



A Test Lab Techno. Corp. RF Testing Lab

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認可編號 : 1330
ILAC MRA

SAR EVALUATION REPORT

Test Report No. :	05-0657-S-00-02-01
Applicant :	CCT R&D Limited
FCC ID :	NC8SD7581
Trade Name :	Motorola
Model Name :	SD758X series, SD7501, SD7500
Battery Type :	Ni-MH Battery (3.6V , 600mAh)
EUT Type :	5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine
Dates of Test :	Nov. 02 - 03 ,2005
Test Environment :	Ambient Temperature : 22 ± 2 °C
Relative Humidity :	< 60%
Test Specification :	Standard C95.1-1999 IEEE Std. 1528-2003
Max. SAR :	0.111 W/kg FHSS Head SAR 0.101 W/kg FHSS Body SAR
FCC Classification:	Part 15 Spread Spectrum Transmitter (DSS)
FCC Rule Part(s):	§2.1093;FCC/OET Bulletin 65 Supplement C [July 2001]
Test Lab :	Tao-Yuan Lab

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Eddie Chen **20051110**

Testing Center Manager

ATL Techno. Corp. RF Testing Lab



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1. Description of Equipment Under Test (EUT)

Applicant :

CCT R&D Limited
18/F., CCT Telecom Building, 11 Wo Shing Street, Fotan, Shatin, N.T. Hong Kong

EUT Type : 5.8GHz Frequency Hopping Spread Spectrum
Cordless Phone with Caller ID, Speakerphone,
and Digital Answering Machine

Trade Name : Motorola

Model Name : SD758X series, SD7501, SD7500

Battery Type : Ni-MH Battery (3.6V , 600mAh)

FCC ID : NC8SD7581

Test Device : Production Unit

Tx Frequency : 5725.809328 – 5848.889420 MHz (FHSS)

Max. RF Conducted Output Power : 0.07 W (18.73 dBm) FHSS

Max. SAR Measurement : 0.111 W/kg FHSS Head SAR
0.101 W/kg FHSS Body SAR

Antenna Type : Fixed Type

Device Category : Portable

RF Exposure Environment : General Population / Uncontrolled

Battery Option : Standard

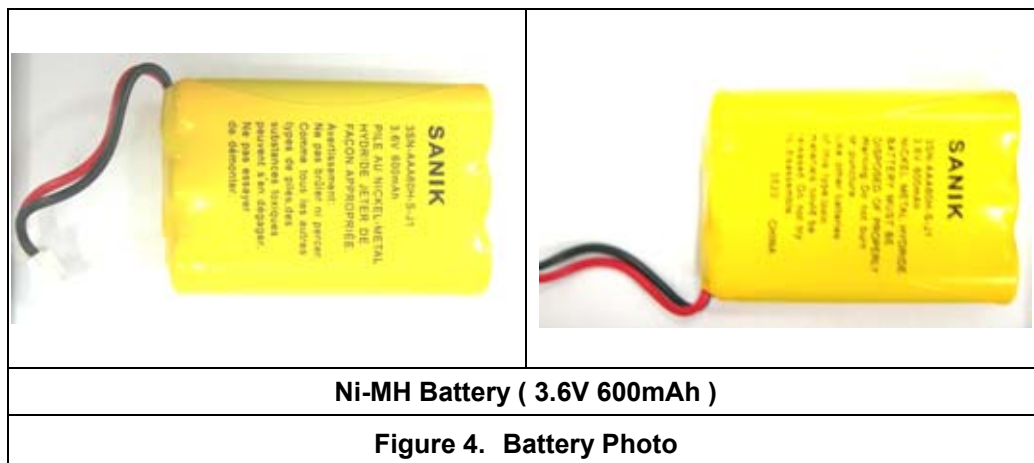
Application Type : Certification

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 Standard C95.1-1999 and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003.



2. Other Accessories

There is headset and Belt-clip will be an accessory with EUT.



3. Introduction

The A Test Lab Techno. Corp. RF Testing Laboratory has performed measurements of the maximum potential exposure to the user of **CCT R&D Limited Trade Name : Motorola Model(s) : SD7581**. The test procedures, as described in American National Standards, , Institute C95.1 - 1999 [1] , FCC/OET Bulletin 65 Supplement C [July 2001] were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

4. SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dw) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

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

Figure 6. SAR Mathematical Equation

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

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

Where :

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m³)

E = 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 relations 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 [2]

5. SAR Measurement Setup

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than $\pm 0.025\text{mm}$. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length = 300mm) to the data acquisition unit.

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Measurement Server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chipdisk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The PC consists of the Intel Pentium 4 2.4GHz computer with Windows2000 system and SAR Measurement Software DASY4, Post Processor SEMCAD, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection...etc. is connected to the Electro-optical converter (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the Measurement Server.

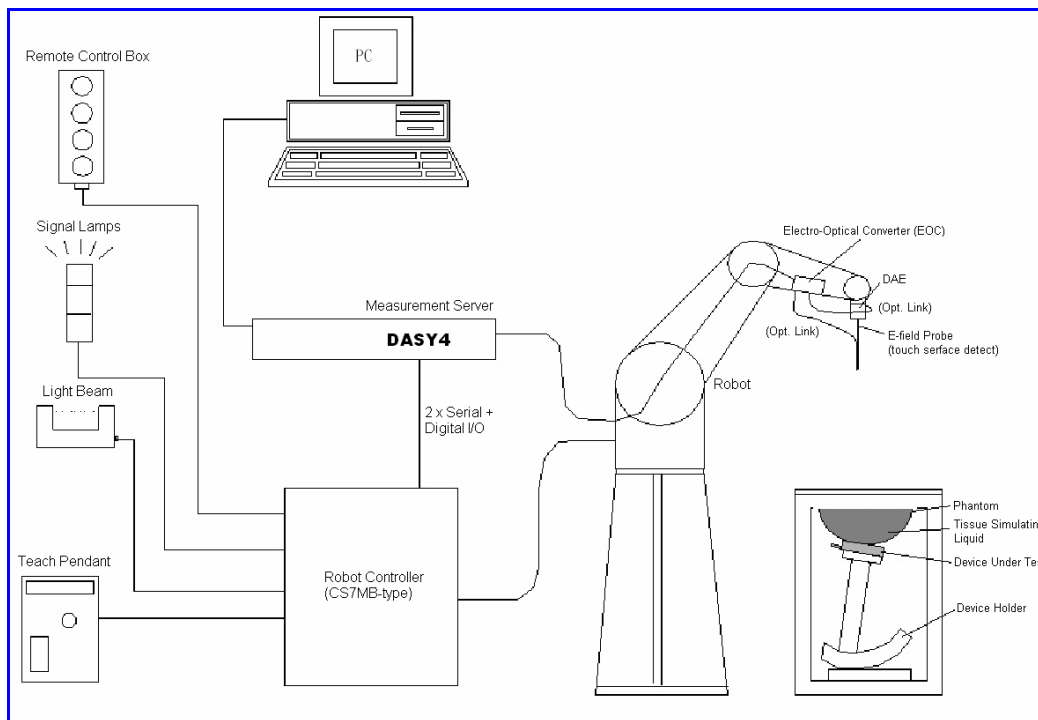


Figure 7. SAR Lab Test Measurement Setup

The DAE3 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [3] .

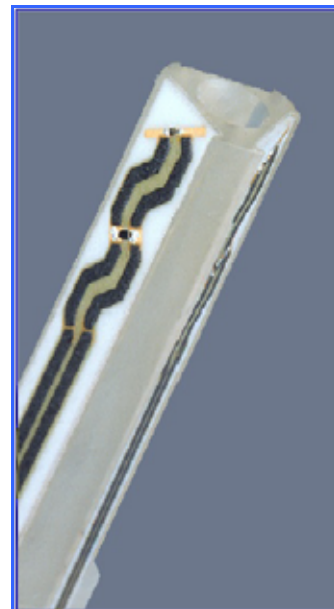
6. System Components

6.1 DASY4 E-Field Probe System

The SAR measurements were conducted with the dosimetric probe ET3DV6 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

6.1.1 EX3DV3 E-Field Probe Specification

Construction	Symmetrical design with triangular core
	Built-in optical fiber for surface detection
	System (EX3DV3 only)
	Built-in shielding against static charges
	PEEK enclosure material (resistant to organic solvents, e.q., glycol)
Calibration	In air from 10 MHz to 6 GHz
	In brain and muscle simulating tissue at frequencies of 900MHz, 1800MHz, 5200MHz and 5500MHz and 5800MHz (accuracy $\pm 8\%$)
	Calibration for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz; Linearity: ± 0.2 dB
	(30 MHz to 3 GHz)
Directivity	± 0.3 dB in brain tissue (rotation around probe axis)
	± 0.5 dB in brain tissue (rotation normal probe axis)
Dynamic Range	10 μ W/g to > 100mW/g; Linearity: ± 0.2 dB
Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surface(EX3DV3 only)
Dimensions	Overall length: 330mm
	Tip length: 20mm
	Body diameter: 12mm
	Tip diameter: 2.5mm
	Distance from probe tip to dipole centers: 1.0mm
Application	General dosimetry up to 6GHz
	Compliance tests of mobile phones
	Fast automatic scanning in arbitrary phantoms



**Figure 8.
EX3DV3 E-field Probe**



**Figure 9.
Probe setup on robot**

6.1.2 EX3DV3 E-Field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure described in [4] with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated with the procedure described in [5] and found to be better than $\pm 0.25\text{dB}$. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1GHz, and in a wave guide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

Where :

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (head or body),

ΔT = Temperature increase due to RF exposure.

