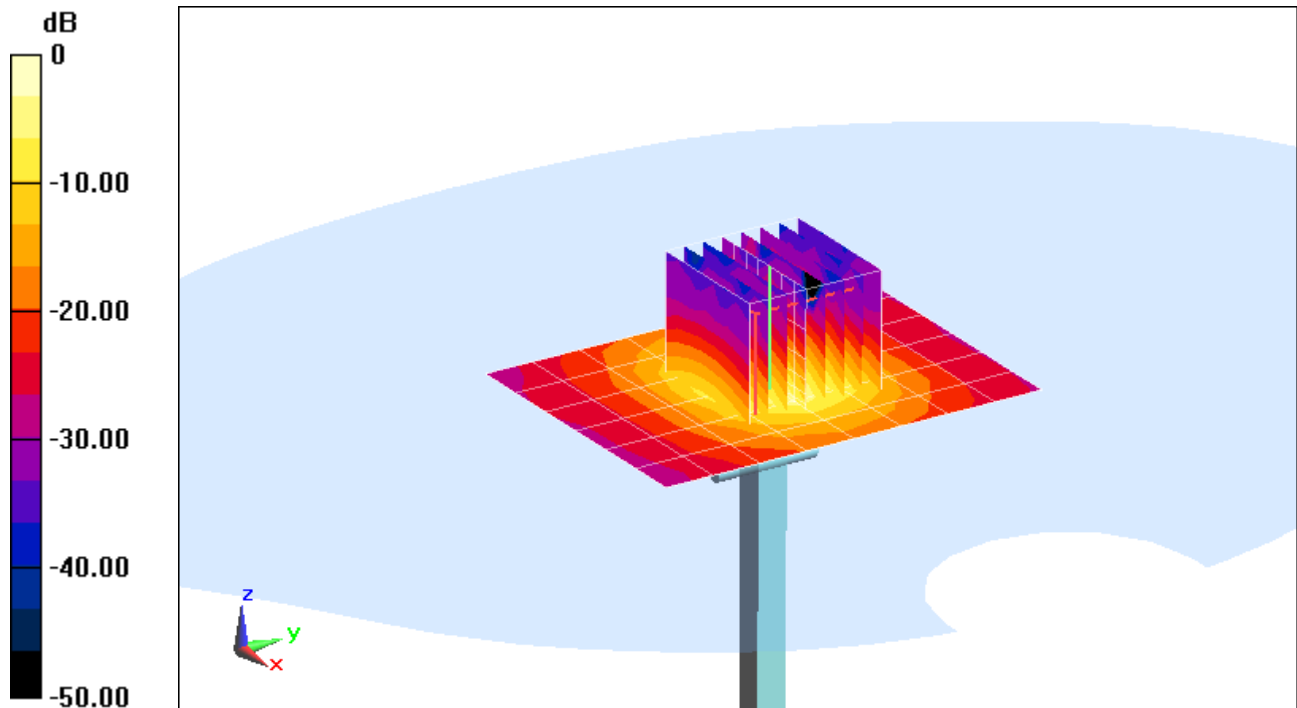
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 36.2 W/kg

SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.24 W/kg

Deviation: -5.05%



0 dB = 18.3 W/kg = 12.62 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 5.117 \text{ S/m}$; $\epsilon_r = 34.82$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 23.5°C; Tissue Temp: 22.4°C

Probe: EX3DV4 - SN3561; ConvF(4, 4, 4); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5600 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

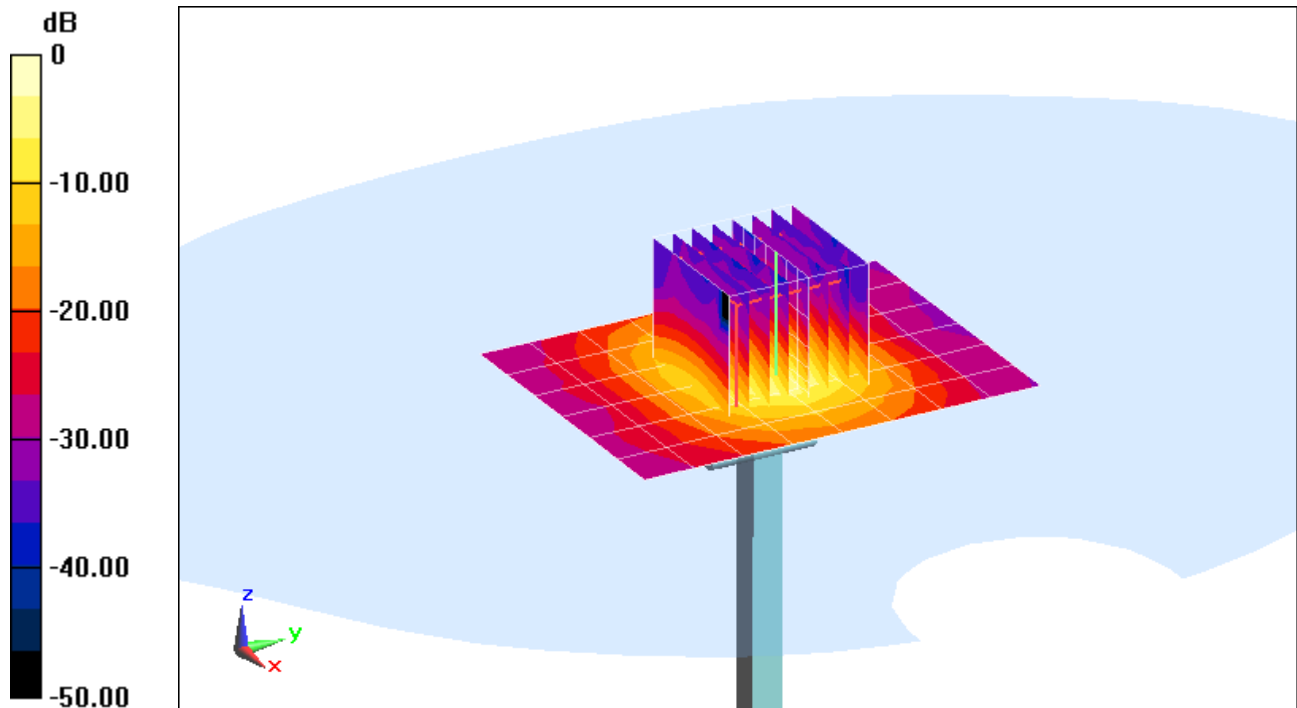
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 38.0 W/kg

SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.26 W/kg

Deviation: -6.04%



0 dB = 19.2 W/kg = 12.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 5.447 \text{ S/m}$; $\epsilon_r = 34.09$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 23.6°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3561; ConvF(3.92, 3.92, 3.92); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5800 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

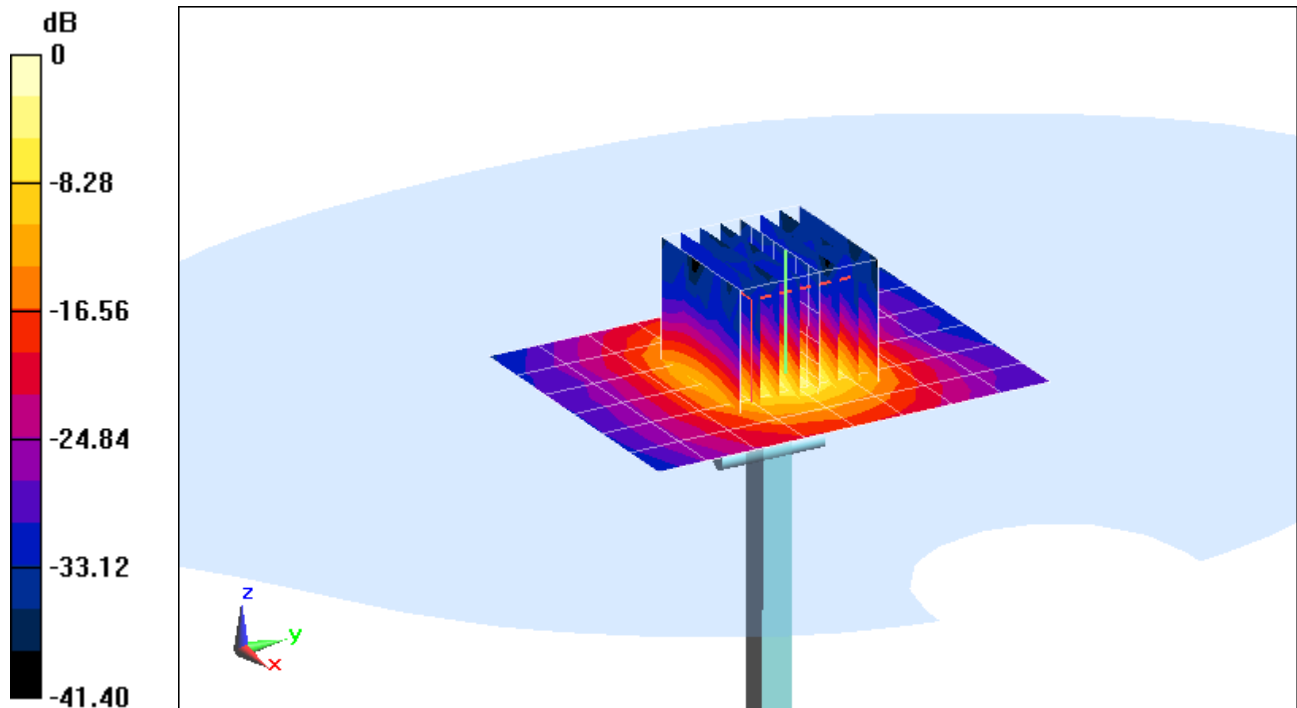
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 37.8 W/kg

SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.2 W/kg

Deviation: -2.76%



0 dB = 19.6 W/kg = 12.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1054

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.967 \text{ mho/m}$; $\epsilon_r = 56.227$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 01-15-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.8°C

Probe: ES3DV3 - SN3288; ConvF(6.44, 6.44, 6.44); Calibrated: 9/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.8 (7028)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

