



## SAR EVALUATION REPORT

**Applicant Name:**  
 Samsung Electronics, Co. Ltd.  
 129, Samsung-ro, Maetan dong,  
 Yeongtong-gu, Suwon-si  
 Gyeonggi-do 443-742, Korea

**Date of Testing:**  
 02/26/13 - 03/08/13  
**Test Site/Location:**  
 PCTEST Lab, Columbia, MD, USA  
**Document Serial No.:**  
 0Y1303060464-R1.A3L

**FCC ID:** A3LSWDSC04E

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

**DUT Type:** Portable Handset  
**Application Type:** Certification  
**FCC Rule Part(s):** CFR §2.1093  
**Model(s):** SC-04E


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	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	32.50	0.27	0.40	0.92
PCE	UMTS 850	826.40 - 846.60 MHz	24.00	0.37	0.45	0.47
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	29.39	0.21	0.32	1.02
DTS	2.4 GHz WLAN	2412 - 2462 MHz	16.55	< 0.1	< 0.1	< 0.1
DTS	5.8 GHz WLAN	5745 - 5825 MHz	12.86	0.18	0.60	
UNII	5.2 GHz WLAN	5180 - 5240 MHz	13.19	< 0.1	0.48	
UNII	5.3 GHz WLAN	5260 - 5320 MHz	12.68	< 0.1	0.37	
UNII	5.5 GHz WLAN	5500 - 5700 MHz	12.79	< 0.1	0.61	
DSS/DTS	Bluetooth	2402 - 2480 MHz	9.24	N/A		
<b>Simultaneous SAR per KDB 690783 D01v01r02:</b>				0.50	1.06	1.03

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.



Note: This revised Test Report (0Y1303060464-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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



FCC ID: A3LSWDSC04E		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 1 of 39

# T A B L E O F C O N T E N T S

1	DEVICE UNDER TEST .....	3
2	INTRODUCTION .....	8
3	DOSIMETRIC ASSESSMENT .....	9
4	DEFINITION OF REFERENCE POINTS .....	10
5	TEST CONFIGURATION POSITIONS FOR HANDSETS .....	11
6	RF EXPOSURE LIMITS .....	14
7	FCC MEASUREMENT PROCEDURES.....	15
8	RF CONDUCTED POWERS.....	17
9	SYSTEM VERIFICATION.....	22
10	SAR DATA SUMMARY .....	24
11	FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS.....	30
12	SAR MEASUREMENT VARIABILITY .....	33
13	EQUIPMENT LIST.....	34
14	MEASUREMENT UNCERTAINTIES .....	35
15	CONCLUSION.....	37
16	REFERENCES .....	38
APPENDIX A: SAR TEST PLOTS		
APPENDIX B: SAR DIPOLE VERIFICATION PLOTS		
APPENDIX C: PROBE AND DIPOLE CALIBRATION CERTIFICATES		
APPENDIX D: SAR TISSUE SPECIFICATIONS		
APPENDIX E: SAR SYSTEM VALIDATION		
APPENDIX F: SAR TEST SETUP PHOTOGRAPHS		

FCC ID: A3LSWDSC04E		<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset	Page 2 of 39	

# 1 DEVICE UNDER TEST

## 1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 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
NFC	Data	13.56 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.

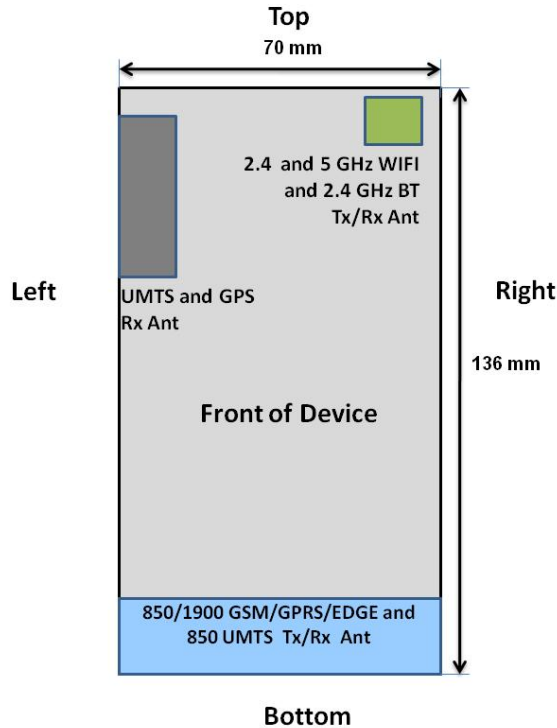
Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
			1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots
GSM/GPRS/EDGE 850	Maximum	33.0	33.0	32.5	31.0	28.5	27.5	27.0	25.5	23.5
	Nominal	32.5	32.5	32.0	30.5	28.0	27.0	26.5	25.0	23.0
GSM/GPRS/EDGE 1900	Maximum	30.0	30.0	29.5	28.5	25.5	27.0	26.5	24.5	22.0
	Nominal	29.5	29.5	29.0	28.0	25.0	26.5	26.0	24.0	21.5

Mode / Band		Modulated Average (dBm)		
		3GPP RMC	3GPP HSDPA	3GPP HSUPA
UMTS Band 5 (850 MHz)	Maximum	24.0	23.0	23.0
	Nominal	23.5	22.5	22.5

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	17.0
	Nominal	16.5
IEEE 802.11g (2.4 GHz)	Maximum	13.5
	Nominal	13.0
IEEE 802.11n (2.4 GHz)	Maximum	12.5
	Nominal	12.0
IEEE 802.11a (5 GHz)	Maximum	13.5
	Nominal	13.0
IEEE 802.11n (5 GHz)	Maximum	13.0
	Nominal	12.5
IEEE 802.11ac (5 GHz)	Maximum	10.5
	Nominal	10.0
Bluetooth	Maximum	9.5
	Nominal	9.0
Bluetooth LE	Maximum	5.5
	Nominal	5.0

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 3 of 39

### 1.3 DUT Antenna Locations





Note: Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC Filing.

**Figure 1-1  
DUT Antenna Locations**

**Table 1-1  
Mobile Hotspot Sides for SAR Testing**

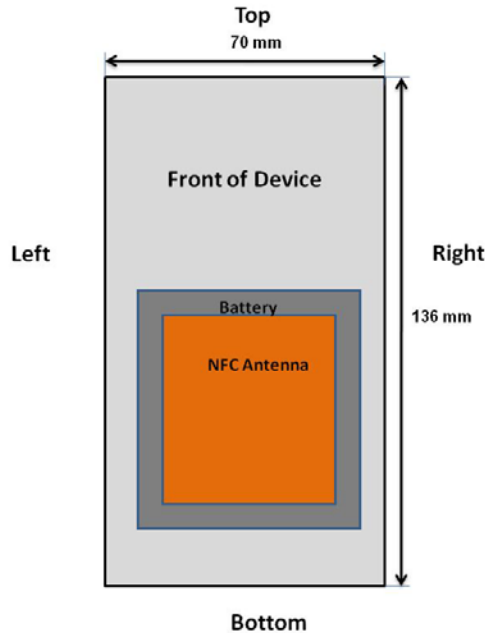
Mobile Hotspot Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	Yes
UMTS 850	Yes	Yes	No	Yes	Yes	Yes
GPRS 1900	Yes	Yes	No	Yes	Yes	Yes
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No

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.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 4 of 39

## 1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the standard battery. The SAR tests were performed with the standard battery (model: B600BD).



**Figure 1-2**  
NFC Antenna Locations



## 1.5 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.

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 Transmit Configurations	Head	Body-Worn Accessory	Hotspot	Note
		IEEE 1528, Supplement C	Supplement C	FCC KDB 941225 D06 Edges/Sides	
1	GSM Voice + Wifi 2.4 GHz	Yes	Yes	N/A	
2	GPRS/EDGE Data + Wifi 2.4 GHz	N/A	N/A	Yes	2G Hotspot
3	UMTS Voice + Wifi 2.4 GHz	Yes	Yes	N/A	
4	UMTS Data + Wifi 2.4 GHz	Yes	Yes	Yes	3G Hotspot
5	GSM Voice + Wifi 5 GHz	Yes	Yes	N/A	
6	UMTS Voice + Wifi 5 GHz	Yes	Yes	N/A	
7	UMTS Data + Wifi 5 GHz	Yes	Yes	N/A	
8	GSM Voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
9	UMTS Voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
10	GPRS/EDGE Data + Wifi 5 GHz	N/A	N/A	N/A	Not supported by S/W

FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 5 of 39

## 1.6 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 conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required;  $[(9/10) * \sqrt{2.441}] = 1.4 < 3.0$ .

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.

This device supports IEEE 802.11ac with the following features:

- a) 80 MHz bandwidth only
- b) No aggregate channel configurations
- c) 1 Tx antenna output
- d) 256 QAM is supported
- e) No new 5 GHz channels

Per October 2012 TCB workshop notes, SAR testing for 802.11ac was not required since the average output power was not more than 0.25 dB higher than the output power of IEEE 802.11a mode.



### (B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS/EDGE Data.

When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.

## 1.7 Power Reduction for SAR

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

FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 6 of 39



## 1.8 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (2G/3G 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)
- October 2012 TCB Workshop Notes (802.11ac)

## 1.9 Device Serial Numbers

Several samples were used with identical hardware to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
GSM/GPRS/EDGE 850	60FBD	60FBD	60FBA
UMTS 850	60FBD	60FBA	60FBA
GSM/GPRS/EDGE 1900	60FBA	60FBD	60FBD
2.4 GHz WLAN	60FBD	60FAD	60FAD
5 GHz WLAN	60838	60838	-

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset		Page 7 of 39

## 2 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.

### 2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density ( $\rho$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

**Equation 2-1**  
**SAR Mathematical Equation**

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



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

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

where:

- $\sigma$  = conductivity of the tissue-simulating material (S/m)
- $\rho$  = mass density of the tissue-simulating material (kg/m<sup>3</sup>)
- 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]

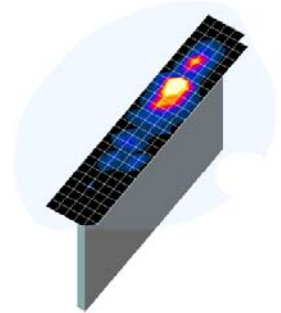
FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset		Page 8 of 39

### 3 DOSIMETRIC ASSESSMENT

#### 3.1 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 3-1).
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 3-1). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASy manual online for more details):
  - a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
  - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
  - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.



**Figure 3-1**  
**Sample SAR Area Scan**

**Table 3-1**  
**Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01**

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

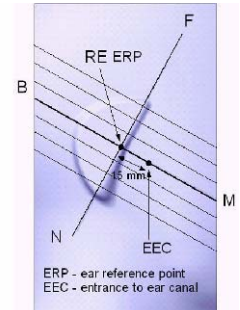
FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 9 of 39

# 4

# DEFINITION OF REFERENCE POINTS

## 4.1 EAR REFERENCE POINT

Figure 4-2 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 4-1. 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 4-1). 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].



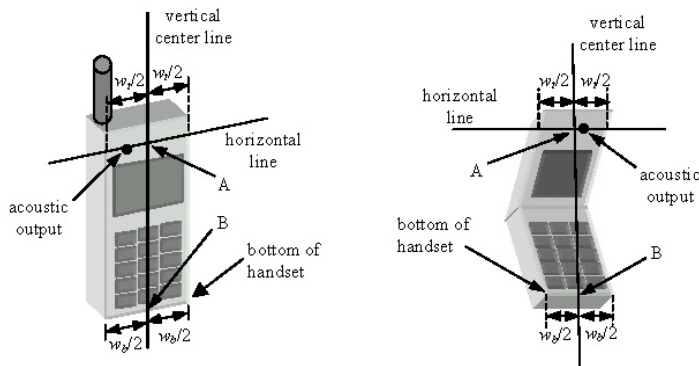
**Figure 4-1**  
Close-Up Side view of ERP

## 4.2 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 4-3). 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 4-2**  
Front, back and side view of SAM Twin Phantom



**Figure 4-3**  
Handset Vertical Center & Horizontal Line Reference Points

FCC ID: A3LSWDSC04E	PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	SAMSUNG	Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 10 of 39

## 5 TEST CONFIGURATION POSITIONS FOR HANDSETS

### 5.1 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  $\delta = 0.02$ .

### 5.2 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 5-1), 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.

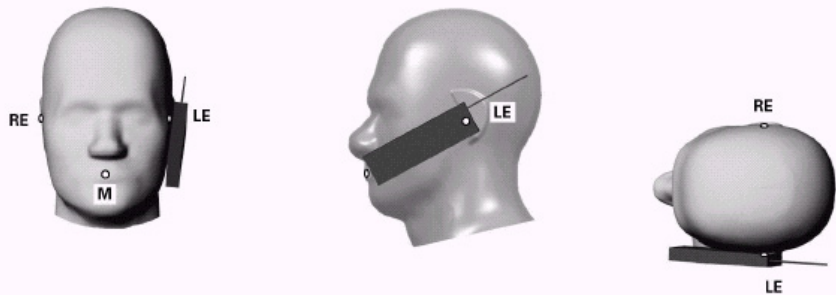




Figure 5-1 Front, Side and Top View of Cheek Position

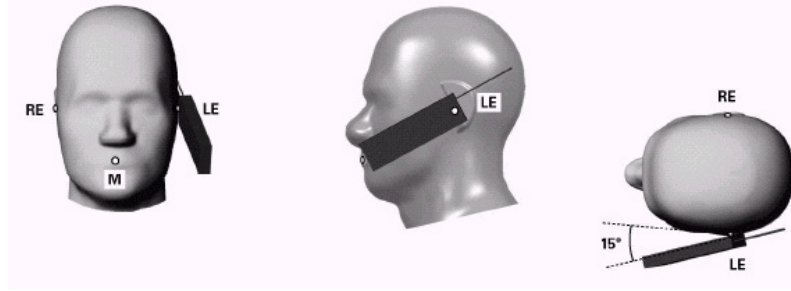
2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (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 5-2).

### 5.3 Positioning for Ear / 15° Tilt

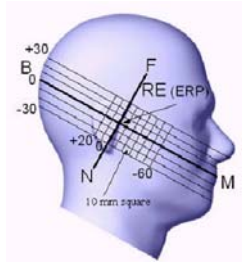
With the test device aligned in the “Cheek Position”:

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 5-2).

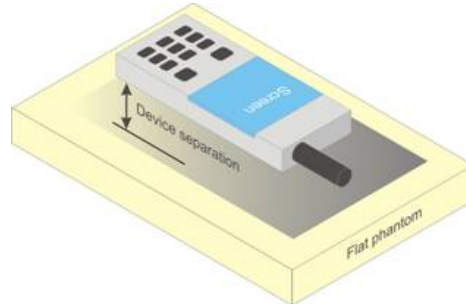
FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 11 of 39



**Figure 5-2 Front, Side and Top View of Ear/15° Tilt Position**



**Figure 5-3 Side view w/ relevant markings**



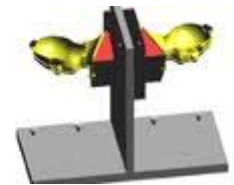
**Figure 5-4 Sample Body-Worn Diagram**

#### 5.4 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 5-5 Twin SAM Chin20**

FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	 SAMSUNG	Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 12 of 39

## 5.5 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 5-4). 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.

## 5.6 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 ( $L \times W \geq 9$  cm  $\times$  5 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.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 13 of 39	

## 6 RF EXPOSURE LIMITS

### 6.1 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.



### 6.2 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 6-1**  
**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)
<b>Peak Spatial Average SAR</b> Head	1.6	8.0
<b>Whole Body SAR</b>	0.08	0.4
<b>Peak Spatial Average SAR</b> Hands, Feet, Ankle, Wrists, etc.	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.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 14 of 39	

## 7 FCC MEASUREMENT PROCEDURES

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

### 7.1 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.

### 7.2 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.

### 7.3 SAR Measurement Conditions for UMTS



#### 7.3.1 Output Power Verification

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

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC (transmit power control) set to all "1s" or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

#### 7.3.2 Head SAR Measurements for Handsets

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

FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 15 of 39

3.4 kbps SRB (signaling radio bearer) using the exposure configuration that resulted in the highest SAR for that RF channel in the 12.2 kbps RMC mode.

### 7.3.3 Body SAR Measurements

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

## 7.4 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n/ac 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.

### 7.4.1 General Device Setup



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

### 7.4.2 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/ac modes and higher data rates for 802.11a/n/ac 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.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 16 of 39	

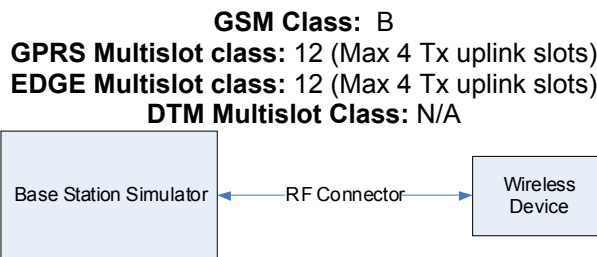
# 8 RF CONDUCTED POWERS

## 8.1 GSM Conducted Powers

		Maximum Burst-Averaged Output Power								
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	32.06	32.30	31.40	<b>30.91</b>	28.00	27.06	26.40	24.91	22.89
	190	32.50	32.39	31.44	<b>30.84</b>	27.79	27.19	26.34	24.79	22.68
	251	32.33	32.24	31.28	<b>30.62</b>	27.83	27.29	26.23	24.79	22.41
GSM 1900	512	29.10	29.34	29.10	<b>27.90</b>	24.79	25.50	25.21	24.17	21.60
	661	29.39	29.50	29.09	<b>28.20</b>	24.89	25.78	25.43	24.13	21.74
	810	29.48	29.40	29.36	<b>28.23</b>	25.00	25.80	25.60	24.27	21.90
		Calculated Maximum Frame-Averaged Output Power								
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	23.03	23.27	25.38	<b>26.65</b>	24.99	18.03	20.38	20.65	19.88
	190	23.47	23.36	25.42	<b>26.58</b>	24.78	18.16	20.32	20.53	19.67
	251	23.30	23.21	25.26	<b>26.36</b>	24.82	18.26	20.21	20.53	19.40
GSM 1900	512	20.07	20.31	23.08	<b>23.64</b>	21.78	16.47	19.19	19.91	18.59
	661	20.36	20.47	23.07	<b>23.94</b>	21.88	16.75	19.41	19.87	18.73
	810	20.45	20.37	23.34	<b>23.97</b>	21.99	16.77	19.58	20.01	18.89

Note:

- Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
- The bolded GPRS modes were selected for SAR testing according to the highest frame-averaged output power table according to KDB 941225 D03v01.
- GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
- EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.
- This device does not support evolved EDGE (eEDGE)



**Figure 8-1**  
**Power Measurement Setup**

FCC ID: A3LSWDSC04E	PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	SAMSUNG	Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 17 of 39

## 8.2 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	
99	WCDMA	12.2 kbps RMC	23.75	24.00	23.85	-
99		12.2 kbps AMR	23.71	23.85	23.80	-
6	HSDPA	Subtest 1	22.95	23.00	22.90	0
6		Subtest 2	22.61	22.93	22.79	0
6		Subtest 3	21.92	22.00	22.13	0.5
6		Subtest 4	21.91	21.61	21.72	0.5
6	HSUPA	Subtest 1	22.70	22.98	22.89	0
6		Subtest 2	21.40	21.50	21.21	2
6		Subtest 3	21.22	21.51	21.17	1
6		Subtest 4	21.05	21.23	21.18	2
6		Subtest 5	22.69	22.70	22.97	0

UMTS SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

This device does not support DC-HSDPA.

It is expected by the manufacturer that MPR for some HSUPA subtests may be but also as low as 0 dB according to the chipset implementation in this model.



**Figure 8-2**  
Power Measurement Setup

## 8.3 WLAN Conducted Powers

**Table 8-1**  
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*	16.21	16.21	16.26	16.22
802.11b	2437	6*	16.55	16.58	16.55	16.54
802.11b	2462	11*	15.77	15.74	15.82	15.79

**Table 8-2**  
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	12.56	12.61	12.65	12.63	12.62	12.64	12.64	12.72
802.11g	2437	6	12.96	12.95	13.01	12.99	12.92	13.03	13.10	12.98
802.11g	2462	11	12.21	12.16	12.24	12.25	12.12	12.15	12.26	12.17

FCC ID: A3LSWDSC04E	PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	SAMSUNG	Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 18 of 39

**Table 8-3  
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	11.77	11.82	11.86	11.76	11.69	11.79	11.85	11.71
802.11n	2437	6	12.09	12.03	12.14	12.11	12.13	12.19	12.16	12.15
802.11n	2462	11	11.34	11.43	11.33	11.41	11.32	11.36	11.38	11.32

**Table 8-4  
IEEE 802.11a Average RF Power**

Mode	Freq [MHz]	Channel	802.11a (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	6		9	12	18	24	36	48	54	
802.11a	5180	36*	13.19	13.17	13.19	13.22	13.13	13.15	13.24	13.03
802.11a	5200	40	13.14	13.18	13.26	13.19	13.13	13.00	13.22	13.06
802.11a	5220	44	13.15	13.21	13.27	13.22	13.21	13.05	13.21	13.01
802.11a	5240	48*	13.14	13.18	13.24	13.16	13.17	13.00	13.22	13.02
802.11a	5260	52*	12.68	12.61	12.66	12.69	12.55	12.54	12.69	12.44
802.11a	5280	56	12.59	12.59	12.63	12.66	12.53	12.42	12.59	12.42
802.11a	5300	60	12.56	12.52	12.58	12.54	12.53	12.58	12.60	12.36
802.11a	5320	64*	12.53	12.55	12.62	12.48	12.54	12.39	12.66	12.43
802.11a	5500	100	12.79	12.72	12.76	12.78	12.67	12.68	12.76	12.50
802.11a	5520	104*	12.61	12.77	12.77	12.73	12.63	12.56	12.78	12.55
802.11a	5540	108	12.76	12.69	12.69	12.65	12.53	12.48	12.58	12.31
802.11a	5560	112	12.57	12.68	12.68	12.67	12.55	12.39	12.57	12.41
802.11a	5580	116*	12.58	12.53	12.64	12.59	12.48	12.38	12.50	12.36
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	12.40	12.43	12.54	12.54	12.39	12.34	12.55	12.31
802.11a	5680	136*	12.31	12.34	12.39	12.40	12.40	12.24	12.41	12.17
802.11a	5700	140	12.30	12.38	12.30	12.29	12.33	12.52	12.52	12.21
802.11a	5745	149*	12.86	12.78	12.85	12.82	12.78	12.64	12.88	12.61
802.11a	5765	153	12.80	12.86	12.87	12.79	12.80	12.68	12.80	12.59
802.11a	5785	157*	12.72	12.72	12.70	12.66	12.74	12.65	12.89	12.50
802.11a	5805	161*	12.76	12.69	12.74	12.76	12.66	12.66	12.67	12.37
802.11a	5825	165	12.59	12.64	12.60	12.63	12.64	12.56	12.73	12.34

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.

FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 19 of 39

**Table 8-5**  
**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	11.94	11.97	12.03	11.98	11.96	12.01	12.03	11.85
802.11n	5200	40	11.89	12.02	11.87	11.95	11.98	11.82	11.82	11.93
802.11n	5220	44	11.88	11.88	11.89	11.77	12.01	11.82	11.78	11.91
802.11n	5240	48	11.93	11.90	11.93	11.82	11.87	11.82	11.86	11.75
802.11n	5260	52	12.15	12.25	12.19	12.16	12.15	12.12	12.25	12.13
802.11n	5280	56	12.26	12.26	12.19	12.12	12.19	12.17	12.12	12.20
802.11n	5300	60	12.28	12.24	12.06	12.28	12.23	12.11	12.12	12.07
802.11n	5320	64	12.25	12.35	12.20	12.22	12.16	12.34	12.22	12.12
802.11n	5500	100	12.38	12.25	12.28	12.30	12.30	12.41	12.34	12.30
802.11n	5520	104	12.39	12.42	12.43	12.45	12.42	12.25	12.29	12.32
802.11n	5540	108	12.35	12.41	12.44	12.49	12.35	12.39	12.34	12.34
802.11n	5560	112	12.39	12.38	12.41	12.43	12.44	12.42	12.48	12.52
802.11n	5580	116	12.56	12.61	12.59	12.50	12.49	12.47	12.48	12.57
802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	12.49	12.48	12.55	12.49	12.48	12.53	12.41	12.55
802.11n	5680	136	12.47	12.45	12.46	12.45	12.41	12.37	12.43	12.44
802.11n	5700	140	12.46	12.47	12.50	12.37	12.31	12.21	12.16	12.23
802.11n	5745	149	12.12	12.08	12.11	11.91	11.98	11.96	12.02	11.99
802.11n	5765	153	12.00	11.93	11.91	11.91	11.99	12.05	12.01	12.11
802.11n	5785	157	11.92	11.92	11.90	11.99	12.01	12.07	11.92	11.95
802.11n	5805	161	11.88	11.96	12.02	12.04	12.06	11.84	11.88	12.01
802.11n	5825	165	11.86	11.91	11.94	11.90	11.89	11.82	11.98	11.93

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.

**Table 8-6**  
**IEEE 802.11n Average RF Power – 40 MHz Bandwidth**

Mode	Freq	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		13.5/15	27/30	40.5/45	54/60	81/90	108/120	121.5/135	135/150
802.11n	5190	38	11.85	11.87	11.95	11.88	11.81	11.78	11.78	11.87
802.11n	5230	46	11.71	11.79	11.82	11.74	11.71	11.62	11.71	11.68
802.11n	5270	54	12.10	12.14	12.14	12.06	12.15	12.03	12.12	12.04
802.11n	5310	62	12.02	12.03	12.10	12.09	11.90	11.90	11.96	11.92
802.11n	5510	102	12.44	12.61	12.53	12.56	12.57	12.44	12.66	12.45
802.11n	5550	110	12.43	12.52	12.54	12.48	12.43	12.41	12.47	12.43
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	12.47	12.50	12.47	12.38	12.43	12.41	12.45	12.35
802.11n	5755	151	11.61	11.94	11.92	12.00	11.82	11.88	11.90	11.97
802.11n	5795	159	12.06	12.26	12.22	12.13	11.73	11.58	11.76	11.62

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.