Or

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

Where :

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

6.2 Data Acquisition Electronic (DAE) System

Cell Controller

Processor : Intel Pentium 4
Clock Speed : 2.4GHz
Operating System : Windows 2000 Professional

Data Converter

Features : Signal Amplifier, multiplexer, A/D converter, and control logic
Software : DASY4 v4.4 (Build 3) & SEMCAD v1.8 (Build 180)
Connecting Lines : Optical downlink for data and status info
Optical uplink for commands and clock

6.3 Robot

Positioner : Stäubli Unimation Corp. Robot Model: RX90L
Repeatability : ± 0.025 mm
No. of Axis : 6

6.4 Measurement Server

Processor : PC/104 with a 166MHz low-power Pentium
I/O-board : Link to DAE3
16-bit A/D converter for surface detection system
Digital I/O interface
Serial link to robot
Direct emergency stop output for robot

6.5 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device (POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeat ably positioned according to the IEEE SCC34-SC2 and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

***Note :** A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [6] . To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Larger DUT cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values. Therefore those devices are normally only tested at the flat part of the SAM.

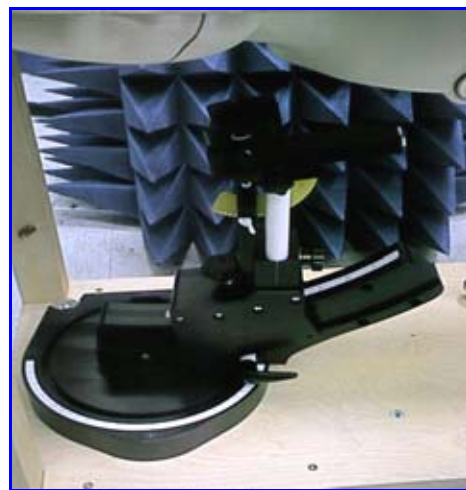


Figure 10. Device Holder

6.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 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. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.



Figure 11. SAM Twin Phantom

Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	810×1000×500 mm (H×L×W)

Table 1. Specification of SAM v4.0

6.7 Data Storage and Evaluation

6.7.1 Data Storage

The DASY4 software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension .DA4. The postprocessing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

6.7.2 Data Evaluation

The DASY4 postprocessing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software :

Probe parameters :	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	dcpi
Device parameters :	- Frequency	f
	- Crest factor	cf
Media parameters :	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as :

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = compensated signal of channel i ($i = x, y, z$)
 U_i = input signal of channel i ($i = x, y, z$)
 cf = crest factor of exciting field (DASY parameter)
 dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated :

E-field probes :

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes :

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with V_i = compensated signal of channel i ($i = x, y, z$)

$Norm_i$ = sensor sensitivity of channel i ($i = x, y, z$)

$\mu V/(V/m)^2$ for E-field Probes

$ConvF$ = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude) :

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with **SAR** = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm³

*** Note :** that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = \frac{H_{tot}^2}{37.7}$$

with P_{pwe} = equivalent power density of a plane wave in mW/cm²

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m

7. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Filed Probe	EX3DV3	3519	Mar. 19, 2004	Mar. 19, 2006
SPEAG	5GHz System Validation Kit	D5GHzV2	1021	Mar.23, 2004	Mar.23, 2006
SPEAG	Data Acquisition Electronics	DAE3	393	April 25, 2005	April 25, 2006
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	Phantom	SAM V4.0	1009	NCR	NCR
SPEAG	Robot	Staubli RX90L	F00/589B1/A/01	NCR	NCR
SPEAG	Software	DASY4 V4.6 Build 19	N/A	NCR	NCR
SPEAG	Software	SEMCAD V1.8 Build 159	N/A	NCR	NCR
SPEAG	Measurement Server	SE UMS 001 BA	1021	NCR	NCR
Agilent	Wireless Communication Test Set	8960(E5515C)	GB41450409	Jan.31,2005	Jan.31,2007
Agilent	S-Parameter Network Analyzer	8720ES	US39172472	Sep. 05, 2005	Sep. 05, 2006
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	NCR
Agilent	Power Meter	E4418B	GB40206143	Jun 14, 2005	Jun 14, 2006
Agilent	Power Sensor	8481H	3318A20779	Jun 14, 2005	Jun 14, 2006
Agilent	Signal Generator	8648C	3847A05201	July 13, 2004	July 13, 2006
Agilent	Dual Directional Coupler	778D	50334	NCR	NCR
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	NCR
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	NCR

Table 2. Test Equipment List

8. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8720ES Network Analyzer.

INGREDIENT	FREQUENCY	
	HSL5G (Head)	MSL5G (Body)
Water	64%	78%
Mineral Oil	18%	11%
Emulsifiers	15%	9%
Additives and Salt	3%	2%

Table 3. Recipes for Head & Body Tissue Simulating Liquids

IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

Target Frequency	Head		Body	
(MHz)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 - 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00
(ϵ_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m ³)				

Table 4. Tissue dielectric parameters for head and body phantoms

8.1 Liquid Confirmation

8.1.1 Parameters

Liquid Verify								
Ambient Temperature : 22±2 °C ; Relative Humidity : < 60%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
5.8GHz Head	5.8GHz	22.0	ϵ_r	35.4	34.83	-1.61%	±5 %	Nov. 02 , 2005
			σ	5.2	5.31	2.12%	±5 %	
5.8GHz Body	5.8GHz	22.0	ϵ_r	48.5	46.11	-4.93%	±5 %	Nov. 02 , 2005
			σ	6.01	6.03	0.33%	±5 %	

Table 5. Measured Tissue dielectric parameters for head and body phantoms

8.1.2 Liquid Depth

The liquid level was during measurement 15cm $\pm$ 0.5cm.

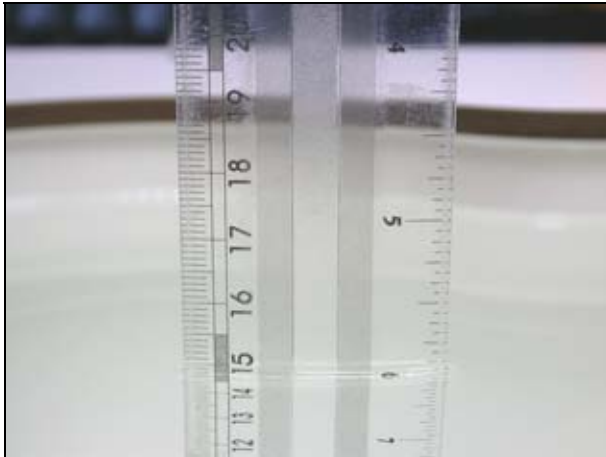


Figure 12. Head-Tissue-Simulating-Liquid 5.8GHz

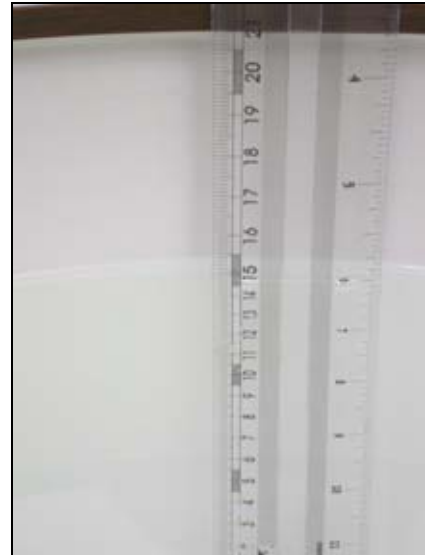


Figure 13. Body-Tissue-Simulating-Liquid 5.8GHz

9. Measurement Process

9.1 Device and Test Conditions

The Test Device was provided by **CCT R&D Limited** for this evaluation. The spatial peak SAR values were assessed for the lowest, middle and highest channels defined by FHSS (Ch1 = 5725.809328MHz , Ch70 = 5787.350344MHz , Ch139 = 5848.889420MHz) systems. The antenna(s), battery and accessories shall be those specified by the manufacturer. The battery shall be fully charged before each measurement and there shall be no external connections.

9.2 System Performance Check

9.2.1 Symmetric Dipoles for System Validation

Construction	Symmetrical dipole with 1/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	450, 900, 1800, 2450, 5000MHz
Return Loss	> 20 dB at specified validation position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D450V2 : dipole length 270 mm; overall height 330 mm D900V2 : dipole length 149 mm; overall height 330 mm D1800V2 : dipole length 72 mm; overall height 300 mm D2450V2 : dipole length 51.5 mm; overall height 300 mm D5GHzV2 : dipole length 20.6 mm; overall height 450 mm



Figure 14. Validation Kit

9.2.2 Validation

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of $\pm 7\%$. The validation was performed at 5800MHz.

Validation kit		Mixture Type		SAR _{1g} [mW/g]	SAR _{10g} [mW/g]	Date of Calibration	
D5GHzV2-SN1021		Head		81.2	22.6	Mar. 23, 2004	
		Body		72.0	20.0		
Frequency (MHz)	Power (dBm)	SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	Drift (dB)	Difference percentage		Date
					1g	10g	
5800 (Head)	250mW	20.8	5.93	-0.1	2.5 %	4.8 %	Nov. 02 , 2005
	Normalize to 1 Watt	83.2	23.72				
5800 (Body)	250mW	18.6	5.26	0.0	3.3 %	5.0 %	Nov. 02 , 2005
	Normalize to 1 Watt	74.4	21.04				

9.3 Dosimetric Assessment Setup

9.3.1 Headset Test Position – Body-Worn

Body-Worn Configuration

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a handset output should be tested with a handset connected to the device.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances.