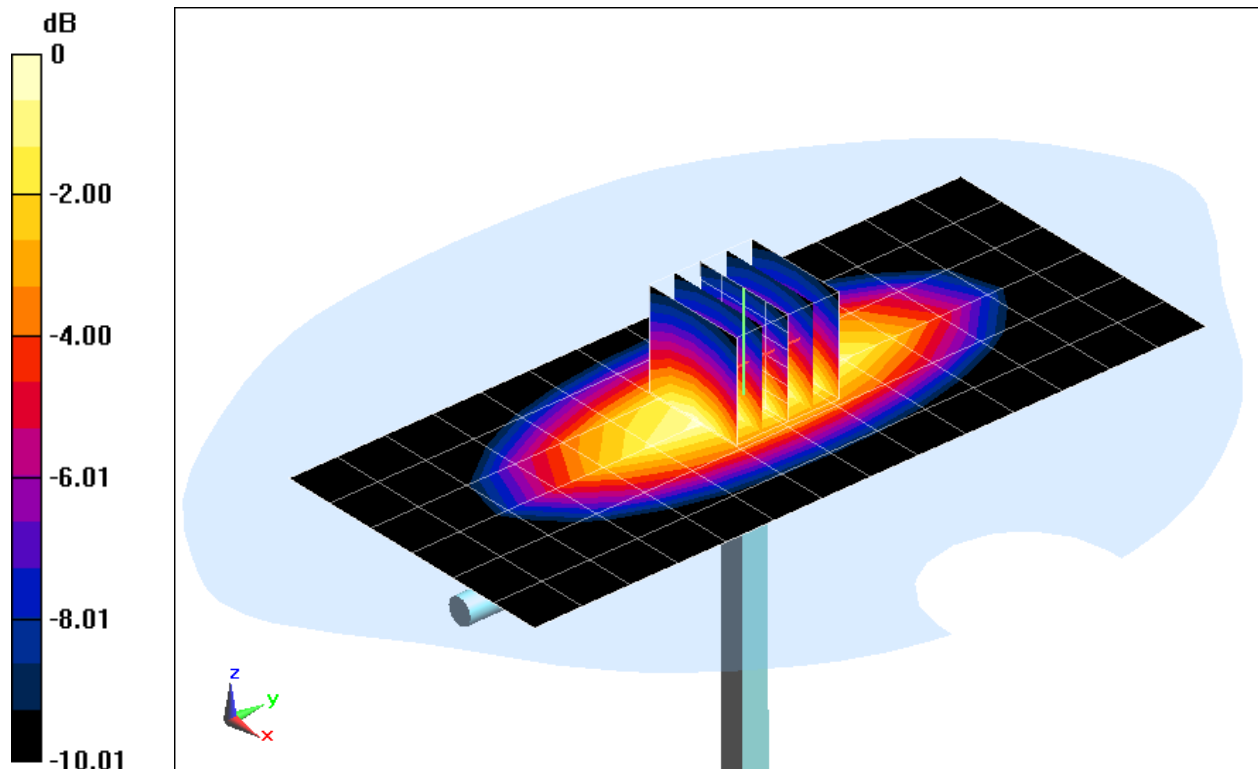
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 17.78 dBm (60 mW)

Peak SAR (extrapolated) = 0.729 W/kg

SAR(1 g) = 0.501 W/kg; SAR(10 g) = 0.332 W/kg

Deviation: -5.54%



0 dB = 0.540 W/kg = -2.68 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:

$f = 835 \text{ MHz}$; $\sigma = 0.955 \text{ S/m}$; $\epsilon_r = 53.15$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 01-10-2013; Ambient Temp: 23.8°C; Tissue Temp: 23.3°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 with CRP; Type: SAM 4.0; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

835 MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm

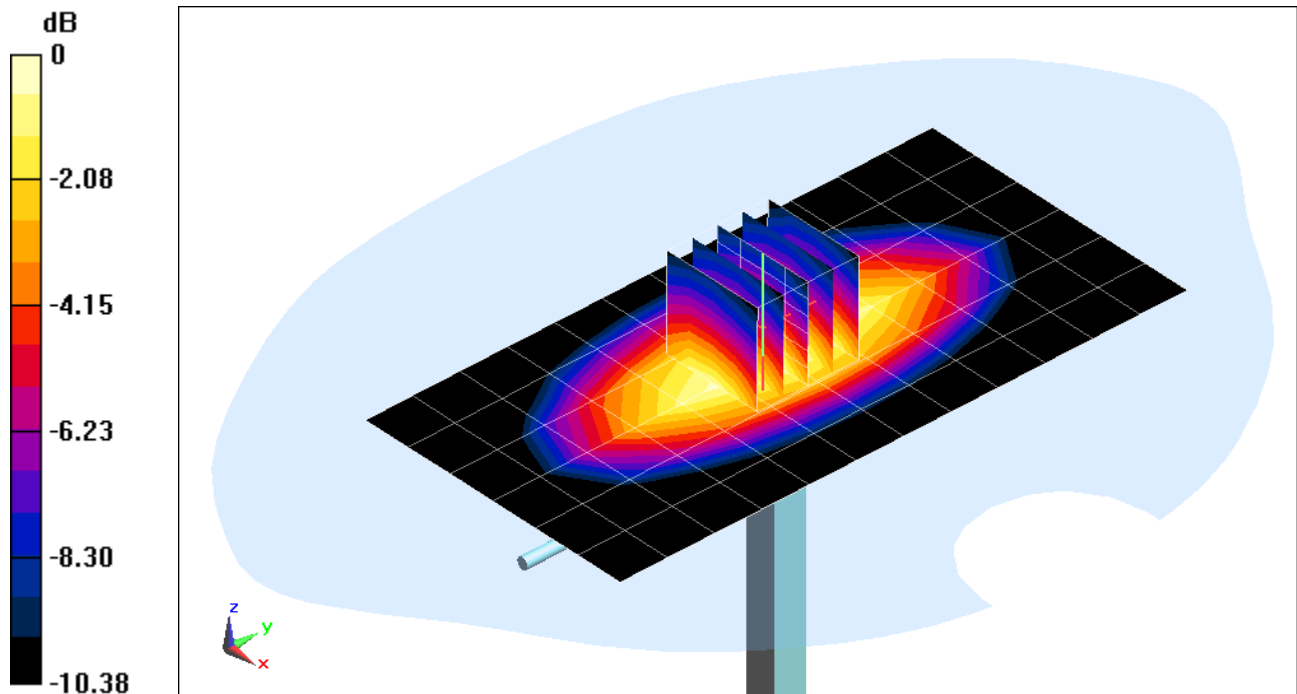
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.39 W/kg

SAR(1 g) = 0.994 W/kg; SAR(10 g) = 0.657 W/kg

Deviation: 3.76%



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

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.984 \text{ S/m}$; $\epsilon_r = 55.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 01-21-2013; Ambient Temp: 23.3°C; Tissue Temp: 20.3°C

Probe: ES3DV3 - SN3288; ConvF(6.31, 6.31, 6.31); 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 (5); SEMCAD X Version 14.6.8 (7028)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

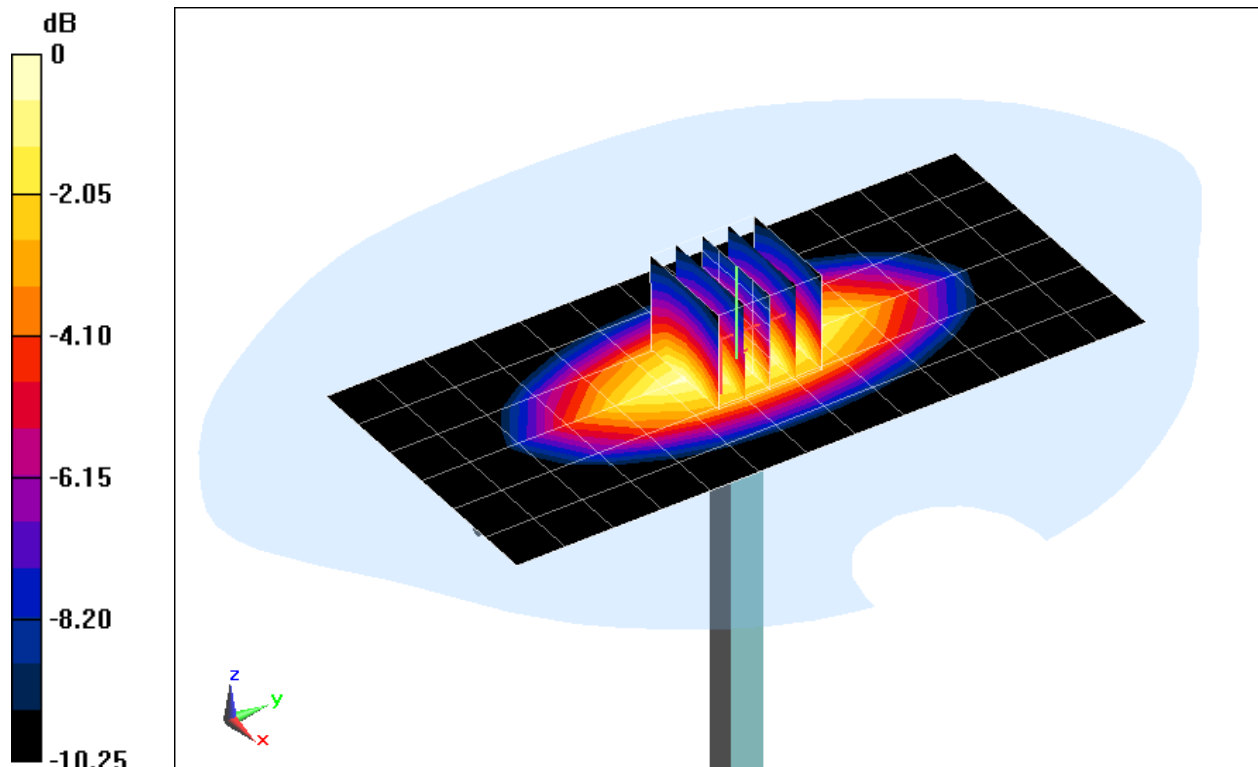
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.39 W/kg

SAR(1 g) = 0.971 W/kg; SAR(10 g) = 0.642 W/kg

Deviation: 3.19%



0 dB = 1.05 W/kg = 0.21 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):

$f = 1900 \text{ MHz}$; $\sigma = 1.588 \text{ S/m}$; $\epsilon_r = 51.72$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-10-2013; Ambient Temp: 21.5°C; Tissue Temp: 20.8°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: SAM Right; Type: QD000P40CD; Serial: 1686

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.8 (7028)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