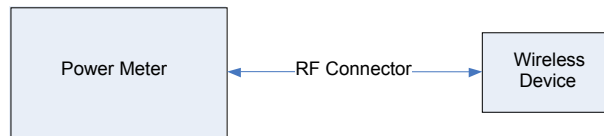
FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 20 of 39

**Table 8-7**  
**IEEE 802.11a/c Average RF Power – 80 MHz Bandwidth**



Freq [MHz]	Channel	80MHz BW 802.11n (5GHz) Conducted Power [dBm]									
		Data Rate [Mbps]									
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
5210	42	9.55	9.53	9.54	9.41	9.46	9.47	9.54	9.47	9.37	9.42
5290	58	9.94	9.89	9.80	9.86	9.92	9.84	9.76	9.69	9.56	9.60
5530	106	9.87	9.84	9.80	9.76	9.74	9.75	9.73	9.66	9.45	9.44
5775	155	10.13	10.09	10.06	10.08	10.13	10.02	9.98	9.80	9.66	9.70

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 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, 40 MHz and IEEE 802.11ac) 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 8-3**  
**Power Measurement Setup**

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> <small>ENGINEERING LABORATORY, INC.</small>	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset	Page 21 of 39	



# 9 SYSTEM VERIFICATION

## 9.1 Tissue Verification

**Table 9-1  
Measured Tissue Properties**

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C°)	Measured Frequency (MHz)	Measured Conductivity, $\sigma$ (S/m)	Measured Dielectric Constant, $\epsilon$	TARGET Conductivity, $\sigma$ (S/m)	TARGET Dielectric Constant, $\epsilon$	% dev $\sigma$	% dev $\epsilon$
03/07/2013	835H	23.5	820	0.917	42.236	0.90	41.57	2.12%	1.60%
			835	0.934	42.102	0.90	41.50	3.78%	1.45%
			850	0.950	41.861	0.92	41.50	3.71%	0.87%
03/07/2013	1900H	22.7	1850	1.388	39.898	1.40	40.00	-0.86%	-0.25%
			1880	1.418	39.846	1.40	40.00	1.29%	-0.39%
			1910	1.452	39.647	1.40	40.00	3.71%	-0.88%
03/07/2013	2450H	22.9	2401	1.780	41.185	1.76	39.30	1.25%	4.80%
			2450	1.837	40.994	1.80	39.20	2.06%	4.58%
			2499	1.899	40.773	1.85	39.14	2.54%	4.19%
02/26/2013	5200H-5800H	24.1	5180	4.644	37.189	4.639	36.020	0.11%	3.25%
			5200	4.660	37.213	4.660	36.000	0.00%	3.37%
			5260	4.742	37.004	4.720	35.940	0.47%	2.96%
			5300	4.792	36.891	4.760	35.900	0.67%	2.76%
			5500	5.037	36.499	4.965	35.650	1.45%	2.38%
			5745	5.366	35.867	5.215	35.355	2.90%	1.45%
03/07/2013	835B	21.9	820	0.980	52.985	0.97	55.26	1.14%	-4.11%
			835	0.994	52.905	0.97	55.20	2.47%	-4.16%
			850	1.009	52.701	0.99	55.15	2.13%	-4.45%
03/08/2013	1900B	23.5	1850	1.464	51.280	1.52	53.30	-3.68%	-3.79%
			1880	1.492	51.082	1.52	53.30	-1.84%	-4.16%
			1910	1.510	50.943	1.52	53.30	-0.66%	-4.42%
03/04/2013	2450B	23.0	2401	1.915	51.521	1.90	52.77	0.63%	-2.36%
			2450	1.977	51.362	1.95	52.70	1.38%	-2.54%
			2499	2.042	51.164	2.02	52.64	1.14%	-2.80%
02/27/2013	5200B-5800B	22.5	5180	5.328	47.607	5.276	49.041	0.99%	-2.92%
			5200	5.346	47.630	5.299	49.014	0.89%	-2.82%
			5220	5.362	47.591	5.323	48.987	0.73%	-2.85%
			5260	5.416	47.528	5.369	48.906	0.88%	-2.82%
			5300	5.472	47.464	5.416	48.851	1.03%	-2.84%
			5500	5.732	47.135	5.650	48.580	1.45%	-2.97%
			5580	5.854	47.031	5.743	48.471	1.93%	-2.97%
			5600	5.848	46.974	5.766	48.444	1.42%	-3.03%
			5660	5.960	46.872	5.837	48.363	2.11%	-3.08%
			5700	6.027	46.799	5.880	48.275	2.50%	-3.06%
			5745	6.069	46.775	5.936	48.248	2.24%	-3.05%
			5765	6.080	46.767	5.959	48.220	2.03%	-3.01%
			5800	6.147	46.555	6.000	48.200	2.45%	-3.41%
5805	6.146	46.596	6.005	48.166	2.35%	-3.26%			

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.

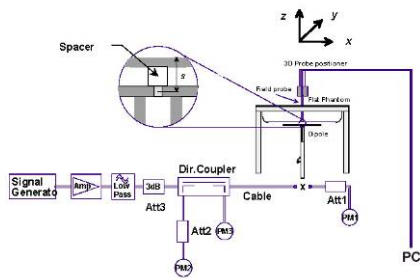
FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 22 of 39

## 9.2 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. Full system validation status and result summary can be found in Appendix E.

**Table 9-2  
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 <sub>1g</sub> (W/kg)	1 W Target SAR <sub>1g</sub> (W/kg)	1 W Normalized SAR <sub>1g</sub> (W/kg)	Deviation (%)
835	HEAD	03/07/2013	24.4	23.5	0.100	4d026	3022	0.996	9.390	9.960	6.07%
1900	HEAD	03/07/2013	24.3	23.2	0.100	5d148	3920	4.070	39.700	40.700	2.52%
2450	HEAD	03/07/2013	23.6	23.1	0.100	719	3287	5.590	52.700	55.900	6.07%
5200	HEAD	02/26/2013	24.2	23.5	0.100	1057	3589	7.400	75.900	74.000	-2.50%
5300	HEAD	02/26/2013	24.3	23.6	0.100	1057	3589	7.160	76.900	71.600	-6.89%
5500	HEAD	02/26/2013	24.4	23.6	0.100	1057	3589	7.430	80.100	74.300	-7.24%
5800	HEAD	02/26/2013	24.2	23.4	0.100	1057	3589	7.330	76.100	73.300	-3.68%
835	BODY	03/07/2013	23.6	21.9	0.100	4d132	3258	1.020	9.360	10.200	8.97%
1900	BODY	03/08/2013	24.5	23.8	0.100	5d148	3920	4.030	40.800	40.300	-1.23%
2450	BODY	03/04/2013	23.8	22.1	0.100	719	3287	4.910	51.600	49.100	-4.84%
5200	BODY	02/27/2013	23.9	22.7	0.100	1057	3589	7.140	75.500	71.400	-5.43%
5300	BODY	02/27/2013	23.7	22.6	0.100	1057	3589	7.340	75.300	73.400	-2.52%
5500	BODY	02/27/2013	23.8	22.6	0.100	1057	3589	7.770	80.800	77.700	-3.84%
5600	BODY	02/27/2013	24.1	22.8	0.100	1057	3589	8.370	80.300	83.700	4.23%
5800	BODY	02/27/2013	24.2	22.8	0.100	1057	3589	7.300	75.100	73.000	-2.80%



**Figure 9-1  
System Verification Setup Diagram**



**Figure 9-2  
System Verification Setup Photo**

FCC ID: A3LSWDSC04E	PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	SAMSUNG	Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 23 of 39

# 10 SAR DATA SUMMARY

## 10.1 Standalone Head SAR Data

**Table 10-1  
GSM 850 Head SAR**



MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	190	GSM850	GSM	33.0	32.50	-0.02	Right	Cheek	60FBD	1:8.3	0.187	1.122	0.210	
836.60	190	GSM850	GSM	33.0	32.50	0.02	Right	Tilt	60FBD	1:8.3	0.119	1.122	0.134	
836.60	190	GSM850	GSM	33.0	32.50	0.06	Left	Cheek	60FBD	1:8.3	0.241	1.122	0.270	A1
836.60	190	GSM850	GSM	33.0	32.50	-0.06	Left	Tilt	60FBD	1:8.3	0.124	1.122	0.139	
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 10-2  
UMTS 850 Head SAR**

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	24.0	24.00	0.02	Right	Cheek	60FBD	1:1	0.292	1.000	0.292	
836.60	4183	UMTS 850	RMC	24.0	24.00	-0.12	Right	Tilt	60FBD	1:1	0.185	1.000	0.185	
836.60	4183	UMTS 850	RMC	24.0	24.00	0.06	Left	Cheek	60FBD	1:1	0.373	1.000	0.373	A2
836.60	4183	UMTS 850	RMC	24.0	24.00	0.04	Left	Tilt	60FBD	1:1	0.201	1.000	0.201	
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 10-3  
GSM 1900 Head SAR**

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.0	29.39	0.05	Right	Cheek	60FBA	1:8.3	0.103	1.151	0.119	
1880.00	661	GSM 1900	GSM	30.0	29.39	0.21	Right	Tilt	60FBA	1:8.3	0.087	1.151	0.100	
1880.00	661	GSM 1900	GSM	30.0	29.39	0.21	Left	Cheek	60FBA	1:8.3	0.184	1.151	0.212	A3
1880.00	661	GSM 1900	GSM	30.0	29.39	0.05	Left	Tilt	60FBA	1:8.3	0.060	1.151	0.069	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							



FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 24 of 39

**Table 10-4  
DTS Head SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.13	Right	Cheek	60FBD	1	1:1	0.032	1.109	0.035	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.14	Right	Tilt	60FBD	1	1:1	0.037	1.109	0.041	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.14	Left	Cheek	60FBD	1	1:1	0.051	1.109	0.057	A4
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.12	Left	Tilt	60FBD	1	1:1	0.046	1.109	0.051	
5745	149	IEEE 802.11a	OFDM	13.5	12.86	0.04	Right	Cheek	60838	6	1:1	0.085	1.159	0.098	
5745	149	IEEE 802.11a	OFDM	13.5	12.86	0.13	Right	Tilt	60838	6	1:1	0.154	1.159	0.178	A6
5745	149	IEEE 802.11a	OFDM	13.5	12.86	0.13	Left	Cheek	60838	6	1:1	0.105	1.159	0.122	
5745	149	IEEE 802.11a	OFDM	13.5	12.86	0.09	Left	Tilt	60838	6	1:1	0.152	1.159	0.176	
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 10-5  
NII Head SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
5180	36	IEEE 802.11a	OFDM	13.5	13.19	0.03	Right	Cheek	60838	6	1:1	0.024	1.074	0.026	
5180	36	IEEE 802.11a	OFDM	13.5	13.19	0.14	Right	Tilt	60838	6	1:1	0.016	1.074	0.017	
5180	36	IEEE 802.11a	OFDM	13.5	13.19	0.04	Left	Cheek	60838	6	1:1	0.017	1.074	0.018	
5180	36	IEEE 802.11a	OFDM	13.5	13.19	0.12	Left	Tilt	60838	6	1:1	0.015	1.074	0.016	
5260	52	IEEE 802.11a	OFDM	13.5	12.68	0.03	Right	Cheek	60838	6	1:1	0.042	1.208	0.050	
5260	52	IEEE 802.11a	OFDM	13.5	12.68	0.08	Right	Tilt	60838	6	1:1	0.017	1.208	0.020	
5260	52	IEEE 802.11a	OFDM	13.5	12.68	0.16	Left	Cheek	60838	6	1:1	0.018	1.208	0.021	
5260	52	IEEE 802.11a	OFDM	13.5	12.68	0.15	Left	Tilt	60838	6	1:1	0.019	1.208	0.023	
5500	100	IEEE 802.11a	OFDM	13.5	12.79	0.08	Right	Cheek	60838	6	1:1	0.059	1.178	0.070	
5500	100	IEEE 802.11a	OFDM	13.5	12.79	-0.13	Right	Tilt	60838	6	1:1	0.059	1.178	0.069	
5500	100	IEEE 802.11a	OFDM	13.5	12.79	0.18	Left	Cheek	60838	6	1:1	0.039	1.178	0.046	
5500	100	IEEE 802.11a	OFDM	13.5	12.79	0.15	Left	Tilt	60838	6	1:1	0.060	1.178	0.070	A5
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram							

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 25 of 39

## 10.2 Standalone Body-Worn SAR Data

**Table 10-6  
GSM/UMTS/ Body-Worn SAR Data**



MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.0	32.50	0.00	10 mm	60FBD	1	1:8.3	back	0.359	1.122	0.403	A7
836.60	4183	UMTS 850	RMC	24.0	24.00	0.01	10 mm	60FBA	N/A	1:1	back	0.450	1.000	0.450	A9
1880.00	661	GSM 1900	GSM	30.0	29.39	-0.18	10 mm	60FBD	1	1:8.3	back	0.278	1.151	0.320	A11
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 10-7  
DTS Body-Worn SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.11	10 mm	60FAD	1	back	1:1	0.061	1.109	0.068	A13
5745	149	IEEE 802.11a	OFDM	13.5	12.86	0.10	10 mm	60838	6	back	1:1	0.521	1.159	0.604	A15
5765	153	IEEE 802.11a	OFDM	13.5	12.80	0.13	10 mm	60838	6	back	1:1	0.449	1.175	0.528	
5805	161	IEEE 802.11a	OFDM	13.5	12.76	0.15	10 mm	60838	6	back	1:1	0.425	1.186	0.504	
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 10-8  
NII Body-Worn SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
5180	36	IEEE 802.11a	OFDM	13.5	13.19	-0.20	10 mm	60838	6	back	1:1	0.443	1.074	0.476	
5220	44	IEEE 802.11a	OFDM	13.5	13.15	-0.20	10 mm	60838	6	back	1:1	0.441	1.084	0.478	
5260	52	IEEE 802.11a	OFDM	13.5	12.68	-0.12	10 mm	60838	6	back	1:1	0.307	1.208	0.371	
5500	100	IEEE 802.11a	OFDM	13.5	12.79	0.20	10 mm	60838	6	back	1:1	0.330	1.178	0.389	
5580	116	IEEE 802.11a	OFDM	13.5	12.58	0.17	10 mm	60838	6	back	1:1	0.445	1.236	0.550	
5660	132	IEEE 802.11a	OFDM	13.5	12.40	0.16	10 mm	60838	6	back	1:1	0.474	1.288	0.611	A14
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 26 of 39

## 10.3 Standalone Wireless Router SAR Data



**Table 10-9  
GPRS/UMTS/ Hotspot SAR Data**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
824.20	128	GSM 850	GPRS	31.0	30.91	0.19	10 mm	60FBA	3	1:2.76	back	0.892	1.021	0.911	A8
836.60	190	GSM 850	GPRS	31.0	30.84	0.17	10 mm	60FBA	3	1:2.76	back	0.852	1.038	0.884	
848.80	251	GSM 850	GPRS	31.0	30.62	0.02	10 mm	60FBA	3	1:2.76	back	0.740	1.091	0.807	
836.60	190	GSM 850	GPRS	31.0	30.84	-0.14	10 mm	60FBA	3	1:2.76	front	0.745	1.038	0.773	
836.60	190	GSM 850	GPRS	31.0	30.84	0.13	10 mm	60FBA	3	1:2.76	bottom	0.166	1.038	0.172	
836.60	190	GSM 850	GPRS	31.0	30.84	-0.15	10 mm	60FBA	3	1:2.76	right	0.567	1.038	0.589	
824.20	128	GSM 850	GPRS	31.0	30.91	-0.17	10 mm	60FBA	3	1:2.76	left	0.721	1.021	0.736	
836.60	190	GSM 850	GPRS	31.0	30.84	-0.12	10 mm	60FBA	3	1:2.76	left	0.887	1.038	0.921	
848.80	251	GSM 850	GPRS	31.0	30.62	0.15	10 mm	60FBA	3	1:2.76	left	0.773	1.091	0.843	
824.20	128	GSM 850	GPRS	31.0	30.91	-0.14	10 mm	60FBA	3	1:2.76	back	0.835	1.021	0.853	
836.60	4183	UMTS 850	RMC	24.0	24.00	0.01	10 mm	60FBA	N/A	1:1	back	0.450	1.000	0.450	
836.60	4183	UMTS 850	RMC	24.0	24.00	0.13	10 mm	60FBA	N/A	1:1	front	0.470	1.000	0.470	A10
836.60	4183	UMTS 850	RMC	24.0	24.00	-0.01	10 mm	60FBA	N/A	1:1	bottom	0.099	1.000	0.099	
836.60	4183	UMTS 850	RMC	24.0	24.00	0.02	10 mm	60FBA	N/A	1:1	right	0.294	1.000	0.294	
836.60	4183	UMTS 850	RMC	24.0	24.00	-0.03	10 mm	60FBA	N/A	1:1	left	0.425	1.000	0.425	
1880.00	661	GSM 1900	GPRS	28.5	28.20	0.01	10 mm	60FBD	3	1:2.76	back	0.607	1.072	0.651	
1850.20	512	GSM 1900	GPRS	28.5	27.90	0.04	10 mm	60FBD	3	1:2.76	front	0.689	1.148	0.791	
1880.00	661	GSM 1900	GPRS	28.5	28.20	-0.02	10 mm	60FBD	3	1:2.76	front	0.766	1.072	0.821	
1909.80	810	GSM 1900	GPRS	28.5	28.23	0.06	10 mm	60FBD	3	1:2.76	front	0.955	1.064	1.016	A12
1880.00	661	GSM 1900	GPRS	28.5	28.20	0.01	10 mm	60FBD	3	1:2.76	bottom	0.467	1.072	0.501	
1880.00	661	GSM 1900	GPRS	28.5	28.20	0.12	10 mm	60FBD	3	1:2.76	right	0.057	1.072	0.061	
1880.00	661	GSM 1900	GPRS	28.5	28.20	-0.04	10 mm	60FBD	3	1:2.76	left	0.316	1.072	0.339	
1909.80	810	GSM 1900	GPRS	28.5	28.23	0.00	10 mm	60FBD	3	1:2.76	front	0.920	1.064	0.979	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Blue entries represent variability data.

**Table 10-10  
WLAN Hotspot SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.11	10 mm	60FAD	1	back	1:1	0.061	1.109	0.068	A13
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.00	10 mm	60FAD	1	front	1:1	0.010	1.109	0.011	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.11	10 mm	60FAD	1	top	1:1	0.025	1.109	0.028	
2437	6	IEEE 802.11b	DSSS	17.0	16.55	0.18	10 mm	60FAD	1	right	1:1	0.004	1.109	0.004	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

FCC ID: A3LSWDSC04E		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset	Page 27 of 39	

## 10.4 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, including NFC antenna, 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  $\leq 1.2$  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 12 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 5.6 for more details).

### GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR.
3. 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  $\leq 0.8$  W/kg then testing at the other channels is not required for such test configuration(s). Since the maximum output power variation across the required test channels is  $< \frac{1}{2}$  dB, the middle channel, instead of the highest output power channel was used.



### UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v05, since the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is not required. Since the maximum output power variation across the required test channels is  $< \frac{1}{2}$  dB, the middle channel, instead of the highest output power channel was used.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset	Page 28 of 39	

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 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 October 2012 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, 40 MHz bandwidths and IEEE 802.11ac) 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. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required. Otherwise additional default or required test channels were evaluated.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 29 of 39	

# 11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

## 11.1 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.

## 11.2 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 physical test configuration is  $\leq 1.6$  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 11-1  
Estimated SAR**

Mode	Frequency	Maximum Allowed Power	Estimated SAR (Held-to-Ear)	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[W/kg]	[mm]	[W/kg]
Bluetooth	2441	9.50	N/A	10	<b>0.187</b>



Note: Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission.

## 11.3 Head SAR Simultaneous Transmission Analysis

**Table 11-2  
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)**

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	$\Sigma$ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	$\Sigma$ SAR (W/kg)
Head SAR	Right Cheek	0.210	0.035	0.245	Head SAR	Right Cheek	0.292	0.035	0.327
	Right Tilt	0.134	0.041	0.175		Right Tilt	0.185	0.041	0.226
	Left Cheek	0.270	0.057	<b>0.327</b>		Left Cheek	0.373	0.057	<b>0.430</b>
	Left Tilt	0.139	0.051	0.190		Left Tilt	0.201	0.051	0.252
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	$\Sigma$ SAR (W/kg)					
Head SAR	Right Cheek	0.119	0.035	0.154					
	Right Tilt	0.100	0.041	0.141					
	Left Cheek	0.212	0.057	<b>0.269</b>					
	Left Tilt	0.069	0.051	0.120					

**Table 11-3**

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 30 of 39

### Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.210	0.098	0.308	Head SAR	Right Cheek	0.292	0.098	0.390
	Right Tilt	0.134	0.178	0.312		Right Tilt	0.185	0.178	0.363
	Left Cheek	0.270	0.122	<b>0.392</b>		Left Cheek	0.373	0.122	<b>0.495</b>
	Left Tilt	0.139	0.176	0.315		Left Tilt	0.201	0.176	0.377

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.119	0.098	0.217
	Right Tilt	0.100	0.178	0.278
	Left Cheek	0.212	0.122	<b>0.334</b>
	Left Tilt	0.069	0.176	0.245

## 11.4 Body-Worn Simultaneous Transmission Analysis

**Table 11-4**  
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.403	0.068	0.471
Back Side	UMTS 850	0.450	0.068	<b>0.518</b>
Back Side	GSM 1900	0.320	0.068	0.388



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

Configuration	Mode	2G/3G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.403	0.611	1.014
Back Side	UMTS 850	0.450	0.611	<b>1.061</b>
Back Side	GSM 1900	0.320	0.611	0.931

**Table 11-6**  
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.403	0.187	0.590
Back Side	UMTS 850	0.450	0.187	<b>0.637</b>
Back Side	GSM 1900	0.320	0.187	0.507

Note: 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.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 31 of 39

## 11.5 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 11-7**  
**Simultaneous Transmission Scenario (Hotspot at 1.0 cm)**



Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.911	0.068	<b>0.979</b>	Body SAR	Back	0.450	0.068	<b>0.518</b>
	Front	0.773	0.011	0.784		Front	0.470	0.011	0.481
	Top	-	0.028	0.028		Top	-	0.028	0.028
	Bottom	0.172	-	0.172		Bottom	0.099	-	0.099
	Right	0.589	0.004	0.593		Right	0.294	0.004	0.298
	Left	0.921	-	0.921		Left	0.425	-	0.425

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.651	0.068	0.719
	Front	1.016	0.011	<b>1.027</b>
	Top	-	0.028	0.028
	Bottom	0.501	-	0.501
	Right	0.061	0.004	0.065
	Left	0.339	-	0.339

## 11.6 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 D01v05.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 32 of 39

## 12 SAR MEASUREMENT VARIABILITY

### 12.1 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  $\geq 0.80$  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  $\geq 1.45$  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  $\geq 1.5$  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 12-1  
Body SAR Measurement Variability Results**

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Service	# of Time Slots	Side	Spacing	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	824.20	128	GSM 850	GPRS	3	back	10 mm	0.892	0.835	1.07	N/A	N/A	N/A	N/A
1900	1909.80	810	GSM 1900	GPRS	3	front	10 mm	0.955	0.920	1.04	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							

### 12.2 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.



FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 33 of 39

# 13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	85070E	Dielectric Probe Kit	2/14/2013	Annual	2/14/2014	MY44300633
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2012	Annual	10/10/2013	3613A00315
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Amplifier Research	551G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231538
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231535
Anritsu	MA2411B	Pulse Power Sensor	12/4/2012	Annual	12/4/2013	1207364
Anritsu	MA2411B	Pulse Power Sensor	12/5/2012	Annual	12/5/2013	1126066
Anritsu	MA2481A	Power Sensor	4/5/2012	Annual	4/5/2013	5605
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	2400
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204419
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204343
Anritsu	ML2438A	Power Meter	2/14/2013	Annual	2/14/2014	1190013
Anritsu	ML2438A	Power Meter	2/14/2013	Annual	2/14/2014	98150041
Anritsu	ML2496A	Power Meter	11/28/2012	Annual	11/28/2013	1138001
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
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	122541143
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014497
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/10/2012	Annual	10/10/2013	1833460
Gigatronics	8651A	Universal Power Meter	10/10/2012	Annual	10/10/2013	8650319
Intelligent Weigh	PD-3000	Electronic Balance	3/27/2012	Annual	3/27/2013	11081534
Intelligent Weighing	PD-3000	Electronic Balance	6/29/2012	Annual	6/29/2013	120405017
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-53W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	5/22/2012	Annual	5/22/2013	109892
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRV-232	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SME06	Signal Generator	10/11/2012	Annual	10/11/2013	832026
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Seekonk	NC-100	Torque Wrench (8" lb)	11/29/2011	Triennial	11/29/2014	21053
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
SPEAG	D1900V2	1900 MHz SAR Dipole	2/6/2013	Annual	2/6/2014	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	D56HV2	5 GHz SAR Dipole	1/11/2013	Annual	1/11/2014	1057
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	4d026
SPEAG	D835V2	835 MHz SAR Dipole	1/7/2013	Annual	1/7/2014	4d132
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/6/2013	Annual	2/6/2014	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/15/2012	Annual	5/15/2013	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/17/2013	Annual	1/17/2014	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/24/2012	Annual	8/24/2013	1322
SPEAG	ES3DV2	SAR Probe	8/28/2012	Annual	8/28/2013	3022
SPEAG	ES3DV3	SAR Probe	2/11/2013	Annual	2/11/2014	3258
SPEAG	ES3DV3	SAR Probe	11/15/2012	Annual	11/15/2013	3287
SPEAG	EX3DV4	SAR Probe	1/17/2013	Annual	1/17/2014	3589
SPEAG	EX3DV4	SAR Probe	2/27/2013	Annual	2/27/2014	3920
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	8010177
VWR	23226-658	Long Stem Thermometer	3/30/2012	Biennial	3/30/2014	122179874
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859323
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886441

**Note:**

1. 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.
2. Agilent 850471A S-Parameter Test Set is used as a connector dock in series with a calibrated network analyzer. All measurements are made by the calibrated network analyzer; therefore no calibration is needed for this Test Set.
3. Agilent 8594A (9 kHz-2.9 GHz) Spectrum Analyzer was used only to verify device transmission for WIFI signal, therefore calibration of this device was not required.



FCC ID: A3LSWDSC04E	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1303060464-R1.A3L	Test Dates: 02/26/13 - 03/08/13	DUT Type: Portable Handset		Page 34 of 39

# 14 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c <sub>i</sub> 1gm	c <sub>i</sub> 10 gms	1gm u <sub>i</sub> (± %)	10gms u <sub>i</sub> (± %)	v <sub>i</sub>
<b>Measurement System</b>									
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	∞
<b>Test Sample Related</b>									
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	∞
<b>Phantom &amp; Tissue Parameters</b>									
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
<b>Combined Standard Uncertainty (k=1)</b>				RSS			12.1	11.7	299
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>				k=2			24.2	23.5	



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

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> OY1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 35 of 39	

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 <sub>i</sub> 1gm	c <sub>i</sub> 10 gms	1gm u <sub>i</sub> (± %)	10gms u <sub>i</sub> (± %)	v <sub>i</sub>	
<b>Measurement System</b>										
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	∞	
<b>Test Sample Related</b>										
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	∞	
<b>Phantom &amp; Tissue Parameters</b>										
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	
<b>Combined Standard Uncertainty (k=1)</b>							RSS	12.4	12.0	299
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)							k=2	24.7	24.0	

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



FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 36 of 39	

## 15 CONCLUSION

### 15.1 Measurement Conclusion



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

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



FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset		Page 37 of 39

## 16 REFERENCES

- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.
- [2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.
- [3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.
- [4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.
- [5] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, June 2001.
- [6] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.
- [7] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.
- [8] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [9] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. -124.
- [10] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.
- [11] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [12] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.
- [13] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [14] G. Hartsgrrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.
- [15] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
- [16] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [17] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> OY1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 38 of 39	

- [18] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.
- [19] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [20] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.
- [21] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.
- [22] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.
- [23] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.
- [24] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009
- [25] FCC Public Notice DA-02-1438. Office of Engineering and Technology Announces a Transition Period for the Phantom Requirements of Supplement C to OET Bulletin 65, June 19, 2002
- [26] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07
- [27] SAR Measurement procedures for IEEE 802.11a/b/g KDB Publication 248227 D01v01r02
- [28] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D02-D04
- [29] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04
- [30] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02
- [31] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02
- [32] Anexo à Resolução No. 533, de 10 de Setembro de 2009.
- [33] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.

FCC ID: A3LSWDSC04E	 <b>PCTEST</b> ENGINEERING LABORATORY, INC.	<b>SAR EVALUATION REPORT</b>		<b>Reviewed by:</b> Quality Manager
<b>Document S/N:</b> 0Y1303060464-R1.A3L	<b>Test Dates:</b> 02/26/13 - 03/08/13	<b>DUT Type:</b> Portable Handset	Page 39 of 39	

## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBD**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 0.936 \text{ S/m}$ ;  $\epsilon_r = 42.076$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-07-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;

Sensor-Surface: 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: GSM 850, Left Head, Cheek, Mid.ch**

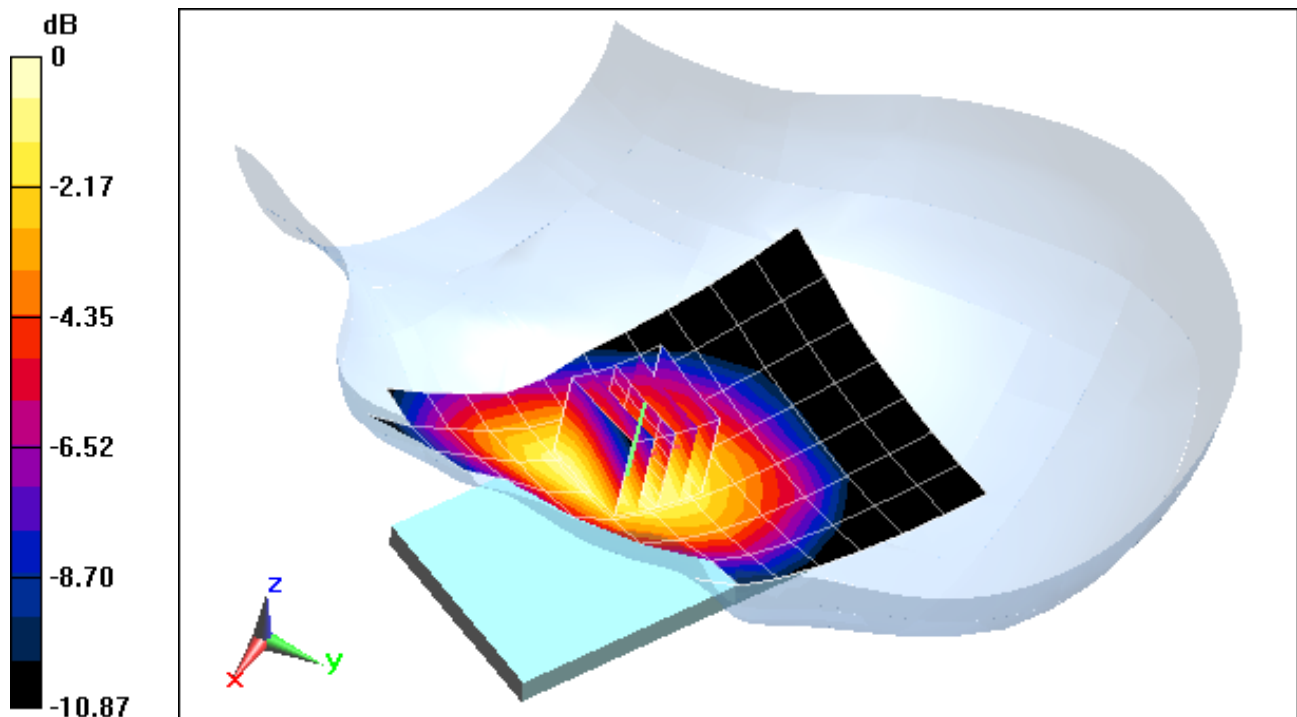
**Area Scan (8x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 16.370 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.298 W/kg

**SAR(1 g) = 0.241 W/kg; SAR(10 g) = 0.180 W/kg**



0 dB = 0.254 W/kg = -5.95 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBD**

Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 0.936 \text{ S/m}$ ;  $\epsilon_r = 42.076$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-07-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;

Sensor-Surface: 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: UMTS 850, Left Head, Cheek, Mid.ch**

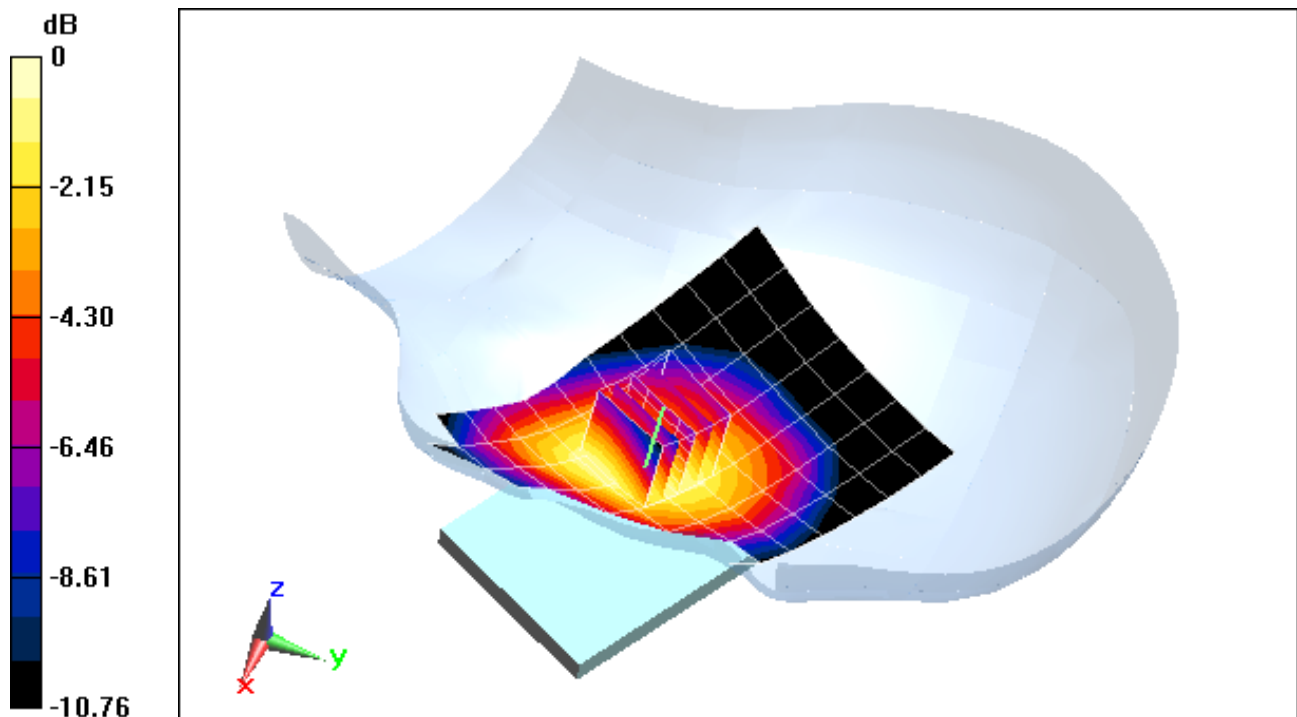
**Area Scan (8x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 20.507 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.458 W/kg

**SAR(1 g) = 0.373 W/kg; SAR(10 g) = 0.280 W/kg**



0 dB = 0.395 W/kg = -4.03 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBA**

Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.418 \text{ S/m}$ ;  $\epsilon_r = 39.846$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-07-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3920; ConvF(7.73, 7.73, 7.73); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

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

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

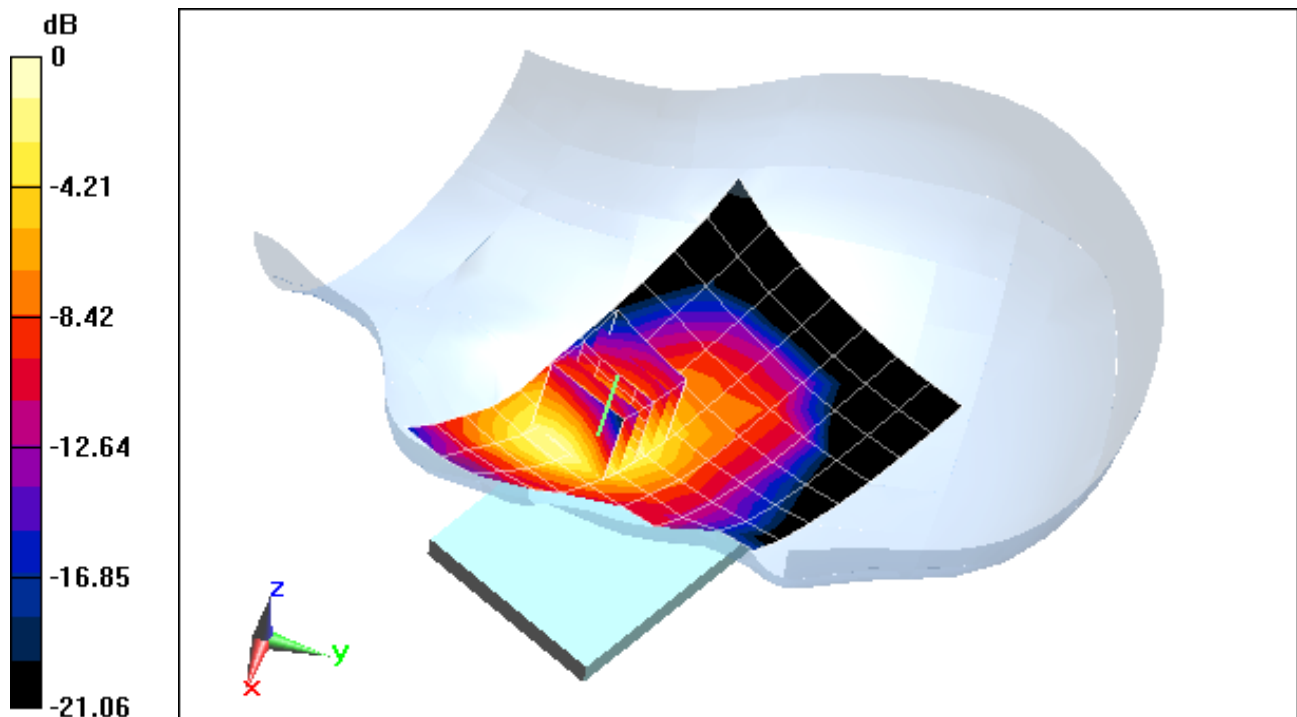
**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 10.379 V/m; Power Drift = 0.21 dB

Peak SAR (extrapolated) = 0.282 W/kg

**SAR(1 g) = 0.184 W/kg**



0 dB = 0.196 W/kg = -7.08 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBD**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.822 \text{ S/m}$ ;  $\epsilon_r = 41.045$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3287; ConvF(4.3, 4.3, 4.3); Calibrated: 11/15/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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: IEEE 802.11b, Left Head, Cheek, Ch 06, 1 Mbps**

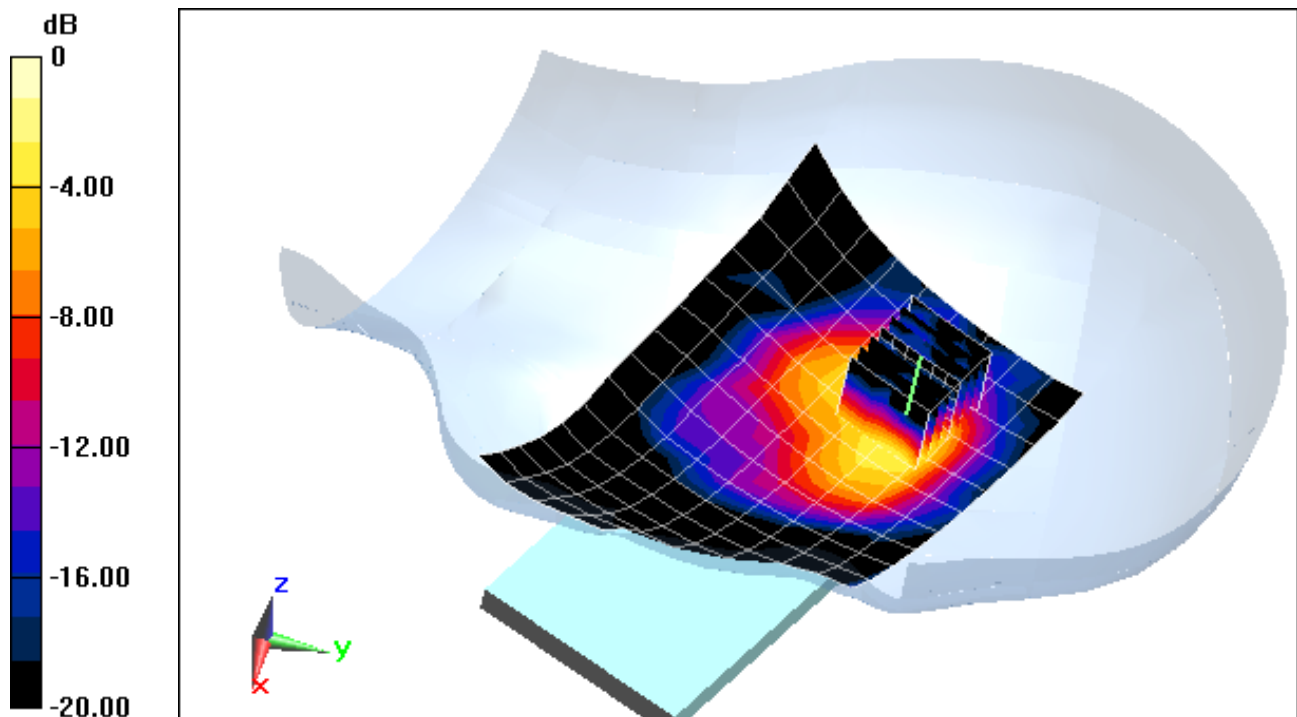
**Area Scan (10x15x1):** Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 5.568 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.126 W/kg

**SAR(1 g) = 0.051 W/kg; SAR(10 g) = 0.023 W/kg**



0 dB = 0.0727 W/kg = -11.38 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60838**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$$f = 5500 \text{ MHz}; \sigma = 5.037 \text{ S/m}; \epsilon_r = 36.5; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Left Section

Test Date: 02-26-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.14, 4.14, 4.14); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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 802.11a, 5.5 GHz Left Head, Tilt, Ch 100, 6 Mbps**

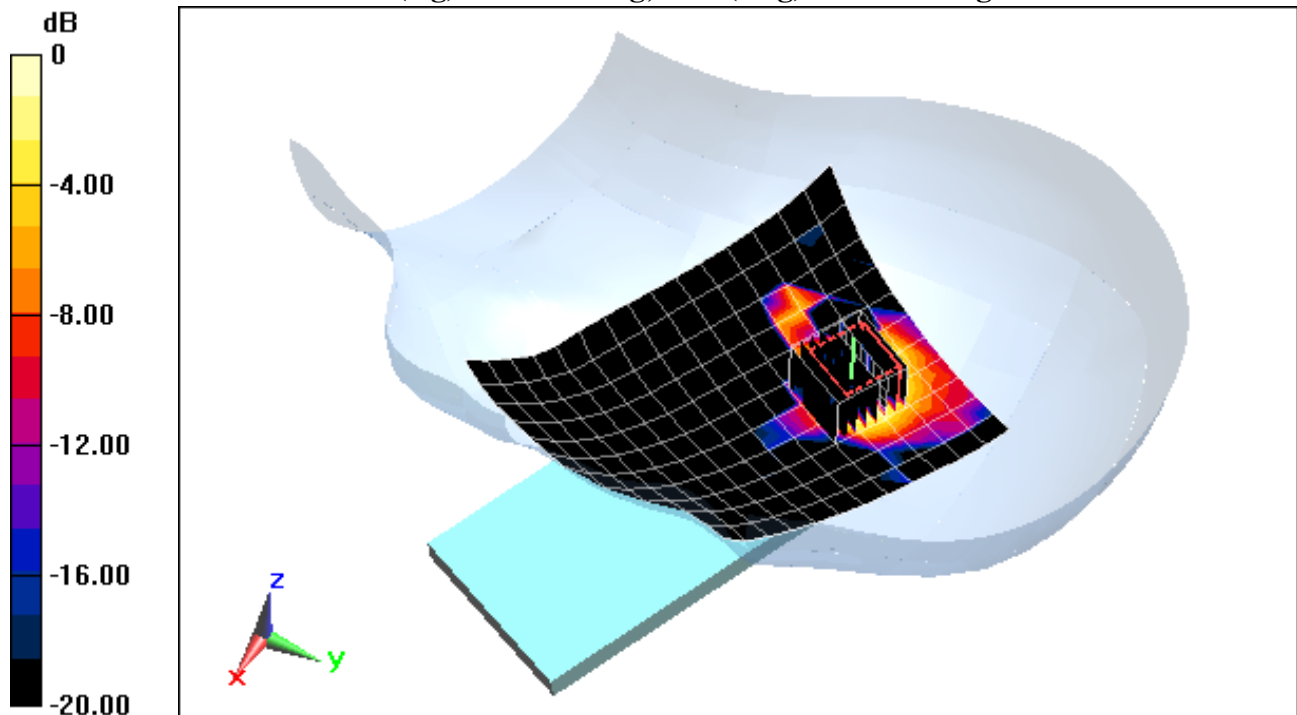
**Area Scan (12x16x1):** Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 3.385 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.631 W/kg

**SAR(1 g) = 0.060 W/kg; SAR(10 g) = 0.019 W/kg**



0 dB = 0.183 W/kg = -7.38 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60838**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1  
Medium: 5 GHz Head Medium parameters used:

$$f = 5745 \text{ MHz}; \sigma = 5.366 \text{ S/m}; \epsilon_r = 35.867; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Right Section

Test Date: 02-26-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3589; ConvF(3.85, 3.85, 3.85); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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 802.11a 5.8 GHz, Right Head, Tilt, Ch 149, 6 Mbps**

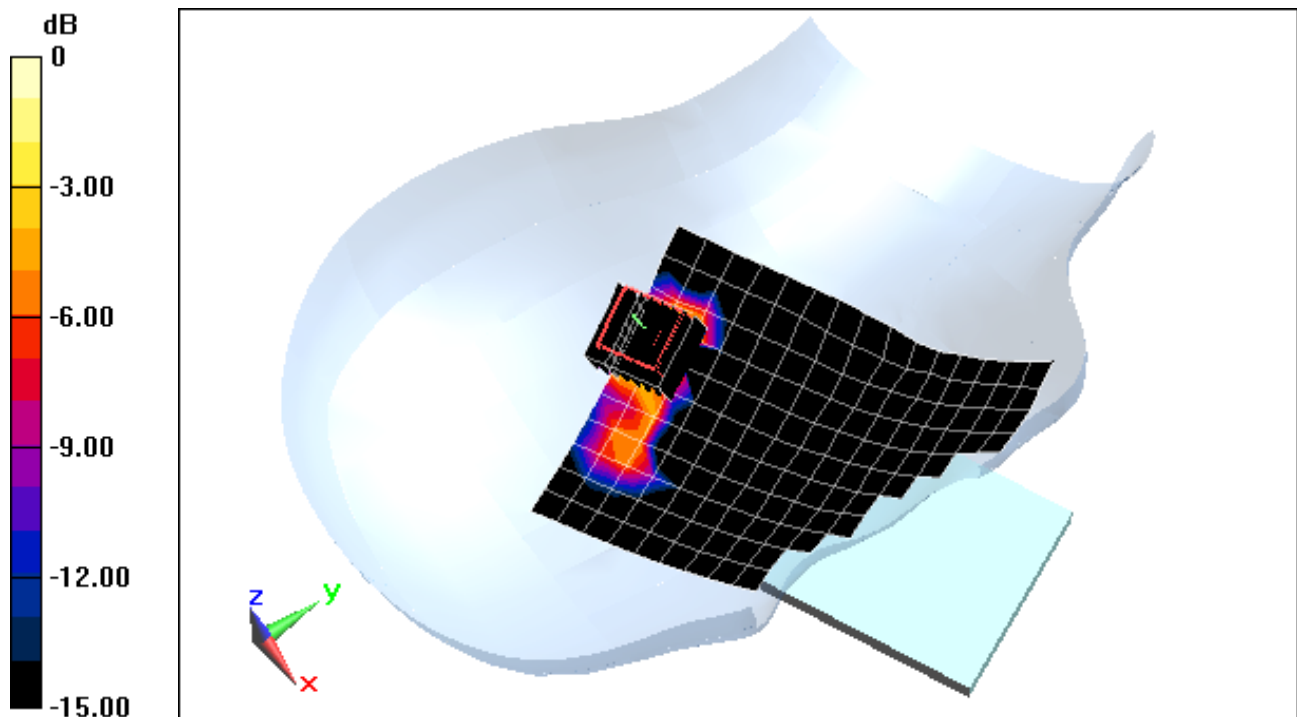
**Area Scan (12x16x1):** Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 4.557 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.617 W/kg

**SAR(1 g) = 0.154 W/kg; SAR(10 g) = 0.051 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBD**

Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 0.996 \text{ S/m}$ ;  $\epsilon_r = 52.883$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3258; ConvF(6.1, 6.1, 6.1); Calibrated: 2/11/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/15/2012

Phantom: SAM Front; Type: QD000P40CD; Serial: 1717

Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Mode: GSM 850, Body SAR, Back side, Mid.ch**

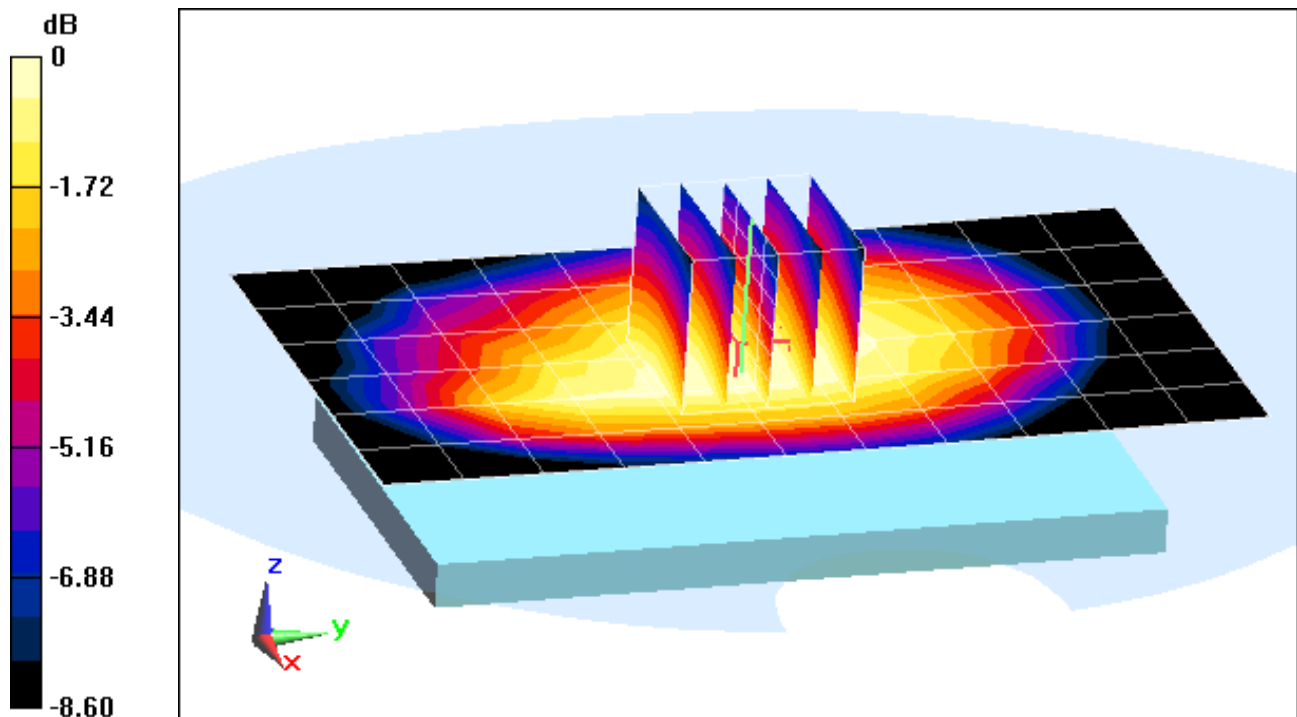
**Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 19.429 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.456 W/kg

**SAR(1 g) = 0.359 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBA**

Communication System: GSM GPRS; 3 Tx slots; Frequency: 824.2 MHz; Duty Cycle: 1:2.76

Medium: 835 Body Medium parameters used (interpolated):

$f = 824.2 \text{ MHz}$ ;  $\sigma = 0.984 \text{ S/m}$ ;  $\epsilon_r = 52.963$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3258; ConvF(6.1, 6.1, 6.1); Calibrated: 2/11/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/15/2012

Phantom: SAM Front; Type: QD000P40CD; Serial: 1717

Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Mode: GPRS 850, Body SAR, Back side, Low.ch, 3 Tx Slots**

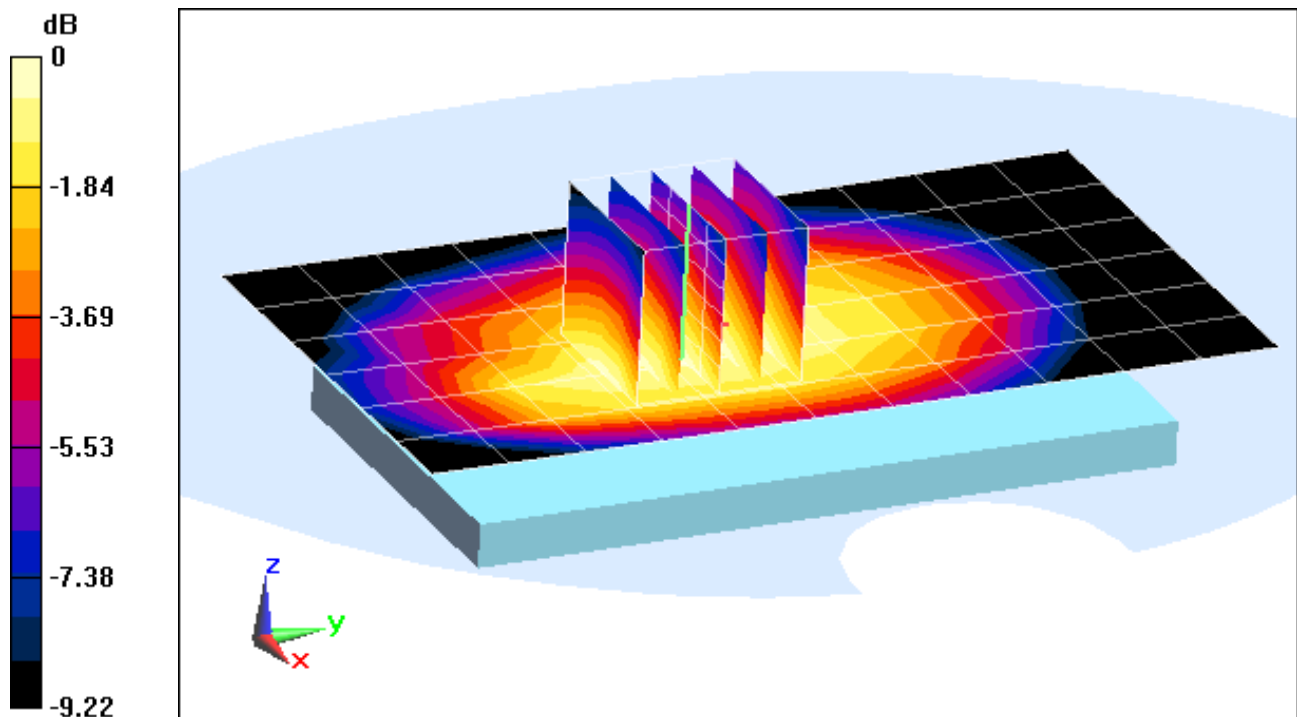
**Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 30.005 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 1.11 W/kg

**SAR(1 g) = 0.892 W/kg**



0 dB = 0.933 W/kg = -0.30 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBA**

Communication System: UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 0.996 \text{ S/m}$ ;  $\epsilon_r = 52.883$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3258; ConvF(6.1, 6.1, 6.1); Calibrated: 2/11/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/15/2012

Phantom: SAM Front; Type: QD000P40CD; Serial: 1717

Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Mode: UMTS 850, Body SAR, Back side, Mid.ch**

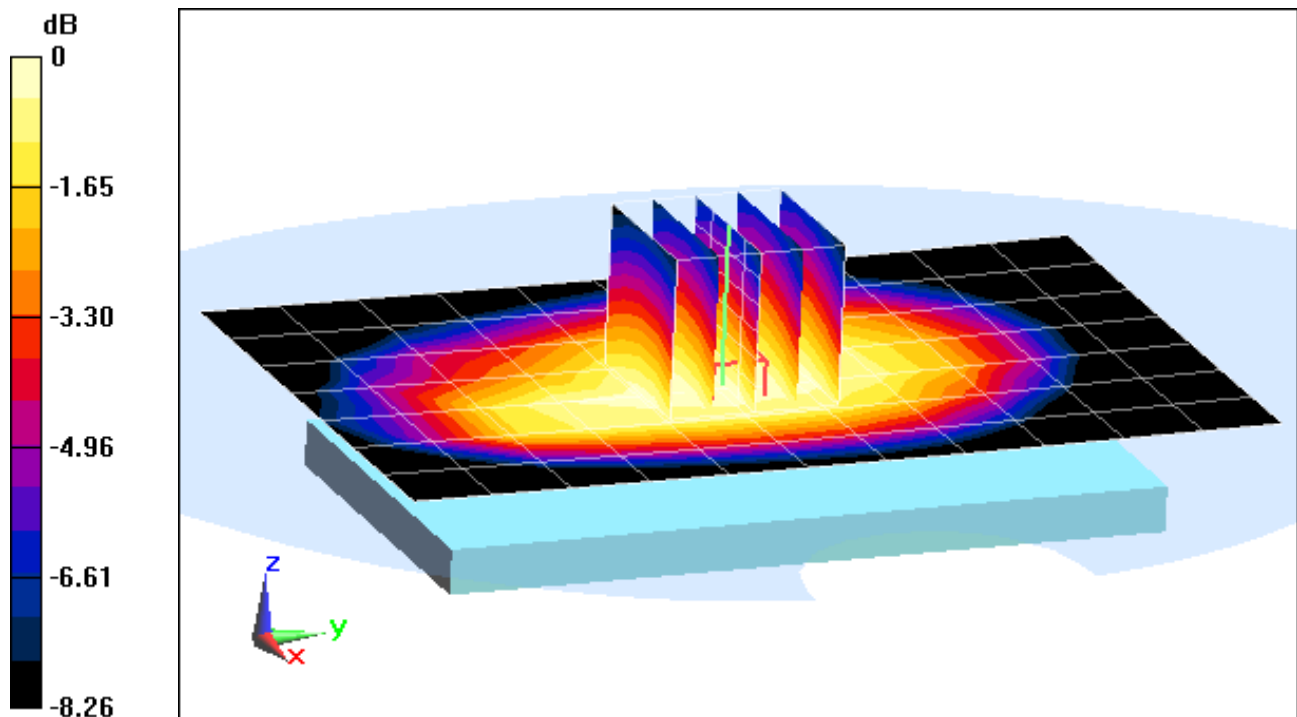
**Area Scan (8x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 21.986 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.568 W/kg

**SAR(1 g) = 0.450 W/kg**



0 dB = 0.470 W/kg = -3.28 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBA**

Communication System: UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$ ;  $\sigma = 0.996 \text{ S/m}$ ;  $\epsilon_r = 52.883$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3258; ConvF(6.1, 6.1, 6.1); Calibrated: 2/11/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/15/2012

Phantom: SAM Front; Type: QD000P40CD; Serial: 1717

Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Mode: UMTS 850, Body SAR, Front side, Mid.ch**

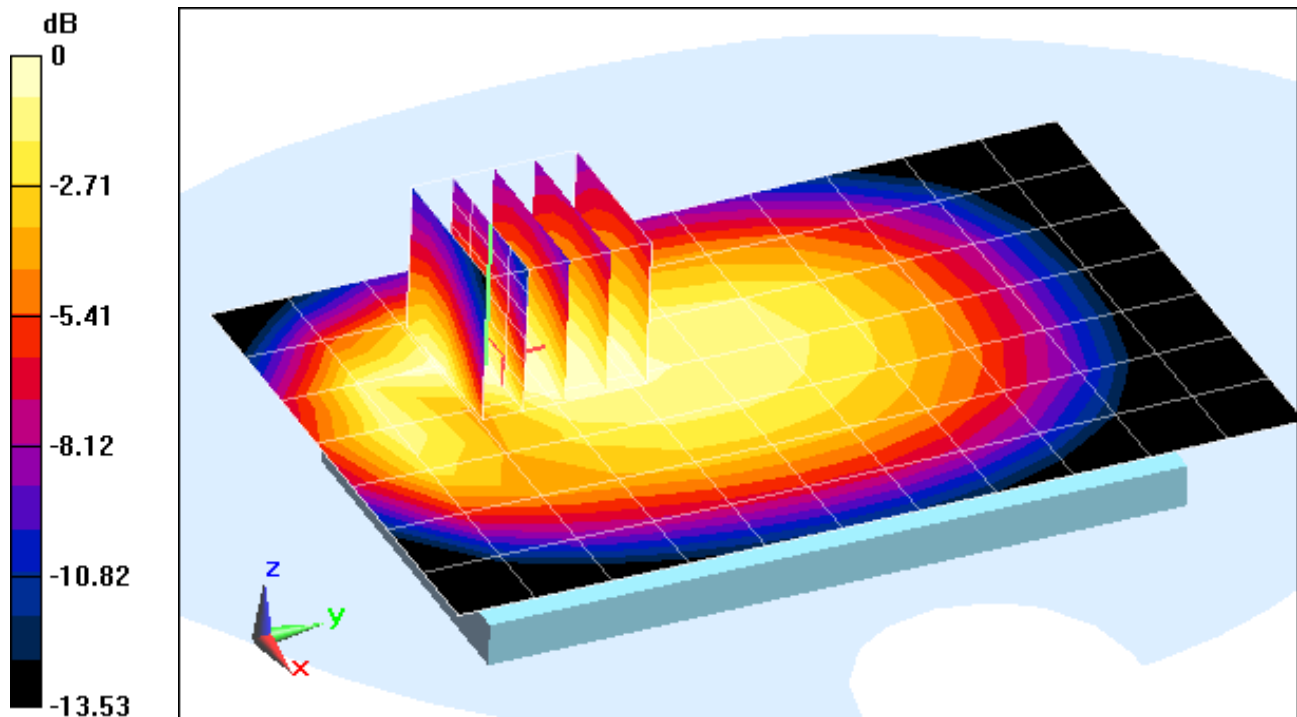
**Area Scan (8x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 22.232 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.656 W/kg

**SAR(1 g) = 0.470 W/kg**



0 dB = 0.501 W/kg = -3.00 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBD**

Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Body, Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.492 \text{ S/m}$ ;  $\epsilon_r = 51.082$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-08-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3920; ConvF(7.38, 7.38, 7.38); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

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

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

**Mode: GSM 1900, Body SAR, Back side, Mid.ch**

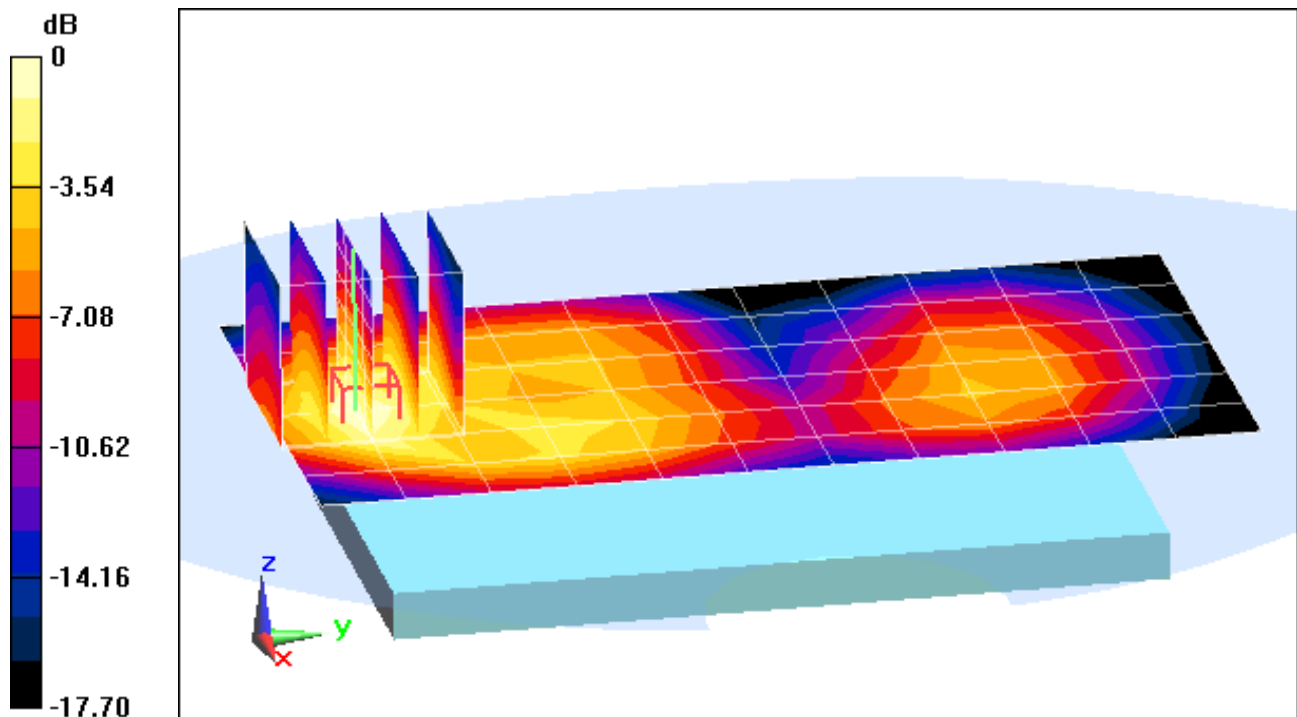
**Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 14.886 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.471 W/kg

**SAR(1 g) = 0.278 W/kg**



0 dB = 0.307 W/kg = -5.13 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FBD**

Communication System: GSM GPRS; 3 Tx slots; Frequency: 1909.8 MHz; Duty Cycle: 1:2.76

Medium: 1900 Body Medium parameters used:

$$f = 1910 \text{ MHz}; \sigma = 1.51 \text{ S/m}; \epsilon_r = 50.943; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-08-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3920; ConvF(7.38, 7.38, 7.38); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

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

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

**Mode: GPRS 1900, Body SAR, Front side, High.ch, 3 Tx Slots**

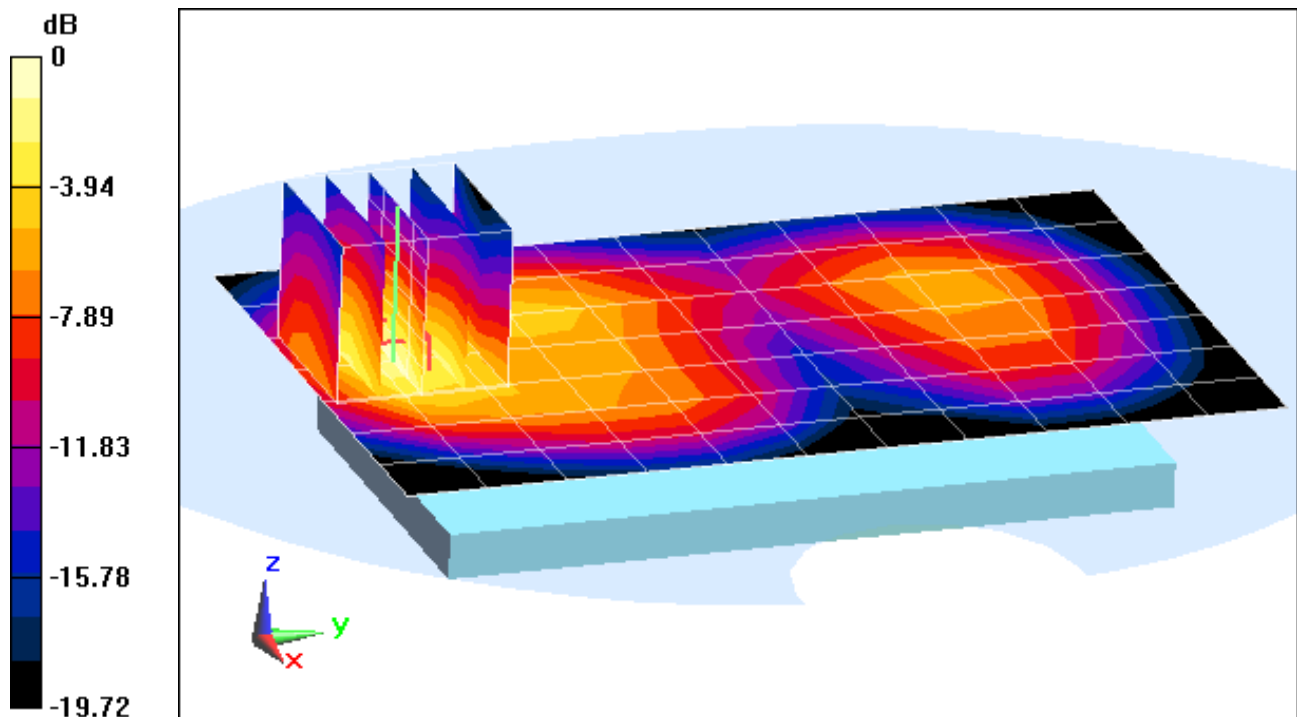
**Area Scan (8x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 26.046 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.75 W/kg

**SAR(1 g) = 0.955 W/kg**



0 dB = 1.11 W/kg = 0.45 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60FAD**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.961 \text{ S/m}$ ;  $\epsilon_r = 51.404$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-04-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3287; ConvF(4.29, 4.29, 4.29); Calibrated: 11/15/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

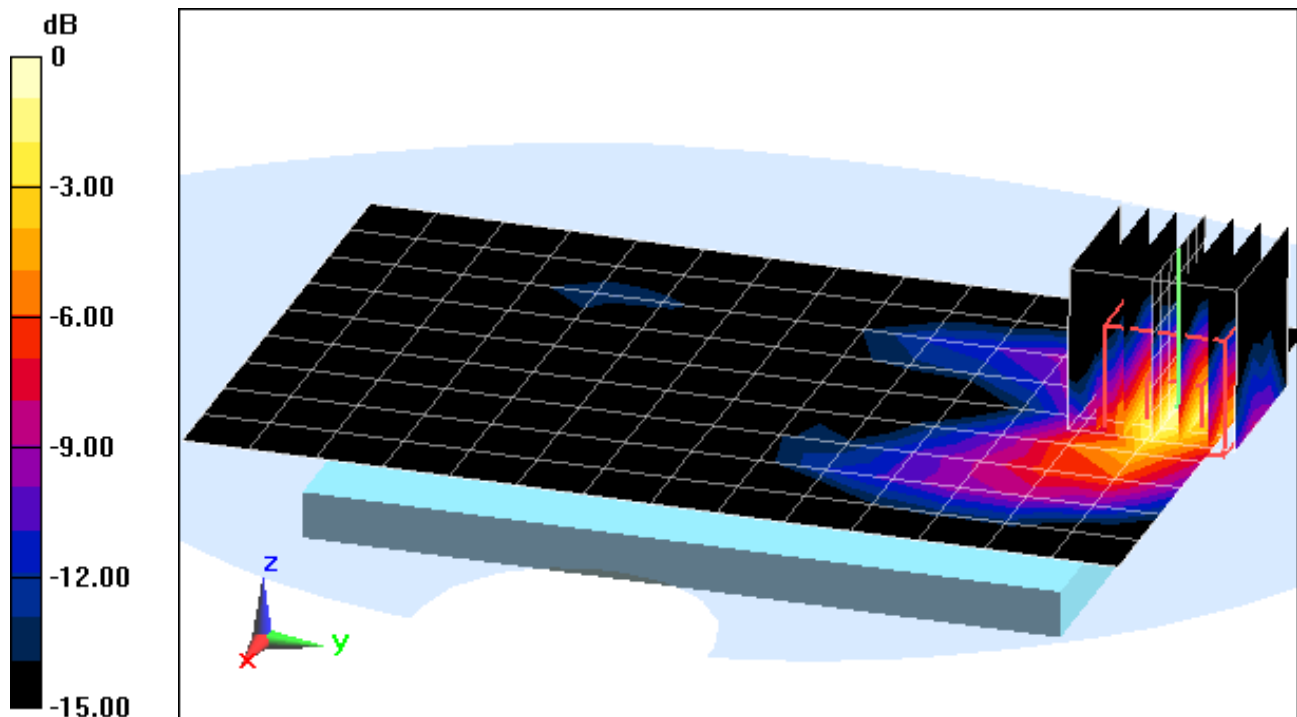
**Area Scan (10x15x1):** Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 5.846 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.144 W/kg

**SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.025 W/kg**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60838**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5660 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$$f = 5660 \text{ MHz}; \sigma = 5.96 \text{ S/m}; \epsilon_r = 46.872; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 24.1°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(3.32, 3.32, 3.32); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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, 5.5 GHz, Body SAR, Ch 132, 6 Mbps, Back Side**

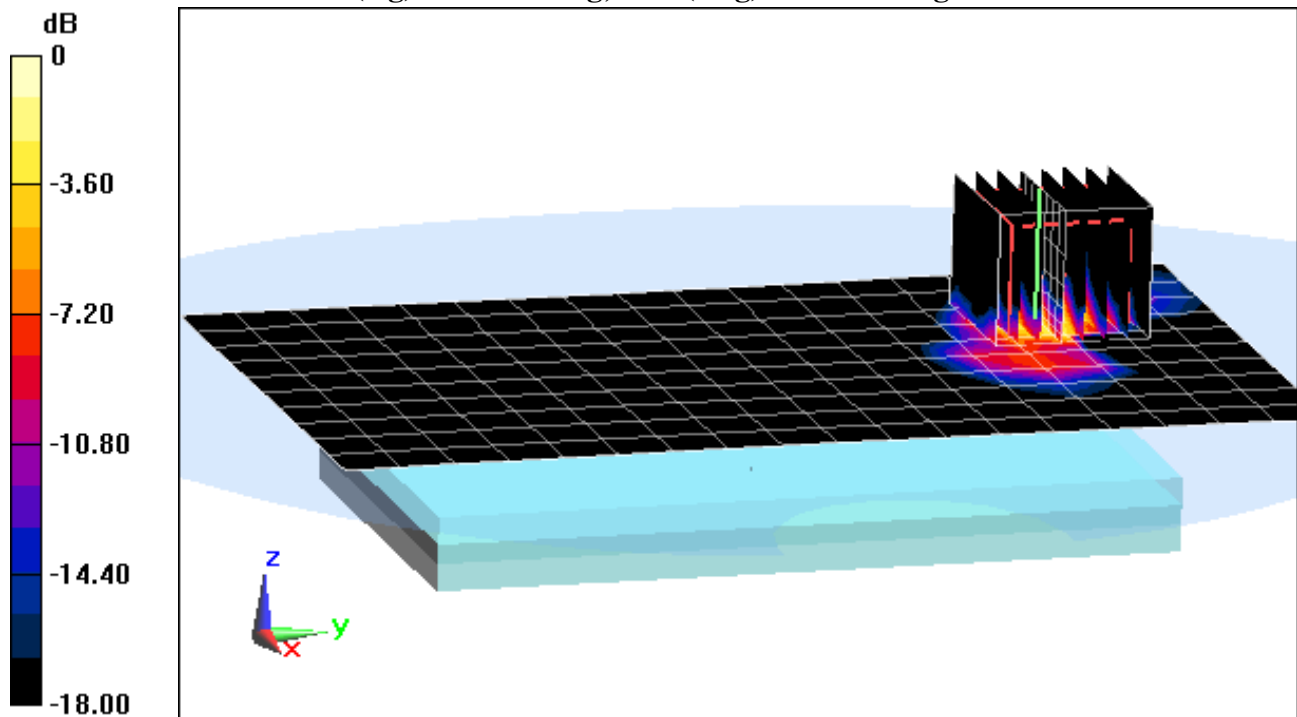
**Area Scan (11x19x1):** Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 9.381 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 2.21 W/kg

.....SAR(1 g) = 0.474 W/kg; SAR(10 g) = 0.129 W/kg



0 dB = 1.17 W/kg = 0.68 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSWDSC04E; Type: Portable Handset; Serial: 60838**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$$f = 5745 \text{ MHz}; \sigma = 6.069 \text{ S/m}; \epsilon_r = 46.775; \rho = 1000 \text{ kg/m}^3$$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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, Body SAR, Ch 149, 6 Mbps, Back Side**

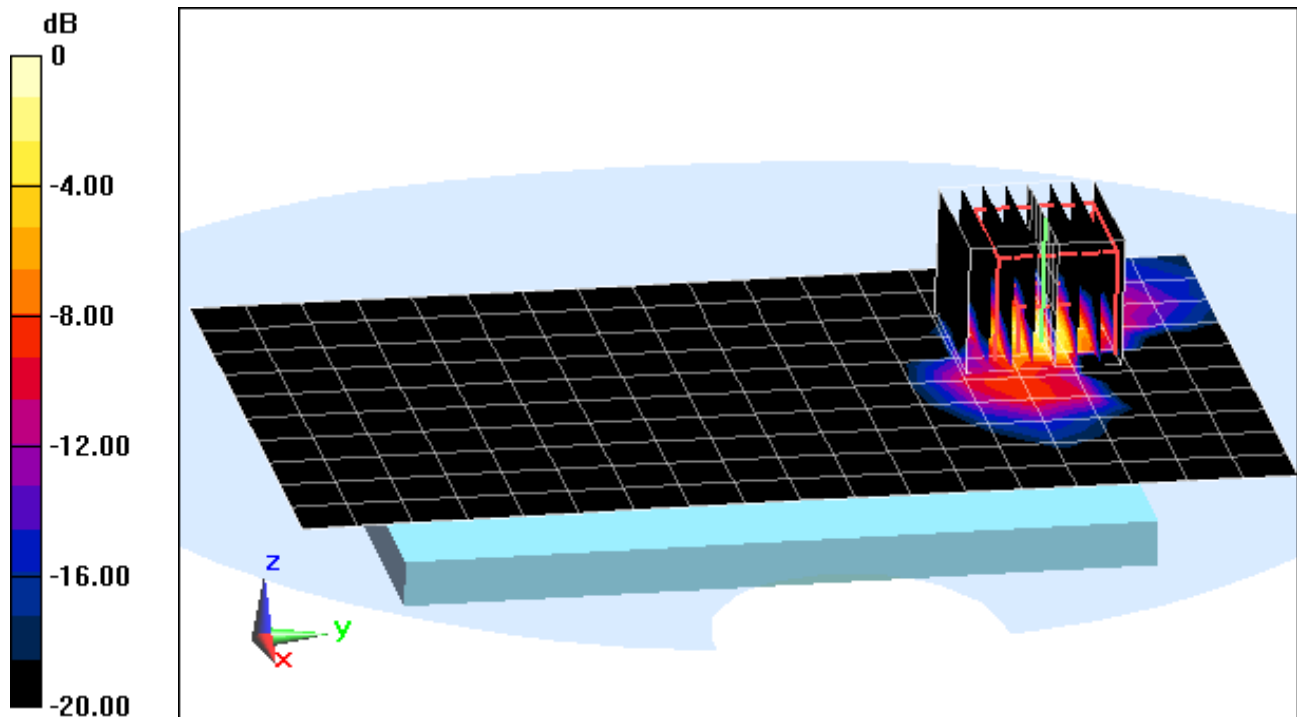
**Area Scan (11x19x1):** Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 9.077 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 2.90 W/kg