For this test :

- ☒ The EUT is placed into the holster/belt clip and the holster is positioned against the surface of the phantom in a normal operating position.
- ☐ Since this EUT doesn't supply any body-worn accessory to the end user, a distance of 1.5 cm was tested to confirm the necessary "minimum SAR separation distance".
 (* **Note** : this distance includes the 2 mm phantom shell thickness.)

9.3.2 Measurement Procedures

The evaluation was performed with the following procedures :

- Surface Check :** A surface check job gathers data used with optical surface detection. It determines the distance from the phantom surface where the reflection from the optical detector has its peak. Any following measurement jobs using optical surface detection will then rely on this value. The surface check performs its search a specified number of times, so that the repeatability can be verified.
- Reference :** The reference job measures the field at a specified reference position, at 4 mm from the selected section's grid reference point.
- Area Scan :** The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines can find the maximum locations even in relatively coarse grids. When an area scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. Any following zoom scan within the same procedure will then perform fine scans around these maxima. The area covered the entire dimension of the EUT and the horizontal grid spacing was 15 mm × 15 mm.
- Zoom Scan :** Zoom scans are used to assess the highest averaged SAR for cubic averaging volumes with 1 g and 10 g of simulated tissue. The zoom scan measures 5 x 5 x 7 points in a 32 x 32 x 30 mm cube whose base faces are centered around the maxima returned from a preceding area scan within the same procedure.
- Drift :** The drift job measures the field at the same location as the most recent reference job within the same procedure, with the same settings. The drift measurement gives the field difference in dB from the last reference measurement. Several drift measurements are possible for each reference measurement. This allows monitoring of the power drift of the device in the batch process. If the value changed by more than 5%, the evaluation was repeated.

9.4 Spatial Peak SAR Evaluation

The DASY4 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. Based on the Draft: SCC-34, SC-2, WG-2 - Computational Dosimetry, IEEE P1529/D0.0 (Draft Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) Associated with the Use of Wireless Handsets - Computational Techniques), a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a "cube" measurement in a volume of $(32 \times 32 \times 30) \text{mm}^3$ ($5 \times 5 \times 7$ points). The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Postprocessing engine (SEMCAD). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Postprocessing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into three stages:

Interpolation and Extrapolation

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY4, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and SAR extrapolation routines. The interpolation, Maxima Search and extrapolation routines are all based on the modified Quadratic Shepard's method [7].

10. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than $\pm 27\%$ [8] .

According to Std. C95.3 [9] , the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ± 1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ± 2 dB can be expected.

According to CENELEC [10] , typical worst-case uncertainty of field measurements is ± 5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ± 3 dB.

Source of Uncertainty	Uncertainty Value	Probability Distribution	Divisor	C_i	Standard Uncertainty $\pm 1\%$ (1-g)	V_i or V_{eff}
Type-A	0.9 %	Normal	1	1	0.9	9
Measurement System						
Probe Calibration	7 %	Normal	2	1	3.5	∞
Axial Isotropy	0.2dB	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
Hemispherical Isotropy	9.6 %	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
Spatial Resolution	0 %	Rectangular	$\sqrt{3}$	1	0	∞
Boundary Effect	11.0 %	Rectangular	$\sqrt{3}$	1	6.4	∞
Linearity	0.2dB	Rectangular	$\sqrt{3}$	1	2.7	∞
Detection Limit	1.0 %	Rectangular	$\sqrt{3}$	1	0.6	∞
Readout Electronics	1.0 %	Normal	1	1	1.0	∞
RF Ambient Conditions	3.0 %	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner Mech. Const.	0.4 %	Rectangular	$\sqrt{3}$	1	0.2	∞
Probe Positioning	0.35 %	Rectangular	$\sqrt{3}$	1	0.2	∞
Extrapolation and Integration	3.9 %	Rectangular	$\sqrt{3}$	1	2.3	∞
Test sample Related						
Test sample Positioning	4.7 %	Normal	1	1	4.7	5
Device Holder Uncertainty	6.1 %	Normal	1	1	6.1	5
Drift of Output Power	5.0 %	Rectangular	$\sqrt{3}$	1	2.9	∞
Phantom and Setup						
Phantom Uncertainty (Including temperature effects)	4.0%	Rectangular	$\sqrt{3}$	1	2.3	∞
Liquid Conductivity (target)	5.0%	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Liquid Conductivity (meas.)	10.0%	Rectangular	$\sqrt{3}$	0.6	3.4	∞
Liquid Permittivity (target)	5.0%	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Liquid Permittivity (meas.)	5.0%	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Combined standard uncertainty		RSS			13.5	88.7
Expanded uncertainty (Coverage factor = 2)		Normal (k=2)			27	

Table 6. Uncertainty Budget of DASY

11. SAR Test Results Summary

11.1 FHSS Head SAR – SD7581

Ambient :

Temperature (°C) :

22 ± 2

Relative HUMIDITY (%) :

< 60
Liquid :

Mixture Type :

HSL5800

Liquid Temperature (°C) :

22.0

Depth of liquid (cm) :

15
Measurement :

Crest Factor :

1

Probe S/N :

3519

Frequency		Battery	Phantom Position	Accessory	SAR _{1g} [mW/g]	Power Drift	Temp.		Remark
MHz	CH						Amb.	Liq.	
5725.809328	1	Ni-MH	Right-Cheek	N/A	0.044	0.009	22.2	22.0	-
5787.350344	70	Ni-MH	Right-Cheek	N/A	0.039	0.171	22.3	22.0	-
5848.889420	139	Ni-MH	Right-Cheek	N/A	0.029	0.155	22.3	22.0	-
5725.809328	1	Ni-MH	Right-Tilted	N/A	0.087	-0.102	22.4	22.0	-
5787.350344	70	Ni-MH	Right-Tilted	N/A	0.107	0.159	22.1	22.0	-
5848.889420	139	Ni-MH	Right-Tilted	N/A	0.111	0.178	22.1	22.0	-
5725.809328	1	Ni-MH	Left-Cheek	N/A	0.046	-0.114	22.2	22.0	-
5787.350344	70	Ni-MH	Left-Cheek	N/A	0.057	-0.108	22.2	22.0	-
5848.889420	139	Ni-MH	Left-Cheek	N/A	0.03	0.109	22.4	22.0	-
5725.809328	1	Ni-MH	Left-Tilted	N/A	0.102	0.069	22.3	22.0	-
5787.350344	70	Ni-MH	Left-Tilted	N/A	0.1	0.182	22.1	22.0	-
5848.889420	139	Ni-MH	Left-Tilted	N/A	0.083	-0.119	22.2	22.0	-
Std. C95.1-1999 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				



Figure 13. Right Head SAR Test Setup (Cheek)



Figure 14. Right Head SAR Test Setup (Tilted)



Figure 15. Left Head SAR Test Setup (Cheek)



Figure 16. Left Head SAR Test Setup (Tilted)



Figure 17. Body SAR Test Setup (Flat Section)



Figure 18. Body SAR Test Setup (Flat Section)

11.2 FHSS Body SAR – SD7581

Ambient :

Temperature (°C) :

22 ± 2

Relative HUMIDITY (%) :

< 60
Liquid :

Mixture Type :

HSL5800

Liquid Temperature (°C) :

22.0

Depth of liquid (cm) :

15
Measurement :

Crest Factor :

1

Probe S/N :

3519

Frequency		Battery	Phantom Position	Accessory	SAR _{1g} [mW/g]	Power Drift	Temp.		Remark
MHz	CH						Amb.	Liq.	
5725.809328	1	Ni-MH	Flat	Headset	0.092	0.006	22.3	22.0	-
5787.350344	70	Ni-MH	Flat	Headset	0.101	0.084	22.2	22.0	-
5848.889420	139	Ni-MH	Flat	Headset	0.074	0.05	22.3	22.0	-
Std. C95.1-1999 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				



Figure 25. Body SAR Test Setup (Flat Section)

11.3 Std. C95.1-1999 RF Exposure Limit

Human Exposure	Population Uncontrolled Exposure (W/kg) or (mW/g)	Occupational Controlled Exposure (W/kg) or (mW/g)
Spatial Peak SAR* (head)	1.60	8.00
Spatial Peak SAR** (Whole Body)	0.08	0.40
Spatial Peak SAR*** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 7. Safety Limits for Partial Body Exposure

Notes :

- * 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.
- ** The Spatial Average value of the SAR averaged over the whole – body.
- *** 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.

Population / Uncontrolled Environments : are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational / 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).

12. Conclusion

The SAR test values found for the portable mobile phone **CCT R&D Limited Trade Name : Motorola Model(s) : SD7581**, are below the maximum recommended level of 1.6 W/kg (mW/g).

13. References

- [1] Std. C95.1-1999, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz*", New York.
- [2] NCRP, National Council on Radiation Protection and Measurements, "*Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields*", NCRP report NO. 86, 1986.
- [3] T. Schmid, O. Egger, and N. Kuster, "*Automatic E-field scanning system for dosimetric assessments*", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.
- [4] K. Poković, T. Schmid, and N. Kuster, "*Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency*", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.
- [5] K. Poković, T. Schmid, and N. Kuster, "*E-field probe with improved isotropy in brain simulating liquids*", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.
- [6] 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.
- [7] Robert J. Renka, "*Multivariate Interpolation Of Large Sets Of Scattered Data*", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.
- [8] 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.
- [9] Std. C95.3-1991, "*IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave*", New York: IEEE, Aug. 1992.
- [10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), "*Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz*", Jan. 1995.