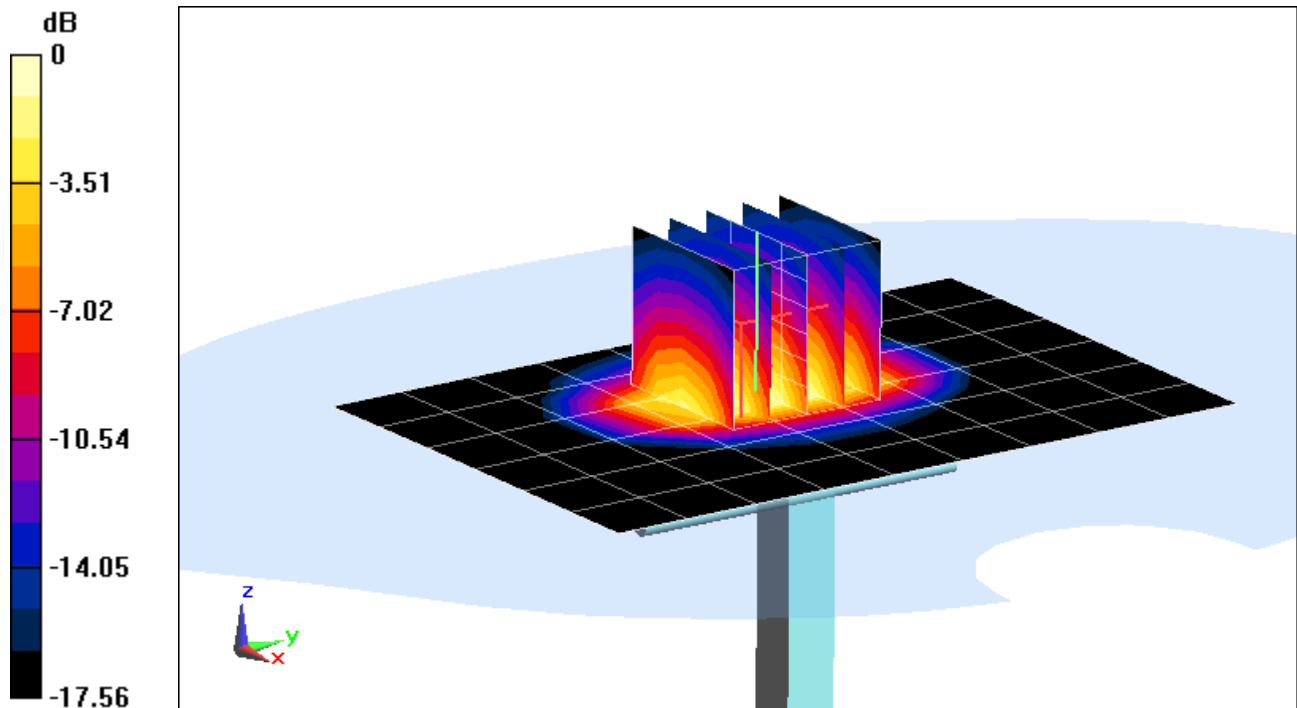
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.76 W/kg

SAR(1 g) = 4.21 W/kg; SAR(10 g) = 2.17 W/kg

Deviation: 7.67%



0 dB = 4.75 W/kg = 6.77 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 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.503 \text{ S/m}$; $\epsilon_r = 53.113$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

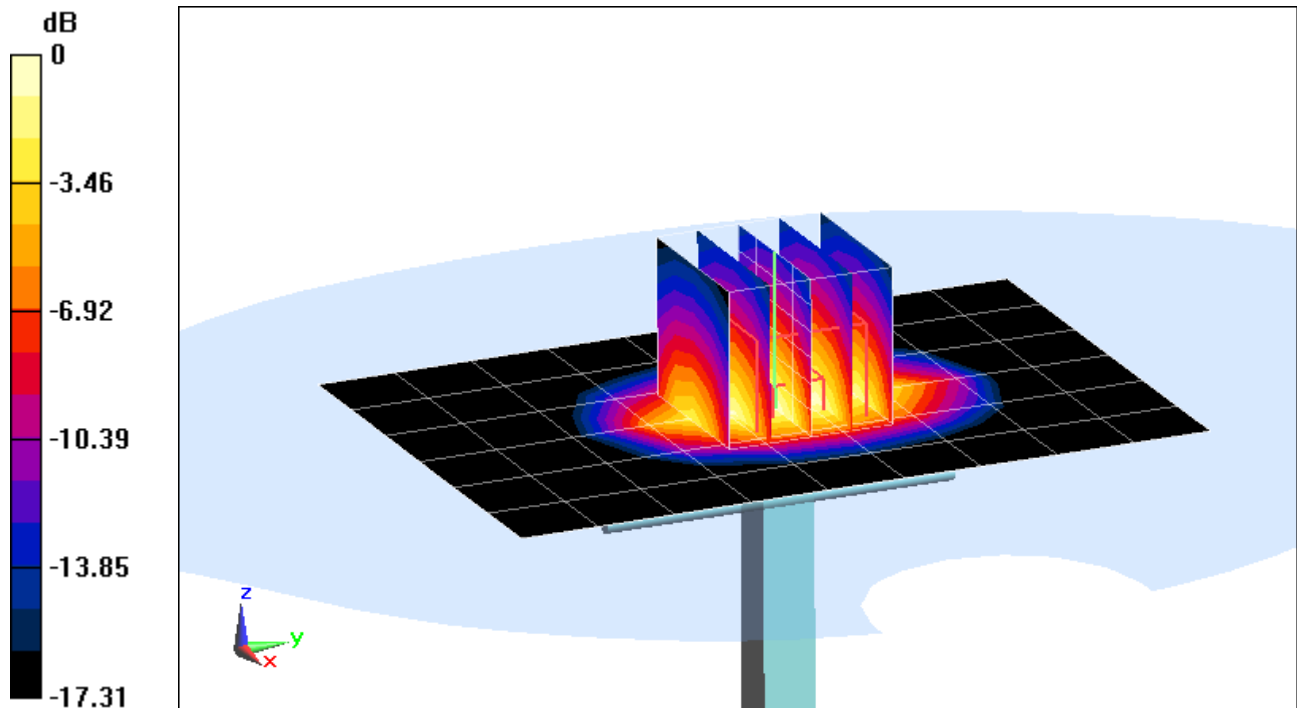
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.28 W/kg

SAR(1 g) = 4.08 W/kg; SAR(10 g) = 2.15 W/kg

Deviation: 3.82%



0 dB = 4.53 W/kg = 6.56 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 2.016 \text{ S/m}$; $\epsilon_r = 50.37$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-15-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.7°C

Probe: ES3DV2 - SN3022; ConvF(3.97, 3.97, 3.97); Calibrated: 8/28/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 11/13/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

2450 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=12mm, dy=12mm

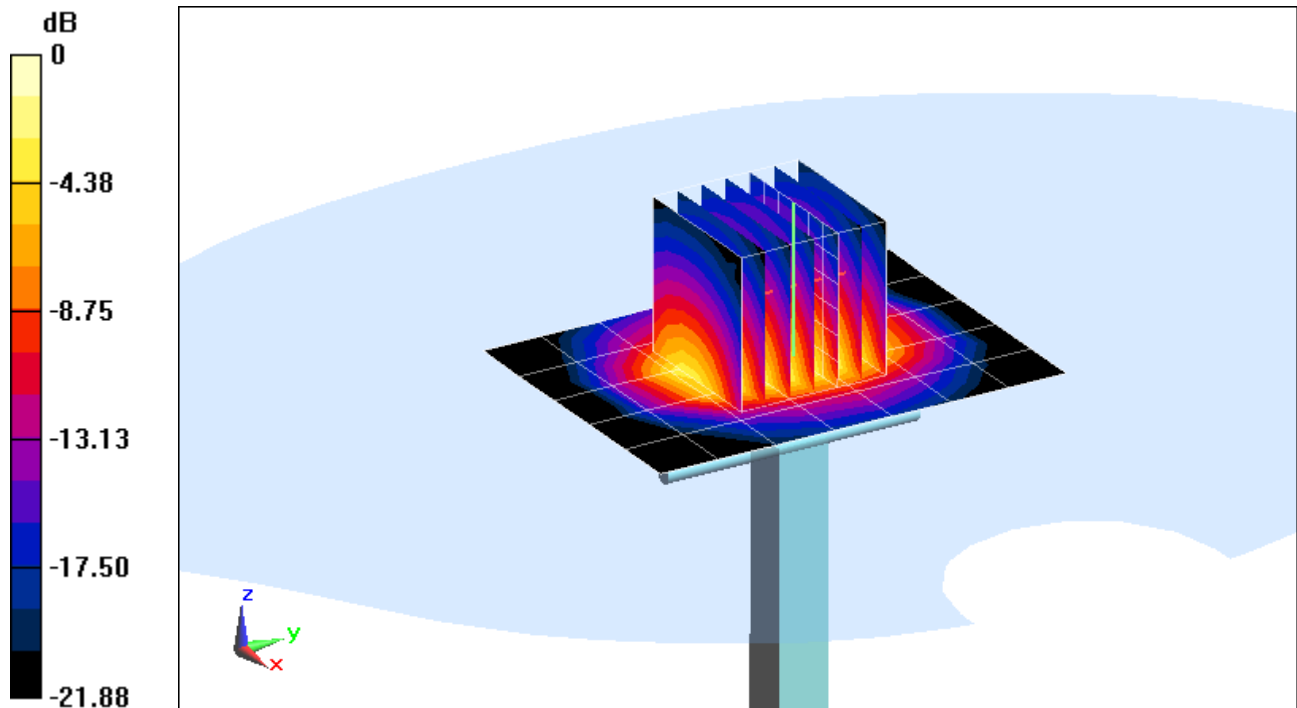
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power: 16.0 dBm (39.8 mW)

Peak SAR (extrapolated) = 4.61 W/kg

SAR(1 g) = 2.17 W/kg; SAR(10 g) = 0.999 W/kg

Deviation: 5.66%



0 dB = 2.73 W/kg = 4.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5200 \text{ MHz}$; $\sigma = 5.248 \text{ S/m}$; $\epsilon_r = 47.65$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3561; ConvF(3.76, 3.76, 3.76); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5200 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