**SAR(1 g) = 0.521 W/kg; SAR(10 g) = 0.134 W/kg**



0 dB = 1.34 W/kg = 1.27 dBW/kg

## APPENDIX B: SYSTEM VERIFICATION

# 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:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.934 \text{ S/m}$ ;  $\epsilon_r = 42.102$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-07-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;

Sensor-Surface: 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)

## 835MHz System Verification

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

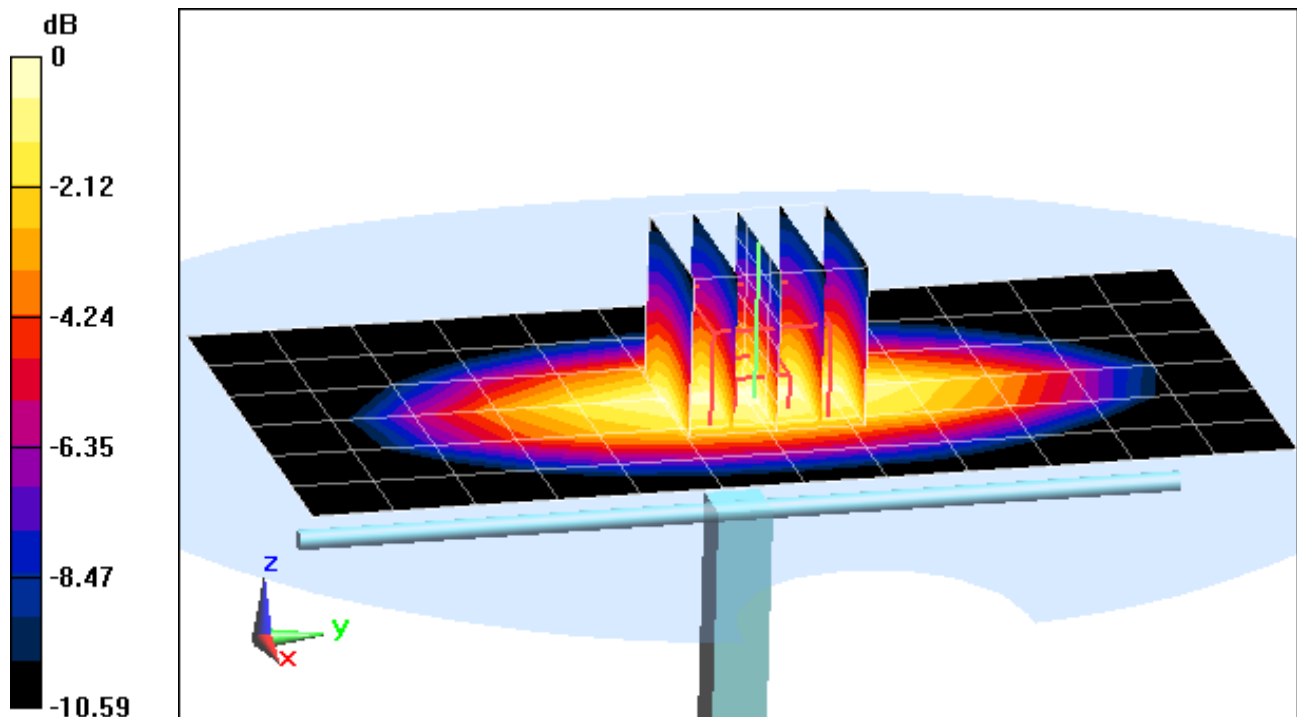
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.47 W/kg

**SAR(1 g) = 0.996 W/kg; SAR(10 g) = 0.652 W/kg**

Deviation = 6.07%



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

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.441 \text{ S/m}$ ;  $\epsilon_r = 39.713$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3920; ConvF(7.73, 7.73, 7.73); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

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

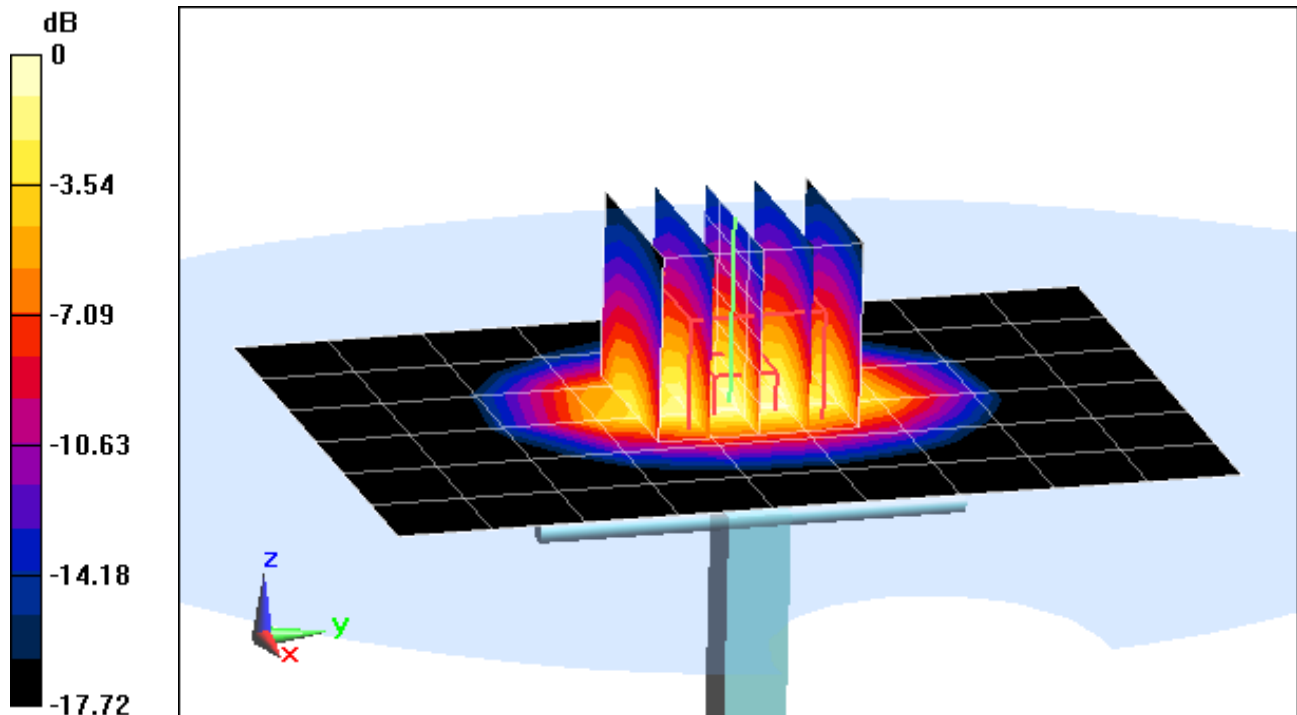
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.51 W/kg

**SAR(1 g) = 4.07 W/kg; SAR(10 g) = 2.12 W/kg**

Deviation = 2.52%



0 dB = 4.56 W/kg = 6.59 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 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.837 \text{ S/m}$ ;  $\epsilon_r = 40.994$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3287; ConvF(4.3, 4.3, 4.3); Calibrated: 11/15/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375

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

## 2450MHz System Verification

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

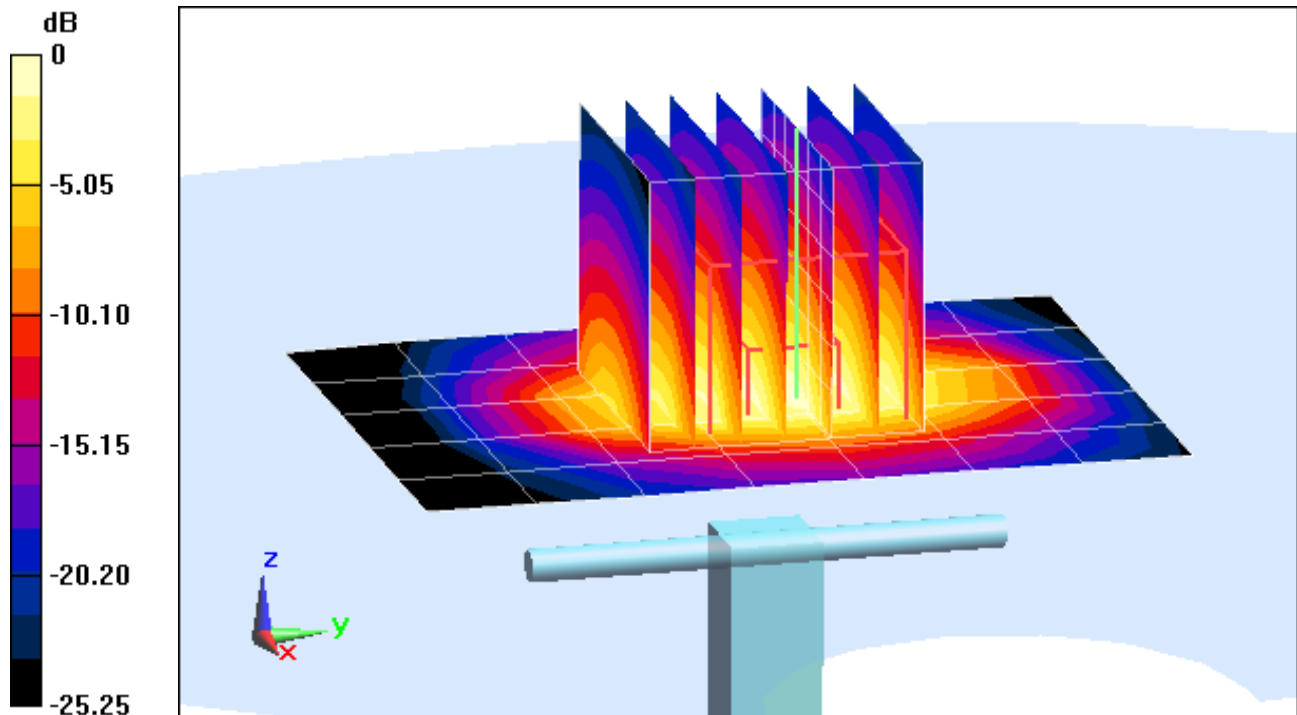
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 11.9 W/kg

**SAR(1 g) = 5.59 W/kg; SAR(10 g) = 2.54 W/kg**

Deviation = 6.07%



0 dB = 7.39 W/kg = 8.69 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Head Medium parameters used:

$f = 5200 \text{ MHz}$ ;  $\sigma = 4.66 \text{ S/m}$ ;  $\epsilon_r = 37.213$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-26-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.48, 4.48, 4.48); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5200MHz System Verification

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

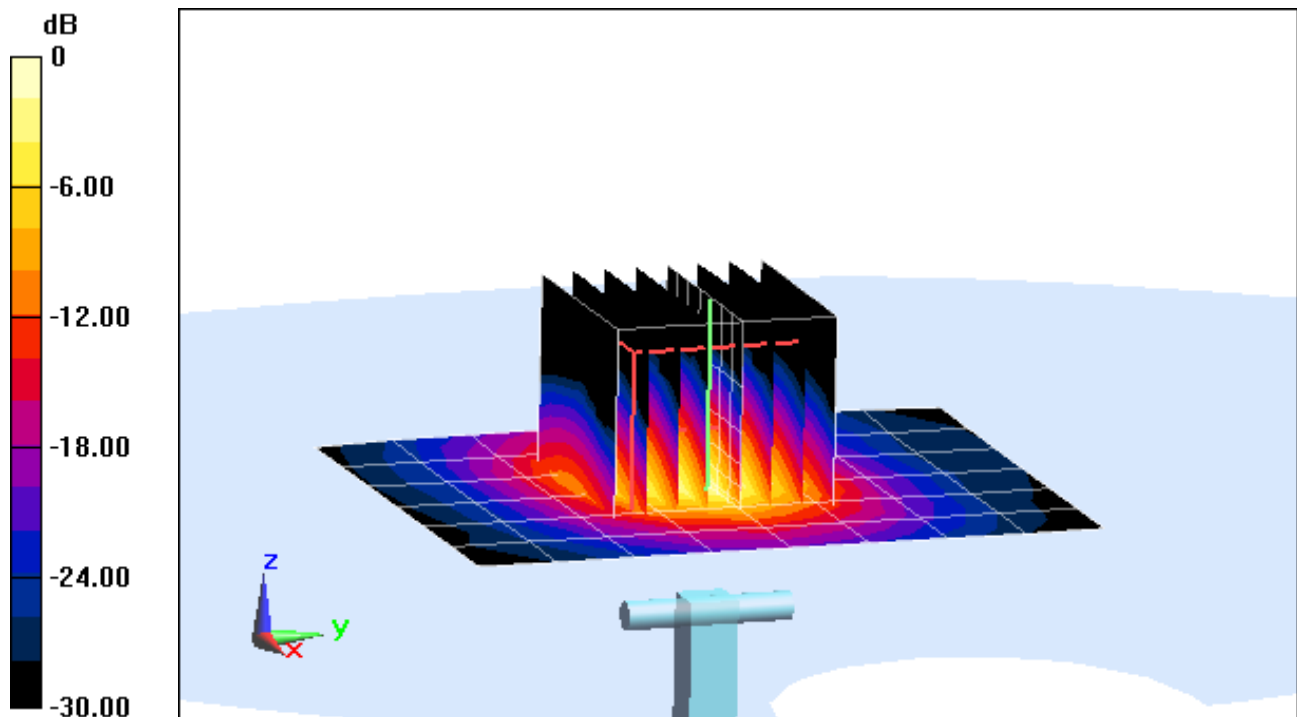
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio:1.4

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 33.8 W/kg

**SAR(1 g) = 7.4 W/kg; SAR(10 g) = 2.1 W/kg**

Deviation = -2.50%



0 dB = 17.9 W/kg = 12.53 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1057**

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

Medium: 5 GHz Head Medium parameters used:

$f = 5300 \text{ MHz}$ ;  $\sigma = 4.792 \text{ S/m}$ ;  $\epsilon_r = 36.891$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-26-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.27, 4.27, 4.27); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5300MHz System Verification

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

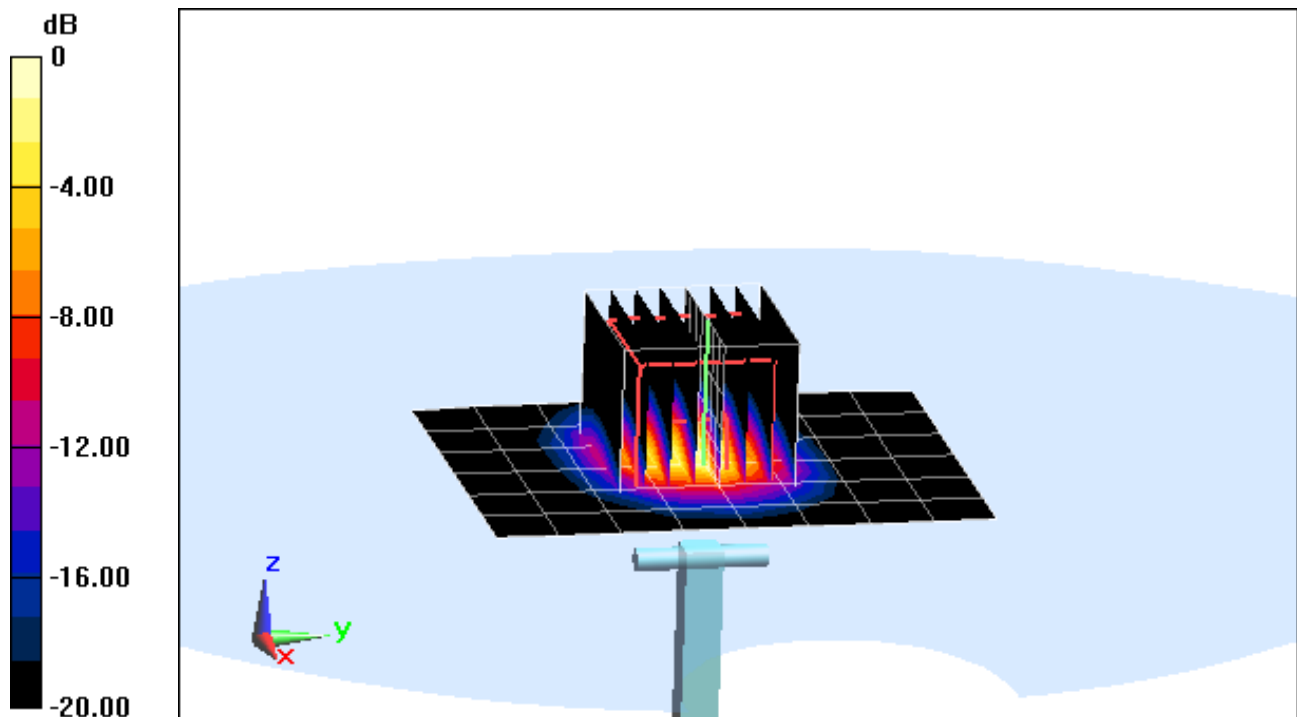
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio:1.4

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 33.3 W/kg

**SAR(1 g) = 7.16 W/kg; SAR(10 g) = 2 W/kg**

Deviation = -6.89%



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

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 5.037 \text{ S/m}$ ;  $\epsilon_r = 36.499$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-26-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.14, 4.14, 4.14); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5500MHz System Verification

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

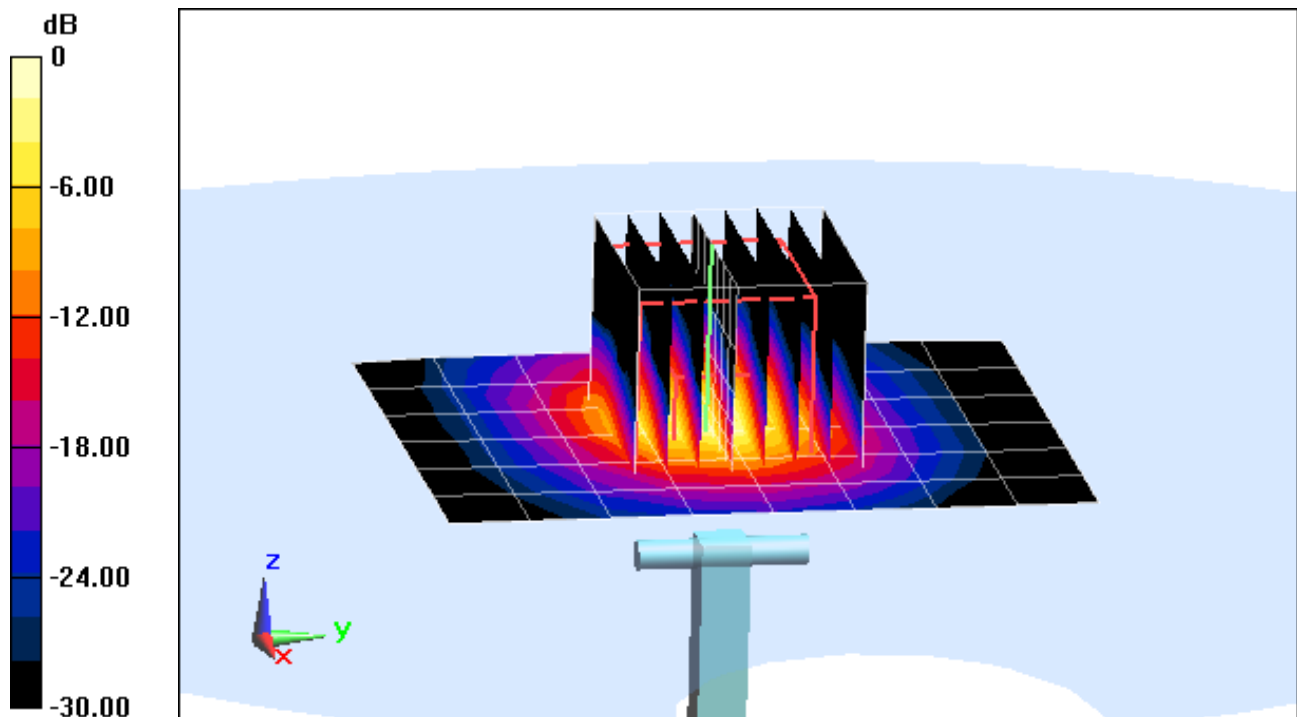
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio:1.4

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 36.6 W/kg

**SAR(1 g) = 7.43 W/kg; SAR(10 g) = 2.05 W/kg**

Deviation = -7.24%



0 dB = 20.1 W/kg = 13.03 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Head Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 5.403 \text{ S/m}$ ;  $\epsilon_r = 35.682$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-26-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3589; ConvF(3.85, 3.85, 3.85); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5800MHz System Verification

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

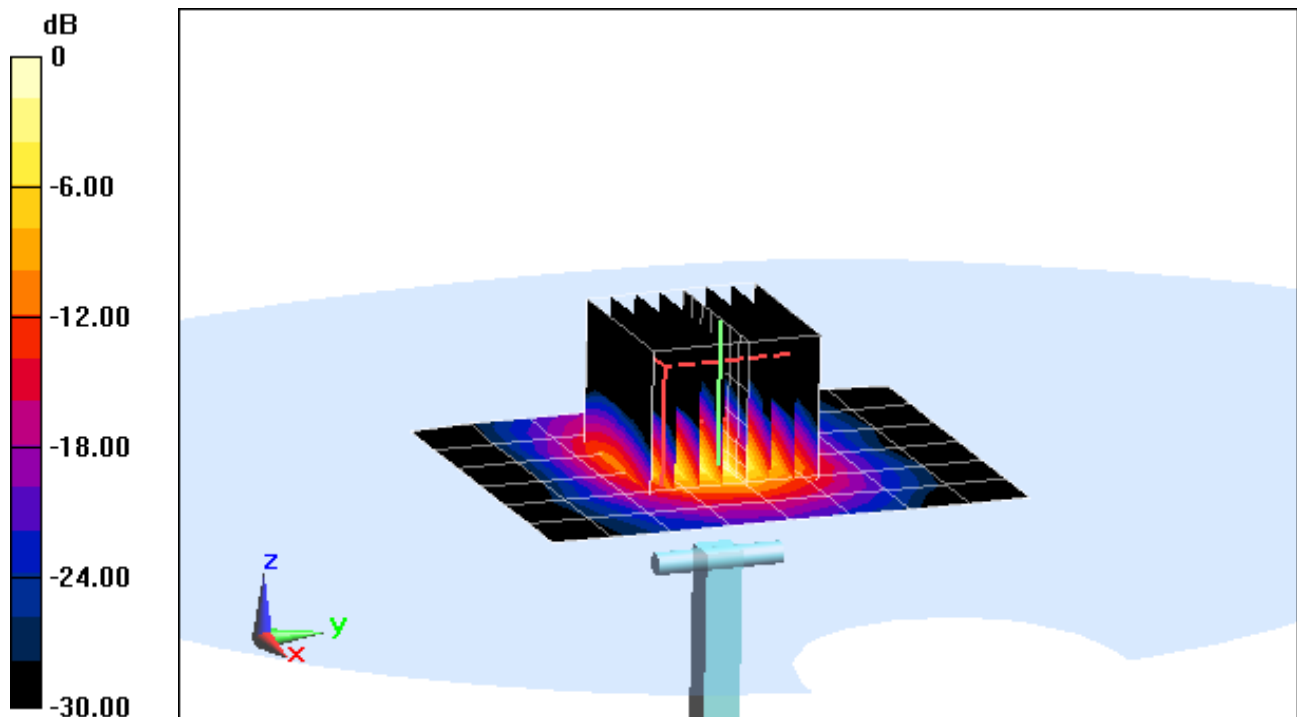
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio:1.4

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 37.9 W/kg

**SAR(1 g) = 7.33 W/kg; SAR(10 g) = 2.02 W/kg**

Deviation = -3.68%



# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.994 \text{ S/m}$ ;  $\epsilon_r = 52.905$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3258; ConvF(6.1, 6.1, 6.1); Calibrated: 2/11/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/15/2012

Phantom: SAM Front; Type: QD000P40CD; Serial: 1717

Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

## 835 MHz System Verification

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

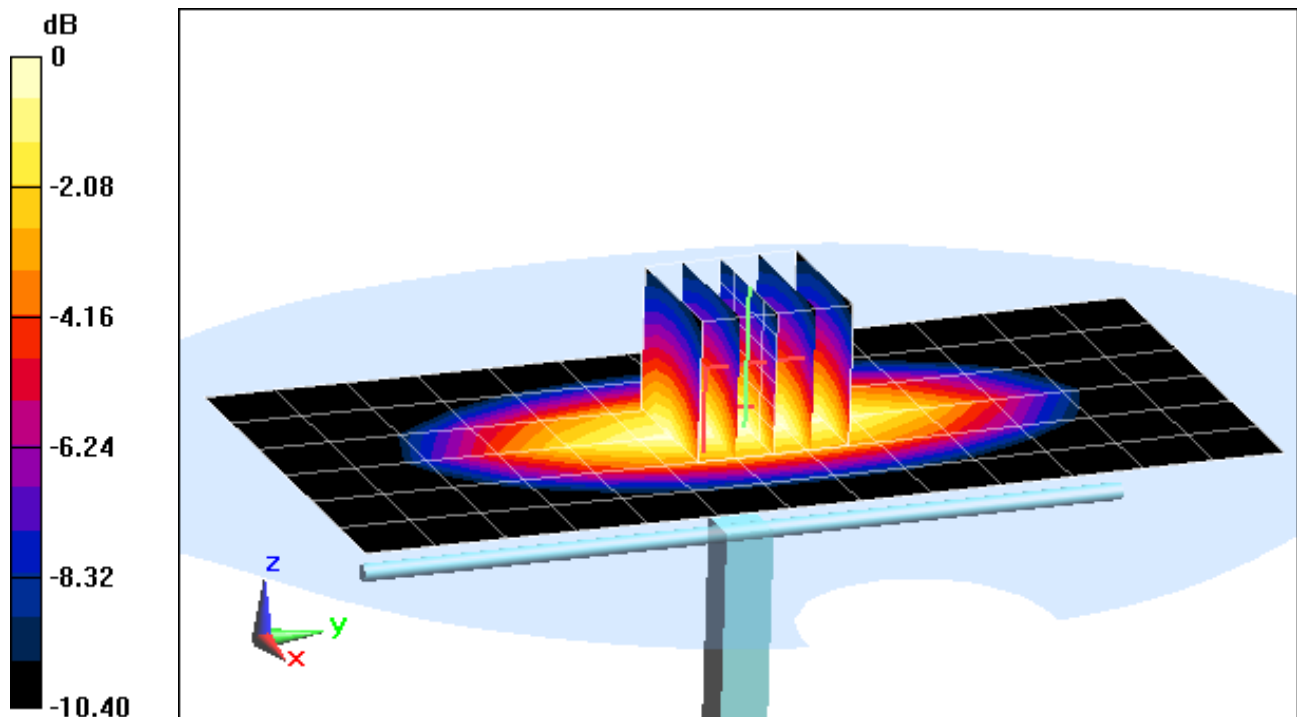
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.50 W/kg

**SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.667 W/kg**

Deviation = 8.97%



0 dB = 1.10 W/kg = 0.41 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.504 \text{ S/m}$ ;  $\epsilon_r = 50.989$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-08-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3920; ConvF(7.38, 7.38, 7.38); Calibrated: 2/27/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/6/2013

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

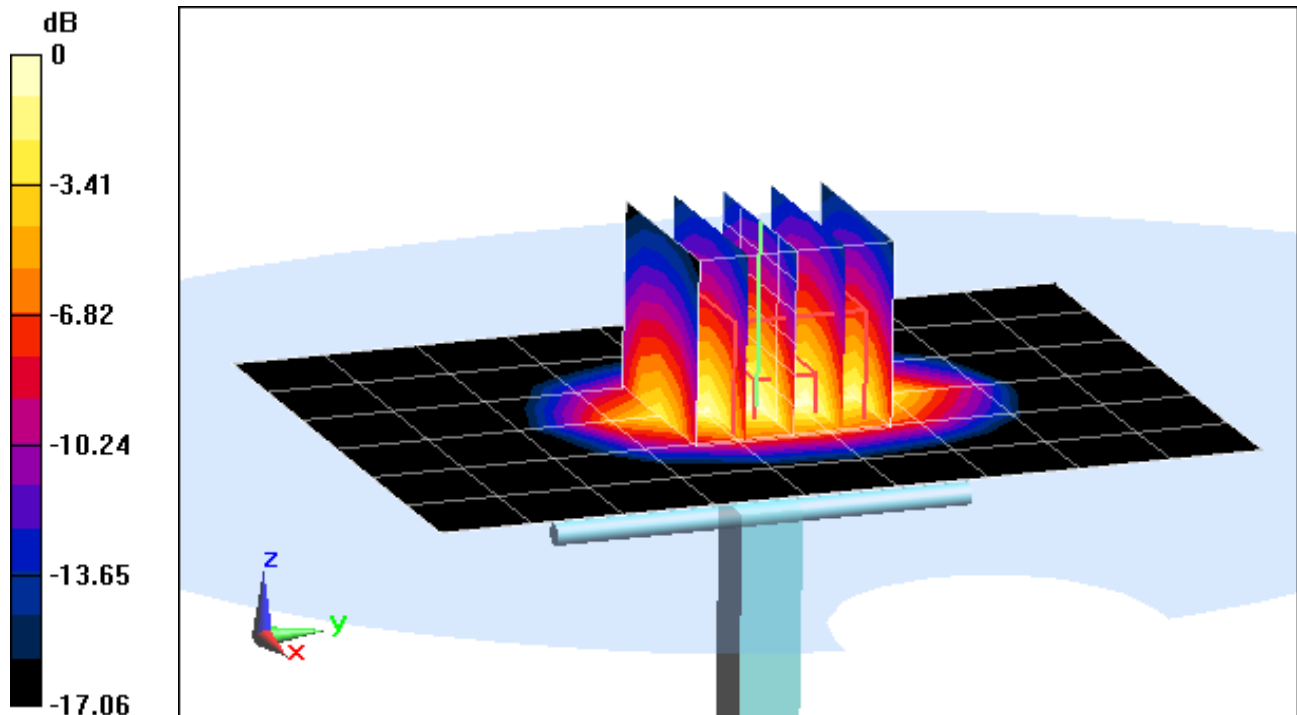
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.18 W/kg

**SAR(1 g) = 4.03 W/kg; SAR(10 g) = 2.13 W/kg**

Deviation = -1.23%



0 dB = 4.48 W/kg = 6.51 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:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.977 \text{ S/m}$ ;  $\epsilon_r = 51.362$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-04-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3287; ConvF(4.29, 4.29, 4.29); Calibrated: 11/15/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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)

## 2450MHz System Verification

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

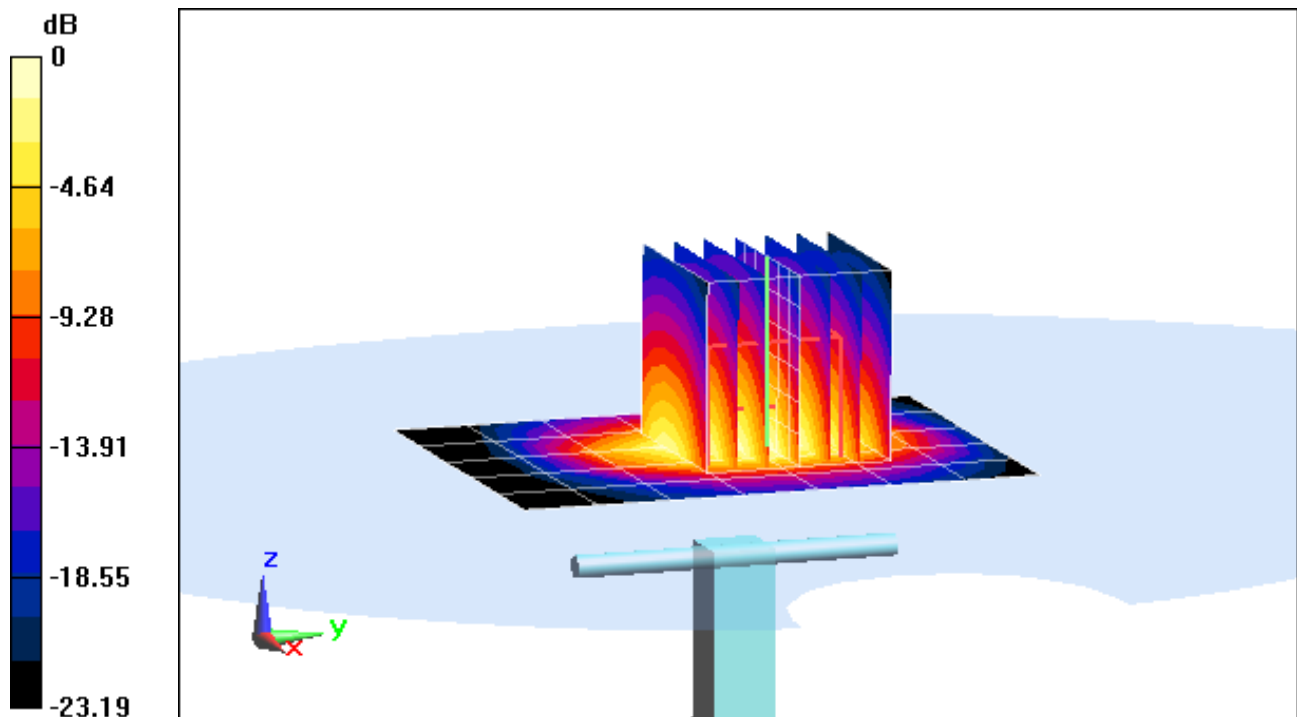
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 10.7 W/kg

**SAR(1 g) = 4.91 W/kg; SAR(10 g) = 2.25 W/kg**

Deviation = -4.84%



0 dB = 6.17 W/kg = 7.90 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body; Medium parameters used:

$f = 5200 \text{ MHz}$ ;  $\sigma = 5.346 \text{ S/m}$ ;  $\epsilon_r = 47.63$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3589; ConvF(3.99, 3.99, 3.99); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5200MHz System Verification

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

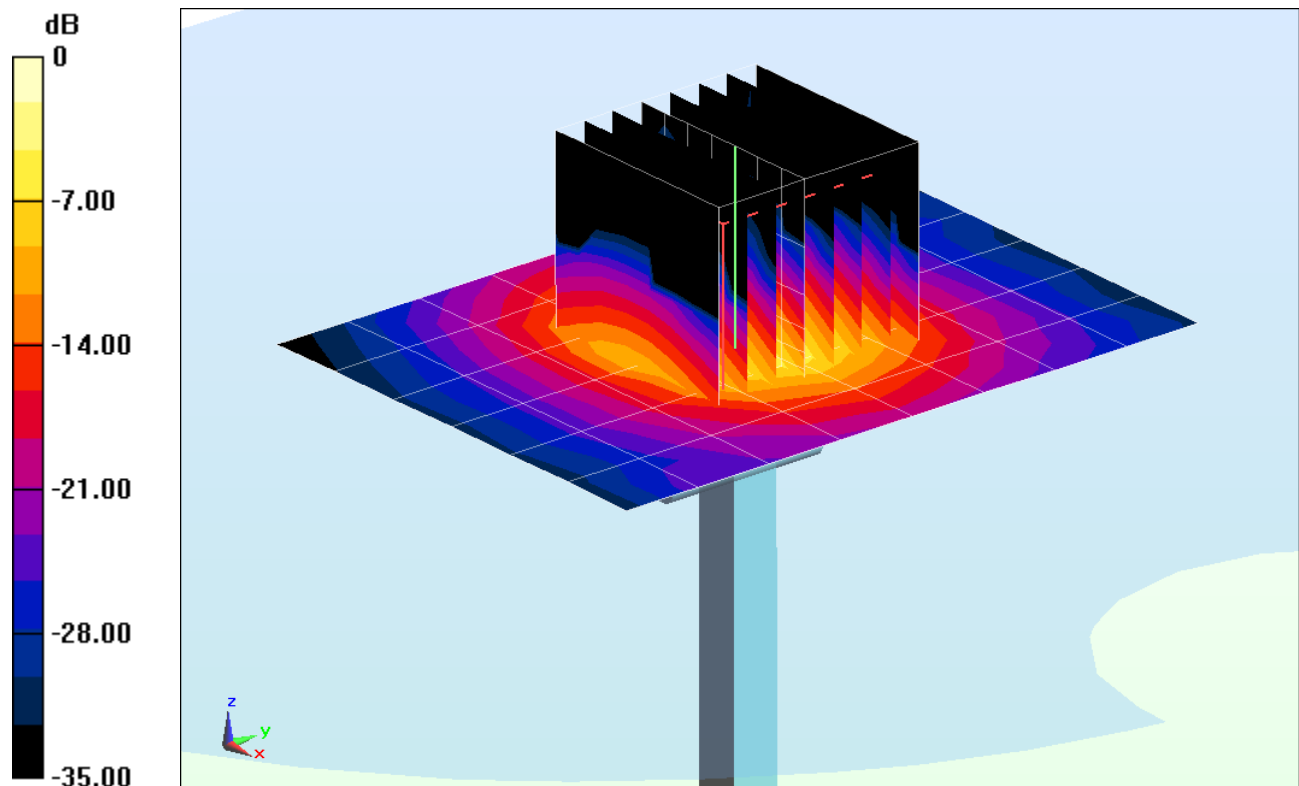
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 32.1 W/kg

**SAR(1 g) = 7.14 W/kg; SAR(10 g) = 1.99 W/kg**

Deviation = -5.43%



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

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1057**

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

Medium: 5 GHz Body; Medium parameters used:

$f = 5300 \text{ MHz}$ ;  $\sigma = 5.472 \text{ S/m}$ ;  $\epsilon_r = 47.464$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.7°C; Tissue Temp: 22.6°C

Probe: EX3DV4 - SN3589; ConvF(3.81, 3.81, 3.81); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5300MHz System Verification

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

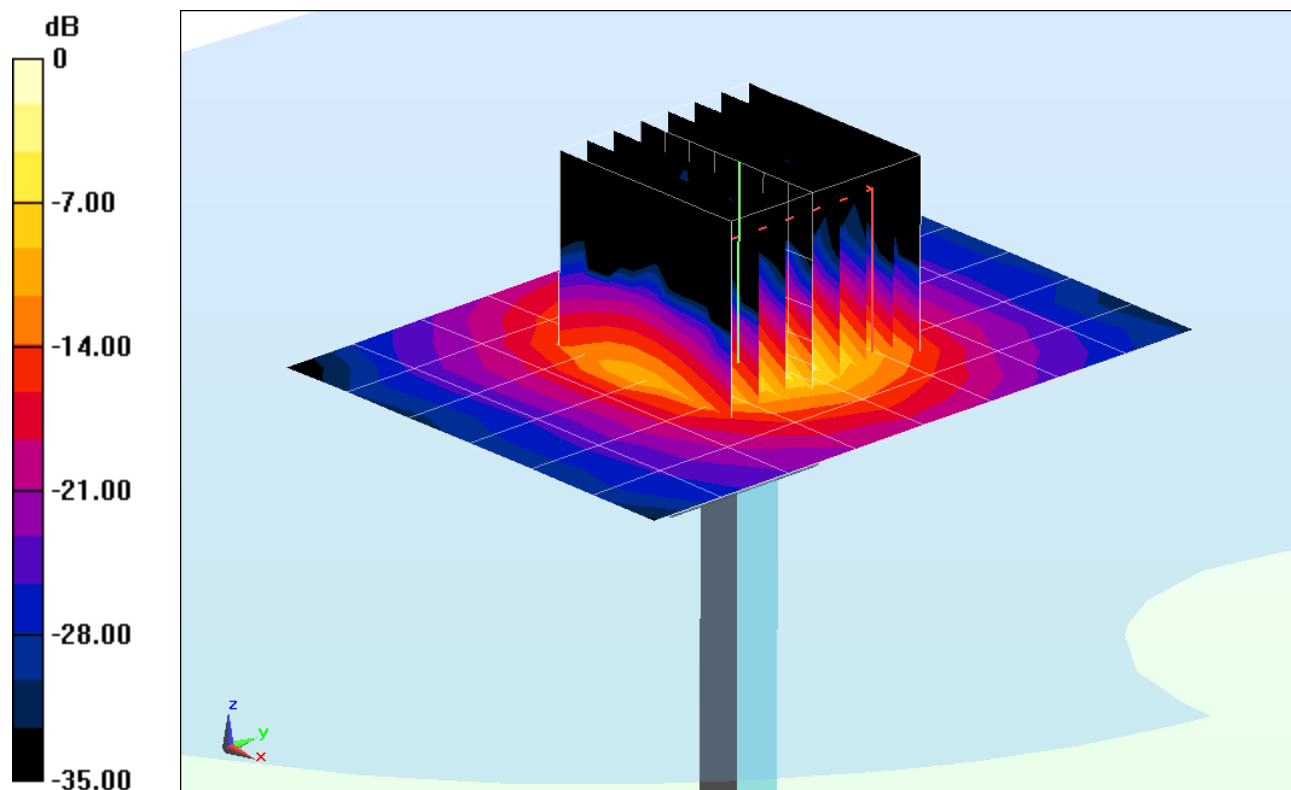
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 34.0 W/kg

**SAR(1 g) = 7.34 W/kg; SAR(10 g) = 2.02 W/kg**

Deviation = -2.52%



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

# PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body; Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 5.732 \text{ S/m}$ ;  $\epsilon_r = 47.135$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.6°C

Probe: EX3DV4 - SN3589; ConvF(3.52, 3.52, 3.52); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5500MHz System Verification

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

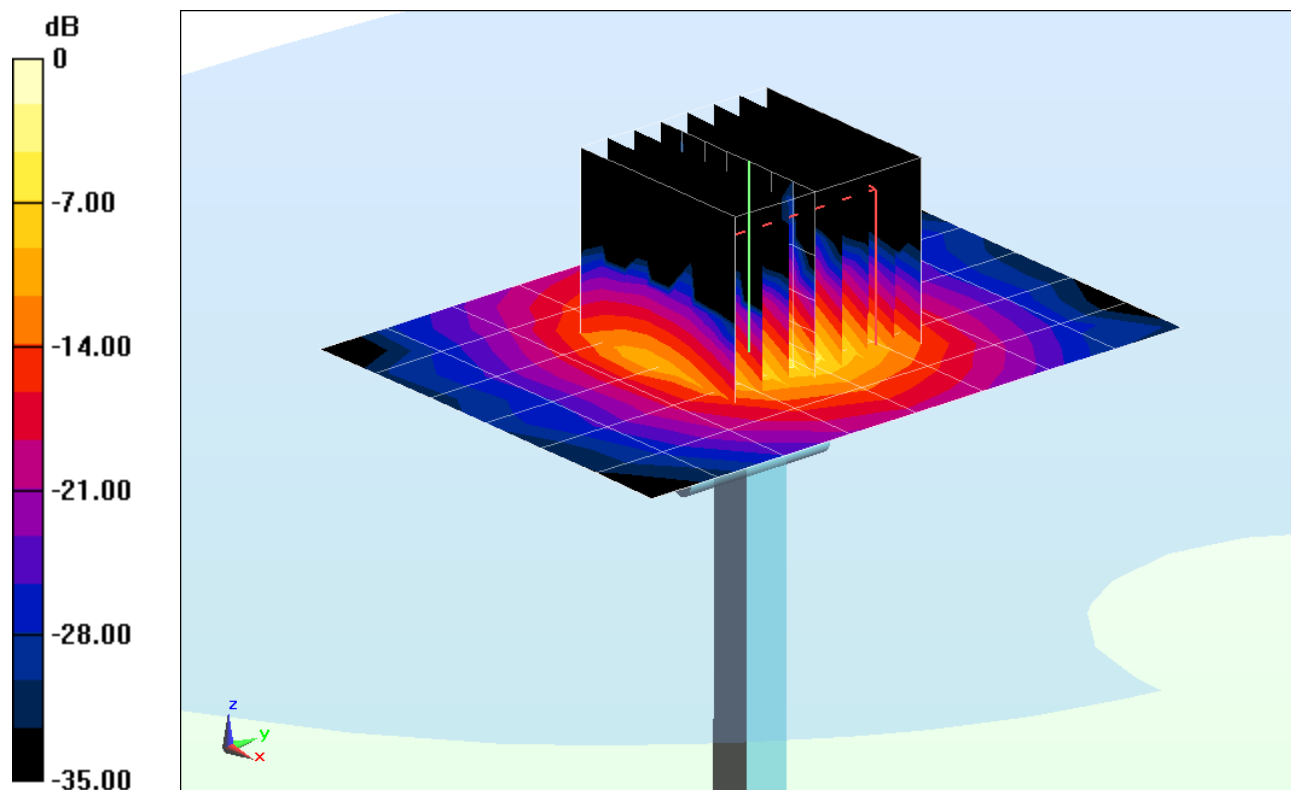
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 35.3 W/kg

**SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.14 W/kg**

Deviation = -3.84%



0 dB = 18.0 W/kg = 12.55 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1057**

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

Medium: 5 GHz Body; Medium parameters used:

$f = 5600 \text{ MHz}$ ;  $\sigma = 5.848 \text{ S/m}$ ;  $\epsilon_r = 46.974$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 24.1°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(3.32, 3.32, 3.32); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5600MHz System Verification

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

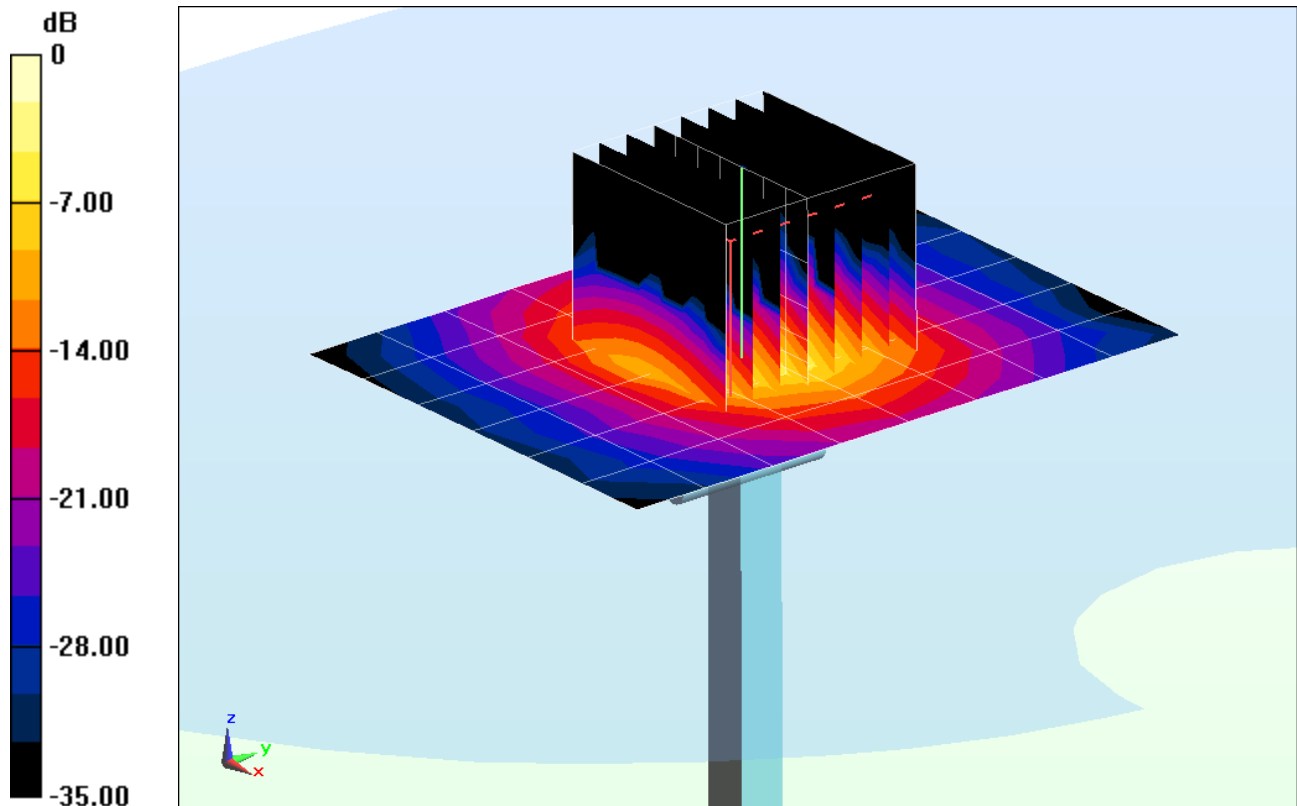
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 38.4 W/kg

**SAR(1 g) = 8.37 W/kg; SAR(10 g) = 2.29 W/kg**

Deviation = 4.23%



0 dB = 20.4 W/kg = 13.10 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body; Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 6.147 \text{ S/m}$ ;  $\epsilon_r = 46.555$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/17/2013

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

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

## 5800MHz System Verification

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

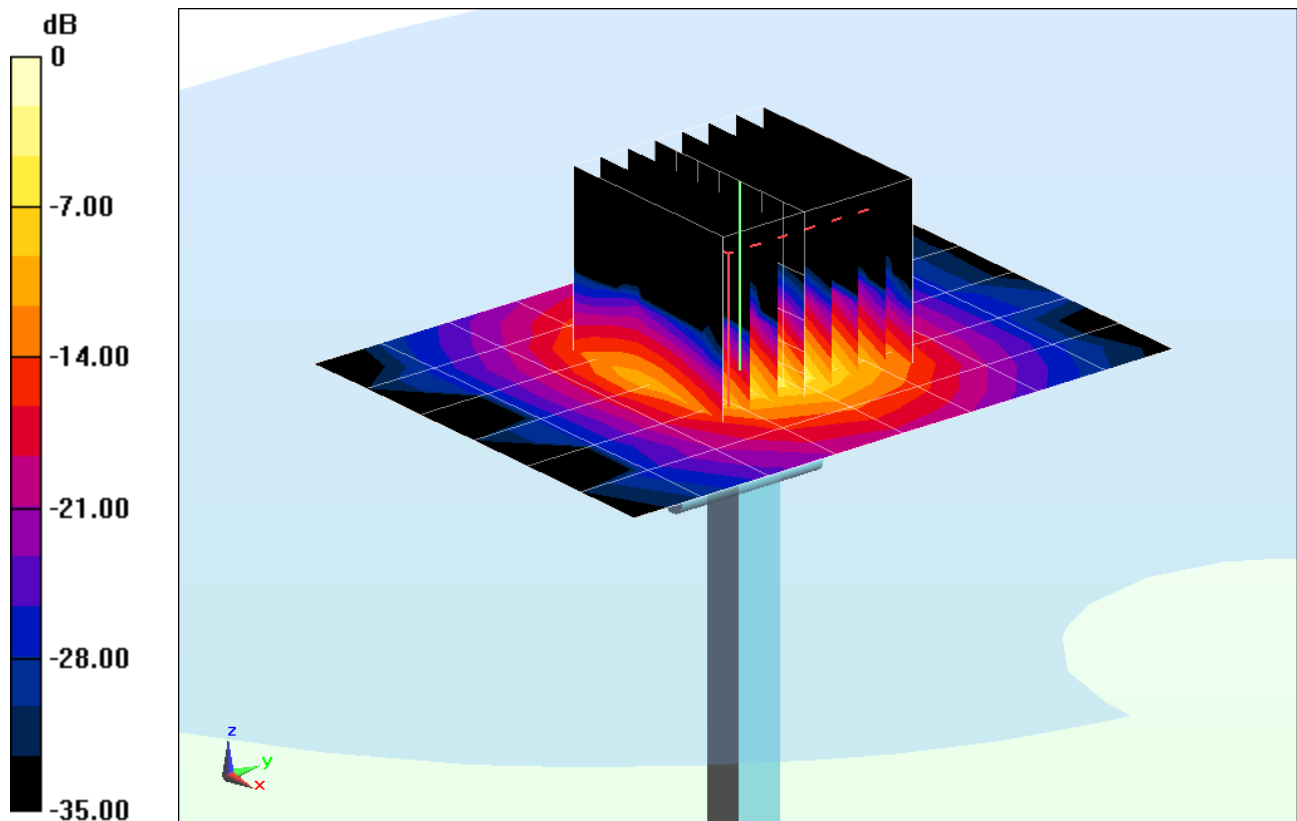
**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 36.9 W/kg

**SAR(1 g) = 7.3 W/kg; SAR(10 g) = 1.99 W/kg**

Deviation = -2.80%



0 dB = 18.0 W/kg = 12.55 dBW/kg

## APPENDIX C: PROBE CALIBRATION

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



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

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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d026\_Aug12**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d026**

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

Calibration date: **August 23, 2012**

*1/10K  
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

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

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



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

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

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
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.

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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.3 $\pm$ 6 %	0.90 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.39 mW / g <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.12 mW / g <math>\pm</math> 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.2 $\pm$ 6 %	1.00 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.58 mW / g <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.33 mW / g <math>\pm</math> 16.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 $\Omega$ - 3.4 j $\Omega$
Return Loss	- 26.4 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 $\Omega$ - 4.8 j $\Omega$
Return Loss	- 26.4 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 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	December 17, 2004

## DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.9$  mho/m;  $\epsilon_r = 41.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:

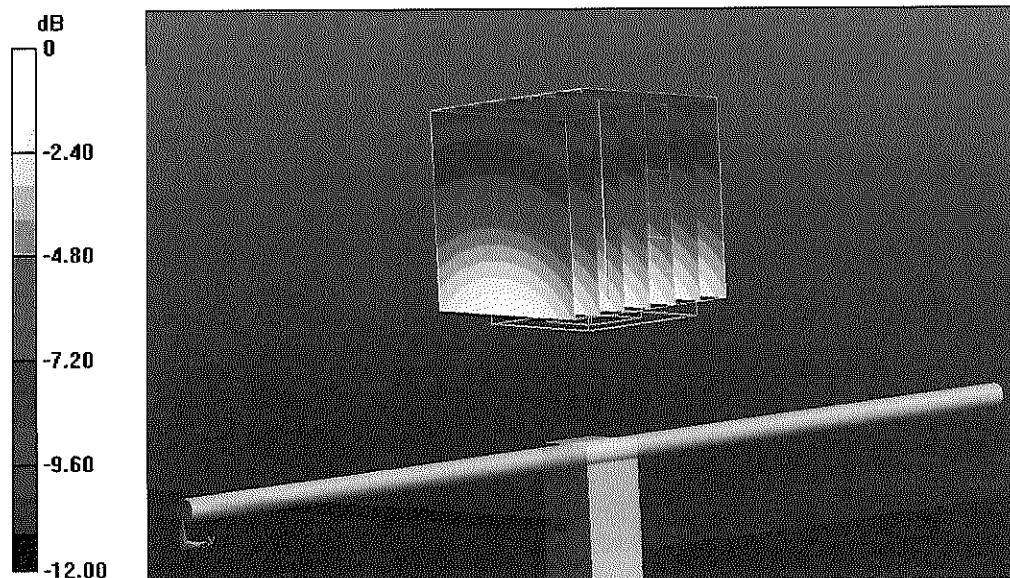
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.824 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.482 mW/g

**SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.53 mW/g**

Maximum value of SAR (measured) = 2.72 W/kg



0 dB = 2.72 W/kg = 8.69 dB W/kg

# Impedance Measurement Plot for Head TSL

23 Aug 2012 12:19:04

CH1 S11 1 U FS

1: 53.662  $\Delta$  -3.3516  $\Delta$  56.870 pF

835.000 000 MHz

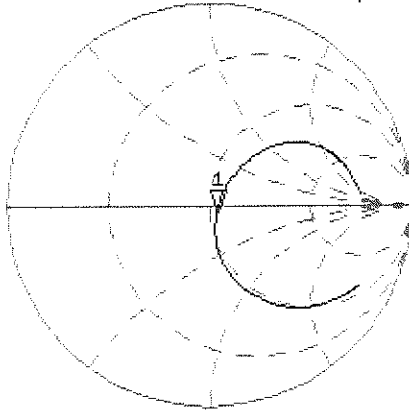
\*

De1

Cor

Avg  
16

H1d

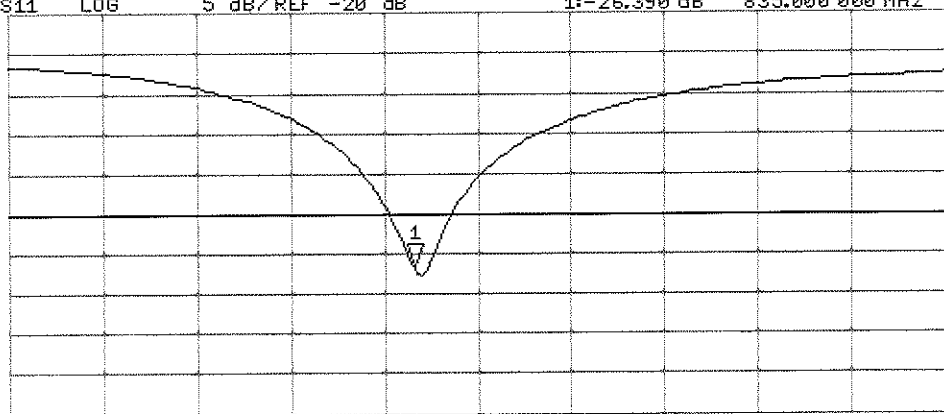


CH2 S11 LOG 5 dB/REF -20 dB 1:-25.390 dB 835.000 000 MHz

Cor

Avg  
16

H1d



START 635.000 000 MHz

STOP 1 100.000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1$  mho/m;  $\epsilon_r = 53.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

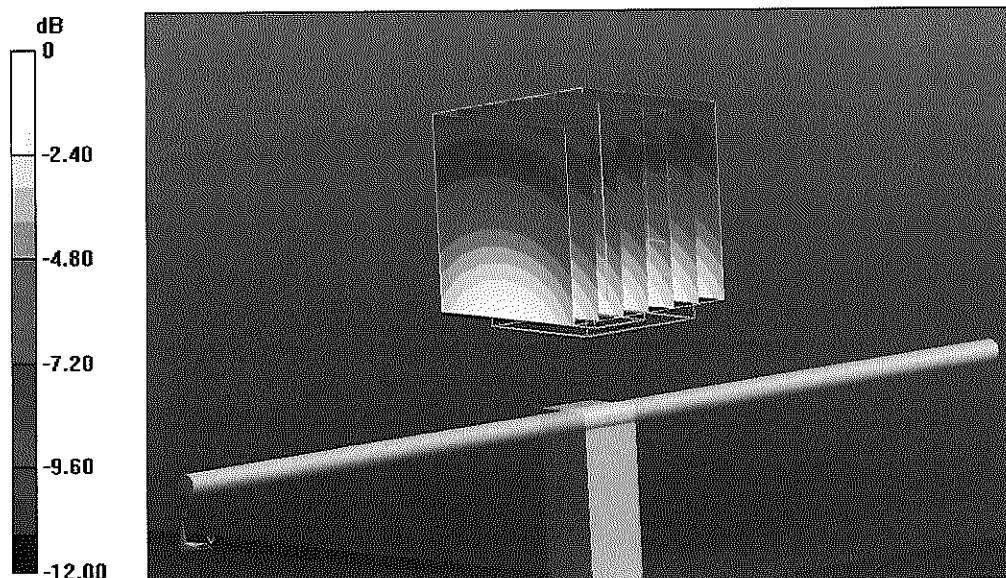
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.339 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.592 mW/g

**SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g**

Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 9.16 dB W/kg

# Impedance Measurement Plot for Body TSL

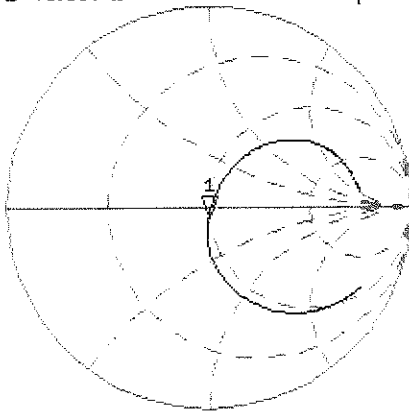
23 Aug 2012 10:54:42

[CH1] S11 1 U FS

1: 49.557  $\Delta$  -4.7500  $\Delta$  40.127 pF

835.000 000 MHz

\*  
Del  
Cor



Avg  
16

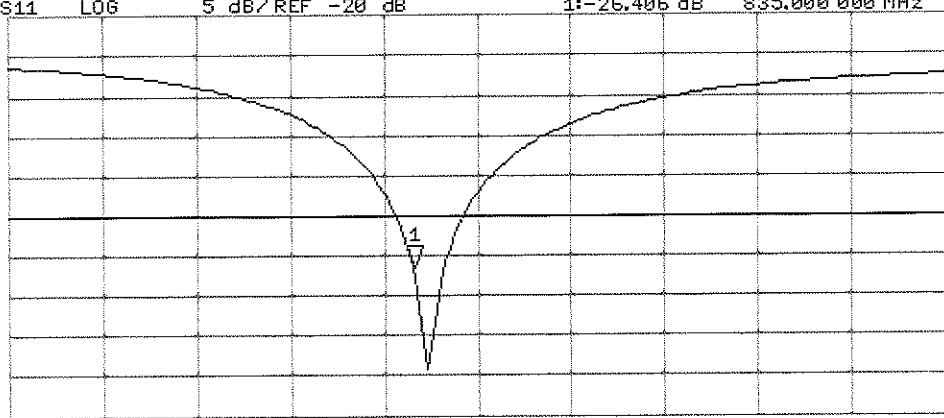
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-26.405 dB 835.000 000 MHz

Cor

Avg  
16

H1d



START 635.000 000 MHz

STOP 1 100.000 000 MHz



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: **D835V2-4d132\_Jan13**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d132**

Calibration procedure(s) **QA CAL-05.v9  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **January 07, 2013**

*✓ KOK  
1/28/13*

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
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

	<b>Name</b>	<b>Function</b>	<b>Signature</b>
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 8, 2013

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
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.

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.

<b>DASY Version</b>	DASY5	V52.8.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	835 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	41.5	0.90 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	42.0 $\pm$ 6 %	0.92 mho/m $\pm$ 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	2.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.66 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.29 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.2	0.97 mho/m
<b>Measured Body TSL parameters</b>	(22.0 $\pm$ 0.2) °C	54.7 $\pm$ 6 %	0.99 mho/m $\pm$ 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.36 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.20 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2 $\Omega$ + 1.3 j $\Omega$
Return Loss	- 27.5 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8 $\Omega$ - 1.3 j $\Omega$
Return Loss	- 34.9 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 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	July 22, 2011

## DASY5 Validation Report for Head TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d132**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.92$  S/m;  $\epsilon_r = 42$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

### **Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**

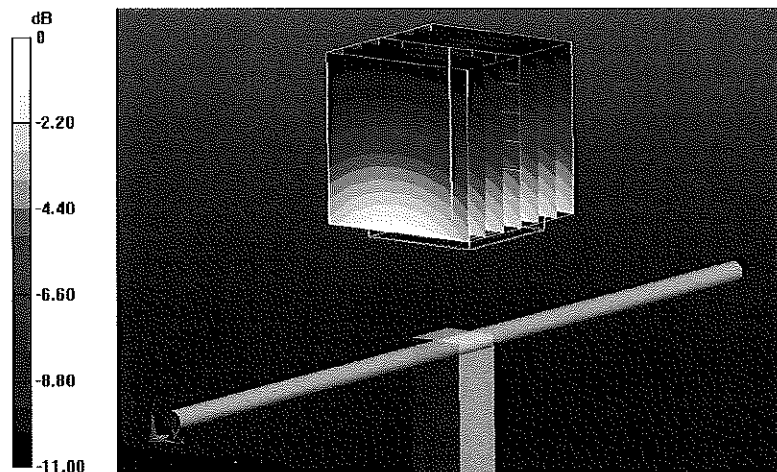
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.542 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 3.71 W/kg

**SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.59 W/kg**

Maximum value of SAR (measured) = 2.88 W/kg



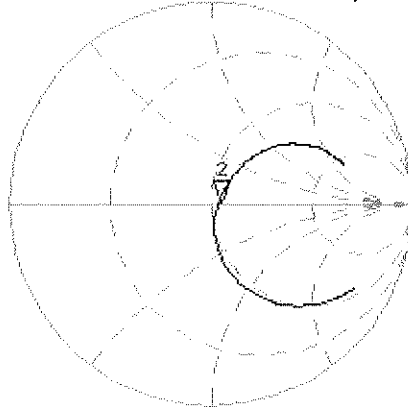
0 dB = 2.88 W/kg = 4.59 dBW/kg

# Impedance Measurement Plot for Head TSL

7 Jan 2013 13:03:50

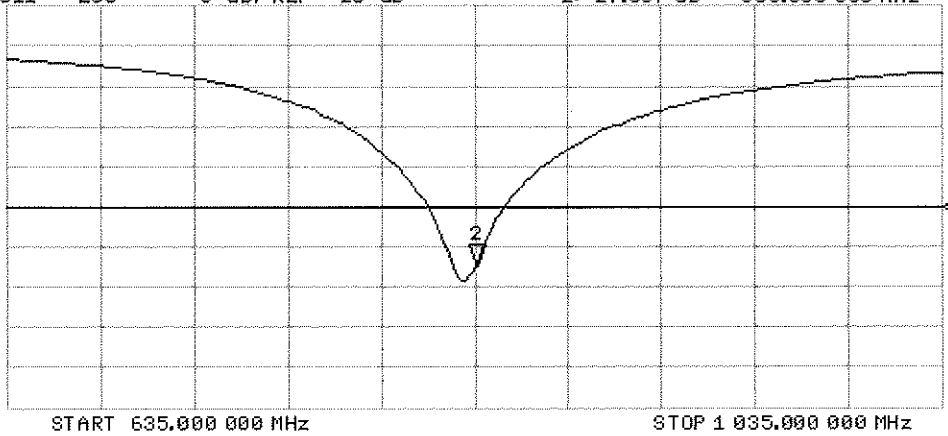
CH1 S11 1 U FS 2: 54.162  $\Omega$  1.3398  $\mu$  255.38 pF 835.000 000 MHz

\*  
Del  
CA  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 2:-27.537 dB 835.000 000 MHz

CA  
Avg  
16  
H1d



## DASY5 Validation Report for Body TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d132**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ S/m}$ ;  $\epsilon_r = 54.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

### Dipole Calibration for Body Tissue/Pin=250 mW, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

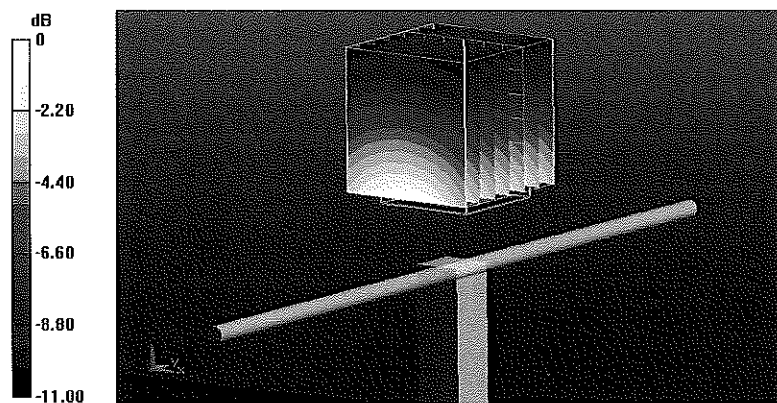
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 54.512 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 3.47 W/kg

**SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.57 W/kg**

Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

# Impedance Measurement Plot for Body TSL

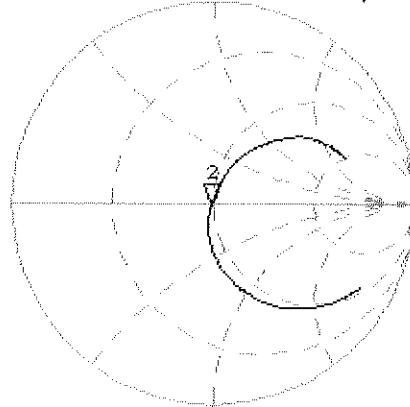
7 Jan 2013 10:07:01

CH1 S11 1 U FS

2: 48.762  $\Omega$  -1.2773  $\Omega$  149.22 pF

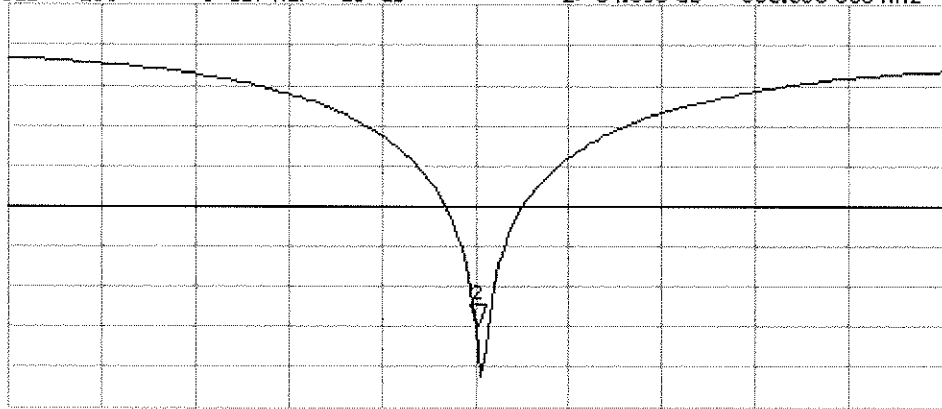
835.000 000 MHz

\*  
De1  
Ca  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 2:-34.896 dB 835.000 000 MHz

Ca  
Avg  
16  
H1d





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\_Feb13**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d148**

Calibration procedure(s) **QA CAL-05.v9  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **February 06, 2013**

*KOK  
2/21/13*

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 ( $22 \pm 3$ )°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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
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: **Leif Klysner**      Name: **Leif Klysner**      Function: **Laboratory Technician**

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

Signature  
*Leif Klysner*  
*Katja Pokovic*

Issued: February 6, 2013

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
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.

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.

<b>DASY Version</b>	DASY5	V52.8.5
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1900 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	39.4 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	9.87 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>39.7 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	5.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>20.8 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	53.3	1.52 mho/m
<b>Measured Body TSL parameters</b>	(22.0 $\pm$ 0.2) °C	51.9 $\pm$ 6 %	1.53 mho/m $\pm$ 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>40.8 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	5.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.7 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 $\Omega$ + 5.9 j $\Omega$
Return Loss	- 24.3 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.3 $\Omega$ + 6.3 j $\Omega$
Return Loss	- 23.6 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: 06.02.2013

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;  $\sigma = 1.38$  S/m;  $\epsilon_r = 39.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

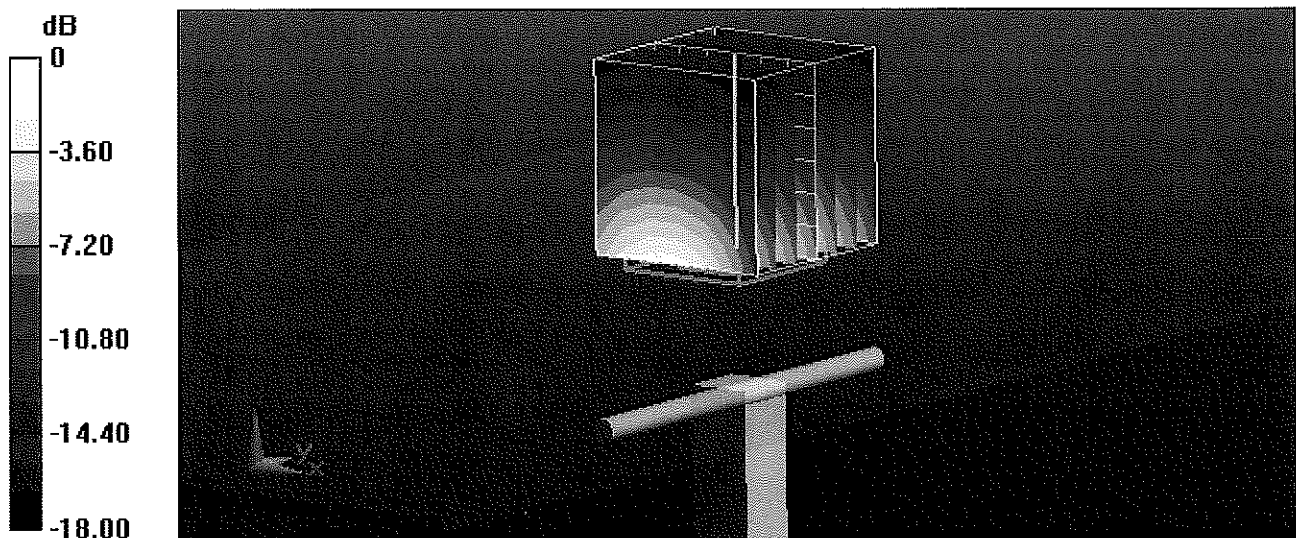
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.534 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 17.8 W/kg

**SAR(1 g) = 9.87 W/kg; SAR(10 g) = 5.18 W/kg**

Maximum value of SAR (measured) = 12.1 W/kg



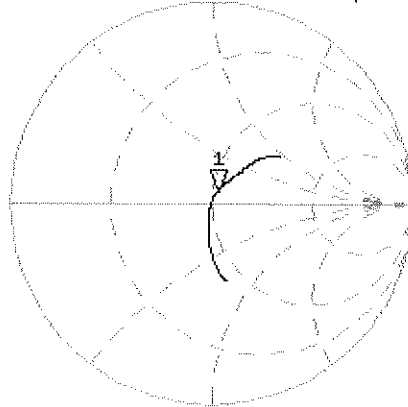
0 dB = 12.1 W/kg = 10.83 dBW/kg

# Impedance Measurement Plot for Head TSL

6 Feb 2013 09:25:10

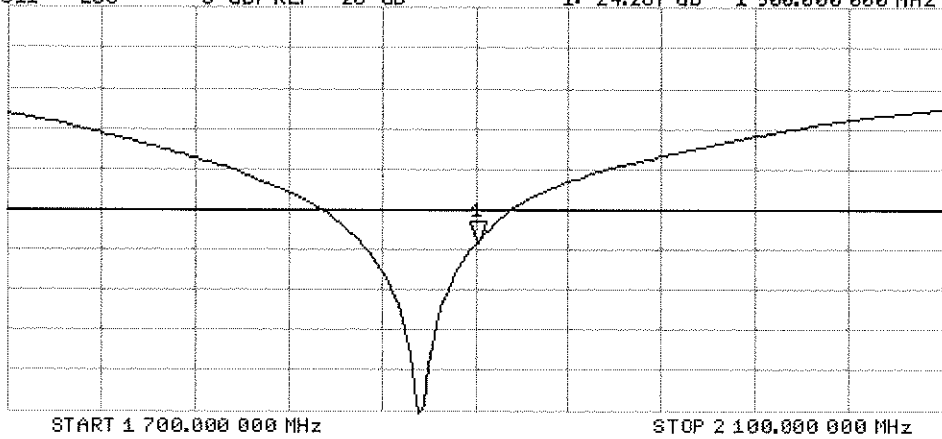
CH1 S11 1 U FS 1: 52.125  $\Omega$  5.8711  $\Omega$  491.80  $\mu$ H 1 900.000 000 MHz

\*  
Del  
CA  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1: -24.287 dB 1 900.000 000 MHz

CA  
Avg  
16  
H1d



## DASY5 Validation Report for Body TSL

Date: 06.02.2013

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;  $\sigma = 1.53$  S/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

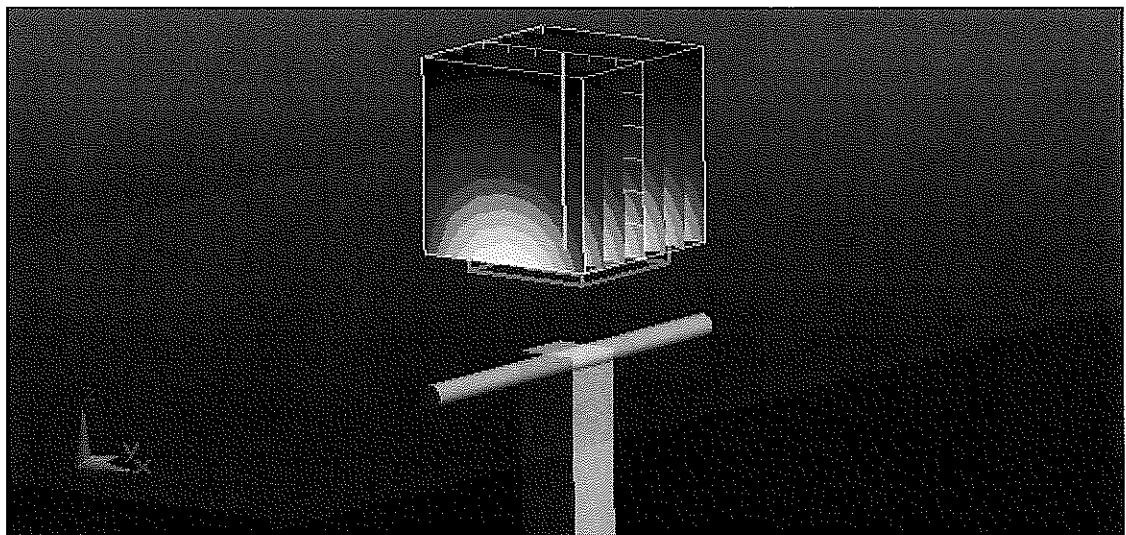
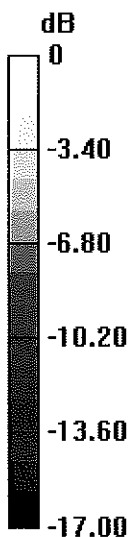
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.534 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 17.9 W/kg

**SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.45 W/kg**

Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

# Impedance Measurement Plot for Body TSL

6 Feb 2013 09:24:17

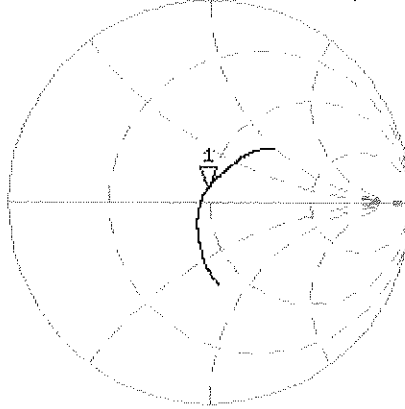
CH1 S11 1 U FS 1: 48.344  $\Omega$  6.2715  $\Omega$  525.34  $\mu$ H 1 900.000 000 MHz

\*  
De1

CA

Avg  
16

H1d

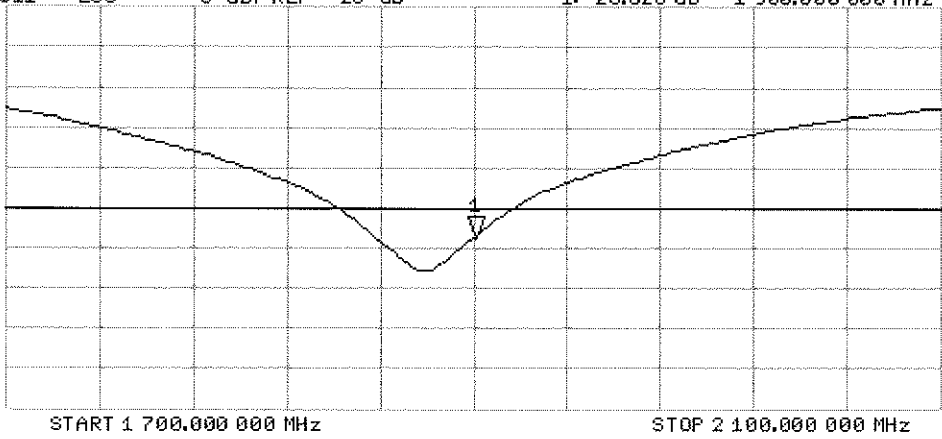


CH2 S11 LOG 5 dB/REF -20 dB 1:-23.628 dB 1 900.000 000 MHz

CA

Avg  
16

H1d



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



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

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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **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

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



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

Accreditation No.: **SCS 108**

**Glossary:**

TSL	tissue simulating liquid
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 ± 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 ± 0.2) °C	39.2 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (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	<b>52.7 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (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	<b>24.7 mW / g ± 16.5 % (k=2)</b>

## 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 ± 0.2) °C	51.3 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (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	<b>51.6 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (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	<b>24.4 mW / g ± 16.5 % (k=2)</b>

## 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
----------------------------------	----------

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/m<sup>3</sup>

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:

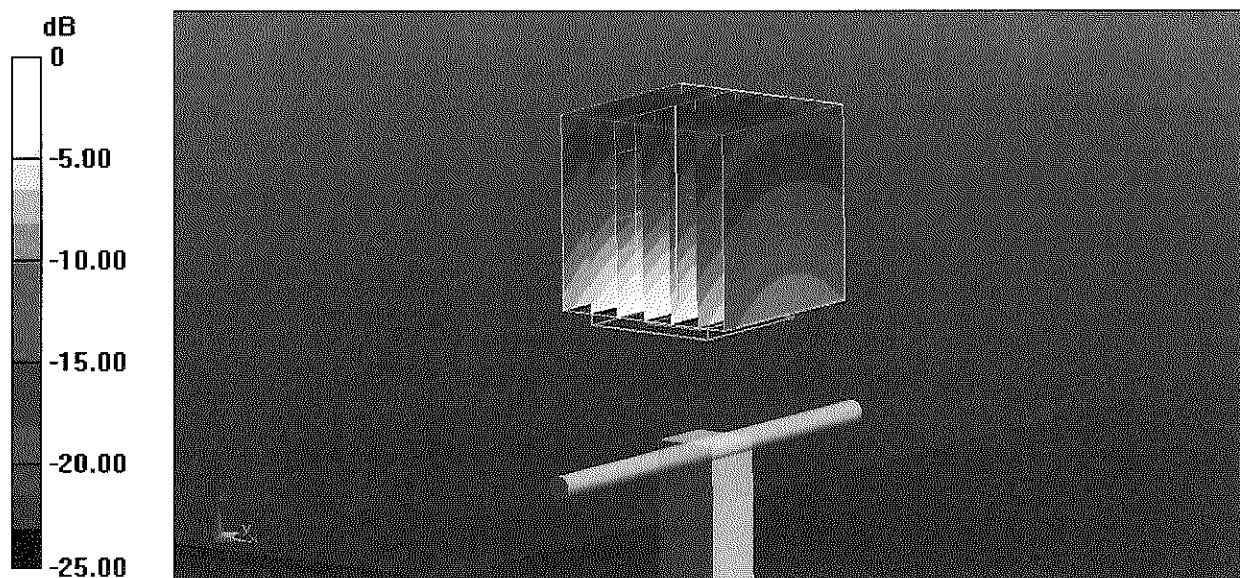
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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  $\Omega$  3.7656  $\Omega$  244.62 pH

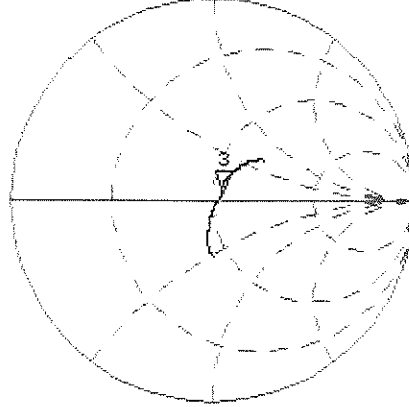
2 450.000 000 MHz

\*  
Del

CΔ

Avg  
15

H1d



CH2 S11

LOG

5 dB/REF -20 dB

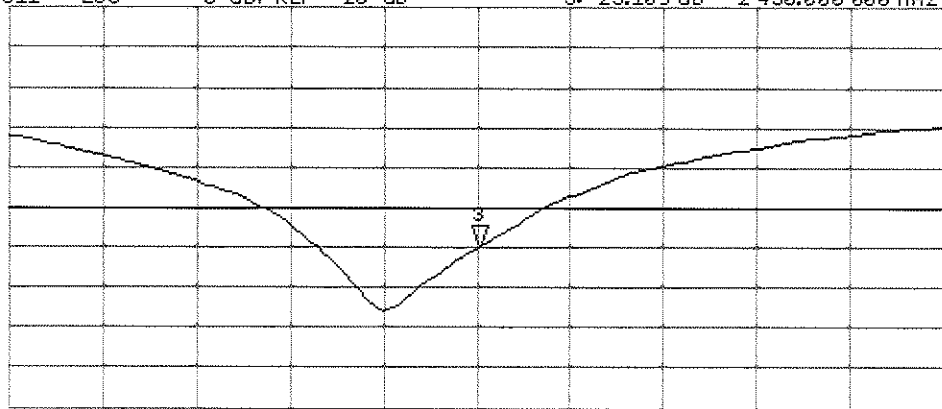
3: -25.109 dB

2 450.000 000 MHz

CΔ

Avg  
15

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/m<sup>3</sup>

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:

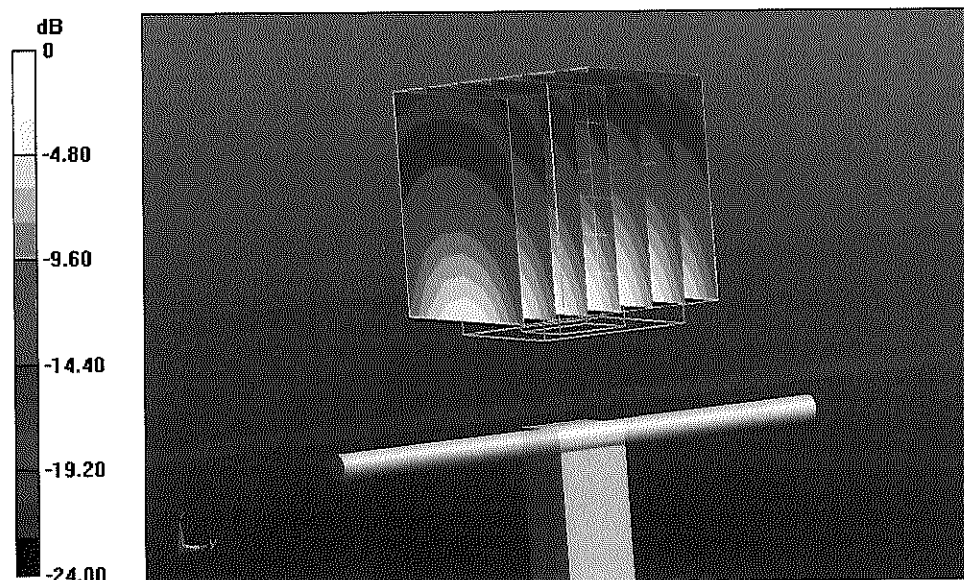
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

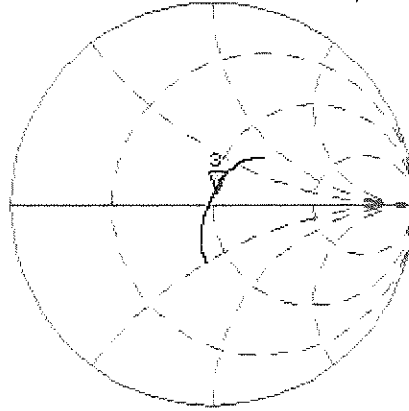
22 Aug 2012 15:38:22

CH1 S11 1 U FS

3: 50.709  $\Omega$  5.8906  $\Omega$  382.66 pF

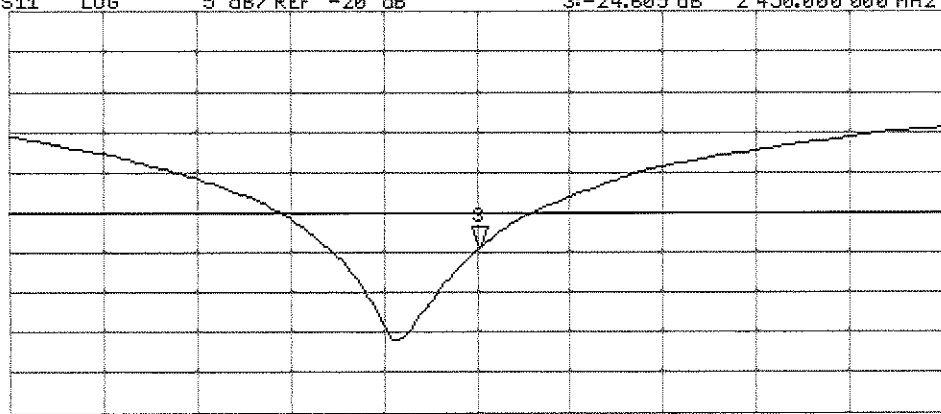
2 450.000 000 MHz

\*  
Del  
CΔ  
Avg  
16  
H1 d



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

CΔ  
Avg  
16  
H1 d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz



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: **D5GHzV2-1057\_Jan13**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1057**

Calibration procedure(s) **QA CAL-22.v2  
Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **January 11, 2013**

✓  
KOK  
1/29/13

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 ( $22 \pm 3$ )°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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
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**      Signature: *Israe El-Naouq*

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

Issued: January 11, 2013

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

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

### Calibration is Performed According to the Following Standards:

- a) 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
- b) 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:

- c) DAS4/5 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.

<b>DASY Version</b>	DASY5	V52.8.5
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V5.0	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	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
<b>Nominal Head TSL parameters</b>	22.0 °C	36.0	4.66 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	34.6 ± 6 %	4.50 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL at 5200 MHz

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	7.66 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>75.9 W/kg ± 19.9 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.4 W/kg ± 19.5 % (k=2)</b>

### 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	34.5 ± 6 %	4.60 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 <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>76.9 W / kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.9 W/kg ± 19.5 % (k=2)</b>

### 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	34.2 ± 6 %	4.79 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 <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>80.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>22.5 W/kg ± 19.5 % (k=2)</b>

### 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	34.1 ± 6 %	4.88 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 <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>80.4 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>22.7 W/kg ± 19.5 % (k=2)</b>

### 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	33.8 ± 6 %	5.09 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 <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.69 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>76.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.4 W/kg ± 19.5 % (k=2)</b>

### 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	47.0 ± 6 %	5.42 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>75.5 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.1 W/kg ± 19.5 % (k=2)</b>

### 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	46.8 ± 6 %	5.55 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>75.3 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.1 W/kg ± 19.5 % (k=2)</b>

### 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	46.5 ± 6 %	5.81 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>80.8 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>22.4 W/kg ± 19.5 % (k=2)</b>

### 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	46.3 ± 6 %	5.94 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>80.3 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (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	<b>22.3 W/kg ± 19.5 % (k=2)</b>

## 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	46.0 ± 6 %	6.21 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>75.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.7 W/kg ± 19.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.5 $\Omega$ - 9.8 j $\Omega$
Return Loss	- 20.3 dB

### Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	48.5 $\Omega$ - 4.5 j $\Omega$
Return Loss	- 26.4 dB

### Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.6 $\Omega$ - 5.8 j $\Omega$
Return Loss	- 24.8 dB

### Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 $\Omega$ - 3.8 j $\Omega$
Return Loss	- 25.6 dB

### Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	52.5 $\Omega$ - 4.4 j $\Omega$
Return Loss	- 26.1 dB

### Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.3 $\Omega$ - 7.9 j $\Omega$
Return Loss	- 22.0 dB

### Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.7 $\Omega$ - 3.2 j $\Omega$
Return Loss	- 29.2 dB

### Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	51.2 $\Omega$ - 4.8 j $\Omega$
Return Loss	- 26.2 dB

### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.6 $\Omega$ - 2.1 j $\Omega$
Return Loss	- 27.9 dB

## Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	53.3 $\Omega$ - 2.9 j $\Omega$
Return Loss	- 27.4 dB

## General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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	November 27, 2006

## DASY5 Validation Report for Head TSL

Date: 11.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057**

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

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.5$  S/m;  $\epsilon_r = 34.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.6$  S/m;  $\epsilon_r = 34.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 4.79$  S/m;  $\epsilon_r = 34.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.88$  S/m;  $\epsilon_r = 34.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.09$  S/m;  $\epsilon_r = 33.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- 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 52.8.5(1059); SEMCAD X 14.6.8(7028)

**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 = 63.671 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 29.4 W/kg

**SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.17 W/kg**

Maximum value of SAR (measured) = 18.5 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 = 63.473 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 30.3 W/kg

**SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.22 W/kg**

Maximum value of SAR (measured) = 18.8 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 = 63.735 V/m; Power Drift = 0.08 dB

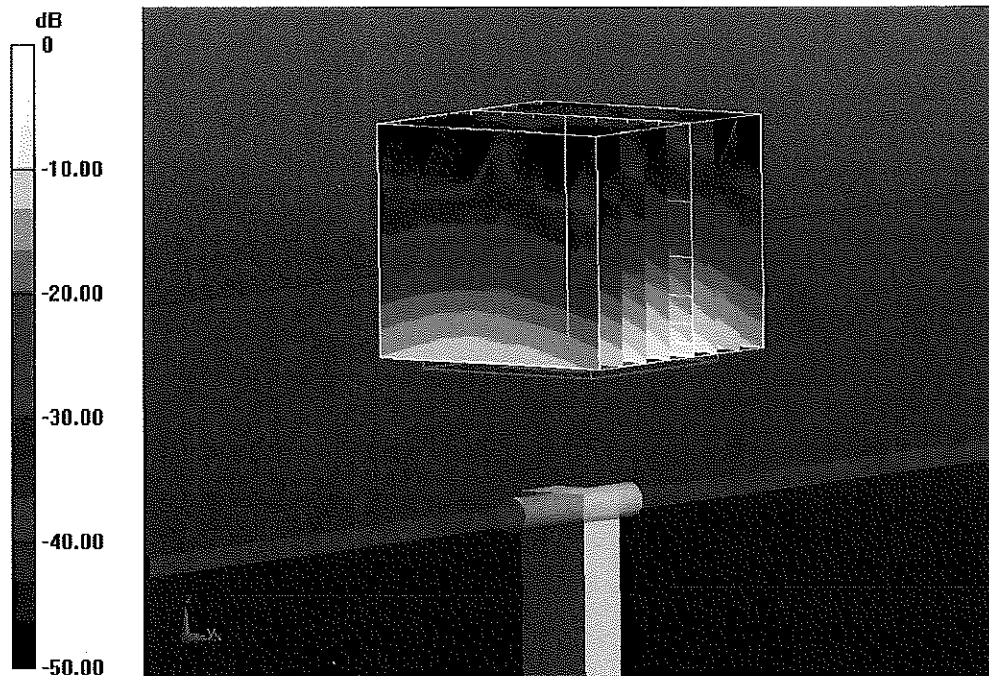
Peak SAR (extrapolated) = 33.2 W/kg

**SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.28 W/kg**

Maximum value of SAR (measured) = 20.1 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 = 63.848 V/m; Power Drift = 0.09 dB  
Peak SAR (extrapolated) = 33.5 W/kg  
**SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 W/kg**  
Maximum value of SAR (measured) = 20.2 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 = 60.467 V/m; Power Drift = 0.08 dB  
Peak SAR (extrapolated) = 33.3 W/kg  
**SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.17 W/kg**  
Maximum value of SAR (measured) = 19.4 W/kg



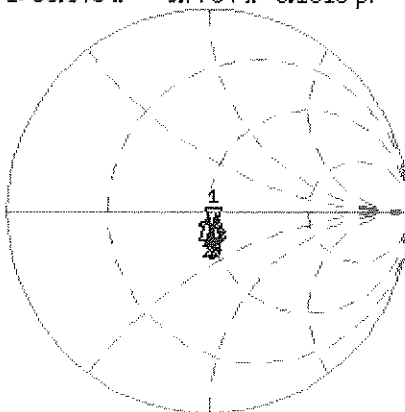
0 dB = 19.4 W/kg = 12.88 dBW/kg

# Impedance Measurement Plot for Head TSL

11 Jan 2013 09:26:56

CH1 S11 1 U FS 1: 50.543  $\Omega$  -9.7754  $\Omega$  3.1310 pF 5 200.000 000 MHz

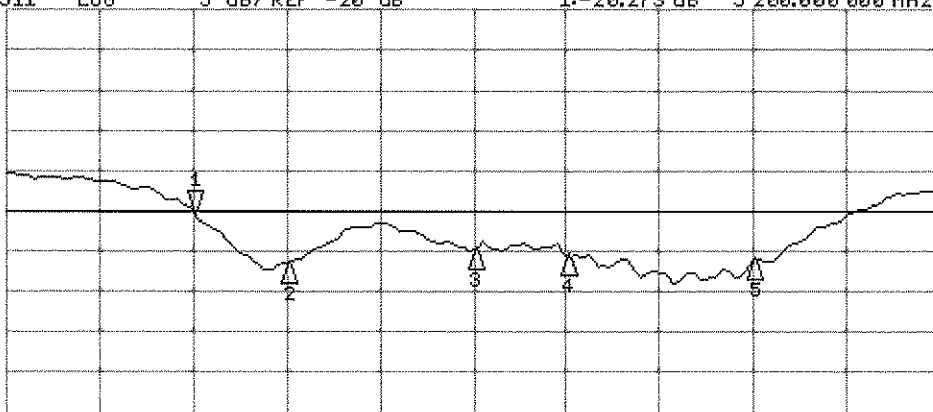
\*  
De1  
CA  
Avg  
16  
H1d



CH1 Markers  
2: 48.508  $\Omega$   
-4.4805  $\Omega$   
5.30000 GHz  
3: 50.617  $\Omega$   
-5.7559  $\Omega$   
5.50000 GHz  
4: 53.891  $\Omega$   
-3.8418  $\Omega$   
5.60000 GHz  
5: 52.500  $\Omega$   
-4.4160  $\Omega$   
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.273 dB 5 200.000 000 MHz

CA  
Avg  
16  
H1d



CH2 Markers  
2: -25.396 dB  
5.30000 GHz  
3: -24.818 dB  
5.50000 GHz  
4: -25.573 dB  
5.60000 GHz  
5: -26.115 dB  
5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 10.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057**

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

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.42$  S/m;  $\epsilon_r = 47$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.55$  S/m;  $\epsilon_r = 46.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.81$  S/m;  $\epsilon_r = 46.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.94$  S/m;  $\epsilon_r = 46.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.21$  S/m;  $\epsilon_r = 46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- 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 52.8.5(1059); SEMCAD X 14.6.8(7028)

**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 = 59.074 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 30.4 W/kg

**SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.13 W/kg**

Maximum value of SAR (measured) = 18.0 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 = 58.924 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 30.9 W/kg

**SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.13 W/kg**

Maximum value of SAR (measured) = 17.9 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 = 59.561 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 35.3 W/kg

**SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.26 W/kg**

Maximum value of SAR (measured) = 19.7 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 = 58.884 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 36.3 W/kg

**SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.25 W/kg**

Maximum value of SAR (measured) = 20.0 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,**

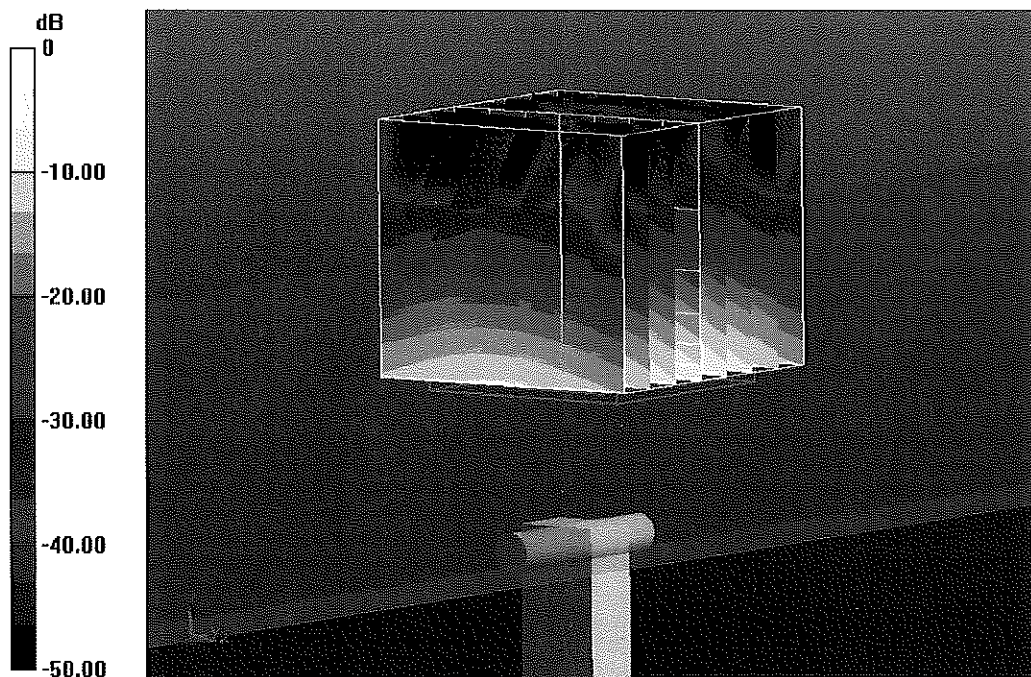
**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.753 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 35.6 W/kg

**SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.09 W/kg**

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



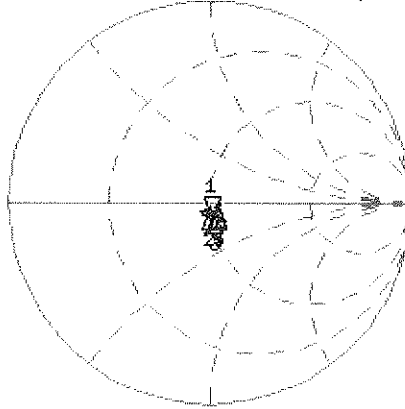
0 dB = 18.9 W/kg = 12.76 dBW/kg

# Impedance Measurement Plot for Body TSL

10 Jan 2013 13:20:10

CH1 S11 1 U FS 1: 49.311  $\Omega$  -7.8789  $\Omega$  3.8846 pF 5 200.000 000 MHz

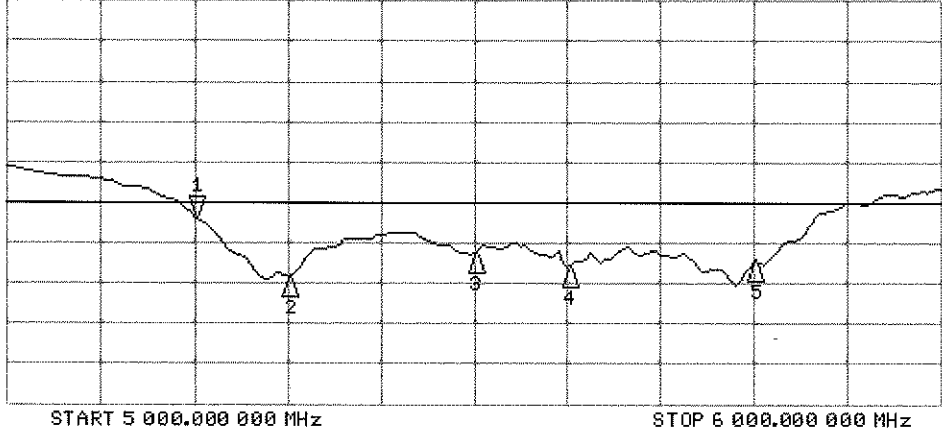
\*  
Del  
CA  
Avg  
16  
H1d



CH1 Markers  
2: 48.729  $\Omega$   
-3.1895  $\Omega$   
5.30000 GHz  
3: 51.209  $\Omega$   
-4.8184  $\Omega$   
5.50000 GHz  
4: 53.596  $\Omega$   
-2.1113  $\Omega$   
5.60000 GHz  
5: 53.314  $\Omega$   
-2.9355  $\Omega$   
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -22.005 dB 5 200.000 000 MHz

CA  
Avg  
16  
H1d



CH2 Markers  
2: -29.181 dB  
5.30000 GHz  
3: -26.190 dB  
5.50000 GHz  
4: -27.903 dB  
5.60000 GHz  
5: -27.367 dB  
5.80000 GHz