

# SAR TEST REPORT

Equipment Under Test :	PCS1900MHz MOBILE PHONE
Model No. :	M881
Market name:	A2
Applicant :	HEDY HOLDING CO., LTD
Address of Applicant :	NO.63 PUNAN ROAD, HUANGPU DISTRICT, GUANGZHOU
Date of Receipt :	2007.01.10
Date of Test :	2007.01.12~2007.01.16
Date of Issue :	2007.01.19

Standards:

**FCC OET Bulletin 65 supplement C,  
ANSI/IEEE C95.1, C95.3, IEEE 1528-2003**

In the configuration tested, the EUT complied with the standards specified above.

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Tested by :

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Date :

2007.01.19

Approved by :

Zhang Yuan

Date :

2007.01.19

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## 1. General Information

### 1.1 Test Laboratory

GSM Lab  
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Internet: <http://www.cn.sgs.com>

### 1.2 Details of Applicant

Name: HEDY HOLDING CO., LTD  
Address: NO.63 PUNAN ROAD, HUANGPU DISTRICT,  
GUANGZHOU

### 1.3 Description of EUT(s)

Brand name	HEDY	
Model No.	M881	
Market Name	A2	
FCC ID	UZSHEDY666777	
Sample Status	Production	
Serial No.	IMEI: 135790246811220	
Battery Type	Lithium-Ion	
Antenna Type	Internal Antenna	
Operation Mode	PCS1900	
Modulation Mode	GMSK	
	PCS1900	Tx: 1850~1910 MHz
		Rx: 1930~1990 MHz
Maximum RF Conducted Power	PCS1900: 30dBm	
GPRS	MultiSlot class 12 uplink 2TS	

#### **1.4 Test Environment**

Ambient temperature: 22.0° C

Tissue Simulating Liquid: 22° C

Relative Humidity: 25%~35%

#### **1.5 Operation Configuration**

Configuration 4: PCS 1900, LeftHandSide Cheek & 15 ° Tilt Position

Configuration 5: PCS 1900, RightHandSide Cheek & 15 ° Tilt Position

Configuration 6: GPRS 1900, BodyWorn (1.5 cm between EUT and phantom)

#### **1.6 SAM Twin Phantom**



The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left hand
- Right hand
- Flat phantom

A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible.

On the phantom top, three reference markers are provided to identify the phantom

position with respect to the robot.

**Phantom specification:**

Construction:	The shell corresponds to the specifications of Specific Anthropomorphic Mannequin(SAM) Phantom defined in IEEE 1528-2003,EN 50361:2001 and IEC 62209.It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid.
Shell Thickness	$2 \pm 0.2\text{mm}$
Filling Volume	Approx.25 liters
Dimensions	Height: 850mm Length: 1000mm Width: 500mm

**1.7 Device Holder for Transmitters**



The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of  $\pm 0.5\text{mm}$  would produce a SAR uncertainty of  $\pm 20\%$ . An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon_r=3$  and loss tangent  $\tan \delta=0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

### **1.8 Recipes for Tissue Simulating Liquid**

The following tables give the recipes for tissue simulating liquids to be used in testing.

<b>Ingredient</b>	<b>1900Head</b>	<b>1900Body</b>
Water	55.24	70.17
DGBE	44.45	29.44
Relative Permittivity	40.0	53.3
Conductivity (S/m)	1.40	1.52

### **1.9 Measurement procedure**

#### **Step 1: Power reference measurement**

The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

#### **Step 2: Area scan**

The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20mm\*20mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

#### **Step 3: Zoom scan**

Around this point, a volume of 30mm\*30mm\*34mm (fine resolution volume scan, zoom scan) was assessed by measuring 7\*7\*7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the center of the dipoles is 2.1mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. (This can be variable. Refer to the probe specification) The



extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The volume was integrated with the trapezoidal algorithm. One thousand points ( $10 \times 10 \times 10$ ) were interpolated to calculate the average. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

#### **Step 4: Power reference measurement (drift)**

The SAR value at the same location as in step 1 was again measured. ( If the value changed by more than 5%, the evaluation is repeated.)

### **1.10 The SAR Measurement System**

A photograph of the SAR measurement System is given in Fig.a.

This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (Speag Dasy 4 professional system). A Model ES3DV3 3088 E-field probe is used to determine the internal electric fields. The SAR can be obtained from the equation  $SAR = \sigma (|E_i|^2) / \rho$  where  $\sigma$  and  $\rho$  are the conductivity and mass density of the tissue-simulant.

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software. An arm extension for accommodation the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to DAE and for the analog signal from the optical surface detection. The EOC is connected to the

measurement server.

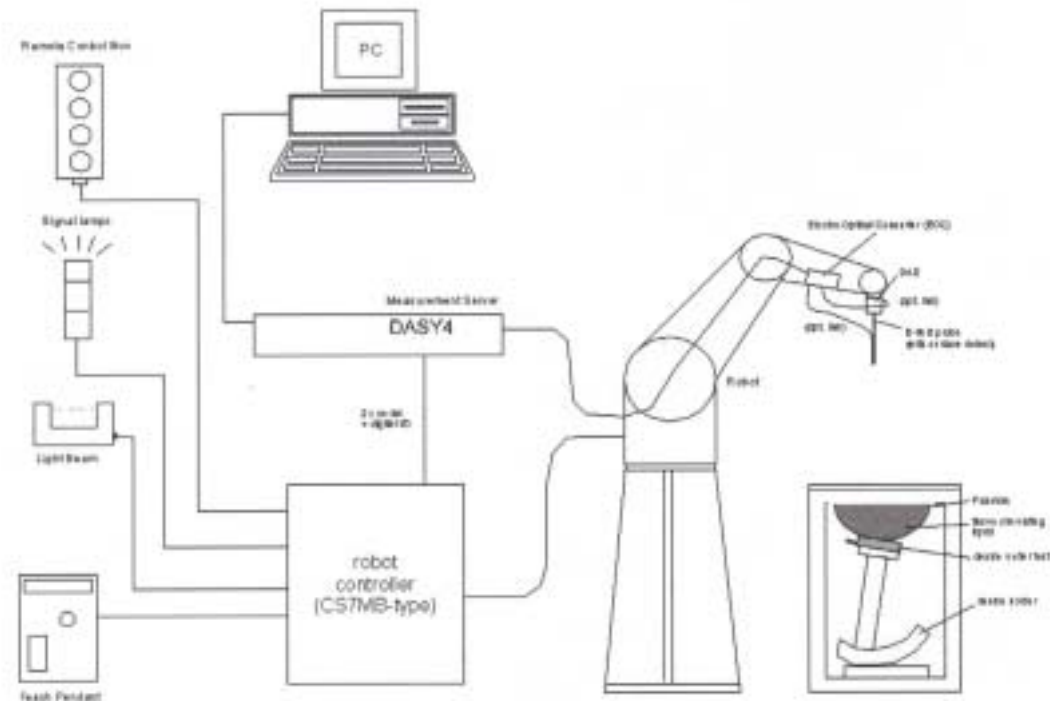


Fig. a SAR System Configuration

- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand, right-hand and body-worn usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

### 1.11 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within  $\pm 10\%$  from the target SAR values. These tests were done at 1900MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1 (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was in the range 22°C, the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

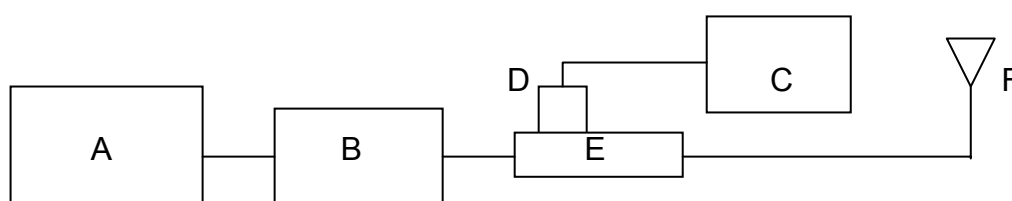


Fig. b the microwave circuit arrangement used for SAR system verification

- A. Agilent Model E4438C Signal Generator
- B. Mini-Circuit Model ZHL-42 Preamplifier
- C. Agilent Model E4416A Power Meter
- D. Agilent Model 8481H Power Sensor
- E. HT CP6100 20N Dual directional coupler
- F. Reference dipole antenna

Validation Kit	Frequency MHz	Target SAR 1g (250mW)	Target SAR 10g (250mW)	Measured SAR 1g	Measured SAR 10g	Measured Date
D1900V2 SN5d028	1900 Head	9.36	4.96	9.23	4.85	2007-01-16
D1900V2 SN5d028	1900 Body	9.5	5.05	9.32	4.93	2007-01-12
D1900V2 SN5d028	1900 Body	9.5	5.05	9.34	4.9	2007-01-15

Table1. System Validation

### 1.12 Tissue Simulant Fluid for the Wlan 802.11b/g

The dielectric properties for this body-simulant fluid were measured by using the HP Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Agilent E5071B Network Analyzer (300 KHz-8500 MHz). The Conductivity ( $\sigma$ ) and Permittivity ( $\rho$ ) are listed in Table 2. For the SAR measurement given in this report. The temperature variation of the Tissue Simulant Fluid was 22°C.

	Tissue Type	Limit/Measured	Permittivity ( $\rho$ )	Conductivity ( $\sigma$ )	Simulated Tissue Temp (°C)
1900	Head	Measured, 2007-01-16	38.53	1.413	22.3
		Recommended Limit	40.0±5%	1.40±5%	20-24
	Body	Measured, 2007-01-12	50.68	1.621	22.6
		Recommended Limit	53.3±5%	1.52±5%	20-24
		Measured, 2007-01-15	50.65	1.624	22.6
		Recommended Limit	53.3±5%	1.52±5%	20-24

Table 2. Dielectric parameters for the Frequency Band 1900MHZ

### 1.13 Test Standards and Limits

According to FCC 47 CFR §2.1093(d) the limits to be used for evaluation are based

generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3KHz to 300GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical & Electronics Engineers, Inc., New York, New York 10071.

<b>Human Exposure</b>	<b>Uncontrolled Environment General Population</b>
Spatial Peak SAR	1.60 mW/g (averaged over a mass of 1g)

Table3. RF Exposure Limits

## Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.

## 2. Summary of Results

Mode	Test Configuration		SAR, Averaged over 1g(W/kg)			Temperature ( )	Verdict
	Channel/Power(dBm)		Low/28.4	Middle/29.3	High/29.2		
PCS1900	Left No Slide	Cheek		0.466		22	Pass
		Tilt		0.294		22	Pass
	Left Slide Up	Cheek	0.336	0.545	0.413	22	Pass
		Tilt		0.278		22	Pass
		Worst Case With SD		0.462		22	Pass
		Worst Case With BT		0.485		22	Pass
	Right No Slide	Cheek	0.502	0.511	0.484	22	Pass
		Tilt		0.233		22	Pass
		Worst Case With SD		0.514		22	Pass
		Worst Case With BT		0.513		22	Pass
	Right Slide Up	Cheek		0.403		22	Pass
		Tilt		0.359		22	Pass
	Body No Slide	Distance 1.5cm	0.891	0.809	0.745	22	Pass
	Body Slide Up	Distance1.5cm	1.14	1.25	1.2	22	Pass
		Worst Case With SD		1.3		22	Pass
		Worst Case With BT		1.26		22	Pass

**Note:**

1. In PCS1900 band, the low, middle and high channels are CH512/1805.2MHz, CH661/1880.0MHz and CH810/1909.8MHz separately.

2. For the Bodyworn measurements the sample was only placed with the antenna toward the phantom since this position delivers the highest SAR values.
3. For the Bodyworn measurements, the distance from the sample to the phantom is 1.5 cm.

### 3. Instruments List

Instrument	Model	Serial number	NO.	Date of last Calibration
Desktop PC	COMPAQ EVO	N/A	GSM-SAR-025	N/A
Dasy 4 software	V 4.7 build 44	N/A	GSM-SAR-001	N/A
Probe	ES3DV3	3088	GSM-SAR-034	2006.12.12
DAE	DAE3	569	GSM-SAR-023	2006.12.08
1900MHz system validation dipole	D1900V2	5d028	GSM-SAR-020	2006.12.12
Phantom	SAM 12	TP-1283	GSM-SAR-005	N/A
Robot	RX90L	F03/5V32A1/A01	GSM-SAR-009	N/A
Dielectric probe kit	85070D	US01440168	GSM-SAR-016	2006.12.19
Agilent network analyzer	E5071B	MY42100549	GSM-SAR-007	2006.12.19
Agilent signal generator	E4438	14438CATO-19719	GSM-SAR-008	2006.12.19
Mini-Circuits preamplifier	ZHL-42	D041905	GSM-SAR-033	2006.04.19
Agilent power meter	E4416A	GB41292095	GSM-SAR-010	2006.12.19
Agilent power sensor	8481H	MY41091234	GSM-SAR-011	2006.12.19
HT CP6100 20N Coupling	6100	SCP301480120	GSM-SAR-012	2006.12.19
R&S Universal radio communication tester	CMU200	103633	GSM-AUD-002	2006.12.19



## 4. Measurements

### **4.1 LeftHandSide-Cheek-PCS1900-Middle-No Slide**

Date/Time: 2007-1-16 17:02:43

Test Laboratory: SGS-GSM

#### **LeftHandSide-Cheek-GSM1900-Mid(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Middle/Area Scan (61x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.526 mW/g

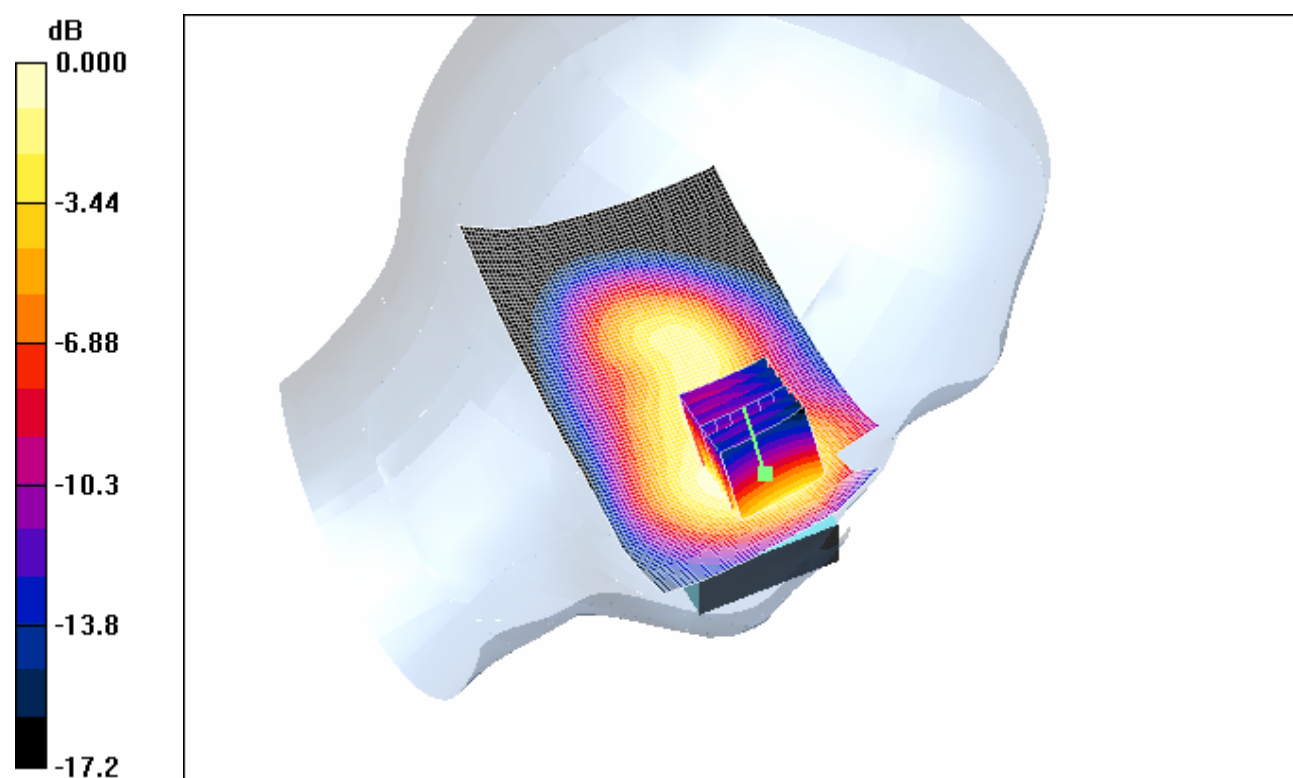
**Cheek position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.5 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 0.737 W/kg

**SAR(1 g) = 0.466 mW/g; SAR(10 g) = 0.281 mW/g**

Maximum value of SAR (measured) = 0.509 mW/g



0 dB = 0.509mW/g

#### **4.2LeftHandSide-Tilt-PCS1900-Middle-No Slide**

Date/Time: 2007-1-16 17:32:15

Test Laboratory: SGS-GSM

**LeftHandSide-Tilt-GSM1900-Mid(No Slide)**

**DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Tilt position - Middle/Area Scan (61x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.350 mW/g