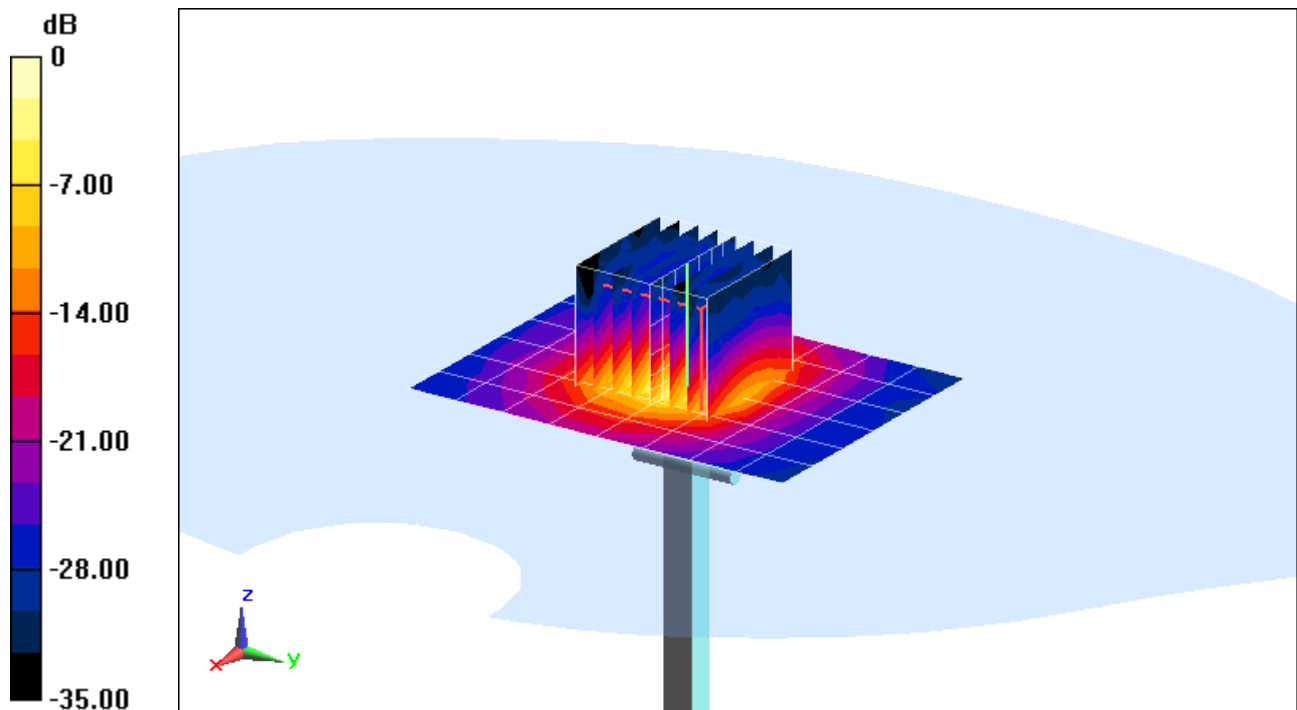
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 27.8 W/kg

SAR(1 g) = 7.21 W/kg; SAR(10 g) = 2.03 W/kg

Deviation: -1.64%



0 dB = 16.7 W/kg = 12.23 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 5.414 \text{ S/m}$; $\epsilon_r = 47.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.3°C; Tissue Temp: 22.6°C

Probe: EX3DV4 - SN3561; ConvF(3.54, 3.54, 3.54); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

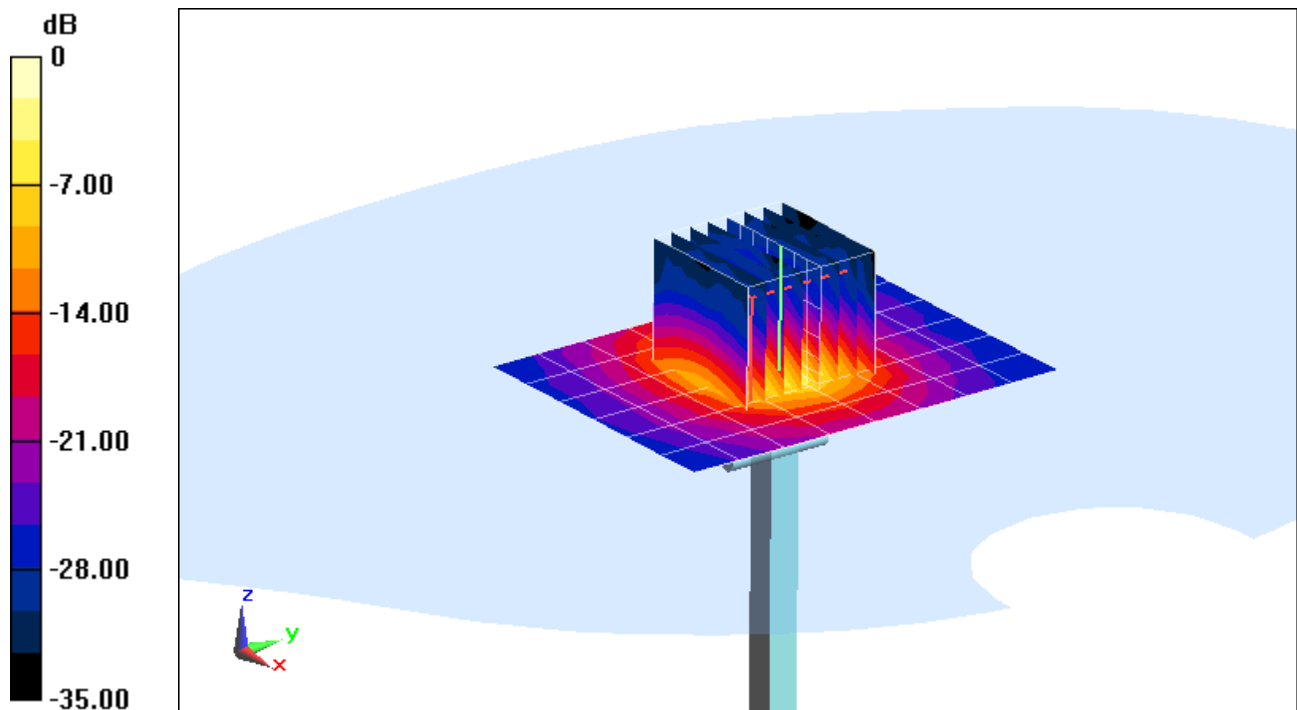
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 29.9 W/kg

SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.2 W/kg

Deviation: 4.10%



0 dB = 17.7 W/kg = 12.48 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 5.862 \text{ S/m}$; $\epsilon_r = 46.64$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.3°C; Tissue Temp: 22.9°C

Probe: EX3DV4 - SN3561; ConvF(3.17, 3.17, 3.17); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5600 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

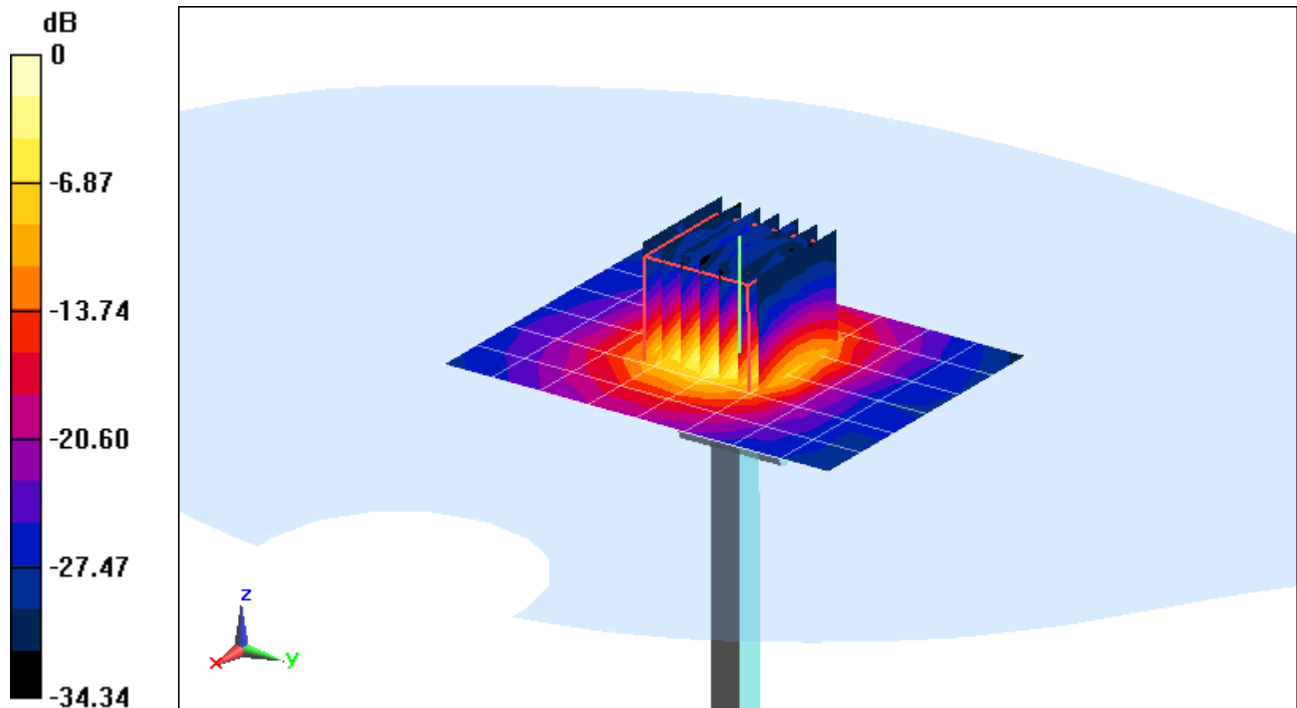
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 37.6 W/kg

SAR(1 g) = 8.18 W/kg; SAR(10 g) = 2.21 W/kg

Deviation: 2.25%



0 dB = 17.5 W/kg = 12.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1007

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 6.17 \text{ S/m}$; $\epsilon_r = 46.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-14-2013; Ambient Temp: 24.5°C; Tissue Temp: 22.9°C

Probe: EX3DV4 - SN3561; ConvF(3.42, 3.42, 3.42); Calibrated: 7/26/2012;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