Appendix A – System Performance Check

Date/Time: 11/2/2005 1:21:14 AM

Test Laboratory: A Test Lab Techno Corp.

System Performance Head 5800MHz_20051102_

DUT: Dipole 5800 MHz - SN:1021; Type: D5GHzV2; Serial: D5GHzV2 - SN:1021

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

Medium: Head 5800MHz Medium parameters used: $f = 5800$ MHz;

$s = 5.31$ mho/m; $\epsilon_r = 34.83$; density = 1000 kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

System Performance/Area Scan (61x61x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm ; Maximum value of SAR (interpolated) = 21.4 mW/g

System Performance/Zoom Scan (8x8x8)/Cube 0:

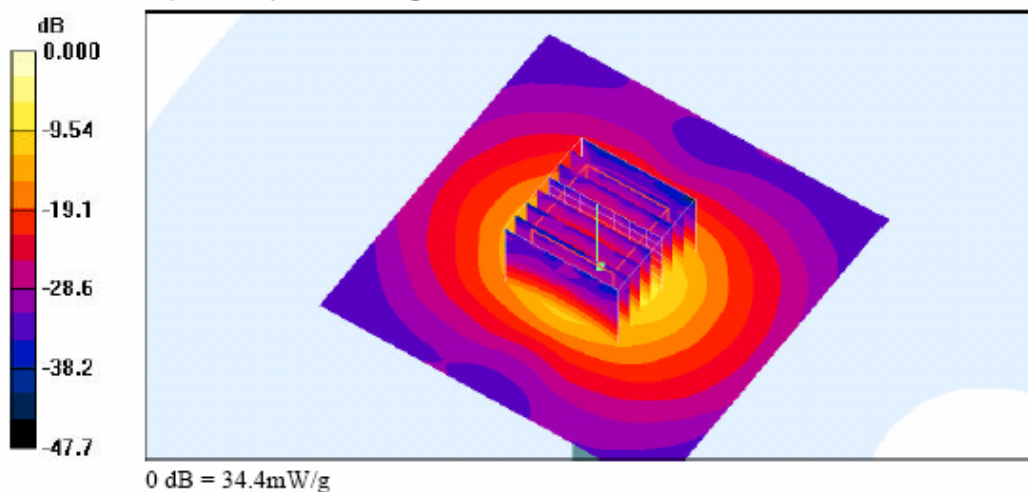
Measurement grid: $dx=4.3$ mm, $dy=4.3$ mm, $dz=3$ mm

Reference Value = 65.4 V/m; Power Drift = -0.075 dB

Peak SAR (extrapolated) = 96.5 W/kg

SAR(1 g) = 20.8 mW/g; SAR(10 g) = 5.93 mW/g

Maximum value of SAR (measured) = 34.4 mW/g



Head-Tissue-Simulating-Liquid 5.8GHz

Date/Time: 11/02/2005 10:31:33 PM

Test Laboratory: A Test Lab Techno Corp.

System Performance Body 5800MHz_20051031_

DUT: Dipole 5800 MHz - SN:1021; Type: D5GHzV2; Serial: D5GHzV2 - SN:1021

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

Medium: body 5800MHz Medium parameters used: $f = 5800$ MHz;

$s = 6.03$ mho/m; $\epsilon_r = 46.11$; density = 1000 kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(3.82, 3.82, 3.82); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

System Performance/Area Scan (61x61x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 20.6 mW/g

System Performance/Zoom Scan (8x8x8)/Cube 0:

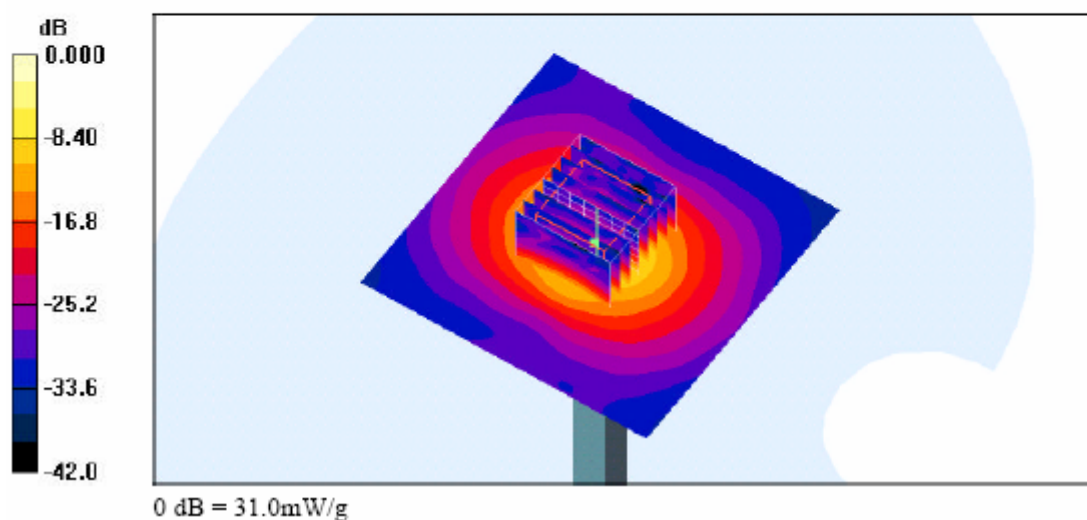
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 60.2 V/m; Power Drift = -0.517 dB

Peak SAR (extrapolated) = 87.9 W/kg

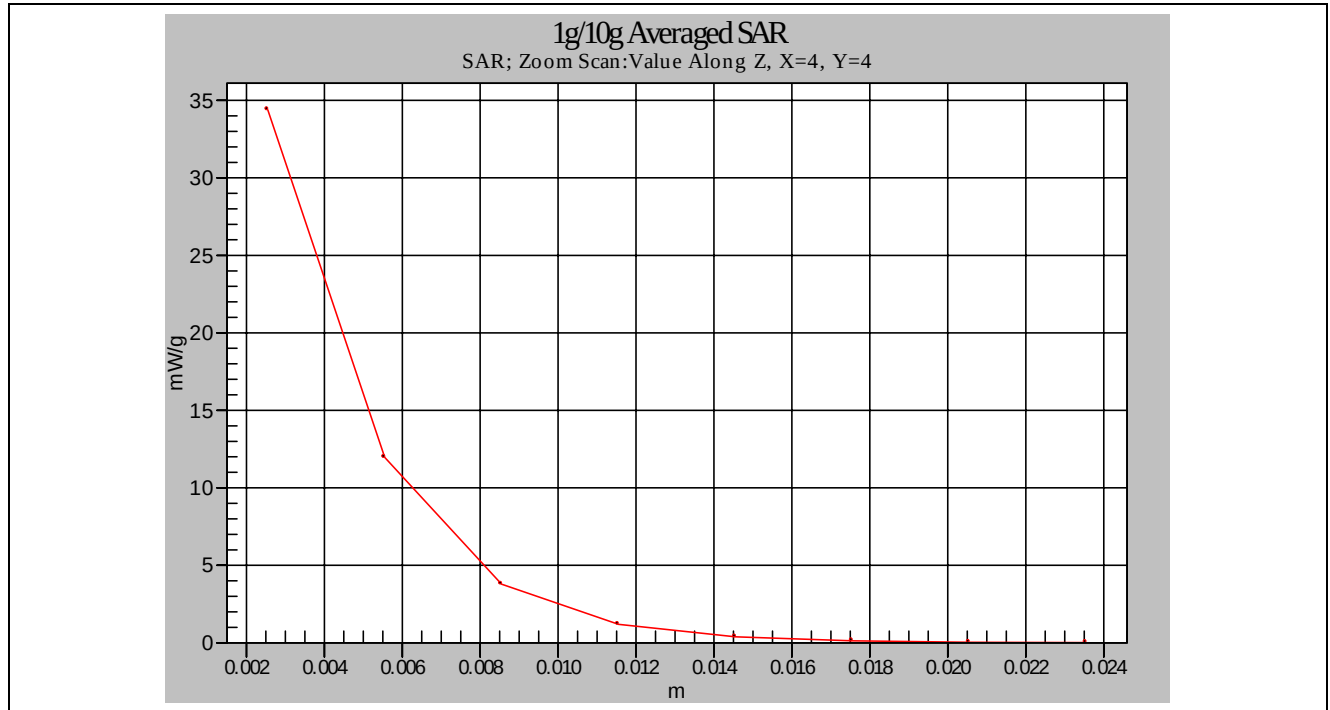
SAR(1 g) = 18.6 mW/g; SAR(10 g) = 5.26 mW/g

Maximum value of SAR (measured) = 31.0 mW/g

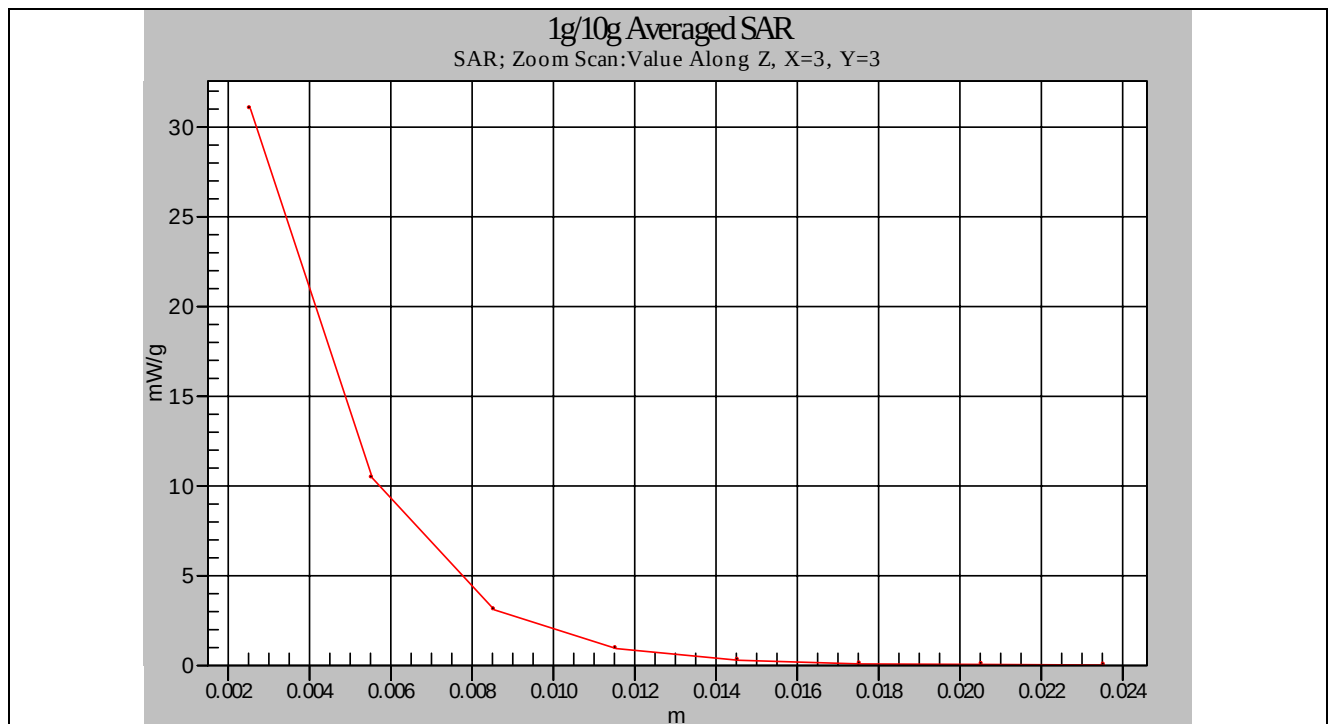


Body-Tissue-Simulating-Liquid 5.8GHz

Z-axis Plot of System Performance Check



Head-Tissue-Simulating-Liquid 5.8GHz



Body-Tissue-Simulating-Liquid 5.8GHz

Appendix B – SAR Measurement Data

Date/Time: 11/2/2005 10:05:58 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Right Cheek_FHSS CH1_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5725.809328 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5725.809328$ MHz;

$s = 5.23$ mho/m; $\epsilon_r = 34.9$; density = 1000 kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Right Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.085 mW/g

Right Cheek/Zoom Scan (5x5x7)/Cube 0:

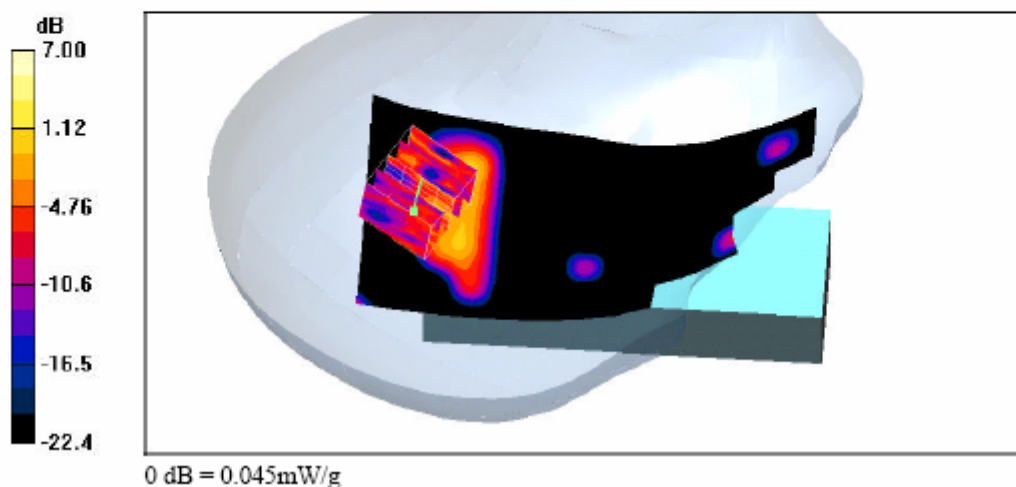
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.15 V/m; Power Drift = 0.009 dB

Peak SAR (extrapolated) = 0.208 W/kg

SAR(1 g) = 0.044 mW/g; SAR(10 g) = 0.015 mW/g

Maximum value of SAR (measured) = 0.045 mW/g



Head-SAR Test Result for Right Cheek Position – Channel 1

Date/Time: 11/2/2005 10:28:50 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Right Cheek_FHSS CH70_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5787.350344 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5787.350344$ MHz;

$s = 5.3$ mho/m; $\epsilon_r = 34.8$; density = 1000 kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Right Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.069 mW/g

Right Cheek/Zoom Scan (5x5x7)/Cube 0:

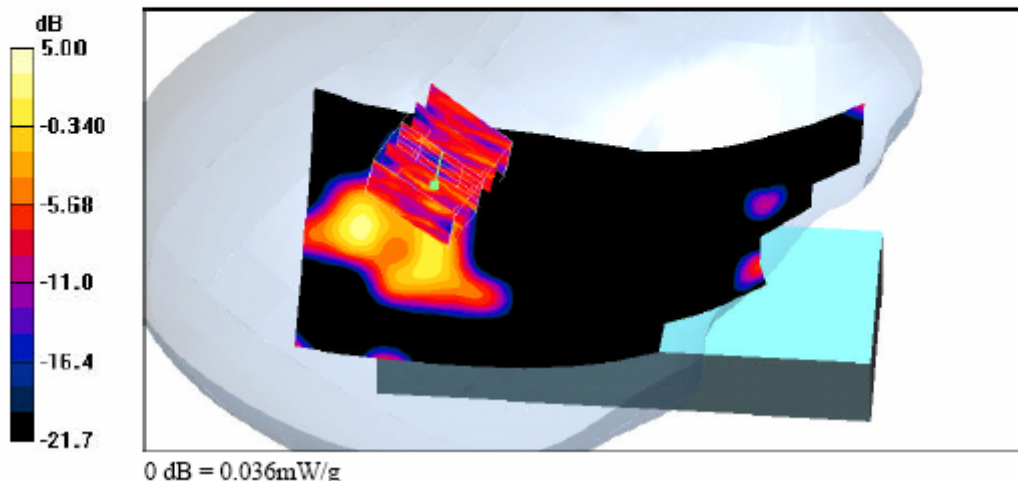
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.46 V/m; Power Drift = 0.171 dB

Peak SAR (extrapolated) = 0.188 W/kg

SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.013 mW/g

Maximum value of SAR (measured) = 0.036 mW/g



Head-SAR Test Result for Right Cheek Position – Channel 70

Date/Time: 11/2/2005 10:53:51 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Right Cheek_FHSS CH139_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5848.889420 MHz; Duty Cycle: 1:1
Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5848.889420$ MHz;
 $s = 5.38$ mho/m; $\epsilon_r = 34.7$; density = 1000 kg/m³
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

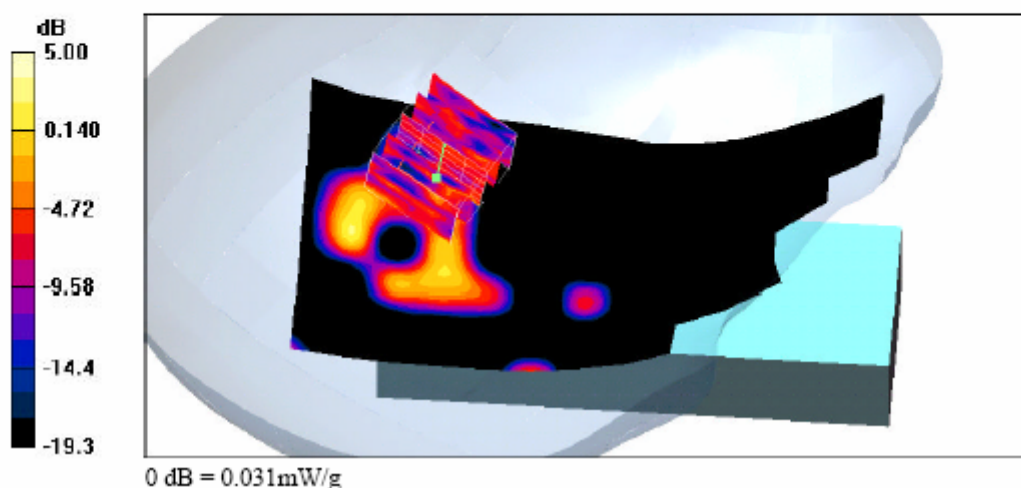
- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Right Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.070 mW/g

Right Cheek/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.54 V/m; Power Drift = 0.155 dB
Peak SAR (extrapolated) = 0.136 W/kg
SAR(1 g) = 0.029 mW/g; SAR(10 g) = 0.00855 mW/g
Maximum value of SAR (measured) = 0.031 mW/g



Head-SAR Test Result for Right Cheek Position – Channel 139

Date/Time: 11/2/2005 11:23:19 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Right Tilted_FHSS CH1_20051102_

**DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID,
Speakerphone, and Digital Answering Machine**

Communication System: FHSS; Frequency: 5725.809328 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5725.809328$ MHz;

$s = 5.23$ mho/m; $\epsilon_r = 34.9$; density = 1000 kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Right Cheek/Area Scan (61x131x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm ; Maximum value of SAR (interpolated) = 0.070 mW/g

Right Cheek/Zoom Scan (5x5x7)/Cube 0:

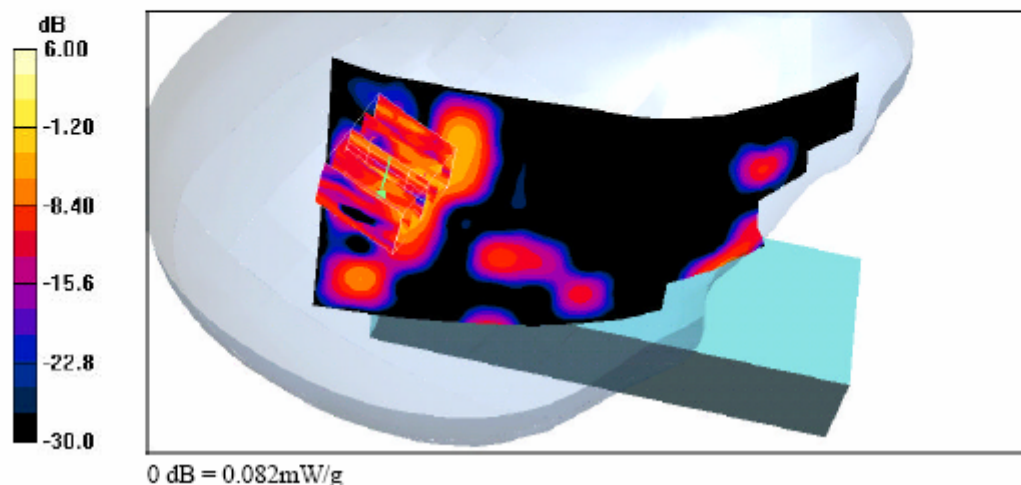
Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 2.00 V/m; Power Drift = -0.102 dB

Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.087 mW/g; SAR(10 g) = 0.029 mW/g

Maximum value of SAR (measured) = 0.082 mW/g



Head-SAR Test Result for Right Tilted Position – Channel 1

Date/Time: 11/2/2005 11:50:14 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Right Tilted_FHSS CH70_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5787.350344 MHz; Duty Cycle: 1:1
Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5787.350344$ MHz;
 $s = 5.3$ mho/m; $\epsilon_r = 34.8$; density = 1000 kg/m³
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Right Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.220 mW/g

Right Cheek/Zoom Scan (5x5x7)/Cube 0:

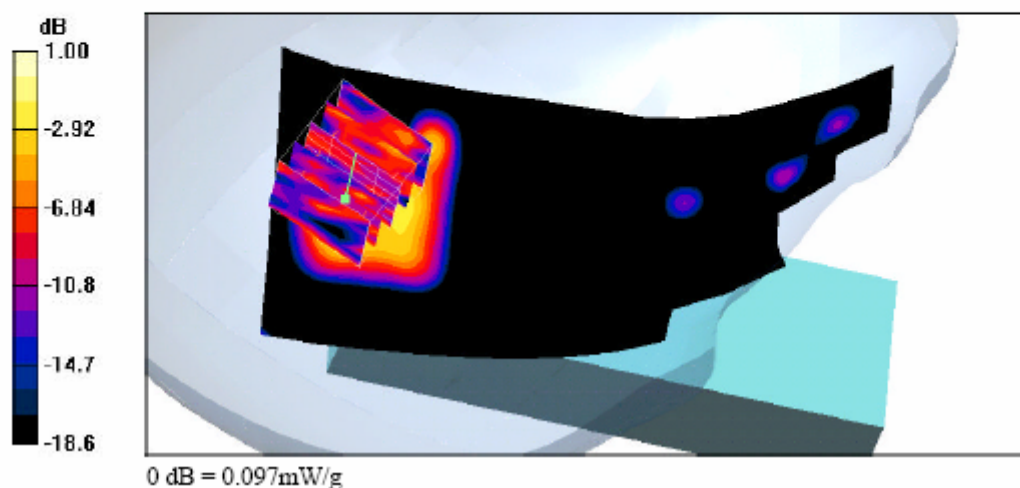
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.04 V/m; Power Drift = 0.159 dB

Peak SAR (extrapolated) = 0.511 W/kg

SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.035 mW/g

Maximum value of SAR (measured) = 0.097 mW/g



Head-SAR Test Result for Right Tilted Position – Channel 70

Date/Time: 11/2/2005 12:15:51 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Right Tilted_FHSS CH139_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID,

Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5848.889420 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5848.889420$ MHz;

$s = 5.38$ mho/m; $\epsilon_r = 34.7$; density = 1000 kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Right Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.174 mW/g

Right Cheek/Zoom Scan (5x5x7)/Cube 0:

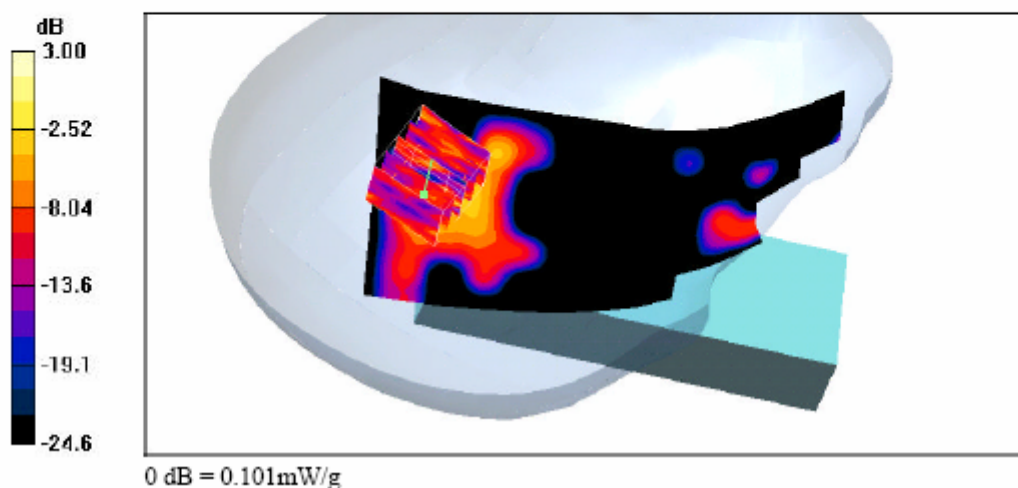
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.05 V/m; Power Drift = 0.178 dB

Peak SAR (extrapolated) = 0.461 W/kg

SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.035 mW/g

Maximum value of SAR (measured) = 0.101 mW/g



Head-SAR Test Result for Right Tilted Position – Channel 139

Date/Time: 11/2/2005 1:53:26 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Left Cheek_FHSS CH1_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5725.809328 MHz; Duty Cycle: 1:1
Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5725.809328$ MHz;
 $s = 5.23$ mho/m; $\epsilon_r = 34.9$; density = 1000 kg/m³
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Left Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.047 mW/g

Left Cheek/Zoom Scan (5x5x7)/Cube 0:

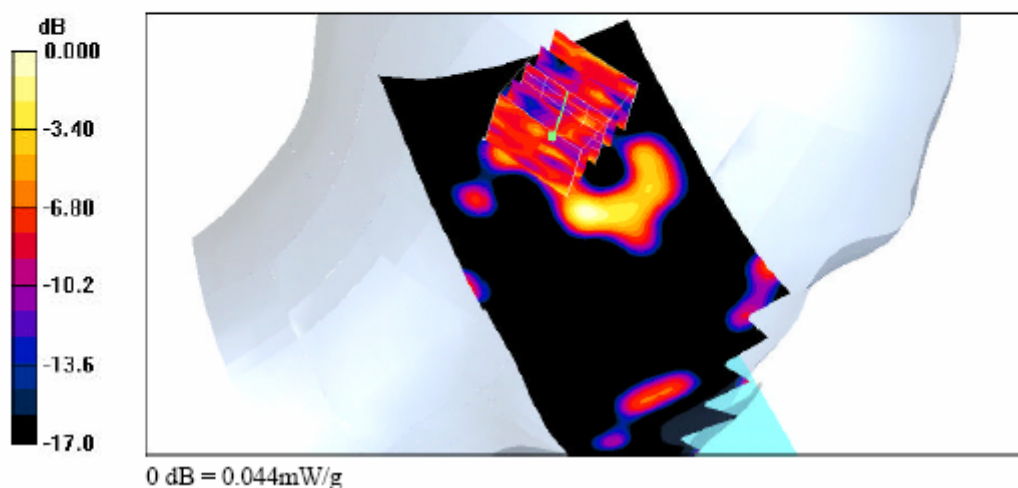
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.84 V/m; Power Drift = -0.114 dB

Peak SAR (extrapolated) = 0.225 W/kg

SAR(1 g) = 0.046 mW/g; SAR(10 g) = 0.014 mW/g

Maximum value of SAR (measured) = 0.044 mW/g

**Head-SAR Test Result for Left Cheek Position – Channel 1**

Date/Time: 11/2/2005 2:20:28 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Left Cheek_FHSS CH70_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5787.350344 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5787.350344$ MHz;

$s = 5.3$ mho/m; $\epsilon_r = 34.8$; density = 1000 kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Left Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.092 mW/g

Left Cheek/Zoom Scan (5x5x7)/Cube 0:

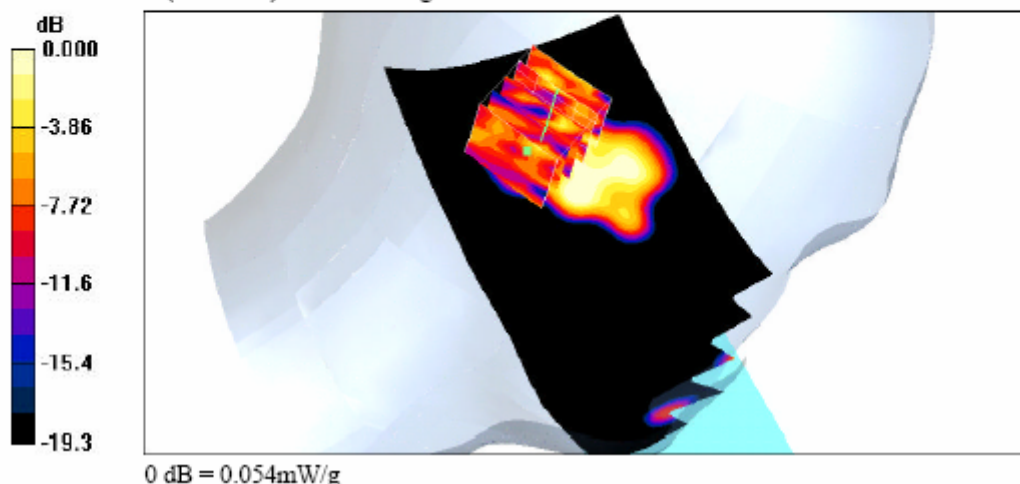
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.02 V/m; Power Drift = -0.108 dB

Peak SAR (extrapolated) = 0.151 W/kg

SAR(1 g) = 0.057 mW/g; SAR(10 g) = 0.014 mW/g

Maximum value of SAR (measured) = 0.054 mW/g



Head-SAR Test Result for Left Cheek Position – Channel 70

Date/Time: 11/2/2005 2:42:57 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Left Cheek_FHSS CH139_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5848.889420 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5848.889420$ MHz;

$s = 5.38$ mho/m; $e_r = 34.7$; density = 1000 kg/m³

Phantom section: Left Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Left Cheek/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.112 mW/g

Left Cheek/Zoom Scan (5x5x7)/Cube 0:

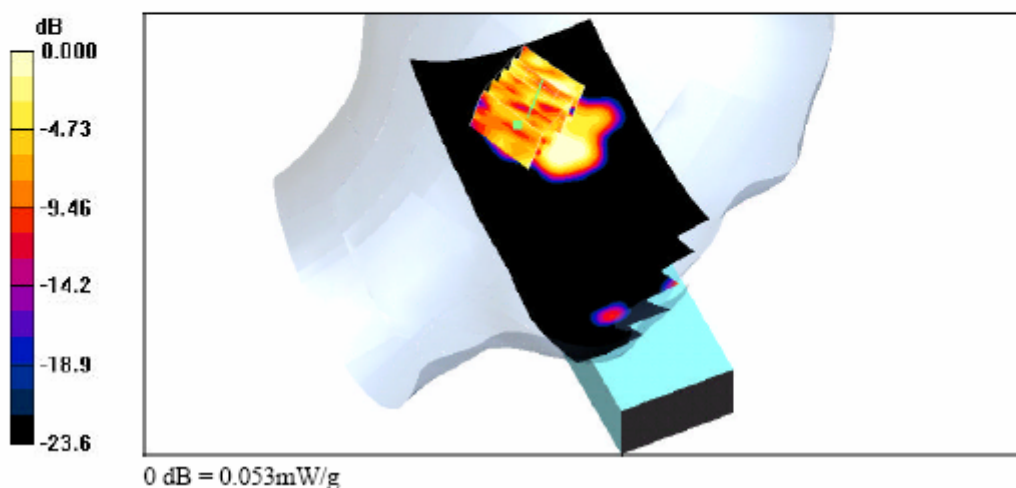
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.54 V/m; Power Drift = 0.109 dB

Peak SAR (extrapolated) = 0.133 W/kg

SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.00624 mW/g

Maximum value of SAR (measured) = 0.053 mW/g



Head-SAR Test Result for Left Cheek Position – Channel 139

Date/Time: 11/2/2005 3:02:47 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Left Tilted_FHSS CH1_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5725.809328 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5725.809328$ MHz;

$s = 5.23$ mho/m; $\epsilon_r = 34.9$; density = 1000 kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Left Tilted/Area Scan (61x131x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm ; Maximum value of SAR (interpolated) = 0.233 mW/g

Left Tilted/Zoom Scan (5x5x7)/Cube 0:

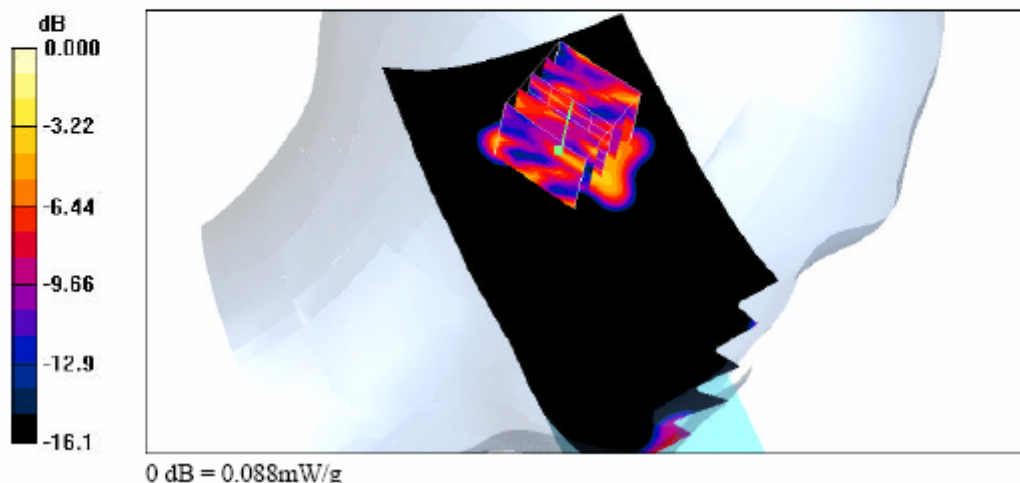
Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 2.80 V/m; Power Drift = 0.069 dB

Peak SAR (extrapolated) = 0.489 W/kg

SAR(1 g) = 0.102 mW/g; SAR(10 g) = 0.031 mW/g

Maximum value of SAR (measured) = 0.088 mW/g



Head-SAR Test Result for Left Tilted Position – Channel 1

Date/Time: 11/2/2005 3:22:40 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Left Tilted_FHSS CH70_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5787.350344 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5787.350344$ MHz;

$s = 5.3$ mho/m; $\epsilon_r = 34.8$; density = 1000 kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Left Tilted/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.123 mW/g

Left Tilted/Zoom Scan (5x5x7)/Cube 0:

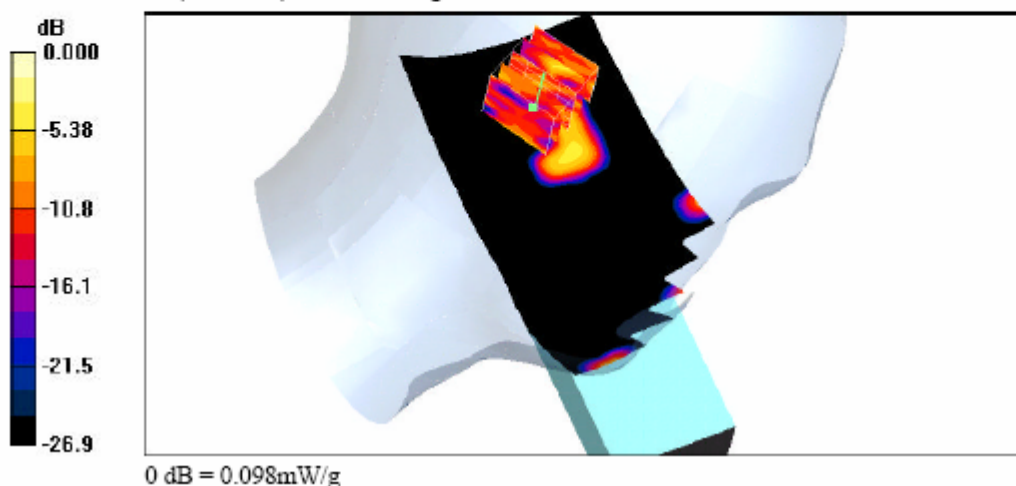
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.79 V/m; Power Drift = 0.182 dB

Peak SAR (extrapolated) = 0.471 W/kg

SAR(1 g) = 0.100 mW/g; SAR(10 g) = 0.030 mW/g

Maximum value of SAR (measured) = 0.098 mW/g



Head-SAR Test Result for Left Tilted Position – Channel 70

Date/Time: 11/2/2005 3:57:03 PM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Left Tilted_FHSS CH139_20051102_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5848.889420 MHz; Duty Cycle: 1:1

Medium: Head 5800MHz Medium parameters used (interpolated): $f = 5848.889420$ MHz;

$s = 5.38$ mho/m; $\epsilon_r = 34.7$; density = 1000 kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(4.34, 4.34, 4.34); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Left Tilted/Area Scan (61x131x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm ; Maximum value of SAR (interpolated) = 0.105 mW/g

Left Tilted/Zoom Scan (5x5x7)/Cube 0:

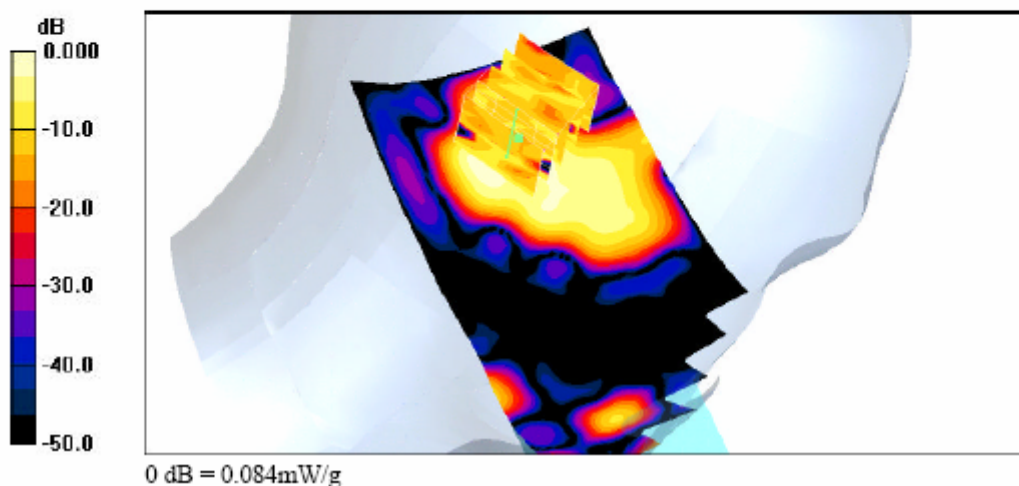
Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 2.12 V/m; Power Drift = -0.119 dB

Peak SAR (extrapolated) = 0.278 W/kg

SAR(1 g) = 0.083 mW/g; SAR(10 g) = 0.030 mW/g

Maximum value of SAR (measured) = 0.084 mW/g



Head-SAR Test Result for Left Tilted Position – Channel 139

Date/Time: 11/3/2005 10:07:25 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Flat_FHSS CH1_20051103_**DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine**

Communication System: FHSS; Frequency: 5725.809328 MHz; Duty Cycle: 1:1
Medium: body_5800MHz Medium parameters used (interpolated): $f = 5725.809328$ MHz;
 $s = 5.97$ mho/m; $\epsilon_r = 46.2$; density = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(3.82, 3.82, 3.82); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Flat/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.167 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:

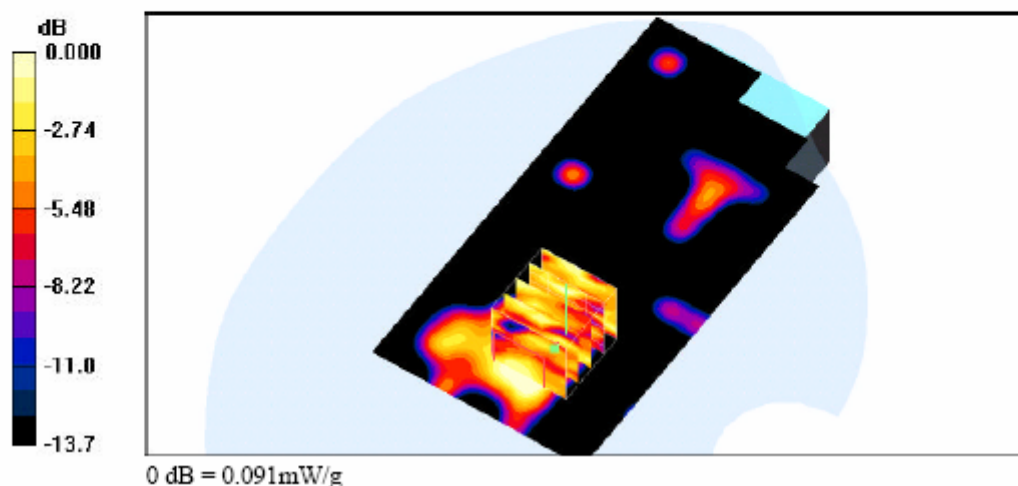
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.37 V/m; Power Drift = 0.006 dB

Peak SAR (extrapolated) = 0.426 W/kg

SAR(1 g) = 0.092 mW/g; SAR(10 g) = 0.023 mW/g

Maximum value of SAR (measured) = 0.091 mW/g

**Body-SAR Test Result for Flat Position – Channel 1**

Date/Time: 11/3/2005 10:40:11 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Flat_FHSS CH70_20051103_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5787.350344 MHz; Duty Cycle: 1:1

Medium: body_5800MHz Medium parameters used (interpolated): $f = 5787.350344$ MHz;

$s = 6.04$ mho/m; $\epsilon_r = 46.1$; density = 1000 kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV3 - SN3519; ConvF(3.82, 3.82, 3.82); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Flat/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.143 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:

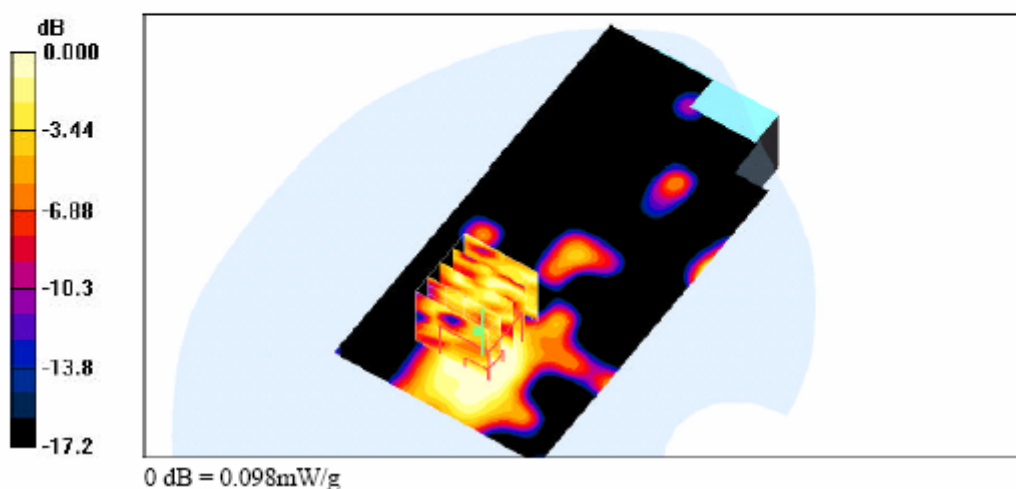
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.95 V/m; Power Drift = 0.084 dB

Peak SAR (extrapolated) = 0.436 W/kg

SAR(1 g) = 0.101 mW/g; SAR(10 g) = 0.020 mW/g

Maximum value of SAR (measured) = 0.098 mW/g



Body-SAR Test Result for Flat Position – Channel 70

Date/Time: 11/3/2005 11:39:35 AM

Test Laboratory: A Test Lab Techno Corp.

05-0657-S_Motorola SD7581_Flat_FHSS CH139_20051103_

DUT: SD7581; Type: 5.8GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone, and Digital Answering Machine

Communication System: FHSS; Frequency: 5848.889420 MHz; Duty Cycle: 1:1
Medium: body_5800MHz Medium parameters used (interpolated): $f = 5848.889420$ MHz;
 $s = 6.19$ mho/m; $\epsilon_r = 47.7$; density = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

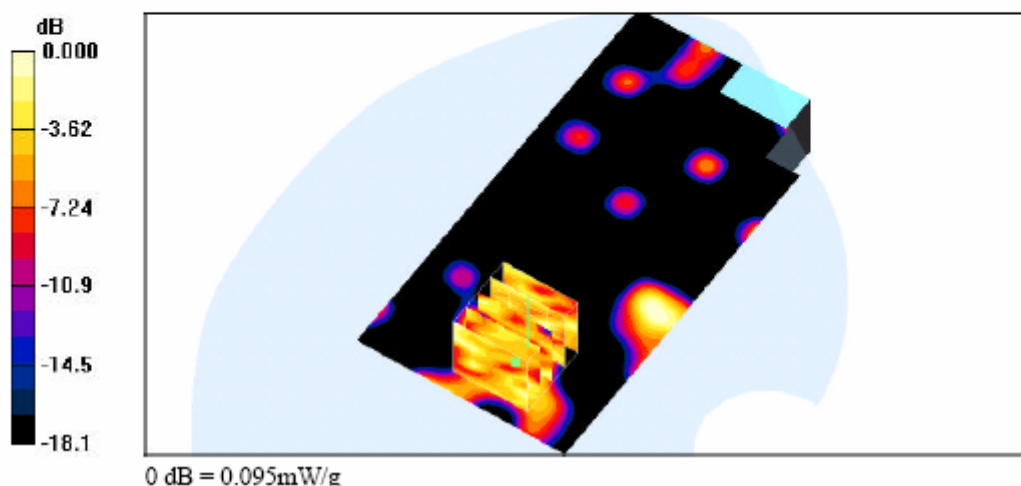
- Probe: EX3DV3 - SN3519; ConvF(3.82, 3.82, 3.82); Calibrated: 3/19/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn393; Calibrated: 4/25/2005
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Flat/Area Scan (61x131x1):

Measurement grid: dx=15mm, dy=15mm ; Maximum value of SAR (interpolated) = 0.239 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.60 V/m; Power Drift = -0.050 dB
Peak SAR (extrapolated) = 0.346 W/kg
SAR(1 g) = 0.074 mW/g; SAR(10 g) = 0.017 mW/g
Maximum value of SAR (measured) = 0.095 mW/g



Body-SAR Test Result for Flat Position – Channel 139