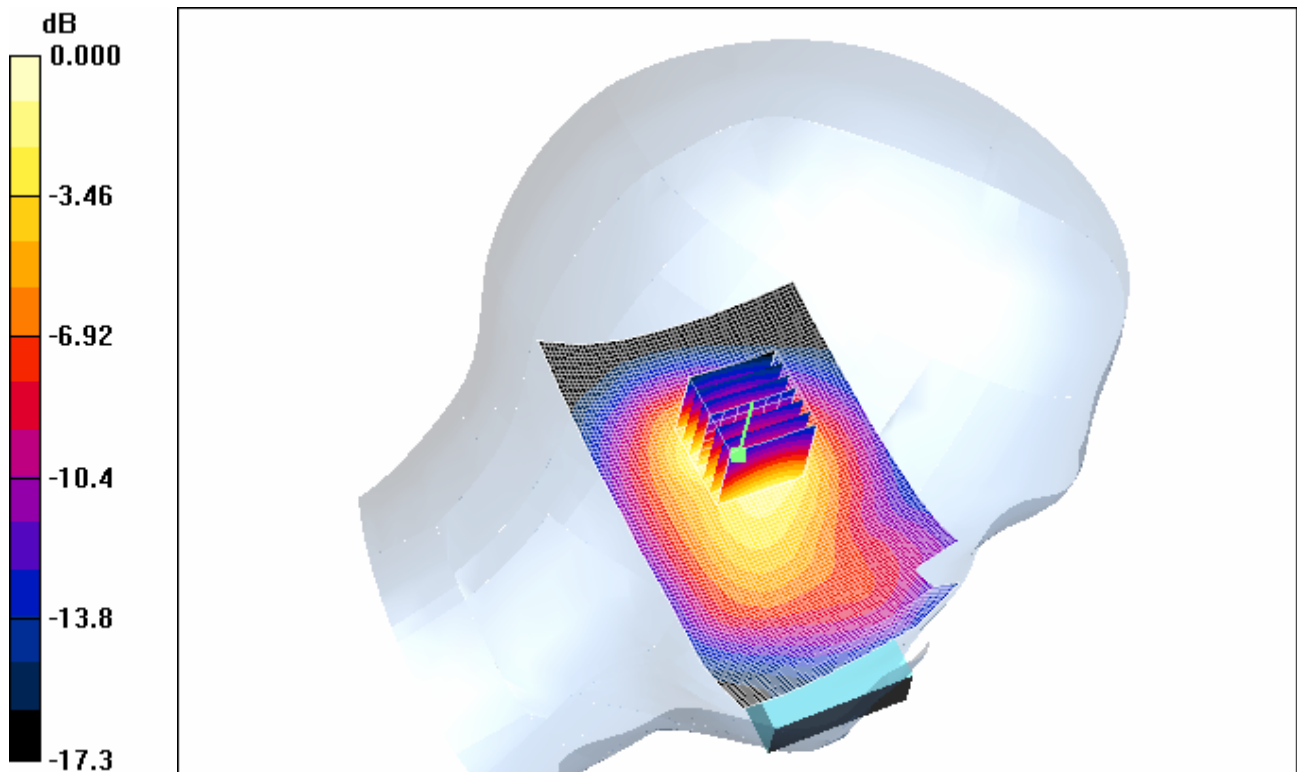
**Tilt position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 15.5 V/m; Power Drift = -0.010 dB

Peak SAR (extrapolated) = 0.486 W/kg

**SAR(1 g) = 0.294 mW/g; SAR(10 g) = 0.168 mW/g**

Maximum value of SAR (measured) = 0.321 mW/g



0 dB = 0.321mW/g

#### **4.3LeftHandSide-Cheek-PCS1900-Middle-Slide Up**

Date/Time: 2007-1-16 17:59:37

Test Laboratory: SGS-GSM

**LeftHandSide-Cheek-GSM1900-Mid(Slide up)**

**DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Middle/Area Scan (61x111x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.609 mW/g

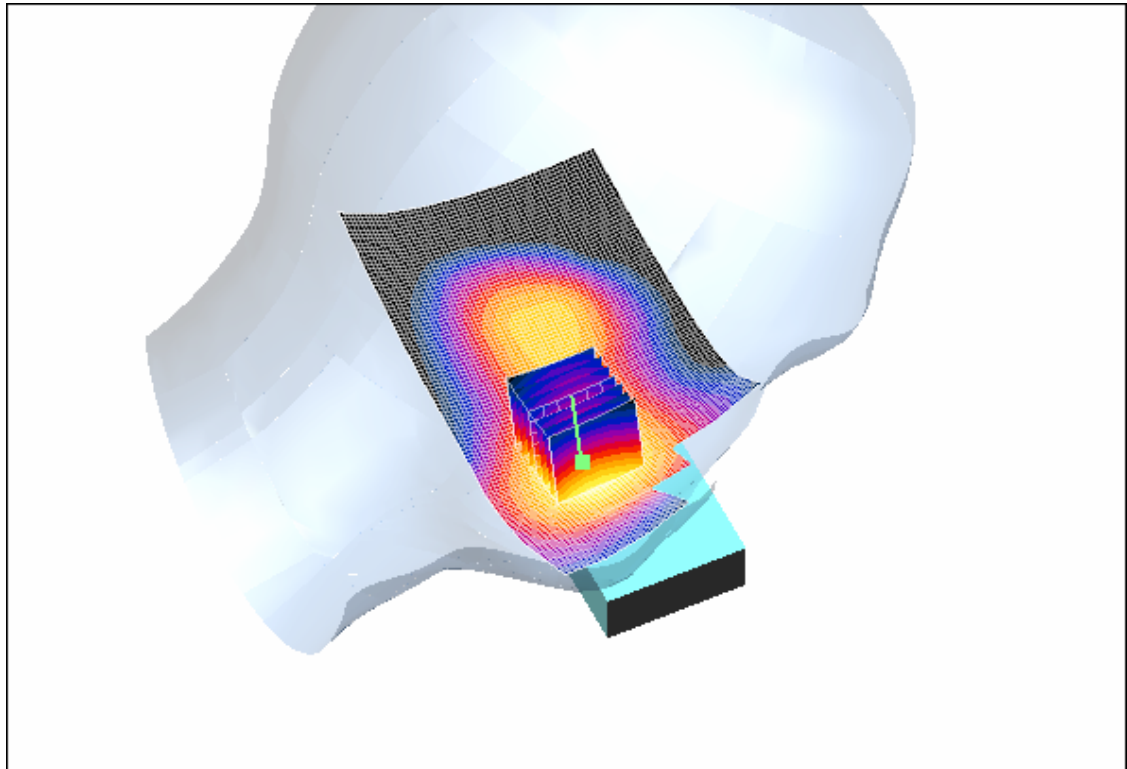
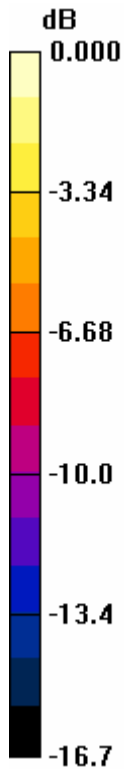
**Cheek position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.98 V/m; Power Drift = -0.054 dB

Peak SAR (extrapolated) = 0.873 W/kg

**SAR(1 g) = 0.545 mW/g; SAR(10 g) = 0.315 mW/g**

Maximum value of SAR (measured) = 0.606 mW/g



$$0 \text{ dB} = 0.606 \text{ mW/g}$$

#### **4.4 LeftHandSide-Tilt-PCS1900-Middle-Slide Up**

Date/Time: 2007-1-16 18:39:48

Test Laboratory: SGS-GSM

#### **LeftHandSide-Tilt-GSM1900-Mid(Slide up)**

**DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Tilt position - Middle/Area Scan (61x111x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.322 mW/g

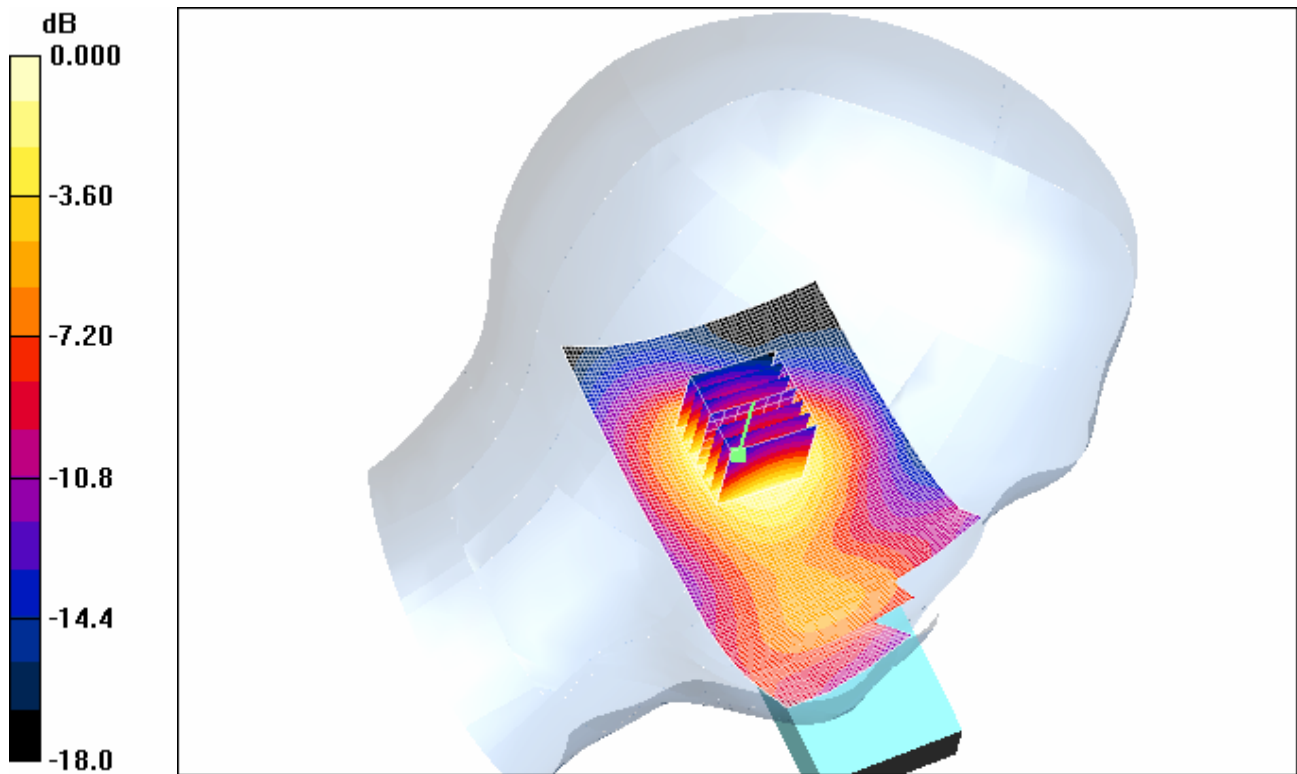
**Tilt position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.3 V/m; Power Drift = -0.030 dB

Peak SAR (extrapolated) = 0.424 W/kg

**SAR(1 g) = 0.278 mW/g; SAR(10 g) = 0.170 mW/g**

Maximum value of SAR (measured) = 0.303 mW/g



0 dB = 0.303mW/g

#### **4.5LeftHandSide-WorstCase-PCS1900-Low**

Date/Time: 2007-1-16 19:59:43

Test Laboratory: SGS-GSM

#### **LeftHandSide-Cheek-GSM1900-Low(Slide up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.35 \text{ mho/m}$ ;  $\epsilon_r = 38.2$ ;  $\rho = 1000 \text{ kg/m}^3$

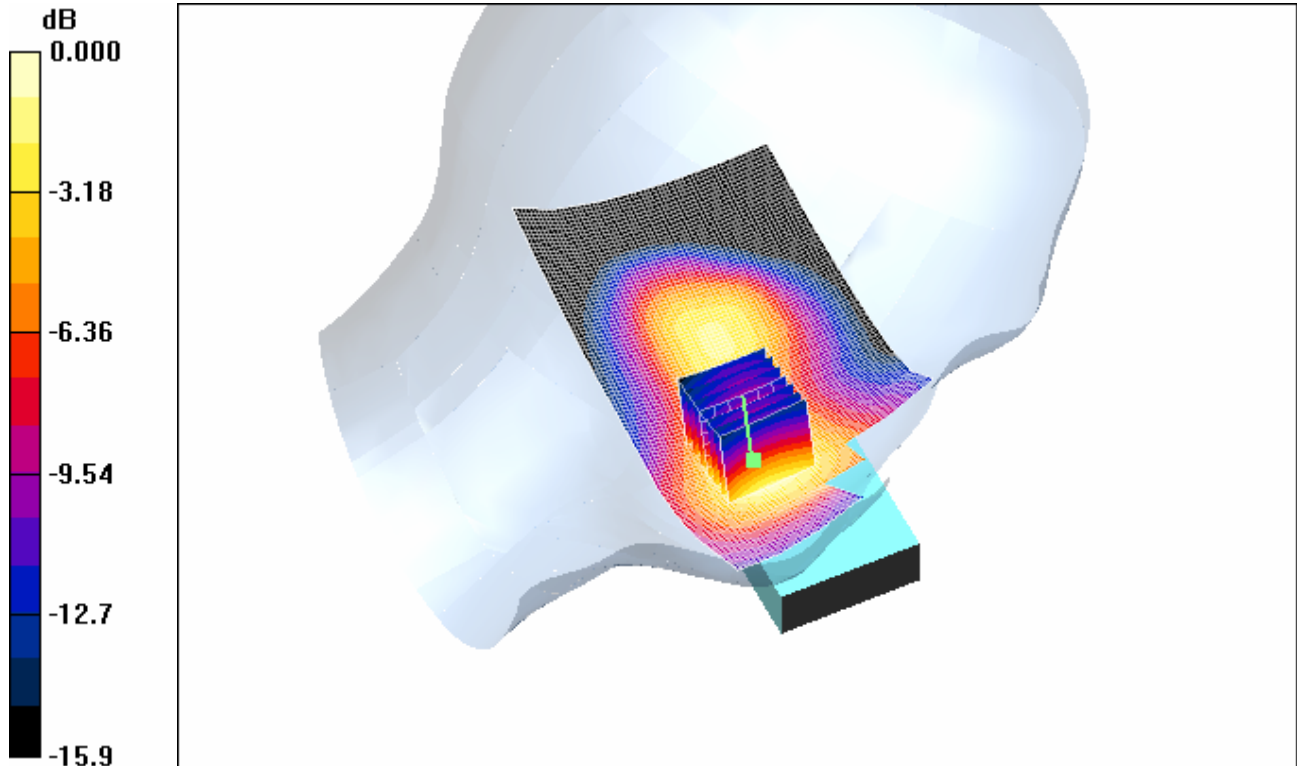
Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Low/Area Scan (61x111x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.374 mW/g

**Cheek position - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 8.18 V/m; Power Drift = -0.086 dB  
Peak SAR (extrapolated) = 0.531 W/kg  
**SAR(1 g) = 0.336 mW/g; SAR(10 g) = 0.196 mW/g**  
Maximum value of SAR (measured) = 0.372 mW/g





$$0 \text{ dB} = 0.372 \text{ mW/g}$$

#### **4.6 LeftHandSide-WorstCase-PCS1900-High**

Date/Time: 2007-1-16 20:46:11

Test Laboratory: SGS-GSM

#### **LeftHandSide-Cheek-GSM1900-High(Slide up)**

**DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1909.8 \text{ MHz}$ ;  $\sigma = 1.45 \text{ mho/m}$ ;  $r = 38.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - High/Area Scan (61x111x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.457 mW/g

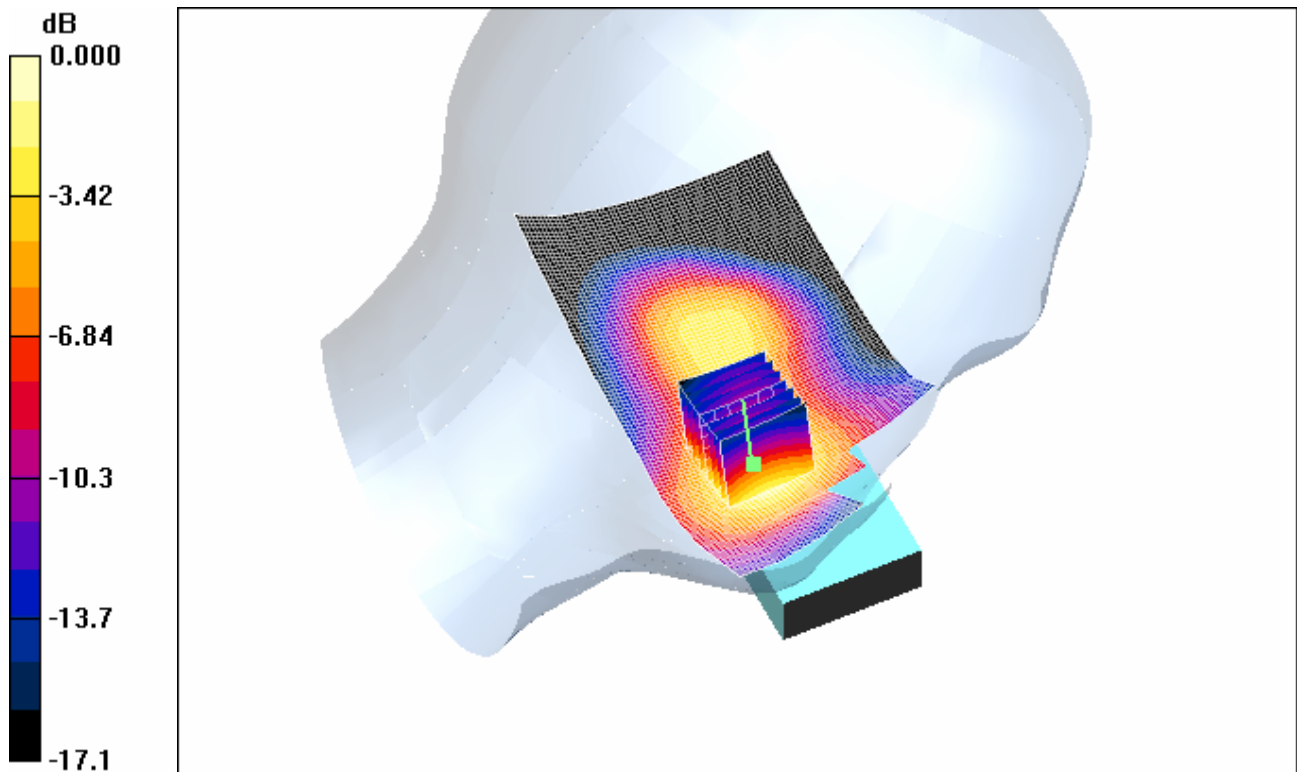
**Cheek position - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 8.80 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.664 W/kg

**SAR(1 g) = 0.413 mW/g; SAR(10 g) = 0.236 mW/g**

Maximum value of SAR (measured) = 0.458 mW/g



0 dB = 0.458mW/g

#### **4.7LeftHandSide-PCS1900-Maximum Value-SD**

Date/Time: 2007-1-16 21:17:02

Test Laboratory: SGS-GSM

**LeftHandSide-Cheek-GSM1900-Mid+SD(Slide up)**

**DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Middle+SD/Area Scan (61x111x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.519 mW/g

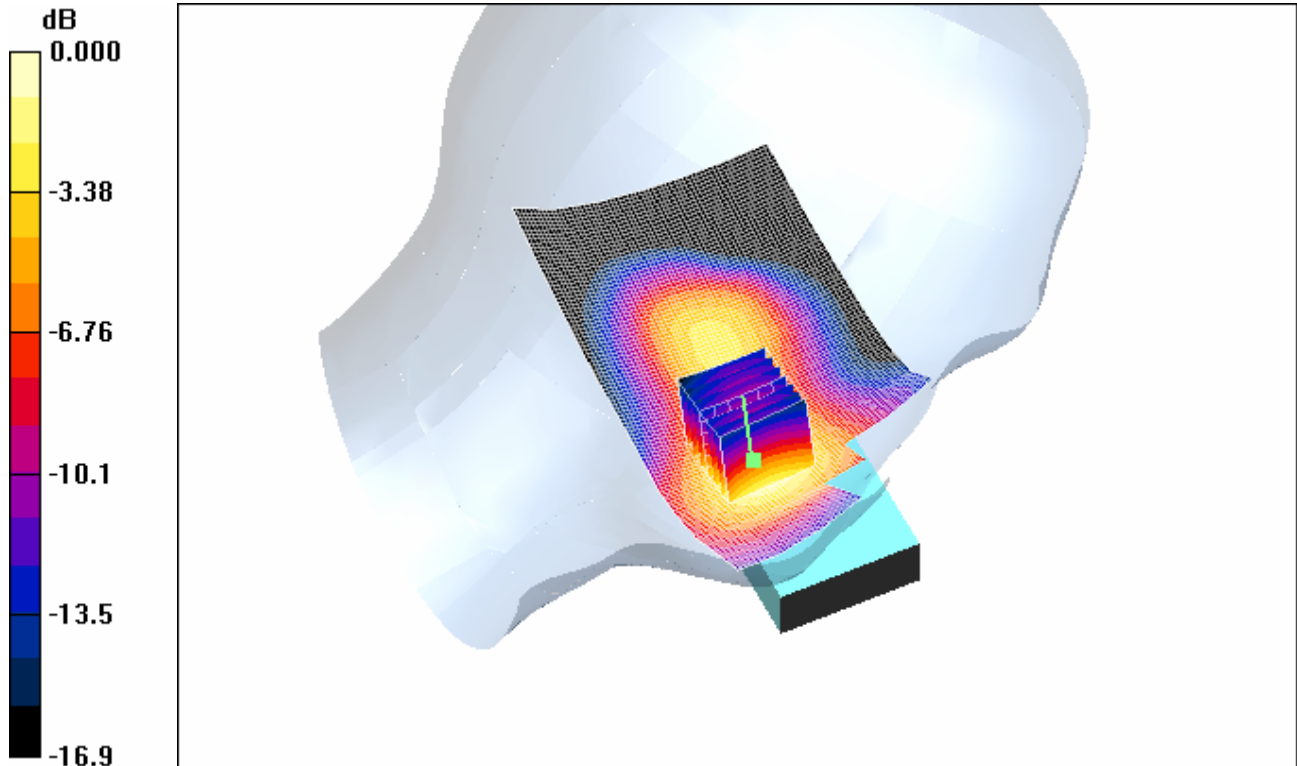
**Cheek position - Middle+SD/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.70 V/m; Power Drift = -0.011 dB

Peak SAR (extrapolated) = 0.743 W/kg

**SAR(1 g) = 0.462 mW/g; SAR(10 g) = 0.265 mW/g**

Maximum value of SAR (measured) = 0.512 mW/g



$$0 \text{ dB} = 0.512 \text{ mW/g}$$

#### **4.8 LeftHandSide-PCS1900-Maximum Value-BT**

Date/Time: 2007-1-16 22:05:44

Test Laboratory: SGS-GSM

#### **LeftHandSide-Cheek-GSM1900-Mid+BT(Slide up)**

**DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Middle+BT/Area Scan (61x111x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.539 mW/g

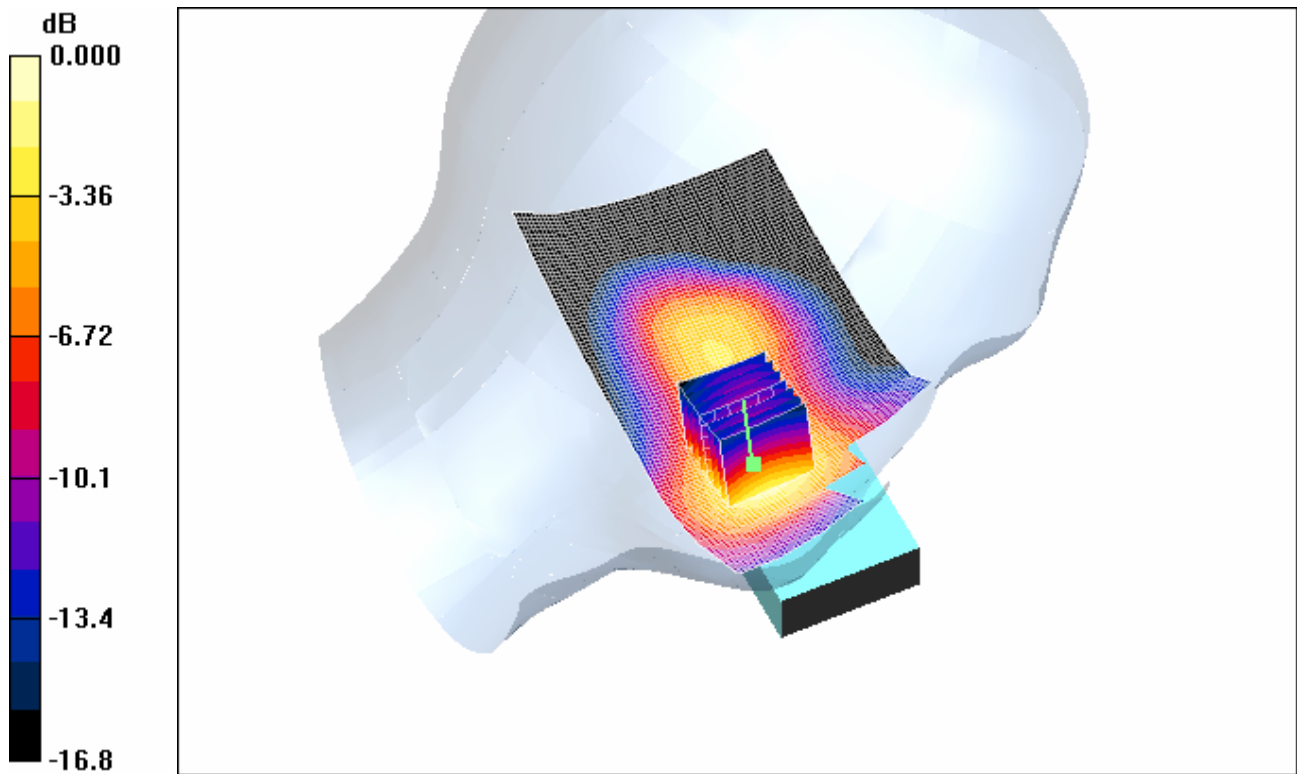
**Cheek position - Middle+BT/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 7.68 V/m; Power Drift = -0.048 dB

Peak SAR (extrapolated) = 0.785 W/kg

**SAR(1 g) = 0.485 mW/g; SAR(10 g) = 0.277 mW/g**

Maximum value of SAR (measured) = 0.541 mW/g



0 dB = 0.541mW/g

#### **4.9RightHandSide-Cheek-PCS1900-Middle-No Slide**

Date/Time: 2007-1-16 10:11:50

Test Laboratory: SGS-GSM

**RightHandSide-Cheek-GSM1900-Mid(No Slide)**

**DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.4$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Middle/Area Scan (61x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.595 mW/g

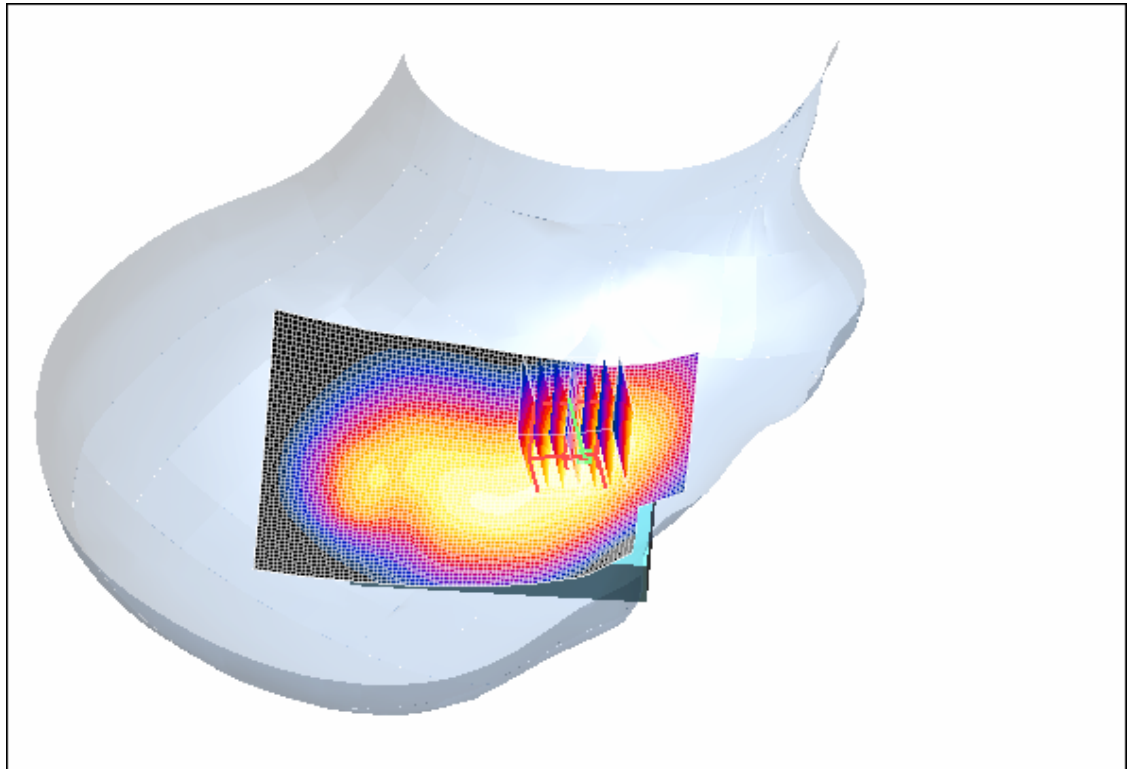
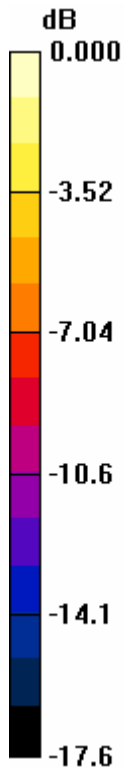
**Cheek position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.9 V/m; Power Drift = -0.128 dB

Peak SAR (extrapolated) = 0.836 W/kg

**SAR(1 g) = 0.511 mW/g; SAR(10 g) = 0.295 mW/g**

Maximum value of SAR (measured) = 0.573 mW/g



$$0 \text{ dB} = 0.573 \text{ mW/g}$$

#### **4.10 RightHandSide-Tilt-PCS1900-Middle-No Slide**

Date/Time: 2007-1-16 10:37:13

Test Laboratory: SGS-GSM

#### **RightHandSide-Tilt-GSM1900-Mid(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Tilt position - Middle/Area Scan (61x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.273 mW/g

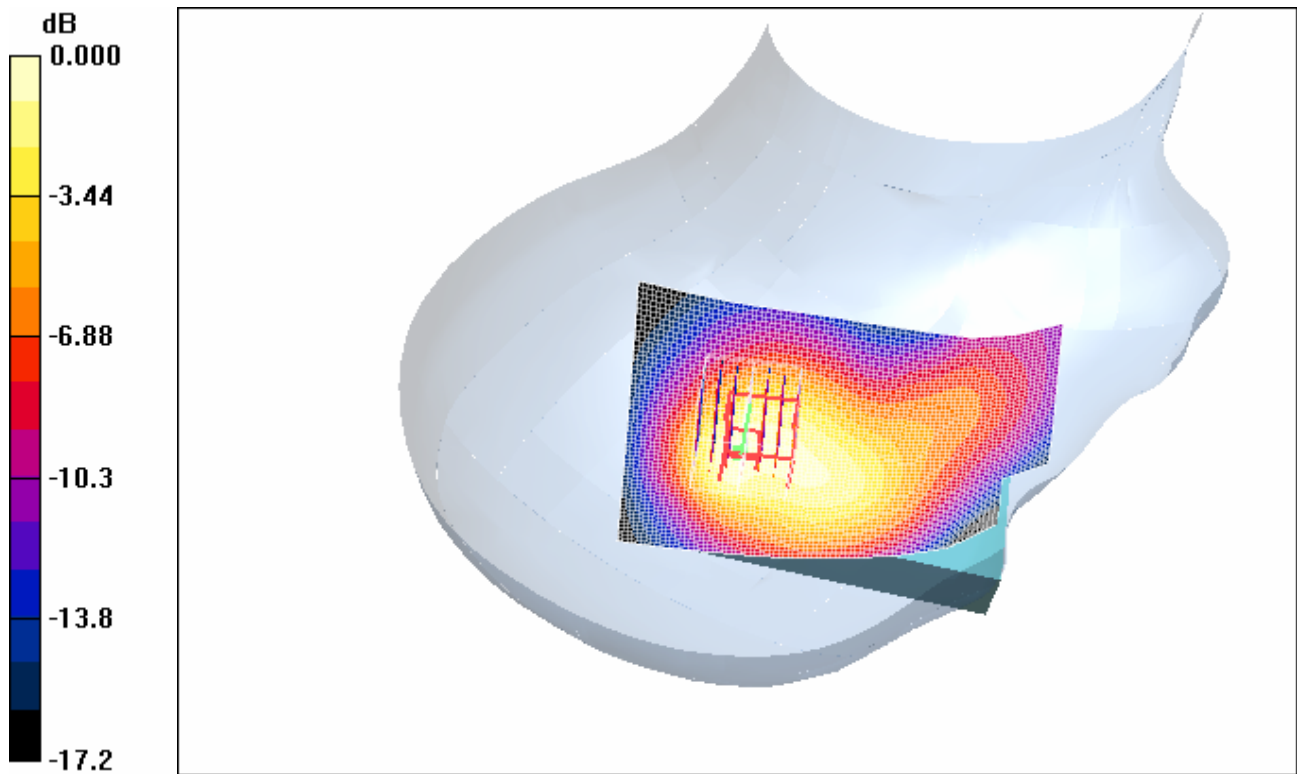
**Tilt position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 13.7 V/m; Power Drift = -0.044 dB

Peak SAR (extrapolated) = 0.392 W/kg

**SAR(1 g) = 0.233 mW/g; SAR(10 g) = 0.139 mW/g**

Maximum value of SAR (measured) = 0.260 mW/g



0 dB = 0.260mW/g

#### **4.11RightHandSide-Cheek-PCS1900-Middle-Slide Up**

Date/Time: 2007-1-16 11:07:59

Test Laboratory: SGS-GSM

#### **RightHandSide-Cheek-GSM1900-Mid(Slide up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.4$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:



- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Middle/Area Scan (61x111x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.450 mW/g

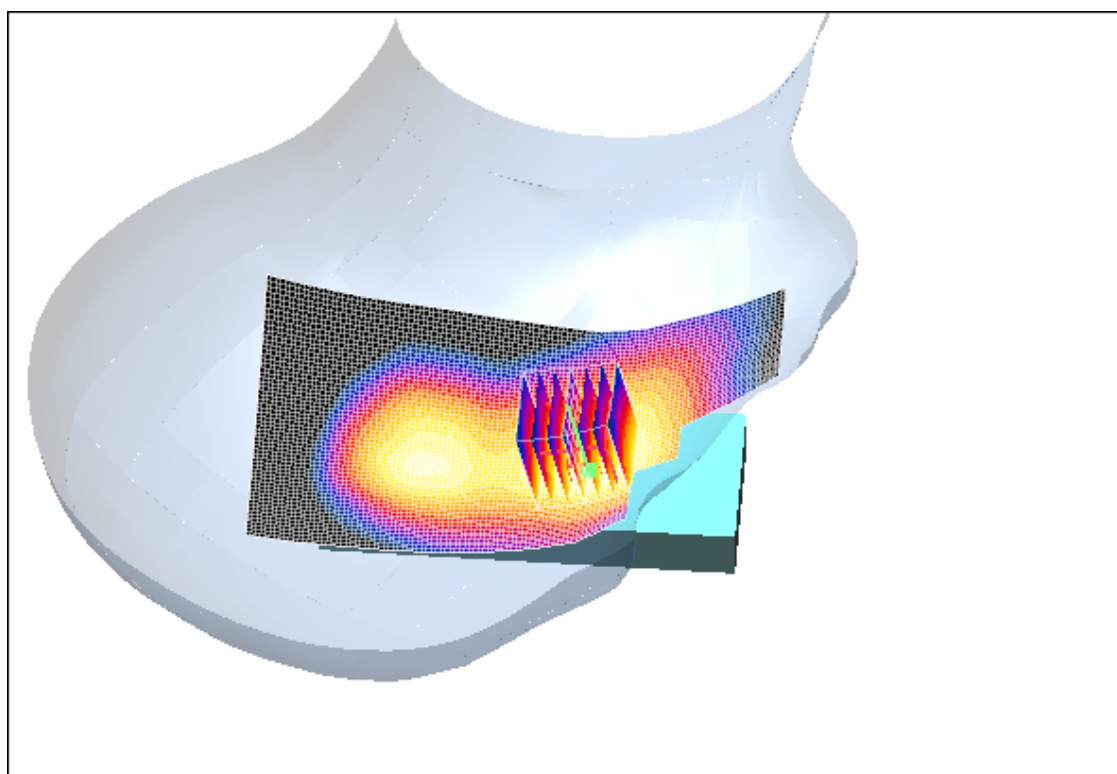
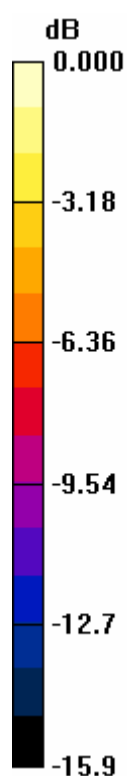
**Cheek position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.1 V/m; Power Drift = 0.087 dB

Peak SAR (extrapolated) = 0.614 W/kg

**SAR(1 g) = 0.403 mW/g; SAR(10 g) = 0.251 mW/g**

Maximum value of SAR (measured) = 0.436 mW/g



$$0 \text{ dB} = 0.436 \text{ mW/g}$$

#### **4.12 RightHandSide-Tilt-PCS1900-Middle-Slide Up**

Date/Time: 2007-1-16 11:34:43

Test Laboratory: SGS-GSM

#### **RightHandSide-Tilt-GSM1900-Mid(Slide up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Tilt position - Middle/Area Scan (61x111x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.434 mW/g

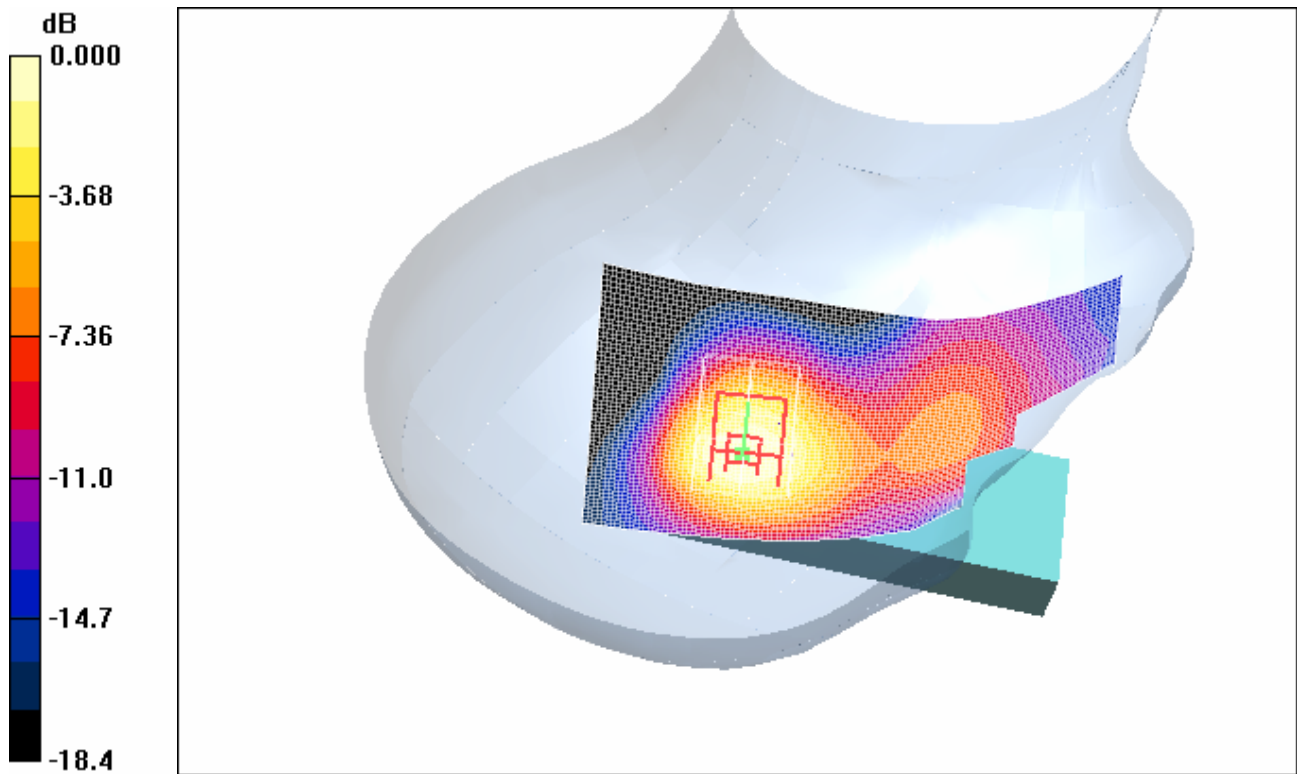
**Tilt position - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.1 V/m; Power Drift = -0.012 dB

Peak SAR (extrapolated) = 0.555 W/kg

**SAR(1 g) = 0.359 mW/g; SAR(10 g) = 0.213 mW/g**

Maximum value of SAR (measured) = 0.391 mW/g



0 dB = 0.391mW/g

#### **4.13RightHandSide-WorstCase-PCS1900-Low**

Date/Time: 2007-1-16 13:03:27

Test Laboratory: SGS-GSM

#### **RightHandSide-Cheek-GSM1900-Low(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.35 \text{ mho/m}$ ;  $\epsilon_r = 38.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - Low/Area Scan (61x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.596 mW/g

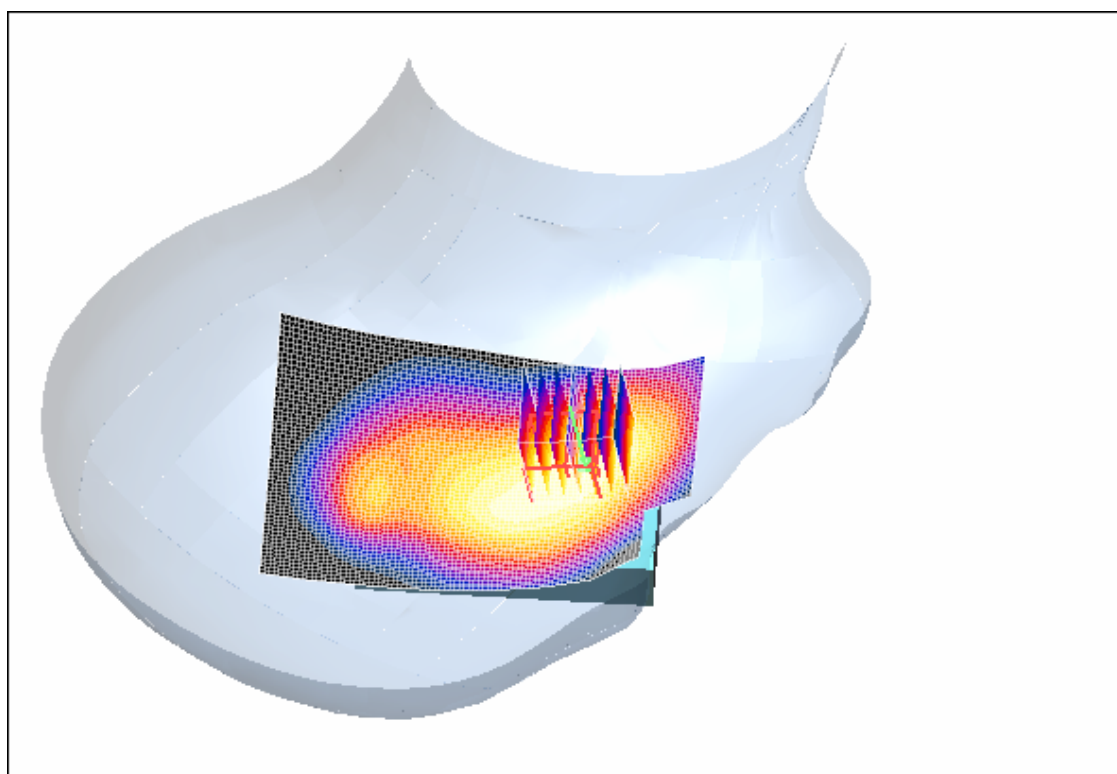
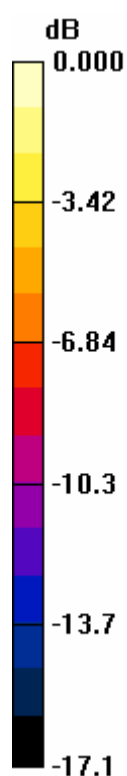
**Cheek position - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.8 V/m; Power Drift = -0.099 dB

Peak SAR (extrapolated) = 0.802 W/kg

**SAR(1 g) = 0.502 mW/g; SAR(10 g) = 0.302 mW/g**

Maximum value of SAR (measured) = 0.555 mW/g



$$0 \text{ dB} = 0.555 \text{ mW/g}$$

#### **4.14 RightHandSide-WorstCase-PCS1900-High**

Date/Time: 2007-1-16 13:29:03

Test Laboratory: SGS-GSM

#### **RightHandSide-Cheek-GSM1900-High(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1909.8 \text{ MHz}$ ;  $\sigma = 1.45 \text{ mho/m}$ ;  $r = 38.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position - High/Area Scan (61x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.563 mW/g

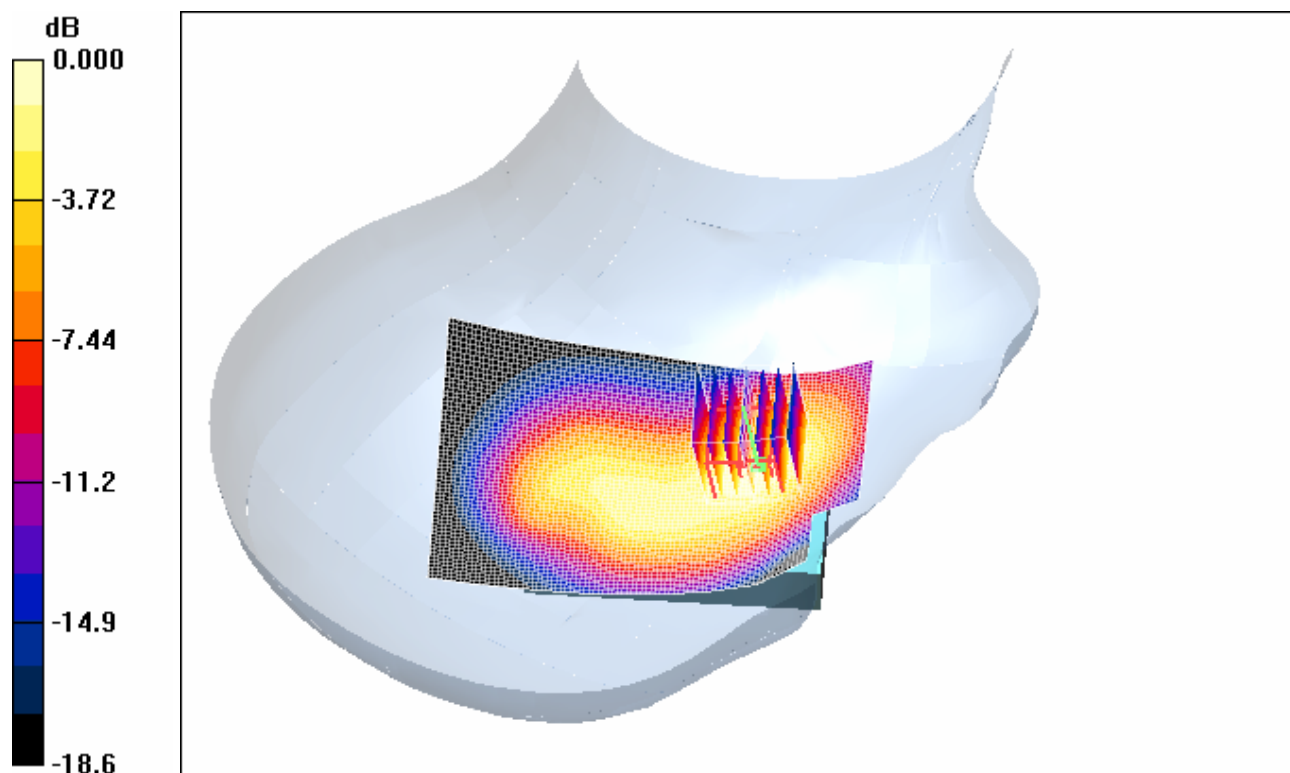
**Cheek position - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.7 V/m; Power Drift = 0.002 dB

Peak SAR (extrapolated) = 0.796 W/kg

**SAR(1 g) = 0.484 mW/g; SAR(10 g) = 0.275 mW/g**

Maximum value of SAR (measured) = 0.535 mW/g



0 dB = 0.535mW/g

#### **4.15RightHandSide-PCS1900-Maximum Value-SD**

Date/Time: 2007-1-16 13:56:45

Test Laboratory: SGS-GSM

**RightHandSide-Cheek-GSM1900-Mid +SD(No Slide)**

**DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position -Mid+SD/Area Scan (61x91x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.595 mW/g

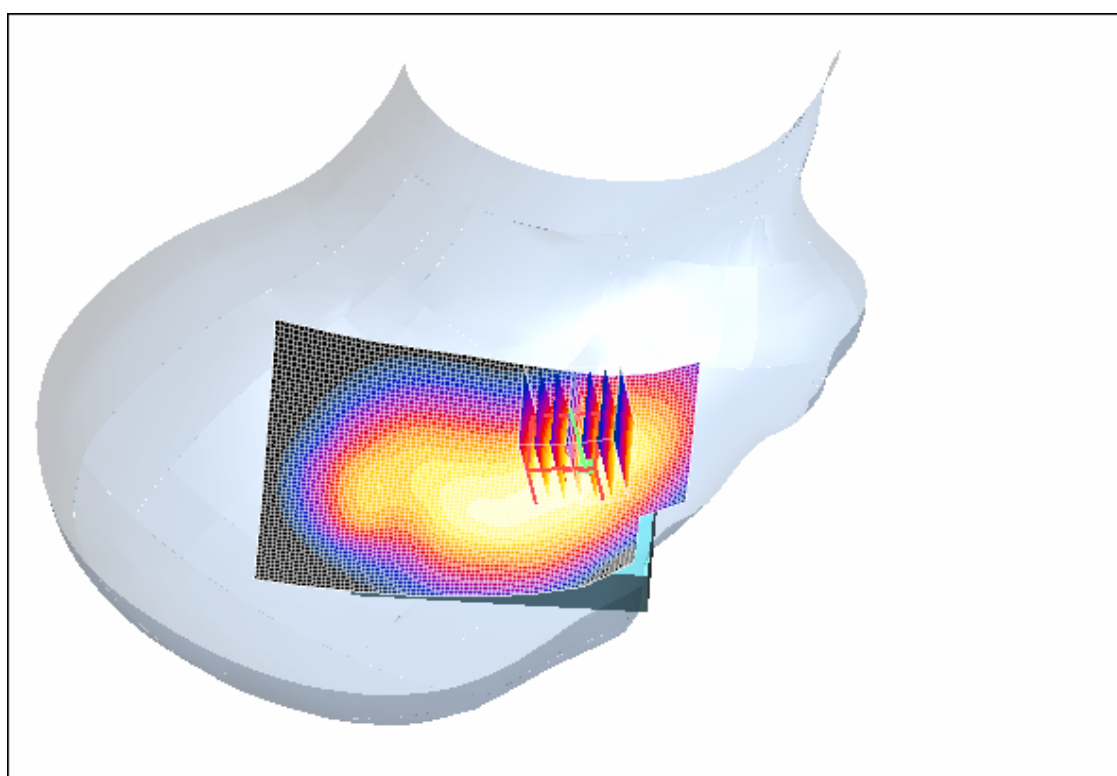
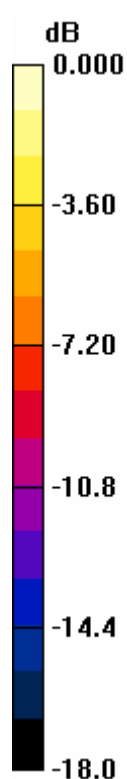
**Cheek position -Mid+SD/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.2 V/m; Power Drift = 0.009 dB

Peak SAR (extrapolated) = 0.846 W/kg

**SAR(1 g) = 0.514 mW/g; SAR(10 g) = 0.299 mW/g**

Maximum value of SAR (measured) = 0.569 mW/g



$$0 \text{ dB} = 0.569 \text{ mW/g}$$

#### **4.16 RightHandSide-PCS1900-Maximum Value-BT**

Date/Time: 2007-1-16 16:27:37

Test Laboratory: SGS-GSM

#### **RightHandSide-Cheek-GSM1900-Mid +BT(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GSM Mode; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900-Head Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(5.07, 5.07, 5.07); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Cheek position -Middle+BT 2/Area Scan (61x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.595 mW/g

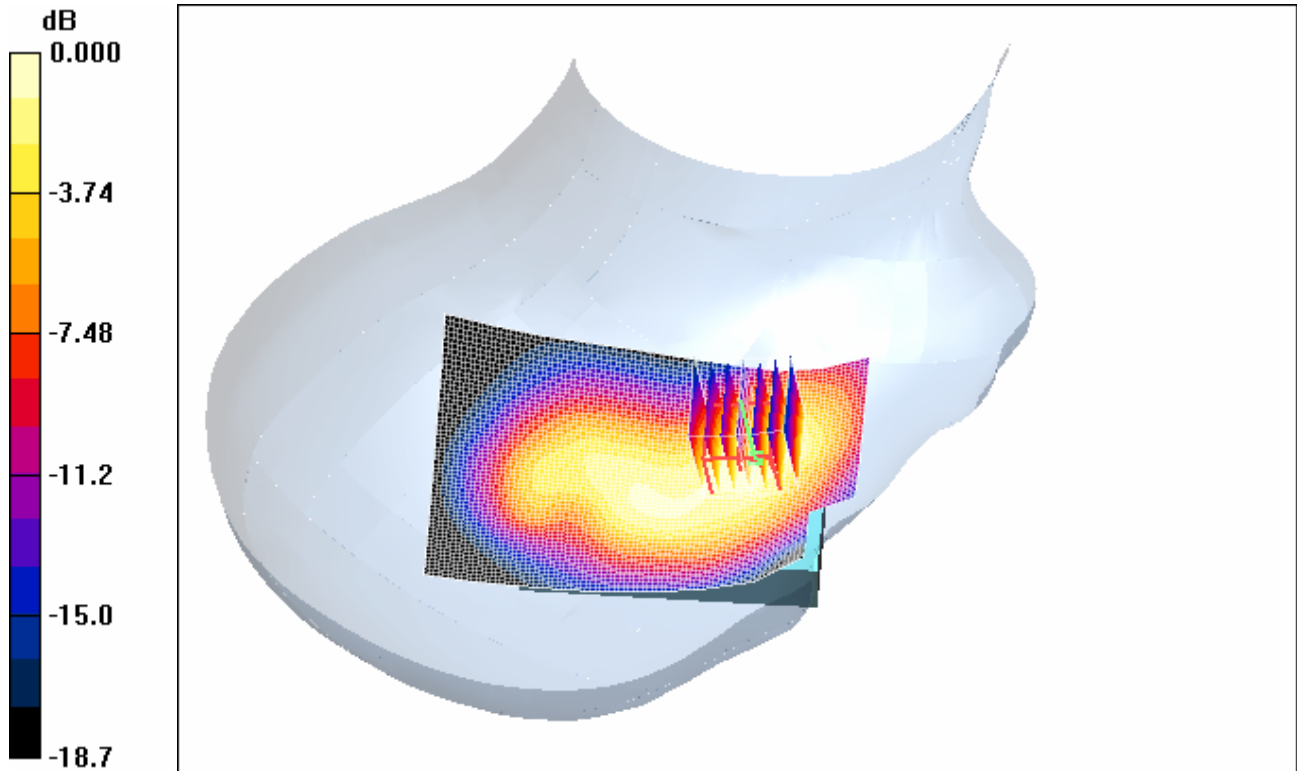
**Cheek position -Middle+BT 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 14.5 V/m; Power Drift = 0.027 dB

Peak SAR (extrapolated) = 0.844 W/kg



SAR(1 g) = 0.513 mW/g; SAR(10 g) = 0.295 mW/g  
Maximum value of SAR (measured) = 0.564 mW/g



0 dB = 0.564mW/g

#### **4.17Body-Worn-PCS1900-GPRS-Middle-No Slide**

Date/Time: 2007-1-12 15:04:09

Test Laboratory: SGS-GSM

**Body-Worn-GSM1900-GPRS-Mid(No Slide)**

**DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220**

Communication System: PCS1900-GPRS Mode; Frequency: 1880 MHz;Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.56$  mho/m;  $\epsilon_r = 50.8$ ;  $\mu_r = 1000$

kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - Middle/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.914 mW/g

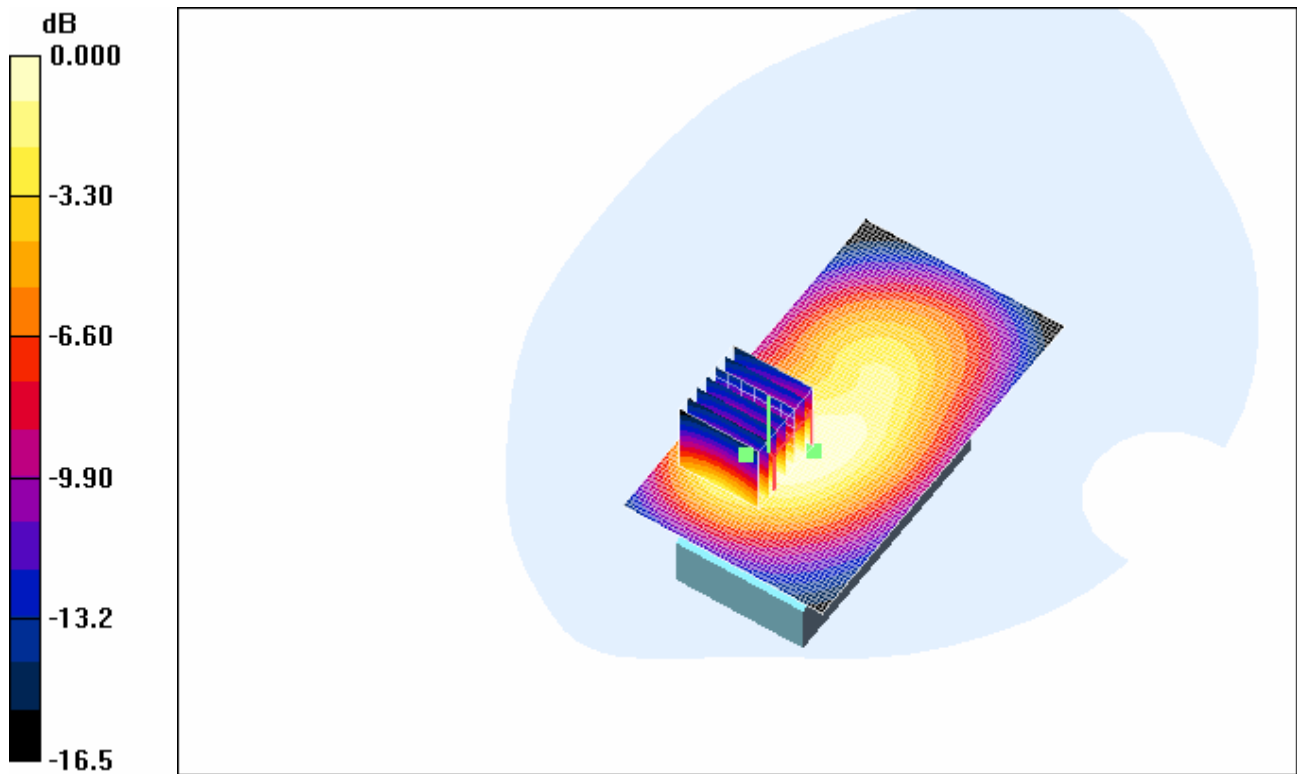
**Body Worn - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.9 V/m; Power Drift = -0.113 dB

Peak SAR (extrapolated) = 1.43 W/kg

**SAR(1 g) = 0.809 mW/g; SAR(10 g) = 0.482 mW/g**

Maximum value of SAR (measured) = 0.868 mW/g



0 dB = 0.868mW/g

#### **4.18Body-Worn-PCS1900-GPRS-Middle-Slide Up**

Date/Time: 2007-1-12 15:34:29

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-Mid(Slide Up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1880 MHz;Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 50.8$ ;  $\rho = 1000 \text{ kg/m}^3$

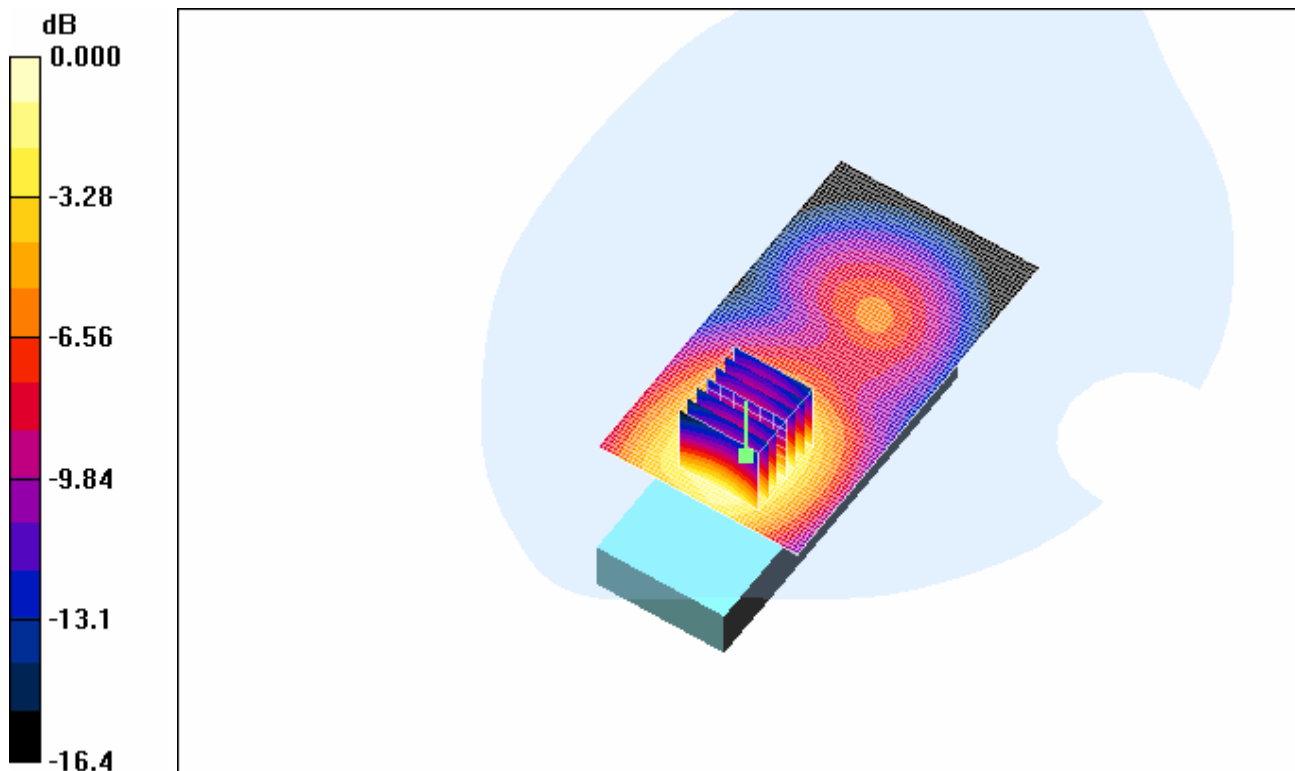
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - Middle/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 1.38 mW/g

**Body Worn - Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 13.0 V/m; Power Drift = 0.025 dB  
Peak SAR (extrapolated) = 2.00 W/kg  
**SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.761 mW/g**  
Maximum value of SAR (measured) = 1.36 mW/g



0 dB = 1.36mW/g

#### **4.19 Body-Worn-PCS1900-GPRS-Low-No Slide**

Date/Time: 2007-1-12 17:27:49

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-Low(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1850.2 MHz; Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.53 \text{ mho/m}$ ;  $\epsilon_r = 50.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - Low/Area Scan (51x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.978 mW/g

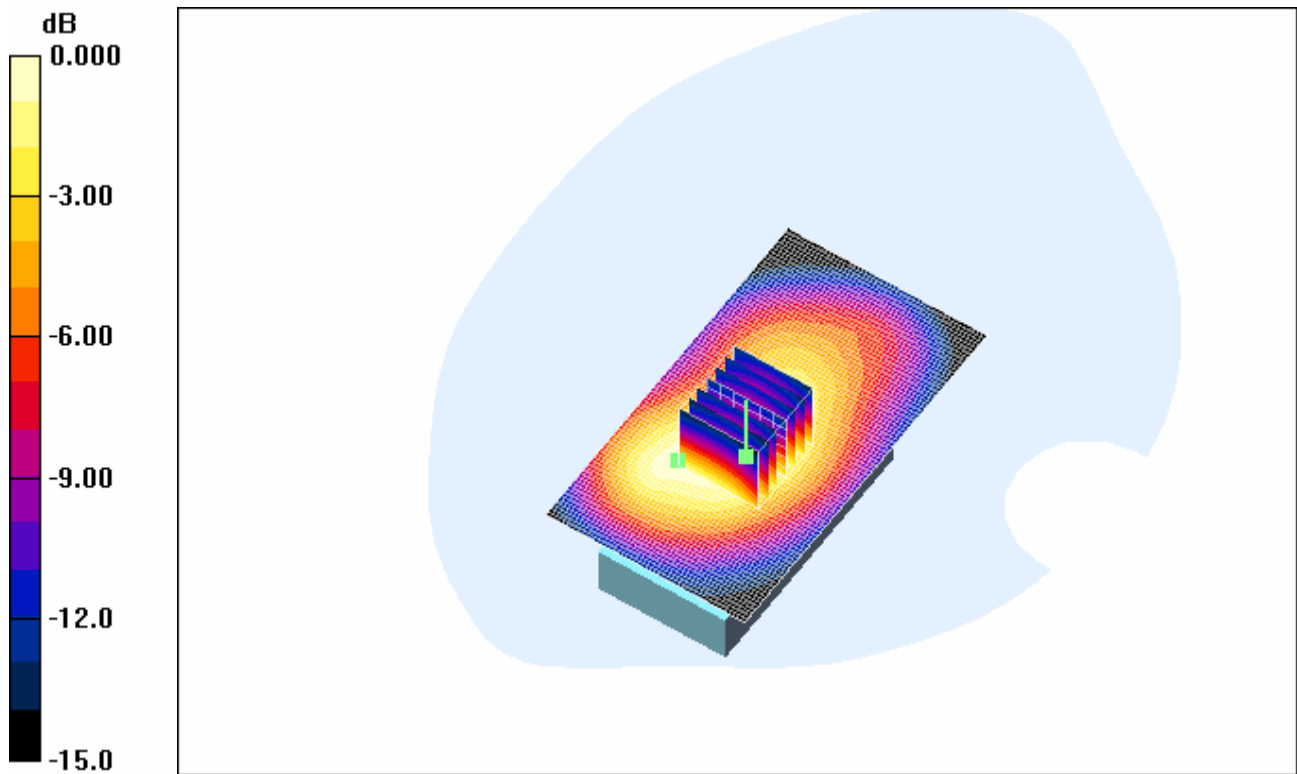
**Body Worn - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 16.0 V/m; Power Drift = -0.002 dB

Peak SAR (extrapolated) = 1.42 W/kg

**SAR(1 g) = 0.891 mW/g; SAR(10 g) = 0.546 mW/g**

Maximum value of SAR (measured) = 0.959 mW/g



0 dB = 0.959mW/g

#### **4.20Body-Worn-PCS1900-GPRS-Low-Slide Up**

Date/Time: 2007-1-12 15:58:54

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-Low(Slide Up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1850.2 MHz;Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.53 \text{ mho/m}$ ;  $\epsilon_r = 50.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - Low/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.25 mW/g

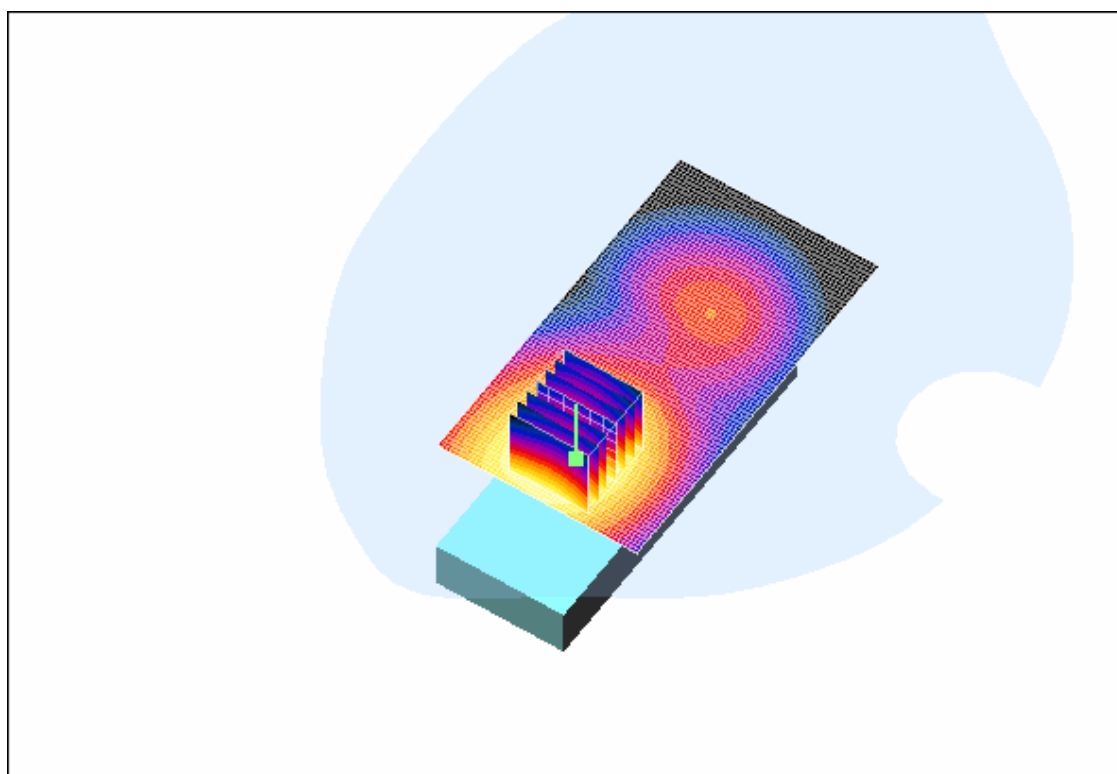
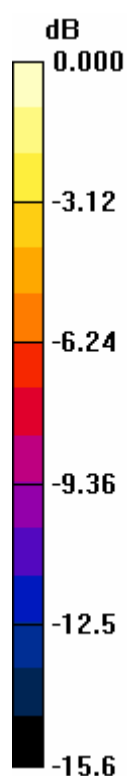
**Body Worn - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.6 V/m; Power Drift = -0.008 dB

Peak SAR (extrapolated) = 1.80 W/kg

**SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.695 mW/g**

Maximum value of SAR (measured) = 1.23 mW/g



$$0 \text{ dB} = 1.23 \text{ mW/g}$$

#### **4.21 Body-Worn-PCS1900-GPRS-High-No Slide**

Date/Time: 2007-1-12 17:04:40

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-High(No Slide)**

DUT: GSM10192215-No Slide; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1909.8 MHz; Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1909.8 \text{ MHz}$ ;  $\sigma = 1.6 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - High/Area Scan (51x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.855 mW/g

**Body Worn - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

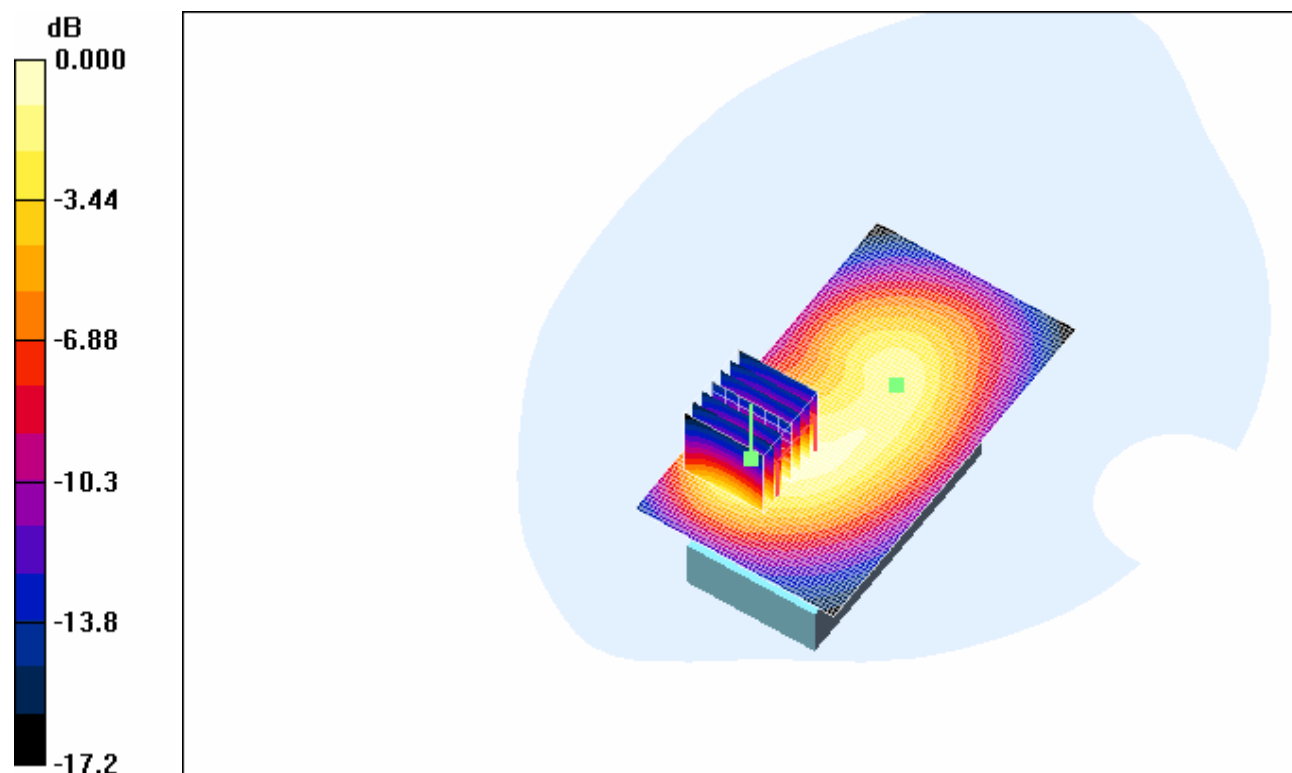
Reference Value = 17.4 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 1.36 W/kg

**SAR(1 g) = 0.745 mW/g; SAR(10 g) = 0.421 mW/g**

Maximum value of SAR (measured) = 0.815 mW/g





0 dB = 0.815mW/g

#### **4.22Body-Worn-PCS1900-GPRS-High-SlideUp**

Date/Time: 2007-1-12 16:40:19

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-High(Slide Up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1909.8 MHz;Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1909.8 \text{ MHz}$ ;  $\sigma = 1.6 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - High/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.35 mW/g

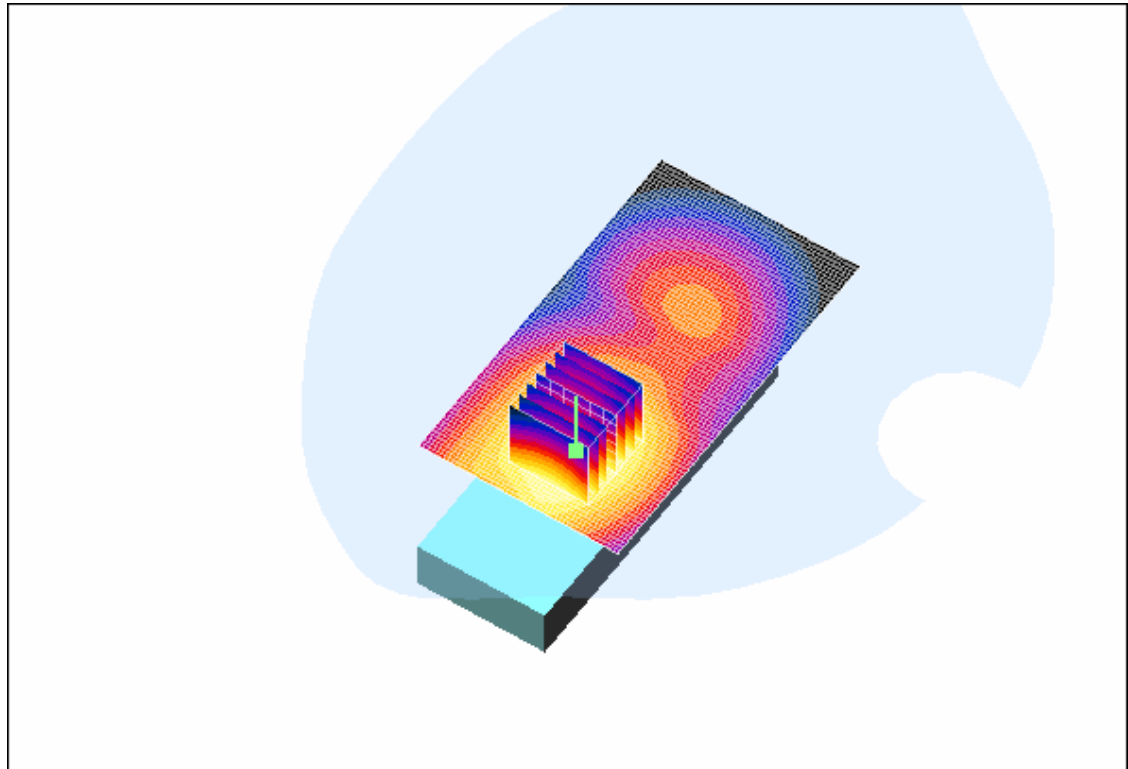
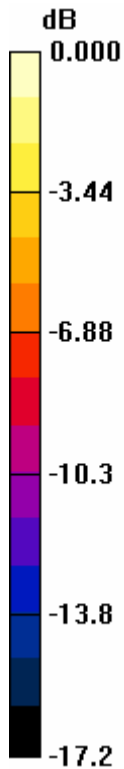
**Body Worn - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.2 V/m; Power Drift = -0.134 dB

Peak SAR (extrapolated) = 1.96 W/kg

**SAR(1 g) = 1.2 mW/g; SAR(10 g) = 0.720 mW/g**

Maximum value of SAR (measured) = 1.29 mW/g



$$0 \text{ dB} = 1.29 \text{ mW/g}$$

#### **4.23 Body-Worn-PCS1900-Maximum Value-SD**

Date/Time: 2007-1-15 14:40:43

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-Mid+SD(Slide Up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1880 MHz; Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $r = 50.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - Middle+SD 2/Area Scan (51x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.45 mW/g

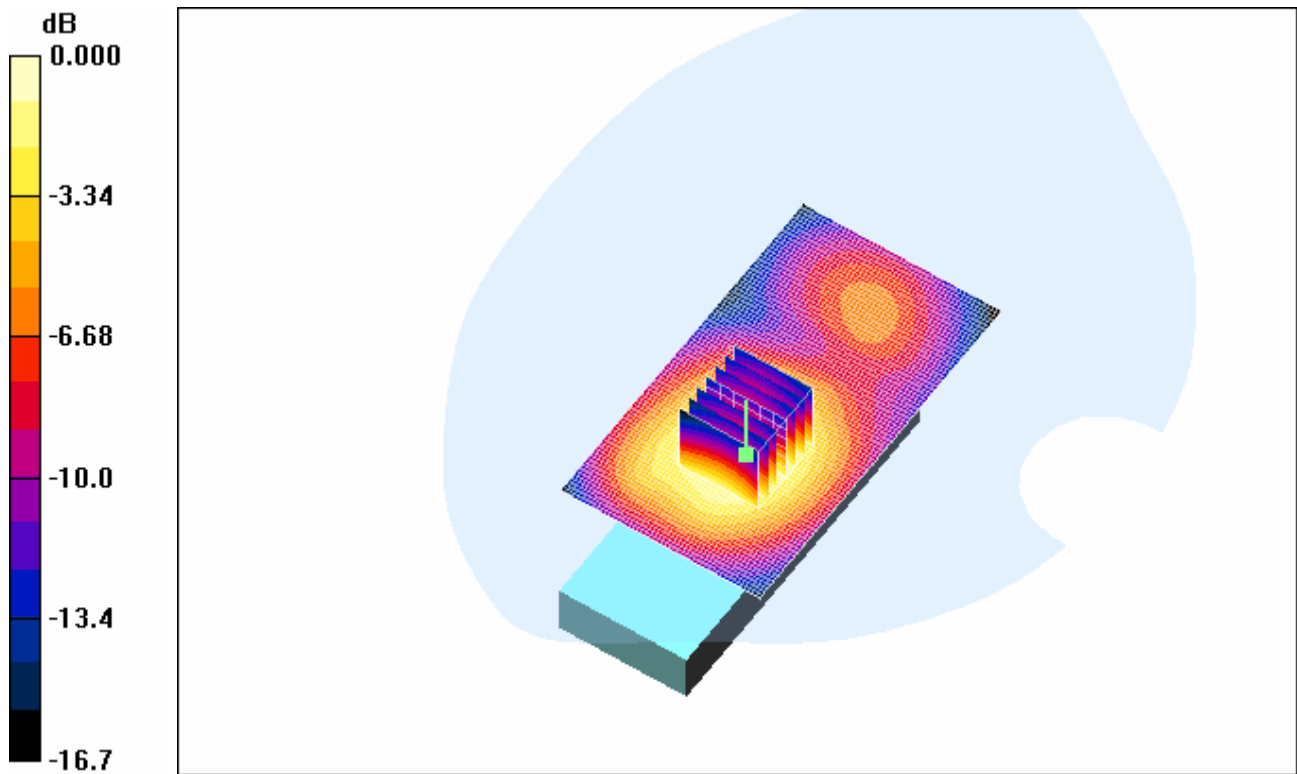
**Body Worn - Middle+SD 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.8 V/m; Power Drift = -0.295 dB

Peak SAR (extrapolated) = 2.05 W/kg

**SAR(1 g) = 1.3 mW/g; SAR(10 g) = 0.789 mW/g**

Maximum value of SAR (measured) = 1.40 mW/g



0 dB = 1.40mW/g

#### **4.24 Body-Worn-PCS1900-Maximum Value-BT**

Date/Time: 2007-1-15 13:39:10

Test Laboratory: SGS-GSM

#### **Body-Worn-GSM1900-GPRS-Mid+BT(Slide Up)**

DUT: GSM10192215-Slide Up; Type: Body; Serial: 135790246811220

Communication System: PCS1900-GPRS Mode; Frequency: 1880 MHz; Duty Cycle: 1:4

Medium: 1900-Body Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.56$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.68, 4.68, 4.68); Calibrated: 2006-12-12
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2006-12-8
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Body Worn - Middle+BT/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.40 mW/g

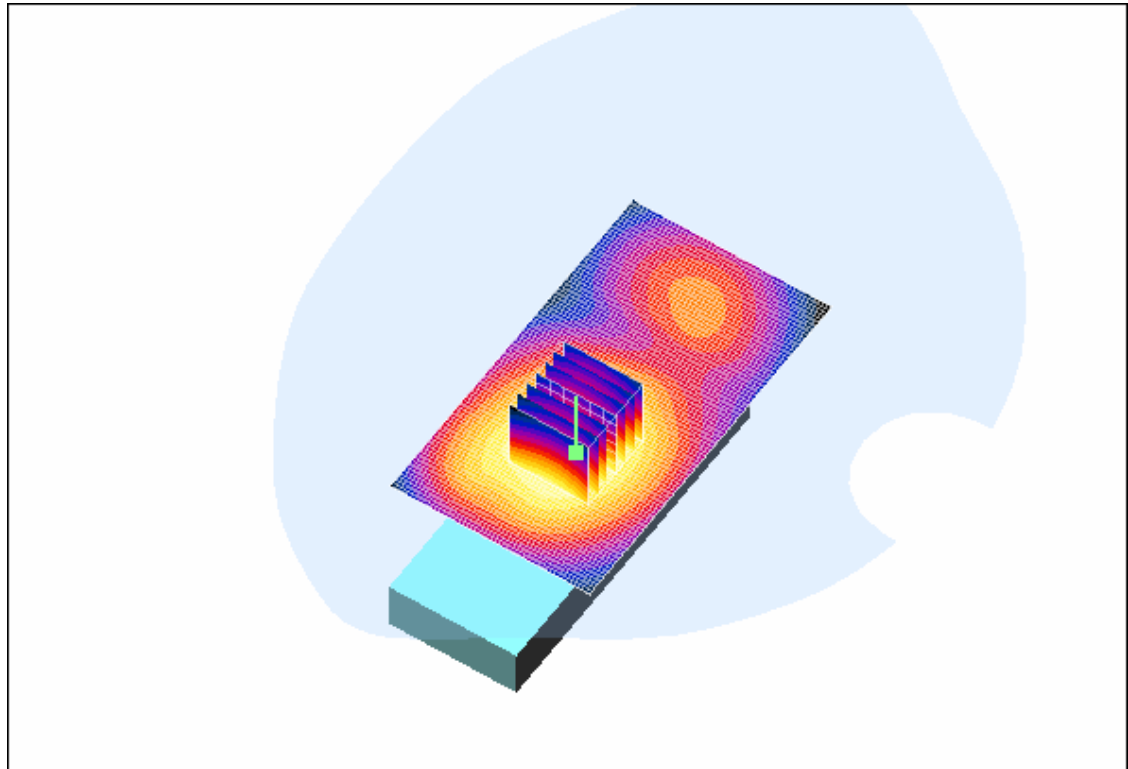
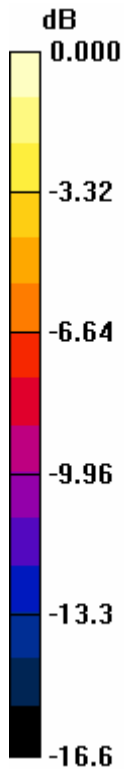
**Body Worn - Middle+BT/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.8 V/m; Power Drift = -0.075 dB

Peak SAR (extrapolated) = 2.03 W/kg

**SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.764 mW/g**

Maximum value of SAR (measured) = 1.37 mW/g



0 dB = 1.37mW/g

## Appendix

### 1. Photographs of Test Setup



Fig.1 Photograph of the SAR measurement System

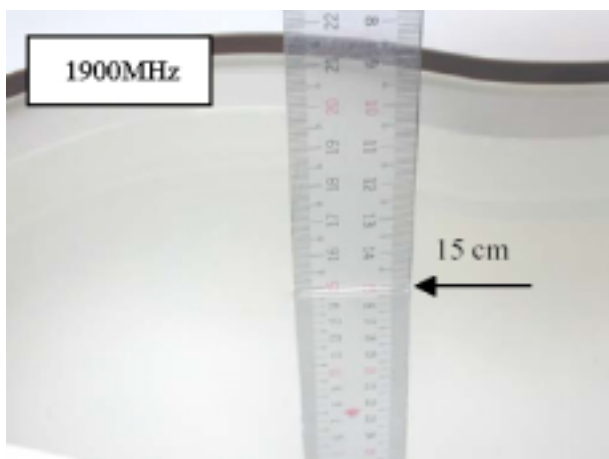


Fig.2 Photograph of the Tissue Simulant  
Fluid Fluid Liquid depth 15cm  
for Left-Head Side

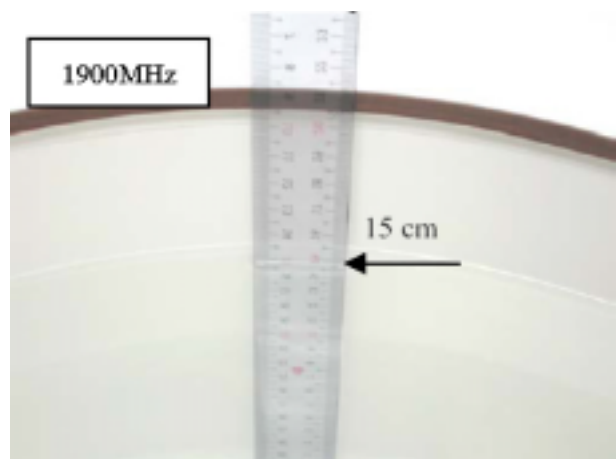


Fig.3 Photograph of the Tissue Simulant  
Liquid depth 15cm for Body-Worn

## 2. Photographs of Test Configuration



Fig.6 Photograph of the Left Hand Side Cheek status(Slide Up)



Fig.7 Photograph of the Right Hand Side Cheek status(No Slide)





Fig.8 Photograph of the Left Hand Side Tilt status(Slide Up)



Fig.9 Photograph of the Left Hand Side Tilt status(No Slide)

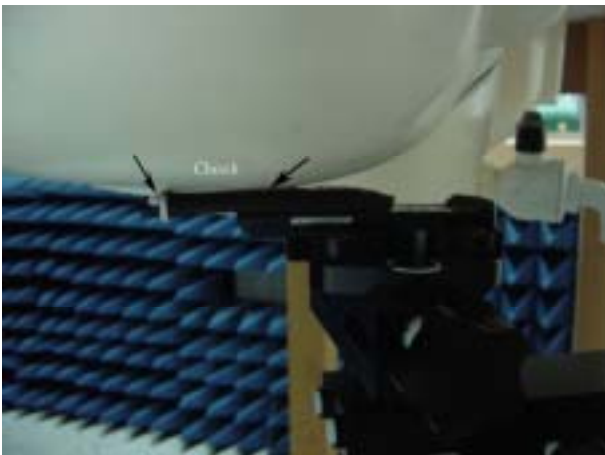


Fig.10 Photograph of the Right Hand Side Cheek status(Slide Up)

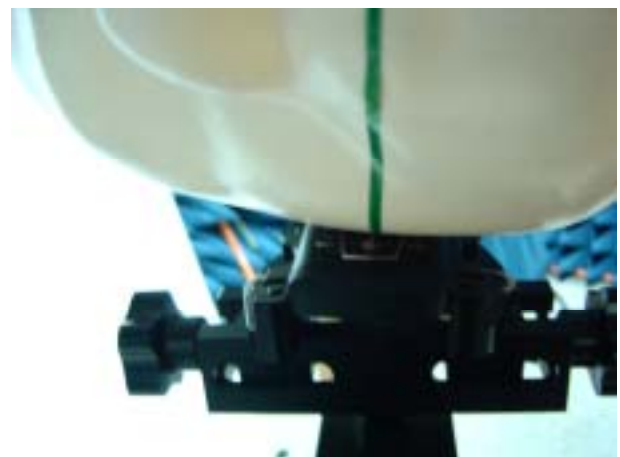
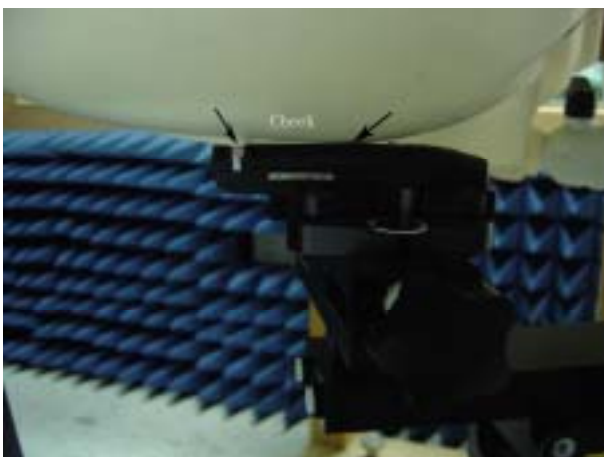


Fig.11 Photograph of the Right Hand Side Cheek status(No Slide)

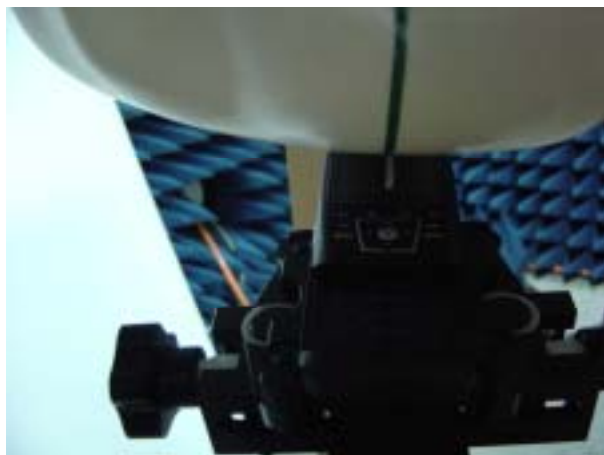


Fig.12 Photograph of the Right Hand Side Tilt status(Slide Up)

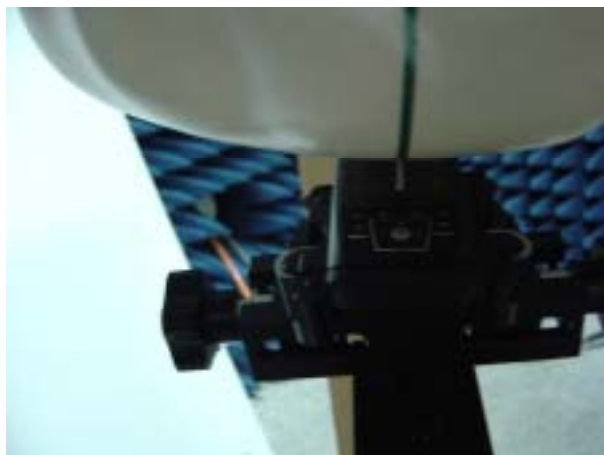
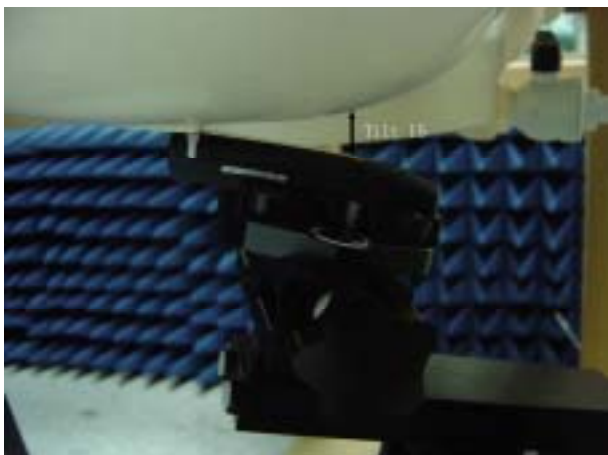


Fig.13 Photograph of the Right Hand Side Tilt status(No Slide)



Fig.14 Photograph of the BodyWorn status

**3. Photographs of the EUT**



Fig.15 Front View



Fig.16 Back View

**4. Photographs of the battery**



Fig.17 Front view of battery

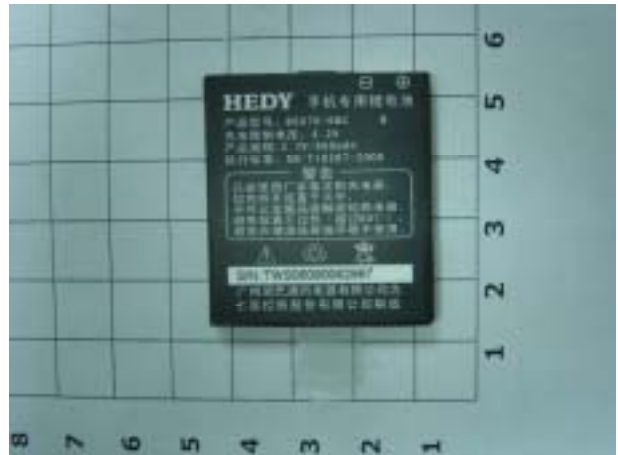


Fig.18 Back view of battery

**5. Photograph of the charger**



Fig.19 Charger



Fig.20 Headset



## 6. Probe Calibration certification

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

Accreditation No.: SCS 108

Client: SGS-CSTC (MTT)

Certificate No: ES3-3088\_Dec06

### CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3088

Calibration procedure(s): QA CAL-01.v5  
 Calibration procedure for dosimetric E-field probes

Calibration date: December 12, 2006

Condition of the calibrated item: In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 2)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: 85064 (30)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: 85066 (20b)	4-Apr-06 (METAS, No. 251-00556)	Apr-07
Reference 30 dB Attenuator	SN: 85129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 054	21-Jun-06 (SPEAG, No. DAE4-054_Jun06)	Jun-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37360586	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

Calibrated by: Name: Kalja Polovic, Function: Technical Manager, Signature: [Signature]

Approved by: Name: Heide Kuster, Function: Quality Manager, Signature: [Signature]

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

Issued: December 13, 2006

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



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

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

Accreditation No.: **SCS 108**

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\phi$	$\phi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis

**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
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

**Methods Applied and Interpretation of Parameters:**

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

ES3DV3 SN:3088

December 12, 2006

# Probe ES3DV3

## SN:3088

Manufactured:	July 20, 2005
Last calibrated:	September 13, 2005
Recalibrated:	December 12, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)



ES3DV3 SN:3088

December 12, 2006

## DASY - Parameters of Probe: ES3DV3 SN:3088

### Sensitivity in Free Space<sup>A</sup>

### Diode Compression<sup>B</sup>

NormX	1.31 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	94 mV
NormY	1.23 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	94 mV
NormZ	1.27 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	93 mV

### Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

### Boundary Effect

TSL 900 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance	3.0 mm	4.0 mm
SAR <sub>iso</sub> [%] Without Correction Algorithm	2.4	0.6
SAR <sub>iso</sub> [%] With Correction Algorithm	1.0	0.0

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance	3.0 mm	4.0 mm
SAR <sub>iso</sub> [%] Without Correction Algorithm	7.6	4.5
SAR <sub>iso</sub> [%] With Correction Algorithm	0.1	0.2

### Sensor Offset

Probe Tip to Sensor Center 2.0 mm

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

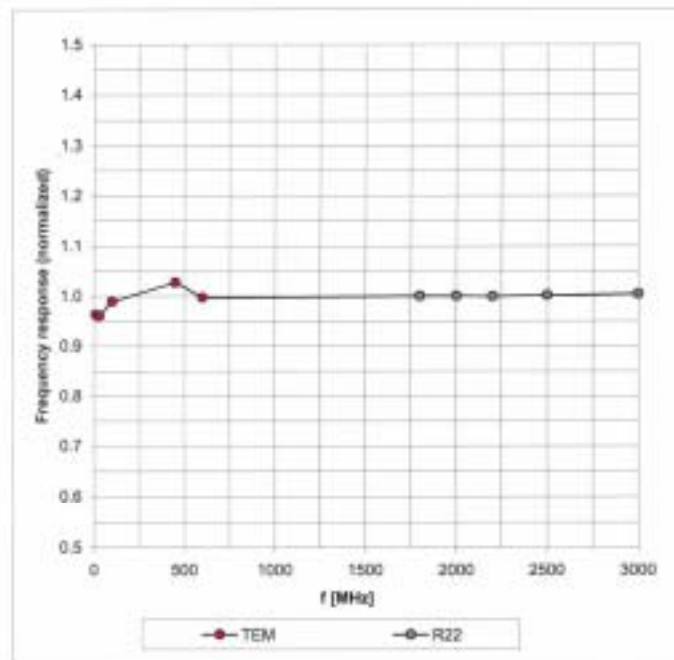
<sup>B</sup> Numerical linearization parameter: uncertainty not required.

ES3DV3 SN:3088

December 12, 2006

### Frequency Response of E-Field

(TEM-Cell:if1110 EXX, Waveguide: R22)

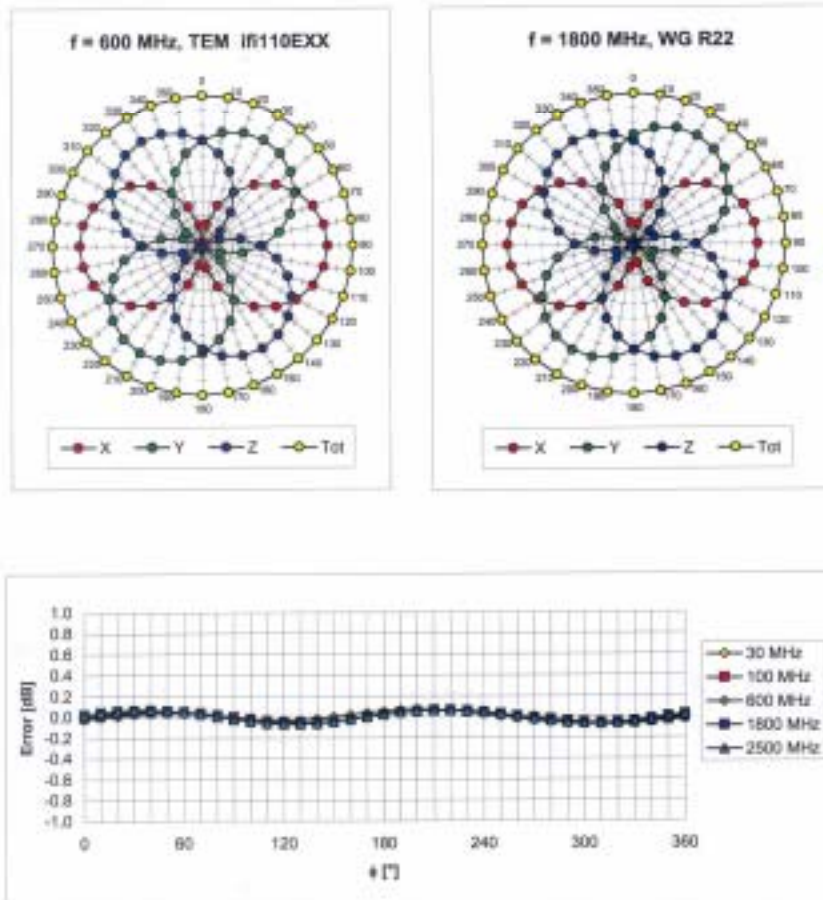


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

ES3DV3 SN:3088

December 12, 2006

### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

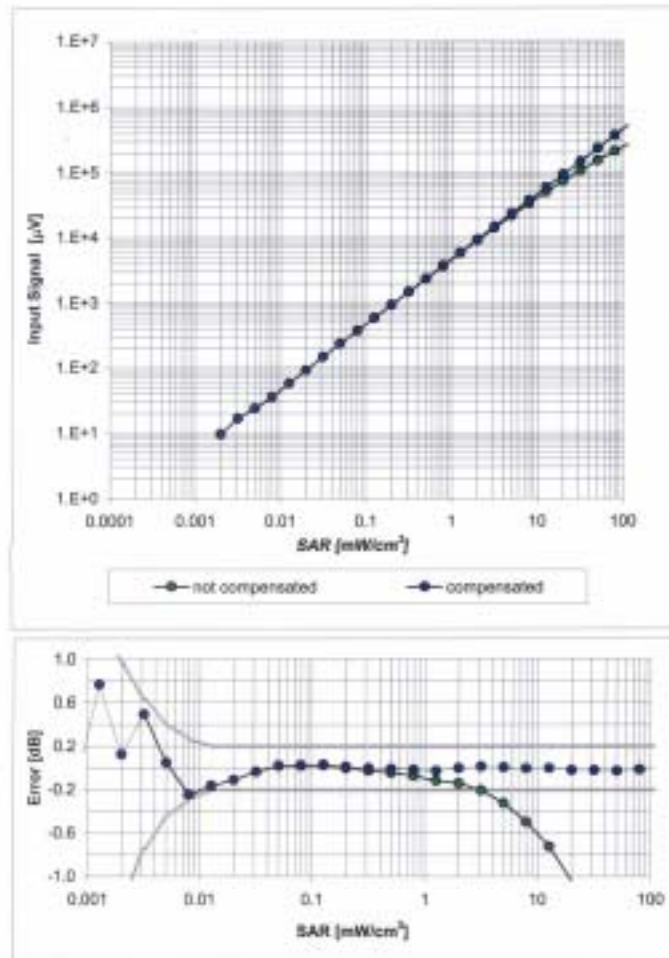


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

ES3DV3 SN:3088

December 12, 2006

**Dynamic Range f(SAR<sub>head</sub>)**  
(Waveguide R22, f = 1800 MHz)

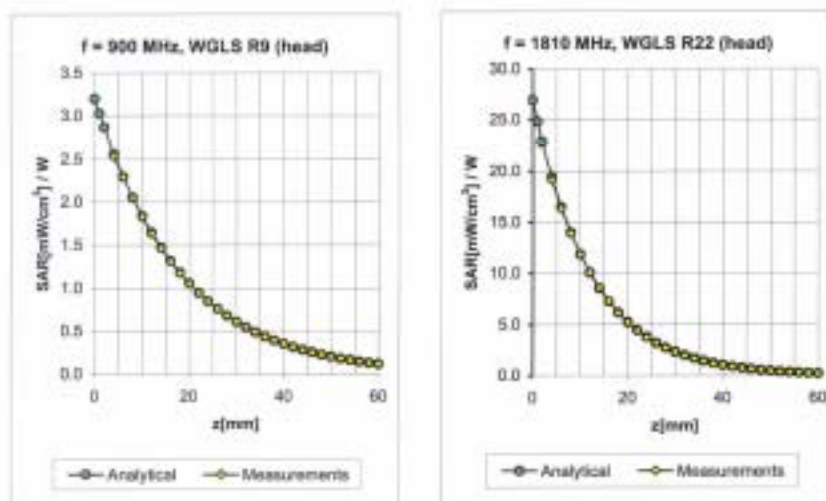


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

ES3DV3 SN:3088

Décembre 12, 2006

## Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>1)</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	1.00	1.18	6.00 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.73	1.39	5.07 ± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.73	1.38	4.97 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.74	1.36	4.89 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	1.00	1.17	5.92 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	1.00	1.18	4.88 ± 11.0% (k=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.89	1.27	4.51 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.80	1.12	4.33 ± 11.8% (k=2)

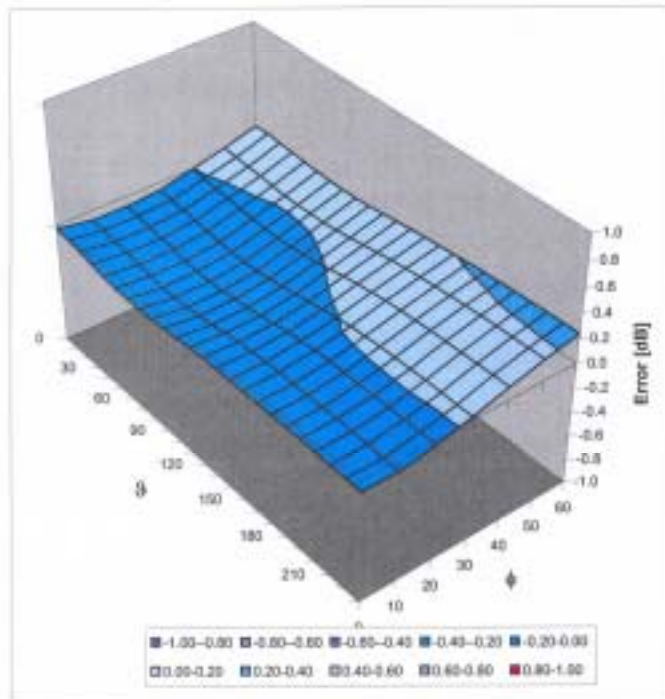
<sup>1)</sup> The validity of ± 100 MHz only applies for DASV v4.4 and higher (see Page 3). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ES3DV3 SN:3088

December 12, 2006

### Deviation from Isotropy in HSL

Error ( $\phi$ ,  $\theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

## 6 . DAE Calibration certification

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client SGS - CSTC (MTT)

Certificate No: DAE3-569\_Dec06

### CALIBRATION CERTIFICATE

Object DAE3 - SD 000 D03 AA - SN: 569

Calibration procedure(s) QA CAL-06.v12  
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: December 8, 2006

Condition of the calibrated item In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (WATE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Ruko Process Calibrator Type 702	SN: 6256933	13-Oct-06 (Elcal AG, No: 5492)	Oct-07
Kethley Multimeter Type 2001	SN: 0610276	03-Oct-06 (Elcal AG, No: 5478)	Oct-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1002	15-Jun-06 (SPEAG, in house check)	In house check Jun-07

Calibrated by:	Name Stefano Giannotta	Function Technician	Signature 
Approved by:	Name Fin Borchelt	Function R&D Director	Signature 

Issued: December 8, 2006

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

#### Glossary

DAE data acquisition electronics  
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

#### Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters contain technical information as a result from the performance test and require no uncertainty.
- **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
- **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
- **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
- **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
- **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
- **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
- **Input resistance:** DAE input resistance at the connector, during internal auto-zeroing and during measurement.
- **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
- **Power consumption:** Typical value for information. Supply currents in various operating modes.



# DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1µV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.742 ± 0.1% (k=2)	404.327 ± 0.1% (k=2)	404.103 ± 0.1% (k=2)
Low Range	3.93547 ± 0.7% (k=2)	3.93513 ± 0.7% (k=2)	3.93385 ± 0.7% (k=2)

# Connector Angle

Connector Angle to be used in DASY system	80 ° ± 1 °
---	------------

## Appendix

### 1. DC Voltage Linearity

High Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	200000	199999.9	0.00
Channel X + Input	20000	20002.27	0.01
Channel X - Input	20000	-19998.87	-0.01
Channel Y + Input	200000	200000.1	0.00
Channel Y + Input	20000	19999.20	0.00
Channel Y - Input	20000	-20003.47	0.02
Channel Z + Input	200000	200000.0	0.00
Channel Z + Input	20000	20001.01	0.01
Channel Z - Input	20000	-20001.46	0.01

Low Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000	1999.9	0.00
Channel X + Input	200	199.91	-0.05
Channel X - Input	200	-200.86	0.43
Channel Y + Input	2000	1999.9	0.00
Channel Y + Input	200	199.35	-0.32
Channel Y - Input	200	-200.57	0.28
Channel Z + Input	2000	2000.1	0.00
Channel Z + Input	200	200.37	0.19
Channel Z - Input	200	-201.04	0.52

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-6.08	-11.00
	-200	8.46	12.92
Channel Y	200	6.85	6.78
	-200	-8.07	-8.07
Channel Z	200	-5.10	-5.59
	-200	4.40	3.64

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	0.47	0.37
Channel Y	200	1.04	-	3.88
Channel Z	200	-1.66	0.07	-

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16395	15608
Channel Y	15744	16385
Channel Z	16312	16061

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.16	-0.70	1.24	0.30
Channel Y	-1.80	-2.48	-0.86	0.32
Channel Z	-0.29	-1.19	0.92	0.39

#### 6. Input Offset Current

Nominal input circuitry offset current on all channels: <25fA

#### 7. Input Resistance

	Zeroing (M $\Omega$ m)	Measuring (M $\Omega$ m)
Channel X	200.2	0.2001
Channel Y	204.0	0.2001
Channel Z	205.8	0.2000

#### 8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

#### 9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9

## 7 . Dipole Calibration certification

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 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: SGS-CSTC (MTT)

Certificate No: D1900V2-5d028\_Dec06

### CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d028

Calibration procedure(s): QA CAL-05.v6  
 Calibration procedure for dipole validation kits

Calibration date: December 12, 2006

Condition of the calibrated item: In Tolerance.

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (N&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	0837480704	09-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37282783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No. 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No. 217-00591)	Aug-07
Reference Probe ET3DV6	SN: 1507	19-Oct-06 (SPEAG, No. ET3-1507_Oct06)	Oct-07
Reference Probe ES3DV3	SN: 3025	19-Oct-06 (SPEAG, No. ES3-3025_Oct06)	Oct-07
DAE4	SN: 801	15-Dec-05 (SPEAG, No. DAE4-801_Dec05)	Dec-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41090317	18-Oct-02 (SPEAG, in house check Oct-05)	in house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	in house check: Nov-07
Network Analyzer HP 8753E	US37300585 84206	18-Oct-01 (SPEAG, in house check Oct-06)	in house check: Oct-07

Calibrated by:	Name Mike Meil	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 14, 2006

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Certificate No: D1900V2-5d028\_Dec06

Page 1 of 9

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**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
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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 System Handbook

**Methods Applied and Interpretation of Parameters:**

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



#### Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.4 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.2 $\pm$ 0.2) °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	9.36 mW / g
SAR normalized	normalized to 1W	37.4 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	36.6 mW / g $\pm$ 17.6 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.96 mW / g
SAR normalized	normalized to 1W	19.8 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	19.5 mW / g $\pm$ 16.5 % (k=2)

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

#### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	1.54 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °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	9.50 mW / g
SAR normalized	normalized to 1W	38.0 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	37.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.05 mW / g
SAR normalized	normalized to 1W	20.2 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	19.8 mW / g ± 16.5 % (k=2)

<sup>2</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.8 \Omega + 4.5 j\Omega$
Return Loss	-24.1 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$51.2 \Omega + 6.6 j\Omega$
Return Loss	-23.6 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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.

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, 2002



## DASY4 Validation Report for Head TSL

Date/Time: 11.12.2006 18:50:48

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d028**

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

Medium: HSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.4$  mho/m;  $\epsilon_r = 38.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

### DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); Const(4.97, 4.97, 4.97); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Pin = 250 mW; d = 10 mm/Area Scan (101x101x1):**

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 10.6 mW/g

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

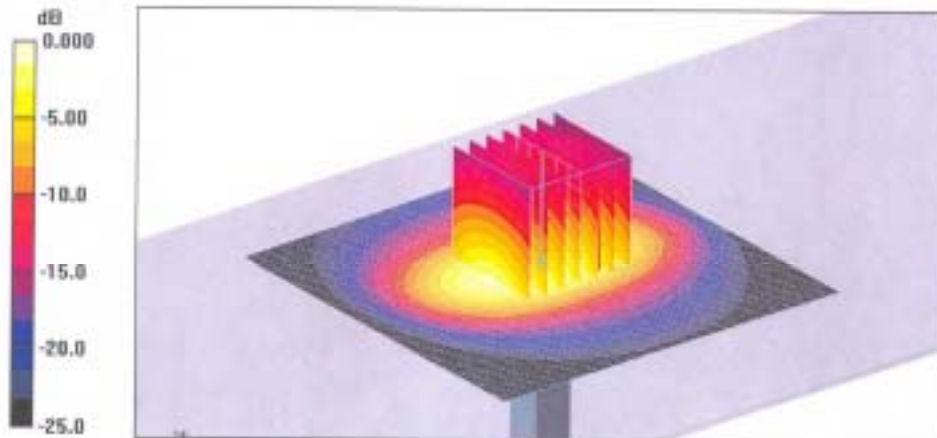
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 86.6 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 15.9 W/kg

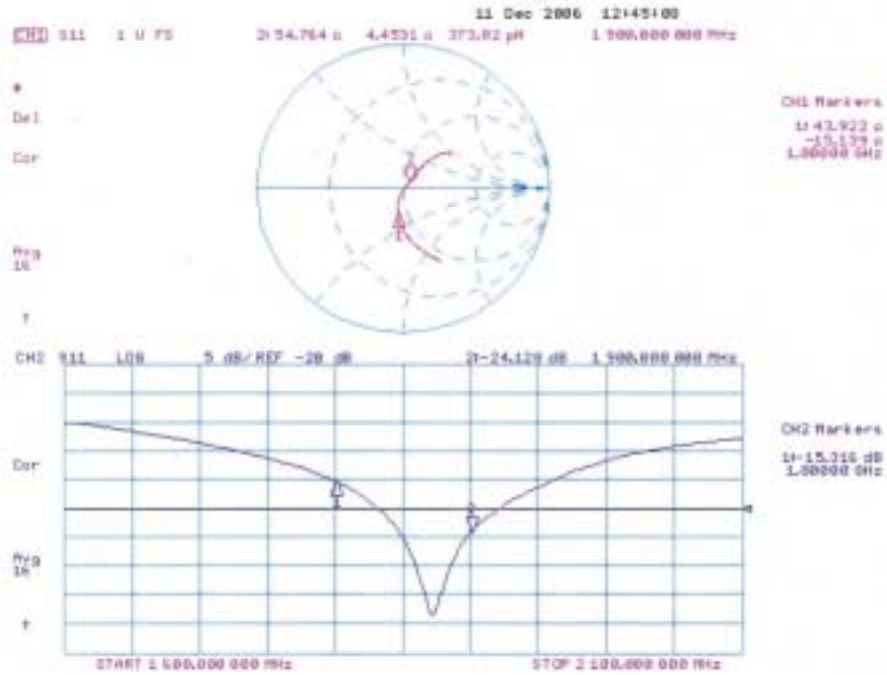
SAR(1 g) = 9.36 mW/g; SAR(10 g) = 4.96 mW/g

Maximum value of SAR (measured) = 10.6 mW/g



0 dB = 10.6mW/g

# Impedance Measurement Plot for Head TSL



## DASY4 Validation Report for Body TSL

Date/Time: 12.12.2006 16:43:40

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d028**

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

Medium: MSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.54$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

### DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); CoaxF(4.43, 4.43, 4.43); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Set01; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD00P50AA
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

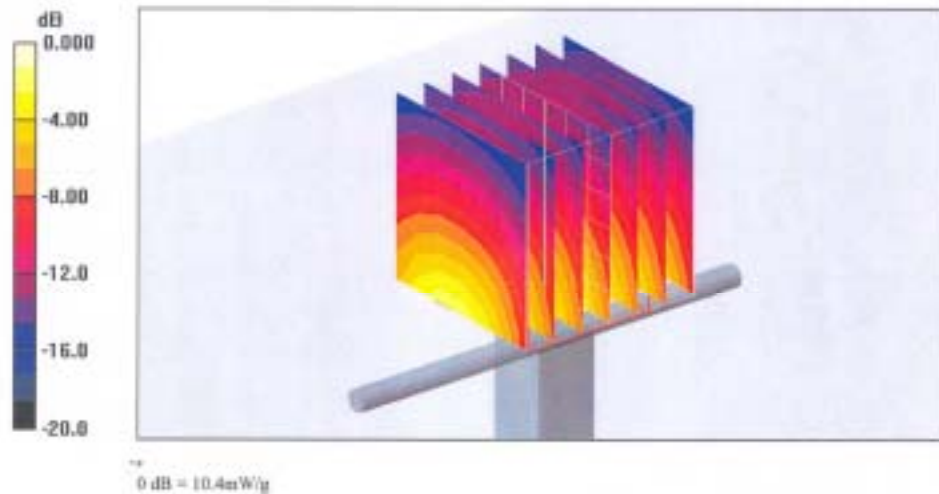
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 89.1 V/m; Power Drift = 0.027 dB

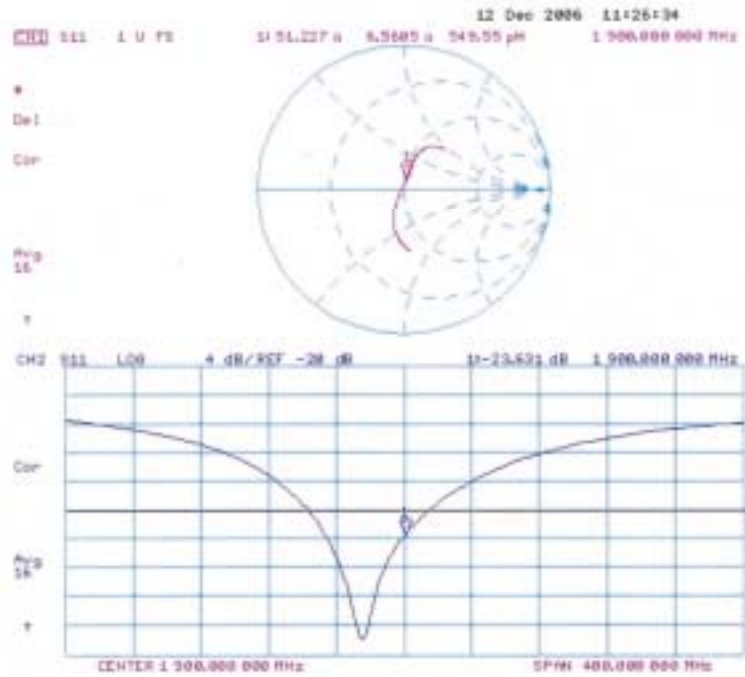
Peak SAR (extrapolated) = 16.2 W/kg

SAR(1 g) = 9.5 mW/g; SAR(10 g) = 5.05 mW/g

Maximum value of SAR (measured) = 10.4 mW/g



# Impedance Measurement Plot for Body TSL



## 8. Uncertainty analysis

Error Description	Tol. (± %)	Prob. dist.	Div.	(c <sub>i</sub> ) (1g)	(c <sub>i</sub> ) (10g)	Std. unc. (± %)		(v <sub>i</sub> )
Measurement System								
Probe Calibration	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	4.7	R	√3	1	1	2.7	2.7	∞
Hemispherical Isotropy	0	R	√3	1	1	0	0	∞
Boundary Effects	1.0	R	√3	1	1	0.6	0.6	∞
Linearity	4.7	R	√3	1	1	2.7	2.7	∞
System Detection Limit	1.0	R	√3	1	1	0.6	0.6	∞
Readout Electronics	1.0	N	1	1	1	1.0	1.0	∞
Response Time	0	R	√3	1	1	0	0	∞
Integration Time	0	R	√3	1	1	0	0	∞
RF Ambient Conditions	3.0	R	√3	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	√3	1	1	0.2	0.2	∞
Probe Positioning	2.9	R	√3	1	1	1.7	1.7	∞
Algorithms for Max. SAR Eval.	1.0	R	√3	1	1	0.6	0.6	∞
Dipole								
Dipole Axis to Liquid Distance	2.0	R	√3	1	1	1.2	1.2	∞
Input power and SAR drift meas.	4.7	R	√3	1	1	2.7	2.7	∞
Phantom and Tissue Param.								
Phantom Uncertainty	4.0	R	√3	1	1	2.3	2.3	∞
Liquid Conductivity (target)	5.0	R.	√3	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (meas.)	2.5	N	1	0.64	0.43	1.6	1.1	∞
Liquid Permittivity (target)	5.0	R	√3	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (meas.)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined Stdandard Uncertainty						8.4	8.1	∞
Coverage Factor for 95%		kp=2						
Expanded Uncertainty						16.8	16.2	

Dasy4 Uncertainty Budget

## 9. Phantom description

### Schmid & Partner Engineering AG

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#### Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 CA
Series No	TP-1150 and higher
Manufacturer / Origin	Unteregg Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

#### Tests

The series production process used allows the limitation to test of first articles. Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1008. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT15 CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz - 3 GHz Relative permittivity < 5 Loss tangent < 0.05	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

#### Standards

- [1] CENELEC EN 50361
- [2] IEEE P1526-200x draft 6.5
- [3] IEC PT 62209 draft 0.9
- (\*) The IT15 CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

#### Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 28.02.2002

Signature / Stamp

*F. Bumbult*

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*Stefan Rigo*

**The end**