5800 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

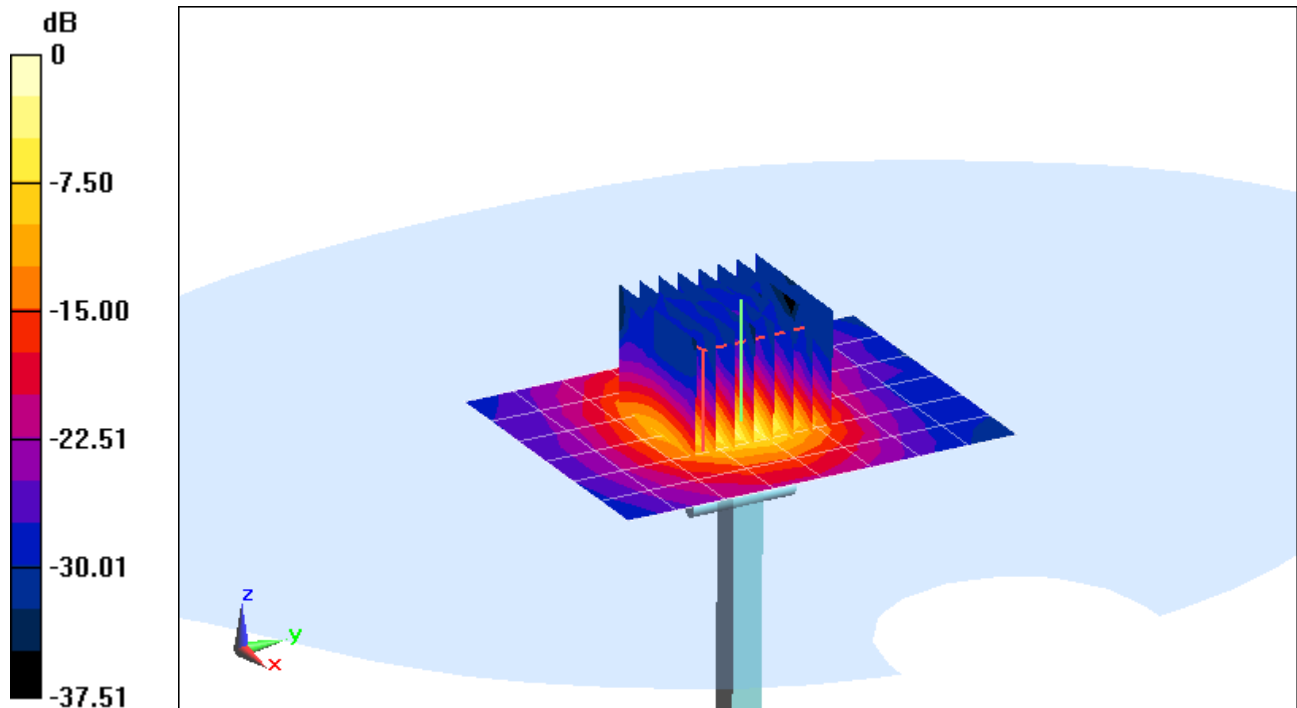
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power: 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 32.3 W/kg

SAR(1 g) = 7.29 W/kg; SAR(10 g) = 2.03 W/kg

Deviation: -1.88%



0 dB = 17.4 W/kg = 12.41 dBW/kg

APPENDIX C: PROBE CALIBRATION



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: **D1900V2-5d148_Feb12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d148**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **February 08, 2012** ✓ 5/14/12
KOK

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 EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature

Issued: February 8, 2012

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	40.4 \pm 6 %	1.40 mho/m \pm 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.5 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.4 mW / g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	53.0 \pm 6 %	1.56 mho/m \pm 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.95 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	39.1 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.25 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.8 mW / g \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω + 4.9 j Ω
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.9 Ω + 6.3 j Ω
Return Loss	- 23.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 08.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (8x7x7)/Cube 0:

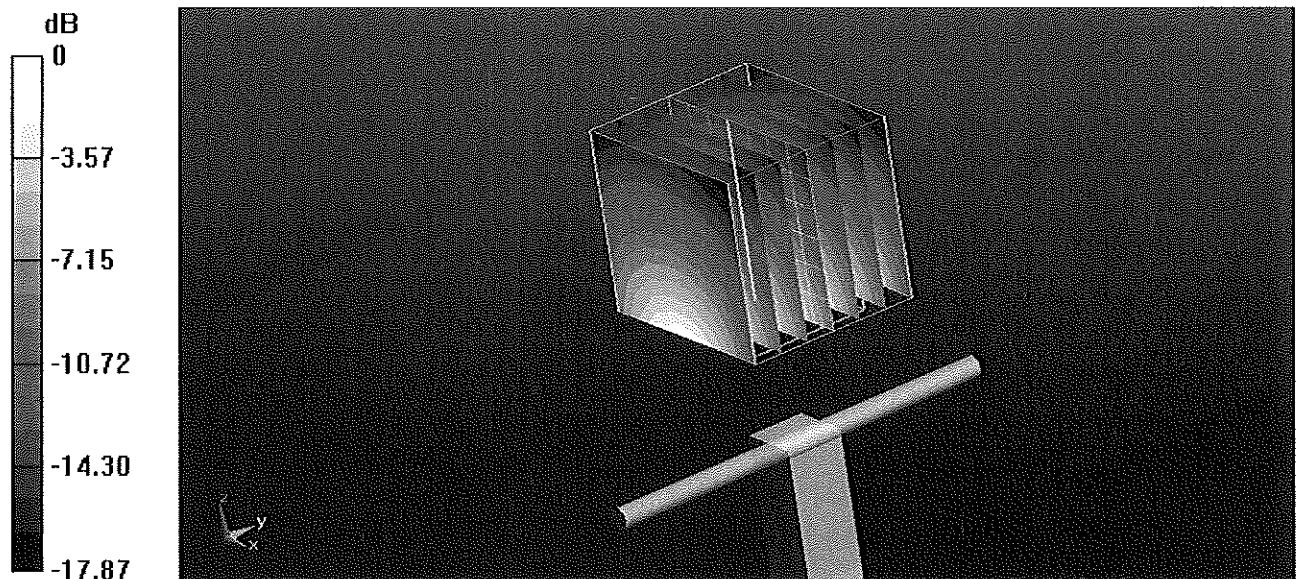
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.284 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 18.0570

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.35 mW/g

Maximum value of SAR (measured) = 12.808 mW/g



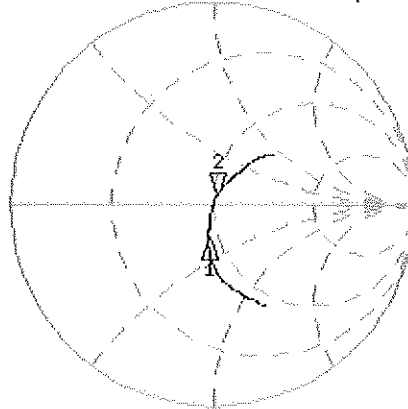
0 dB = 12.810mW/g = 22.15 dB mW/g

Impedance Measurement Plot for Head TSL

8 Feb 2012 11:26:41

[CH1] S11 1 U FS 2: 51.727 Ω 4.8828 Ω 409.01 μ H 1 900.000 000 MHz

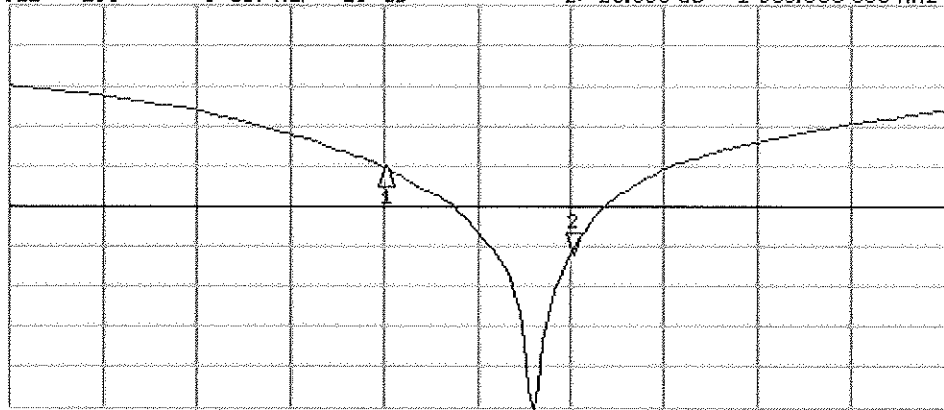
*
De1
CA
Avg
16
H1d



CH1 Markers
1: 44.816 Ω
-16.234 Ω
1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2:-25.868 dB 1 900.000 000 MHz

CA
Avg
15
H1d



CH2 Markers
1:-15.032 dB
1.80000 GHz

DASY5 Validation Report for Body TSL

Date: 06.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

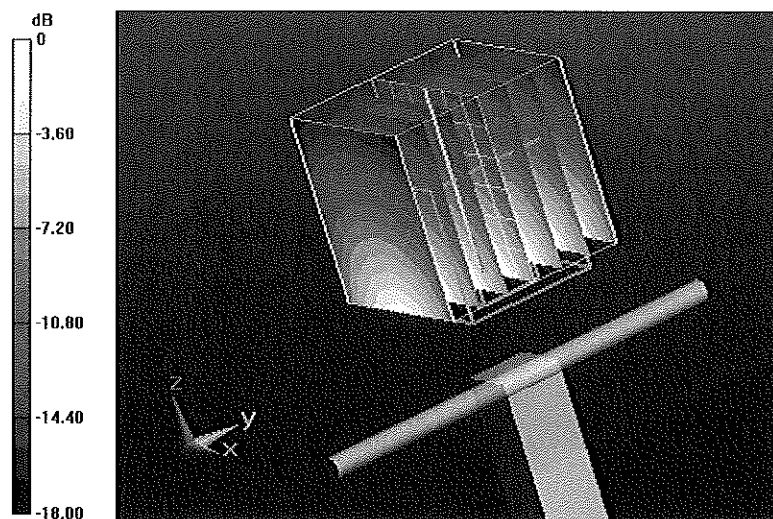
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.855 V/m; Power Drift = 0.006 dB

Peak SAR (extrapolated) = 17.7160

SAR(1 g) = 9.95 mW/g; SAR(10 g) = 5.25 mW/g

Maximum value of SAR (measured) = 12.606 mW/g



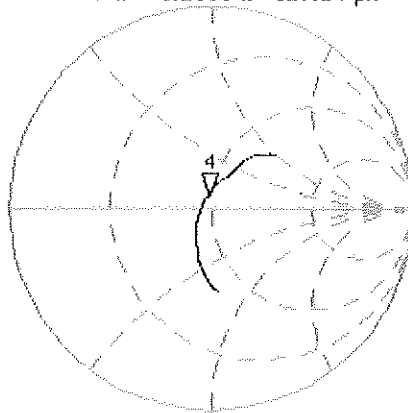
0 dB = 12.610mW/g = 22.01 dB mW/g

Impedance Measurement Plot for Body TSL

6 Feb 2012 12:11:40

CH1 S11 1 U FS 4: 47.852 Ω 6.2930 Ω 527.14 μH 1 900.000 000 MHz

*
De1
CA



Avg
16

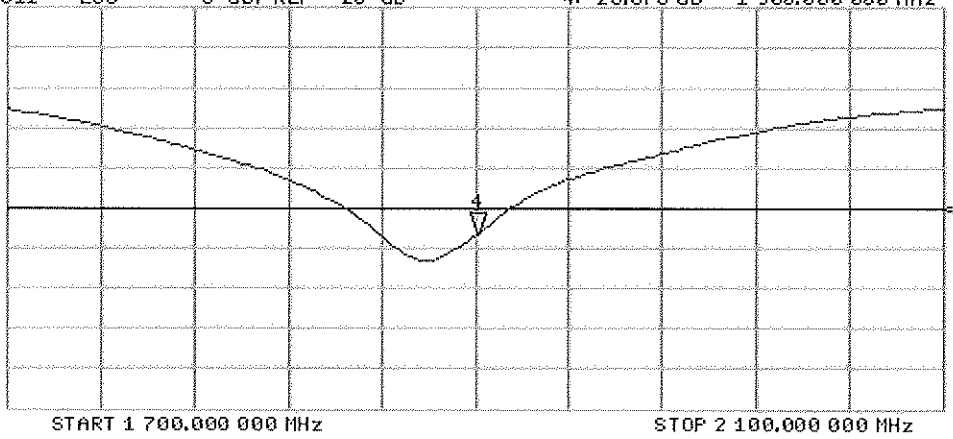
H1d

CH2 S11 LOG 5 dB/REF -20 dB 4: -23.373 dB 1 900.000 000 MHz

CA

Avg
16

H1d





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d149_Feb12**

CALIBRATION CERTIFICATE

Object: **D1900V2 - SN: 5d149**

Calibration procedure(s): **QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **February 22, 2012**

*✓ KOK
4/11/12*

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 EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Israe El-Naouq** (Name), **Laboratory Technician** (Function), *Israe El-Naouq* (Signature)

Approved by: **Katja Pokovic** (Name), **Technical Manager** (Function), *Katja Pokovic* (Signature)

Issued: February 23, 2012

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	40.4 \pm 6 %	1.40 mho/m \pm 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.80 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.3 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW / g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	53.0 \pm 6 %	1.56 mho/m \pm 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	39.3 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.23 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.7 mW / g \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 5.5 j Ω
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0 Ω + 6.7 j Ω
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 22.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

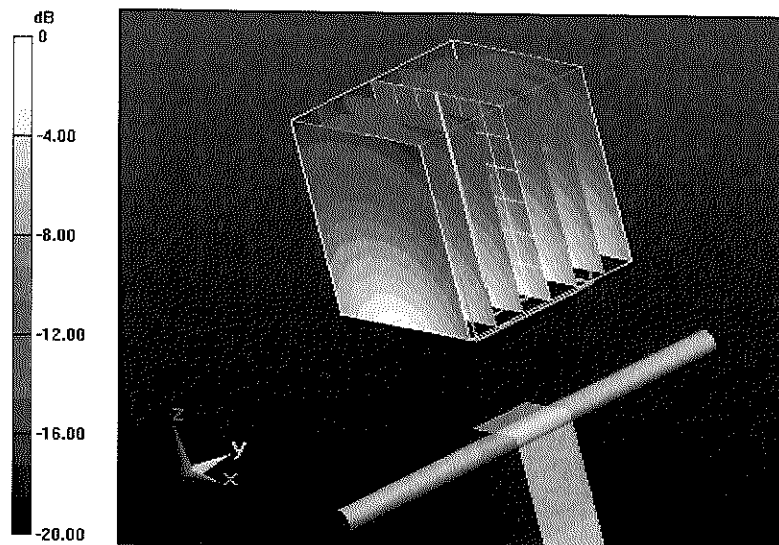
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.685 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.4710

SAR(1 g) = 9.8 mW/g; SAR(10 g) = 5.18 mW/g

Maximum value of SAR (measured) = 12.114 mW/g



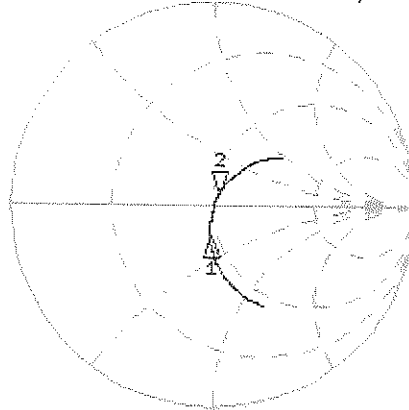
0 dB = 12.110mW/g = 21.66 dB mW/g

Impedance Measurement Plot for Head TSL

22 Feb 2012 09:56:56

CH1 S11 1 U FS 2: 52.387 Ω 5.5859 Ω 461.20 μ H 1 900.000 000 MHz

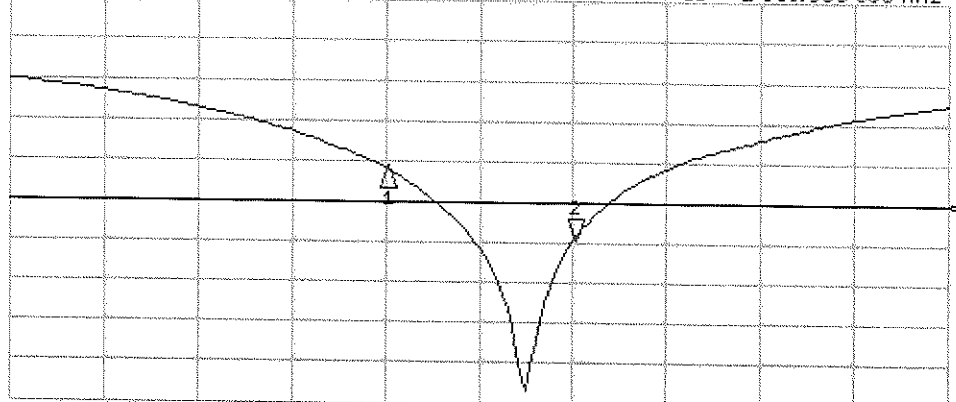
*
Del
Cor
Avg
16
H1 d



CH1 Markers
1: 46.287 Ω
2: -15.180 Ω
1.00000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2: -24.647 dB 1 900.000 000 MHz

Cor
Avg
16
H1 d



CH2 Markers
1: -15.901 dB
2: -24.647 dB
1.00000 GHz

START 1 600.000 000 MHz STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 06.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

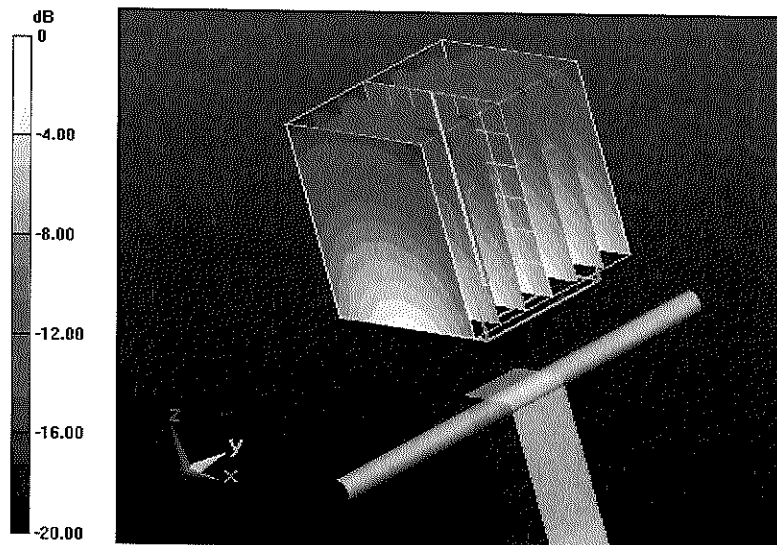
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.047 V/m; Power Drift = 0.0017 dB

Peak SAR (extrapolated) = 18.1310

SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.23 mW/g

Maximum value of SAR (measured) = 12.672 mW/g



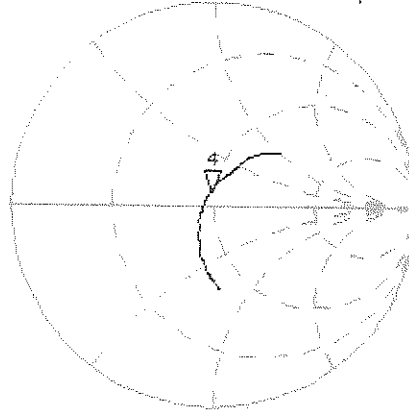
0 dB = 12.670mW/g = 22.06 dB mW/g

Impedance Measurement Plot for Body TSL

6 Feb 2012 12:15:29

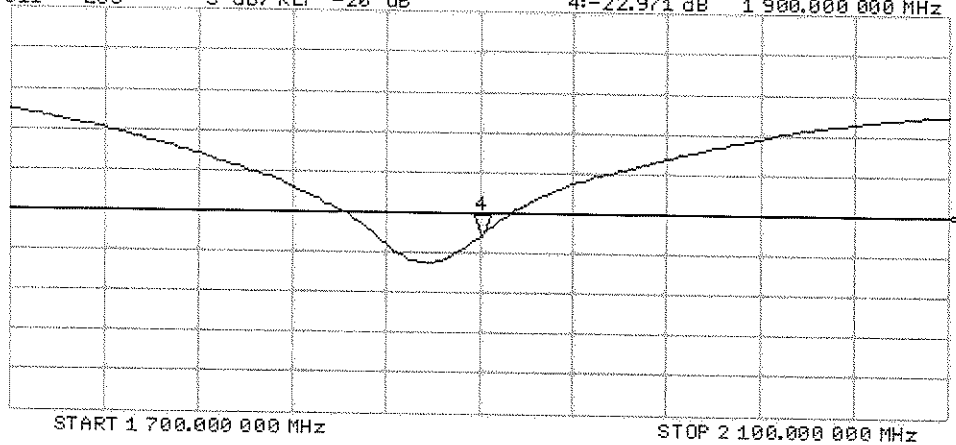
CH1 S11 1 U FS 4: 47.961 Ω 6.8680 Ω 558.55 μ H 1 900.000 000 MHz

*
Del
Ca
Avg
15
H1 d



CH2 S11 LOG 5 dB/REF -20 dB 4:-22.971 dB 1 900.000 000 MHz

Ca
Avg
15
H1 d



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



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

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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-719_Aug12**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **August 23, 2012**

*✓ KOK
9/17/12*

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 EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature
Israe El-Naouq
Katja Pokovic

Issued: August 23, 2012

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.2 \pm 6 %	1.81 mho/m \pm 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.7 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.7 mW / g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	51.3 \pm 6 %	1.99 mho/m \pm 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.6 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.4 mW / g \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.4 \Omega + 3.8 j\Omega$
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.7 \Omega + 5.9 j\Omega$
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.81$ mho/m; $\epsilon_r = 39.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

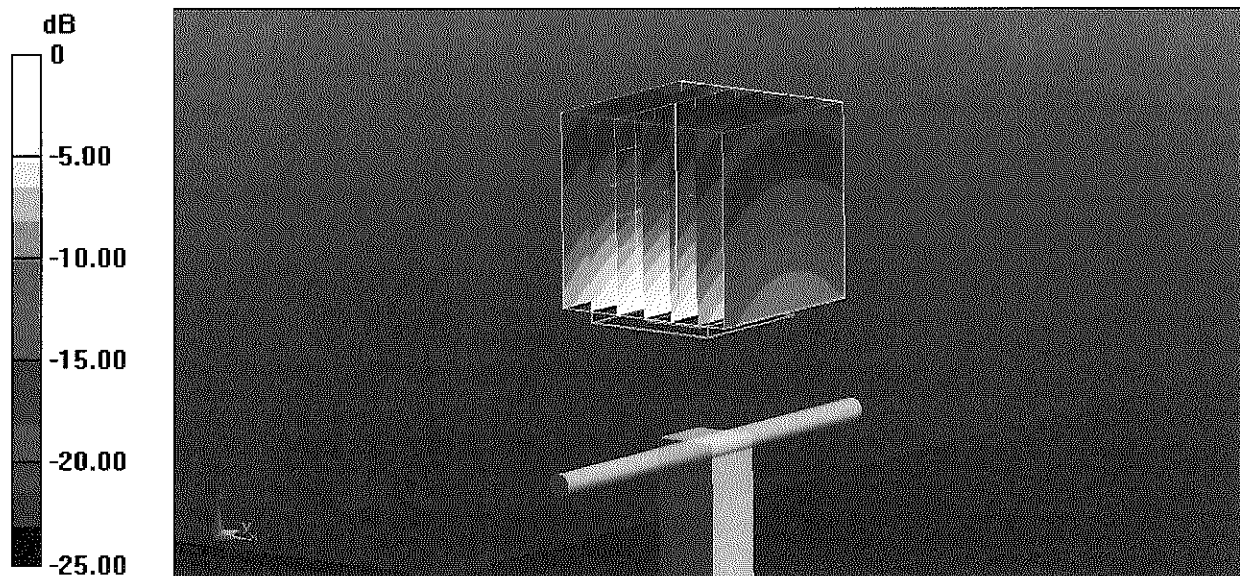
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.219 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.633 mW/g

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g

Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 24.35 dB W/kg

Impedance Measurement Plot for Head TSL

22 Aug 2012 15:39:08

CH1 S11 1 U FS

3: 54.416 Ω 3.7656 μ 244.62 pH

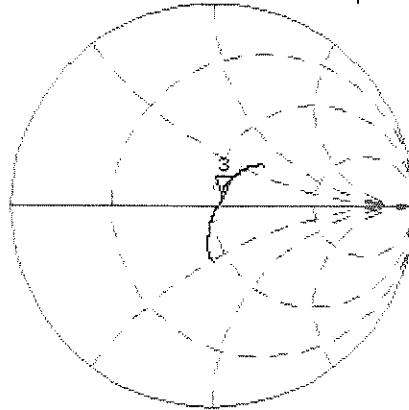
2 450.000 000 MHz

*
De1

CΔ

Avg
16

H1d



CH2 S11

LOG

5 dB/REF

-20 dB

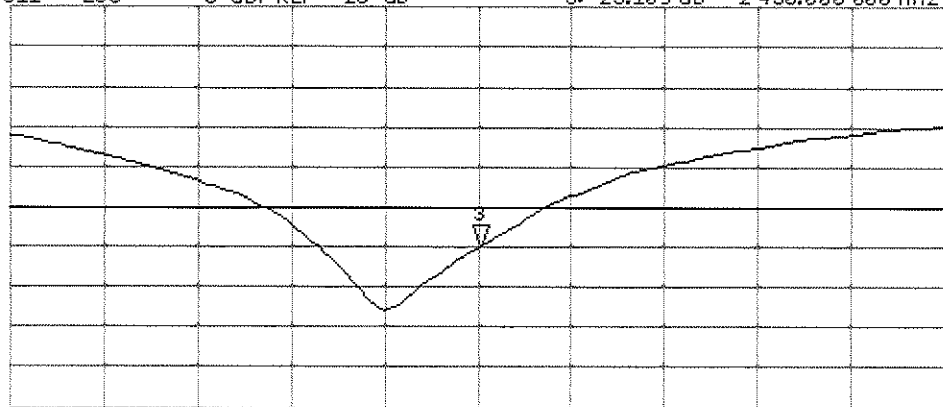
3: -25.109 dB

2 450.000 000 MHz

CΔ

Avg
16

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

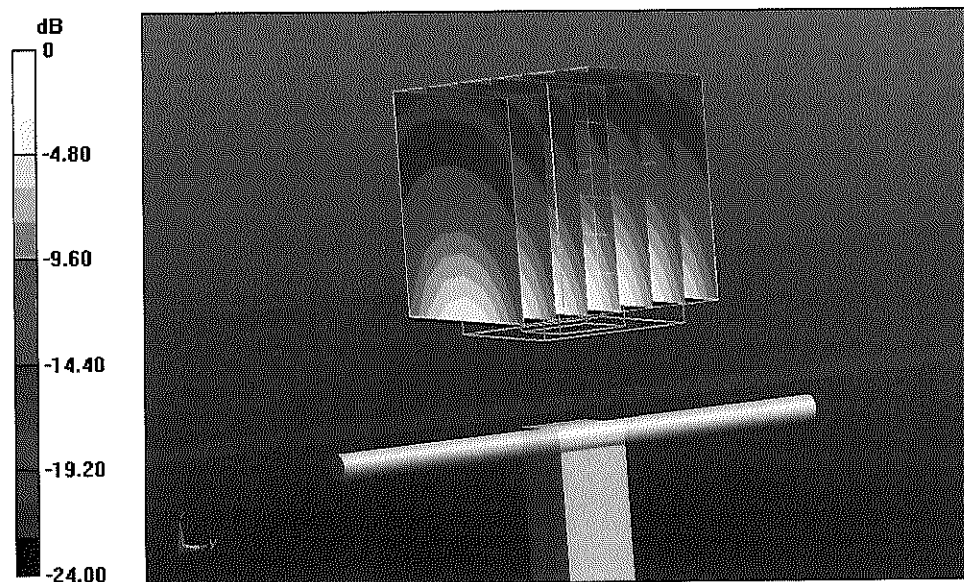
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.970 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.692 mW/g

SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.16 mW/g

Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 24.66 dB W/kg

Impedance Measurement Plot for Body TSL

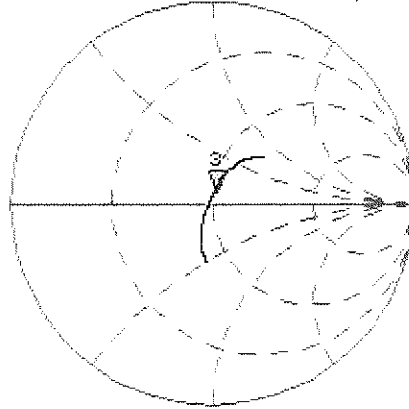
22 Aug 2012 15:38:22

[CH1] S11 1 U FS

3: 50.709 Ω 5.8906 Ω 382.66 pF

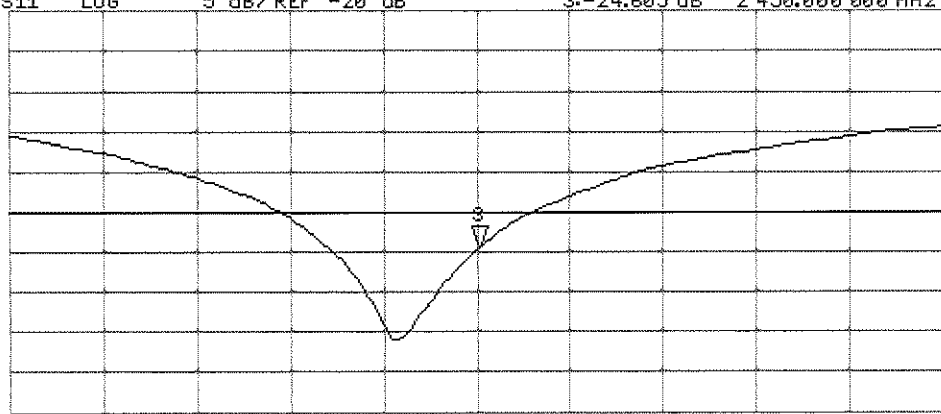
2 450.000 000 MHz

*
Del
CA
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 3: -24.605 dB 2 450.000 000 MHz

CA
Avg
16
H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D5GHzV2-1007_Oct12**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1007**

Calibration procedure(s) **QA CAL-22.v1**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **October 30, 2012**

KOK
11/15/12

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 EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	30-Dec-11 (No. EX3-3503_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature: *Israe El-Naouq*
Katja Pokovic

Issued: October 31, 2012

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.63 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.9 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.5 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.0 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	5.15 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.7 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.41 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.7 ± 6 %	5.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.63 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.78 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.8 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	5.90 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	80.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	45.9 ± 6 %	6.18 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 19.5 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	55.1 Ω - 11.2 j Ω
Return Loss	- 18.7 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	56.8 Ω - 1.2 j Ω
Return Loss	- 23.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.5 Ω - 4.3 j Ω
Return Loss	- 27.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	59.3 Ω - 7.4 j Ω
Return Loss	- 19.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	57.2 Ω + 5.4 j Ω
Return Loss	- 21.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	52.1 Ω - 10.0 j Ω
Return Loss	- 20.1 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	55.6 Ω - 3.0 j Ω
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.1 Ω - 3.3 j Ω
Return Loss	- 29.5 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.6 Ω - 6.2 j Ω
Return Loss	- 20.8 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	59.7 Ω + 4.5 j Ω
Return Loss	- 20.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 28, 2003

DASY5 Validation Report for Head TSL

Date: 30.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1007

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz,
Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.53$ mho/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.63$ mho/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.83$ mho/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.93$ mho/m; $\epsilon_r = 34.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.15$ mho/m; $\epsilon_r = 34$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 30.12.2011, ConvF(5.1, 5.1, 5.1); Calibrated: 30.12.2011, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2011, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2011, ConvF(4.81, 4.81, 4.81); Calibrated: 30.12.2011;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.518 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.31 W/kg

Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.964 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 31.8 W/kg

SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.435 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 33.8 W/kg

SAR(1 g) = 8.56 W/kg; SAR(10 g) = 2.44 W/kg

Maximum value of SAR (measured) = 20.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.179 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 8.53 W/kg; SAR(10 g) = 2.43 W/kg

Maximum value of SAR (measured) = 20.4 W/kg

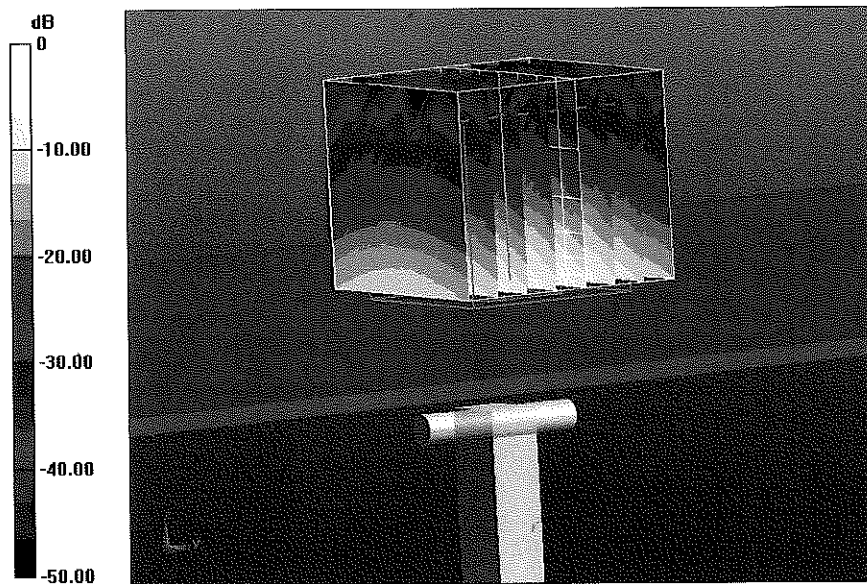
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.223 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.29 W/kg

Maximum value of SAR (measured) = 19.6 W/kg



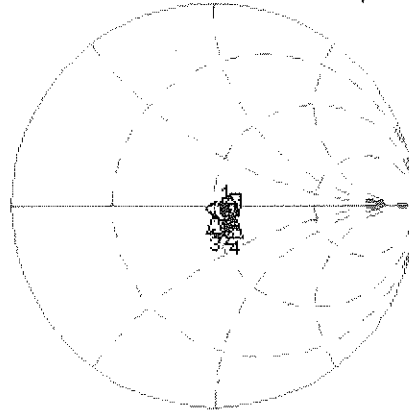
0 dB = 19.6 W/kg = 12.92 dBW/kg

Impedance Measurement Plot for Head TSL

30 Oct 2012 11:43:37

CH1 S11 1 U FS 1: 55.082 Ω -11.236 Ω 2.7239 pF 5 200.000 000 MHz

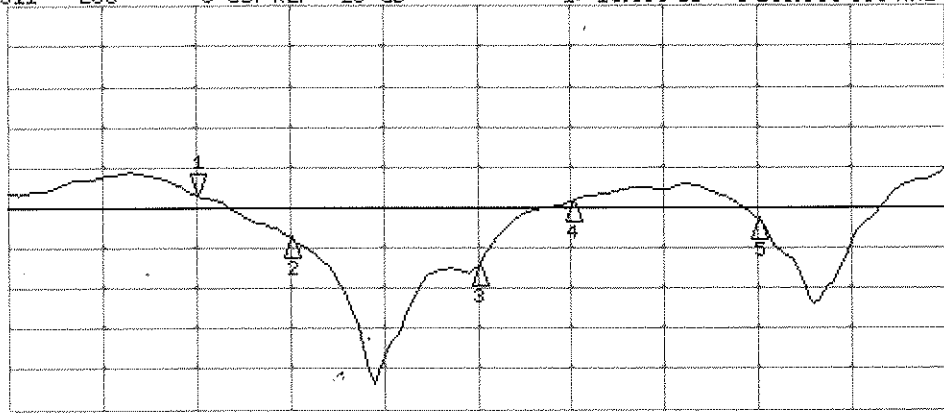
*
Del
Cor
Avg
16
H1d



CH1 Markers
2: 56.760 Ω
-1.2324 Ω
5.30000 GHz
3: 49.537 Ω
-4.2871 Ω
5.50000 GHz
4: 59.338 Ω
-7.4336 Ω
5.60000 GHz
5: 57.160 Ω
5.3867 Ω
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -18.659 dB 5 200.000 000 MHz

Cor
Avg
16
H1d



CH2 Markers
2: -23.826 dB
5.30000 GHz
3: -27.278 dB
5.50000 GHz
4: -19.256 dB
5.60000 GHz
5: -21.566 dB
5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 30.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1007

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz; $\sigma = 5.41$ mho/m; $\epsilon_r = 46.8$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5300 MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 46.7$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5500 MHz; $\sigma = 5.78$ mho/m; $\epsilon_r = 46.3$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5600 MHz; $\sigma = 5.9$ mho/m; $\epsilon_r = 46.2$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5800 MHz; $\sigma = 6.18$ mho/m; $\epsilon_r = 45.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2011, ConvF(4.67, 4.67, 4.67); Calibrated: 30.12.2011, ConvF(4.43, 4.43, 4.43); Calibrated: 30.12.2011, ConvF(4.22, 4.22, 4.22); Calibrated: 30.12.2011, ConvF(4.38, 4.38, 4.38); Calibrated: 30.12.2011;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X.14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.536 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 29.4 W/kg

SAR(1 g) = 7.4 W/kg; SAR(10 g) = 2.08 W/kg

Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.637 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 7.63 W/kg; SAR(10 g) = 2.14 W/kg

Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.216 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 34.4 W/kg

SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.21 W/kg

Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.347 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 35.9 W/kg

SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.25 W/kg

Maximum value of SAR (measured) = 19.9 W/kg

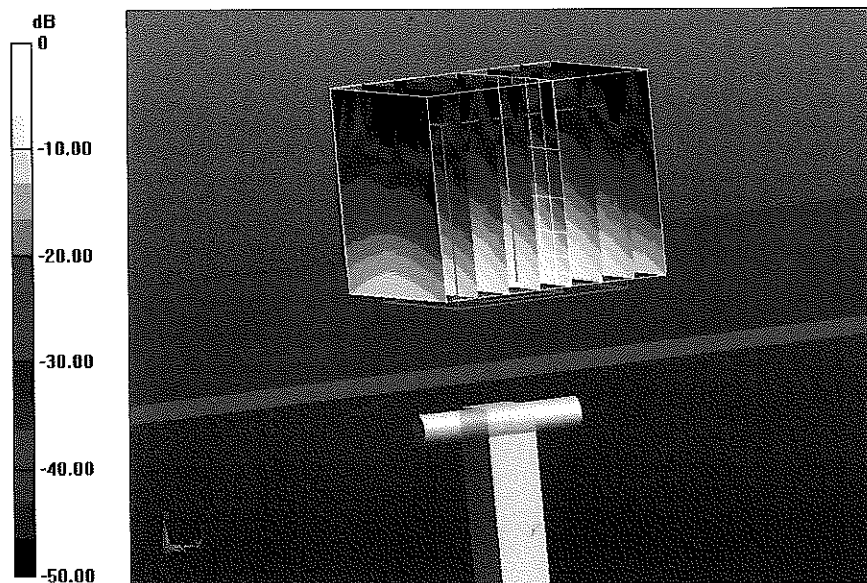
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.261 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 35.4 W/kg

SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.08 W/kg

Maximum value of SAR (measured) = 18.9 W/kg



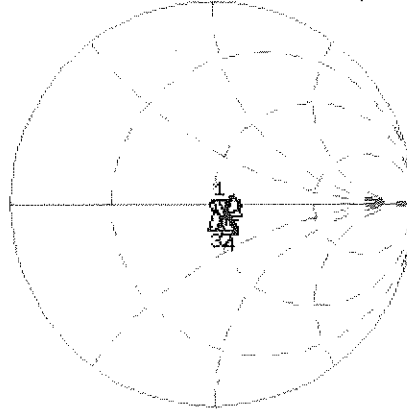
0 dB = 18.9 W/kg = 12.76 dBW/kg

Impedance Measurement Plot for Body TSL

30 Oct 2012 11:02:08

CH1 S11 1 U FS 1: 52.068 Ω -9.9570 Ω 3.0739 pF 5 200.000 000 MHz

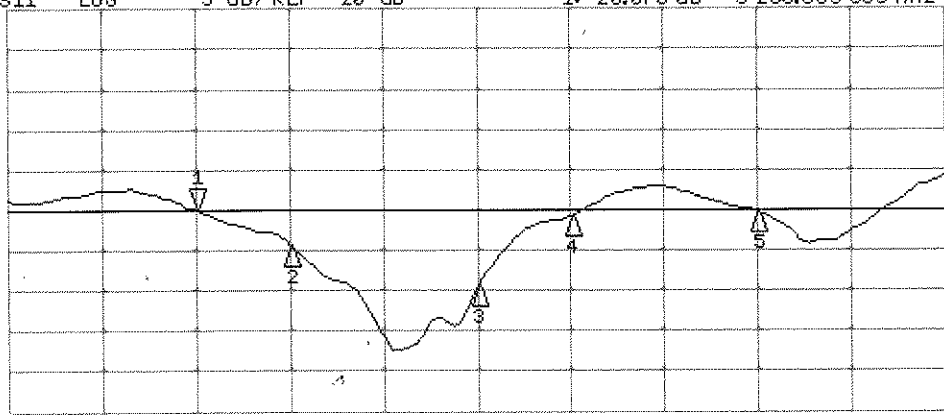
*
De1
Cor
Avg
16
H1d



CH1 Markers
2: 55.563 Ω
-3.0234 Ω
5.30000 GHz
3: 50.104 Ω
-3.3438 Ω
5.50000 GHz
4: 57.613 Ω
-6.1699 Ω
5.60000 GHz
5: 59.734 Ω
4.4648 Ω
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.070 dB 5 200.000 000 MHz

Cor
Avg
16
H1d



CH2 Markers
2: -24.438 dB
5.30000 GHz
3: -29.525 dB
5.50000 GHz
4: -20.822 dB
5.60000 GHz
5: -20.219 dB
5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz