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SAR Compliance Test Report

APPLICANT NAME & ADDRESS :

LG Electronics Inc.
459-9, Kasan-dong, Keumchun-ku,
Seoul 153-023, Korea

DATA & LOCATION OF TESTING

Dates of testing : 22 December 2006 ~ 12 January 2006
Test Site : ESTECH Co., Ltd. Korea

Test Device :

Models : MG225d

FCC ID : BEJMG225D

TYPE : GSM/GPRS Phone (Prototype)

Test report no :

ESTSAR0701-001

Number of page :

23

Contact person :

Bong Hyo, Han

Responsible test Engineer :

I.K.Hong

Testing has been
Carried out in
Accordance with :

IEEE 1528(Dec.2003)

Recommended Practice for Determining the Peak Spatial-Average Specific
Absorption Rate(SAR) in the Human Body Due to Wireless Communications

Device : Experimental Techniques

Applicant Type :

Certification

FCC CLASSIFICATION :

Licensed Non-Broadcast Transmitter Held to Ear (TNE)
Licensed Portable Transmitter Held to Ear (PCE)

FCC Rule Part(s)

§2.1093; FCC/OET Bulletin 65 Supplement C (July 2001)

Test results :

The Tested device complies with the requirements in respect of all parameters subject to the test. The test results and statements relate only to the items tested. The test report shall not be reproduced receipt in full, without written approval of the laboratory.

Date and Signatures : 12 January 2007

Report Prepared By : Engineer/ I.K.Hong

(Signature)

Engineering Manager/ Jay Kim

(Signature)

Test report no : ESTSAR0701-001

FCC ID : BEJMG225D

Web : www. estech. co. kr

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1. SUMMARY FOR TEST REPORT

FCC ID	BEJMG225D
Date of test	22 December 2006 ~ 12 January 2006
Responsible test engineer	Jay Kim
Measurement performed by	I.K.Hong
EUT Type	GSM/GPRS Phone (Prototype)
Tx Frequency	824.2~848.8MHz(GSM850), 1850.2~1909.8MHz(PCS1900)
Rx Frequency	869.2~893.8MHz(GSM850), 1930.2~1989.8MHz(PCS1900)
Max. RF Output Power	GSM850(33 dBm) PCS1900 (30 dBm)

1.1 Head Configuration

Max. SAR Measurement

FREQUENCY		Modulation	Conducted Power(dBm)		Device test position	SAR (W/kg)
MHz	Ch		dBm	Battery		
836.6	190	GSM	33	Standard	Right touch	1.25
1880	661	GSM	30	Standard	Right touch	0.775

1.2 Body Worn Configuration

Max. SAR Measurement

FREQUENCY		Modulation	Conducted Power(dBm)		Separation test position	SAR (W/kg)
MHz	Ch		dBm	Battery		
836.6	190	GSM	33	Standard	1.5cm [w/o Holster]	1.00
1850.2	512	GSM	30	Standard	1.5cm [w/o Holster]	1.01

1.3 Measurement Uncertainty

Combine Standard Uncertainty	± 11.00 (k=1)
Extended Standard Uncertainty	± 22.00 (k=2, 95% CONFIDENCE LEVEL)



2. INTRODUCTION

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

The safety limits used for the environmental evaluation measurements are the criteria published by the based on American National Standards Institute (ANSI) For localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for safety Levels with Respect to Human Exposure to Radio Frequency Electronic Fields, 3 kHz to 300 GHz. (c) 1992 by the institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave[3] is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (IC NRP) in Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields," IC NRP Report No. 86 (c) IC NRP, 1986, Bethesda, MD 20814.[6] SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). it is also defined as the rate of rf energy absorption per unit mass at a point in an absorbing body (see Fig. 2.1.).

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

Figure 2.1 SAR Mathematical Equation

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

$$SAR = \sigma E^2 / \rho$$

Where:

σ = conductivity of the tissue-simulant material (S/m)

E = mass density of the tissue-simulant material (kg/m³)

ρ = Total RMS electric field strength (V/m)

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3. DESCRIPTION OF THE DEVICE UNDER TEST

The FCC rules for evaluating portable devices for RF exposure compliance are contained in 47 CFR §2.1093. For purposes of RF exposure evaluation, a portable device is defined as a transmitting device designed to be used with any part of its radiating structure in direct contact with the user's body or within 20 centimeters of the body of a user or bystanders under normal operating conditions. This category of devices would include hand-held cellular and PCS telephones that incorporate the radiating antenna into the hand-piece and wireless transmitters that are carried next to the body. Portable devices are evaluated with respect to SAR limits for RF exposure. The applicable SAR limit for portable transmitters used by consumers is 1.6 watts/kg, which is averaged over any one gram of tissue defined as a tissue volume in the shape of a cube.

2.1 Antenna Description

Type	Internal Antenna
Location	the Top of the device
Radiator Material	Copper

2.2 Device Description

FCC ID	FCC ID : BEJMG225D
Serial numbers	-
Exposure environment	Uncontrolled exposure
Device category	Portable device
Mode(s) of Operation	GSM / GPRS
Modulation Mode(s)	GSM
Duty Cycle	8.3 / 4.15
Transmitting	824.2~848.8MHz(GSM850), 1850.2~1909.8MHz(PCS1900)
Frequency Range(s)	
test signal method	☒ Base station simulator ☐ Internal test code

2.3 Battery Options

There is only one battery option available for tested device,



4. TEST CONDITIONS

4.1 Ambient Conditions

Ambient Temperature (°C)	22
Tissue simulating liquid temperature (°C)	22
Humidity (%)	43

4.2 RF Characteristics of The Test Site

Tests were performed in a fully enclosed RF Shielded environment

4.3 Test Signal, Frequencies, And Output Power

The handset was placed into simulated call mode (850MHz GSM,1900MHz PCS modes)

In all operation bands the measurements were performed on lowest, middle and highest channels.

The phone was set to maximum power level during the all tests and at the beginning of the each test the battery was fully charged.

DASY4 system measures power drift during SAR testing by comparing e-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

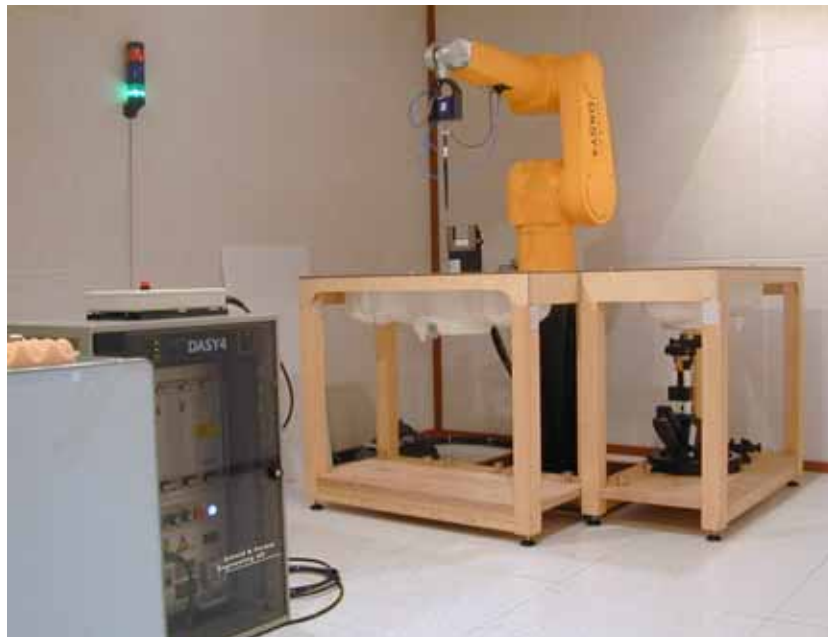


Fig. 4.1 SAR Measurement System



5. DESCRIPTION OF THE TEST EQUIPMENT

An SAR measurement system usually consists of a small diameter isotropic electric field probe, a multiple axis probe positioning system, a test device holder, one or more phantom models, the field probe instrumentation, a computer and other electronic equipment for controlling the probe and making the measurements. Other supporting equipment, such as a network analyzer, power meters and RF signal generators, are also required to measure the dielectric parameters of the simulated tissue media and to verify the measurement accuracy of the SAR system.

5.1 Test System Specifications

Test Equipment	Model	Serial Number	Cal.Due Date
DAE	DAE4	551	2007-04-27
E-Field Probe	ET3DV3	3123	2007-10-17
Dipole validation kit	D1900V2	5d058	2007-09-13
	D835V2	475	2007-09-12
Network analyzer	8753ES	MY40000609	2007-10-09
Signal generator	E4432B	GB40050840	2007-03-03
RF Power meter	EPM-442A	GB37170412	2007-10-11
Power Sensor	8481A	3318A90368	2007-03-08
RF Power meter	E4418A	GB38272722	2007-03-03
Power Sensor	8481A	3318A90368	2007-03-08
Dielectric Probe	85070D	US01440154	-
Power Amplifier	BBS3Q7ECK	NONE	2007-12-16
LP Filter	LA-15N	NONE	2007-10-30
	LA-30N	NONE	2007-10-30
Attenuator	8491B	21828	2007-06-03
Dual Directional Coupler	778D	17575	2007-05-02
Wireless Communications Test Set	E5515C	GB42230119	2007-02-06

5.2 SAR Measurement Setup

Measurement are performed using the DASY4 dosimetric assessment system. The DASY4 is made by Schmid & Partner Engineering AG(SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Pentium IV computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field(EMF) (see Fig. 5.1) A cell controller system contains the power supply, robot controller, teach pendant(Joystick), and a remote control used to drive the robot motors. The pc consists of the Intel Pentium IV 2.4 GHz computer with WindowsXP system and SAR measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc.

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5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

Is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

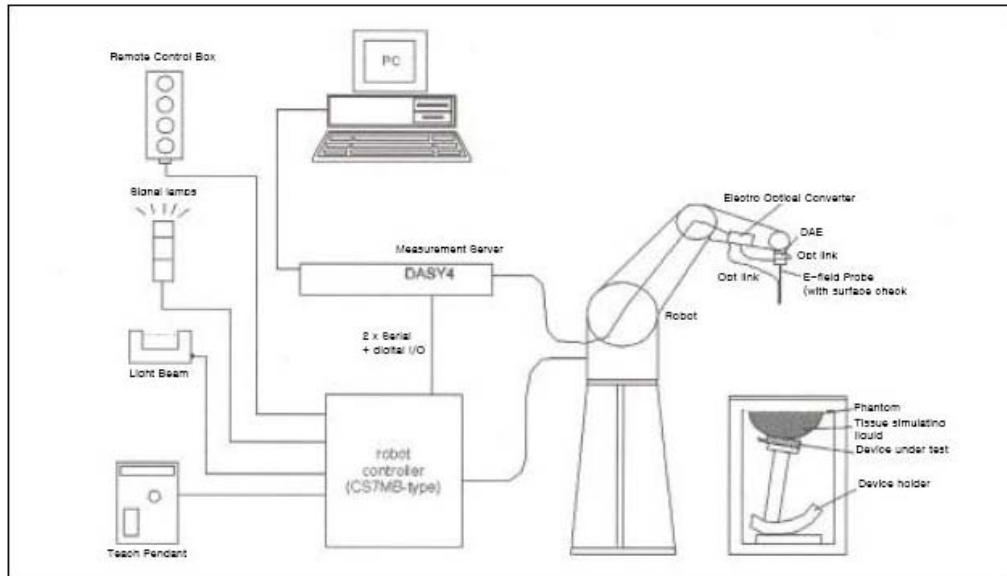


Fig. 5.1 SAR Measurement System Setup

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gainswitching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the Ethernet 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 [7].

5.3 DASY4 E-Field Probe System

The SAR measurements were conducted with the dosimetric probe ET3DV6, designed in the classical triangular configuration [7] (see Fig.5.2) 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 multifiber line ending at the front of the probe tip. It is connected to the EOC box in the robot arm and provides an automatic detection transmitter, the other half to a synchronized receiver.



5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

As the probe approach 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 coupling is zero. The distance of the coupling maximum to the surface is probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Fig. 5.2). The approach is stopped at reaching the maximum.

 Isotropic E-Field Probe	Isotropic E-Field Probe for Dosimetric Measurements	
	Construction	Symmetrical design with triangular core Interleafed sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycol)
	Calibration	In air from 10 MHz to 3 GHz In brain and muscle simulating tissue at frequencies of 450 MHz, 900 MHz and 1.8 GHz (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	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.3 dB in brain tissue (rotation normal to probe axis)
	Dynamic Range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
	Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.7 mm

Fig. 5.2 Probe Specifications



5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

5.4 Phantom & Equivalent Tissues

SAM Phantom

The SAM Twin Phantom V4.0 is constructed of the fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [11][12]. 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 the 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 in the robot.

Head & Muscle simulation Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose(HEC) gelling agent and saline solution (see Fig 5.3). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been specified in 1528(Dec.2003) are derived from the issue dielectric parameters computed from

the 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissue simulation liquids are according to the data by C. Gabriel and G. Hartagrove [13]. (see Fig. 5.3)

Frequency	Head		Body	
(MHz)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800-2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73
5800	35.3	5.27	48.2	6

Fig.5.3 Head and body tissue parameters by the IEEE SCC-34/SC-2 in P1528



5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

835MHz			1900MHz		
	Head	Body		Head	Body
Sugar	47.31%	34.31%	DGBE(diethylene Glycol buty Ether)	44.91%	29.96%
Deionized water	51.07%	65.45%	Deionized water	54.88%	69.91%
Salt	1.15%	0.62%	Salt	0.21%	0.13%
HEC (hydroxyethy cellulose)	0.24%				
Preventol	0.24%	0.10%			
ϵ	$41.0 \pm 5\%$	$55.2 \pm 5\%$	ϵ	$40.0 \pm 5\%$	$53.3 \pm 5\%$
σ	$0.89 \pm 10\%$	$0.97 \pm 10\%$	σ	$1.45 \pm 10\%$	$1.52 \pm 10\%$

Fig. 5.4 Composition of the Tissue Equivalent Matter

Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device enables the rotation of the accurately, and repeatably be positioned according to the FCC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Note : A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations [12]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



6. DESCRIPTION OF THE TEST PROCEDURE

6.1 Definition of Reference Point

EAR Reference point

The point “M” is the reference point for the center of the mouth, “ERP” is the ear reference point. The ERP are 15mm posterior to the entrance to the ear canal(EEC) along the B-M line (Back-Mouth), as shown is figure 6.1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the ERP is called the Reference Pivoting Line (see Figure 6.1) B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

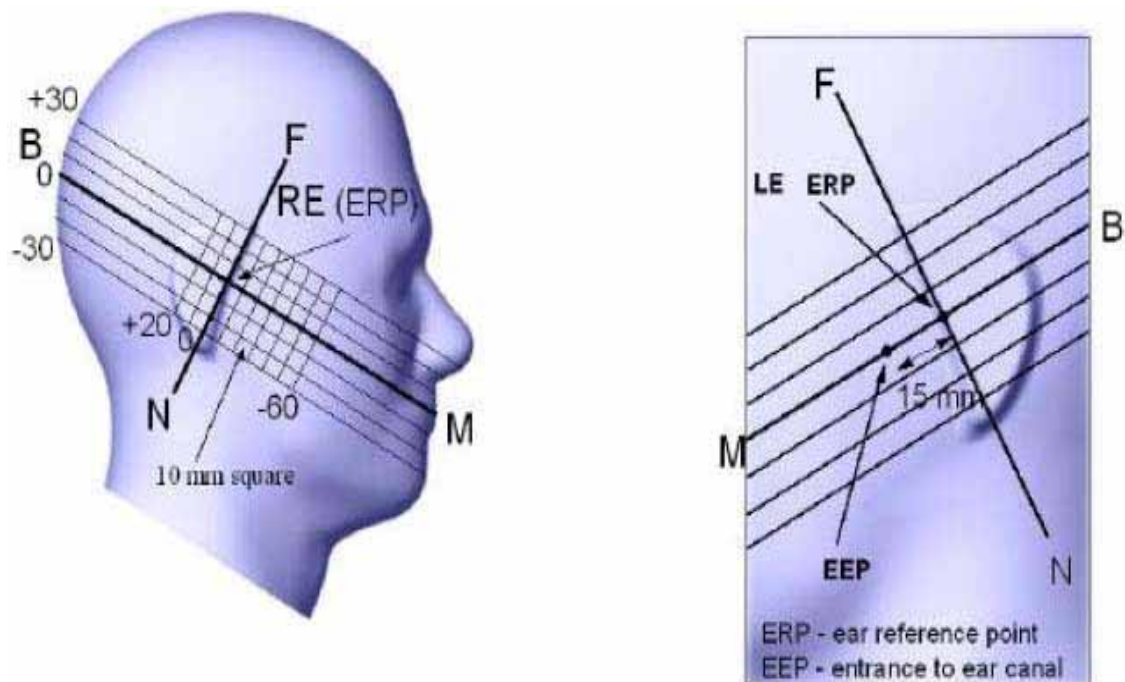


Figure 6.1 Close-up side view of ERP

Handset Reference Points

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (see Fig. 6.2). The “test device reference point” was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at it’s top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.

6. DESCRIPTION OF THE TEST PROCEDURE(continued)

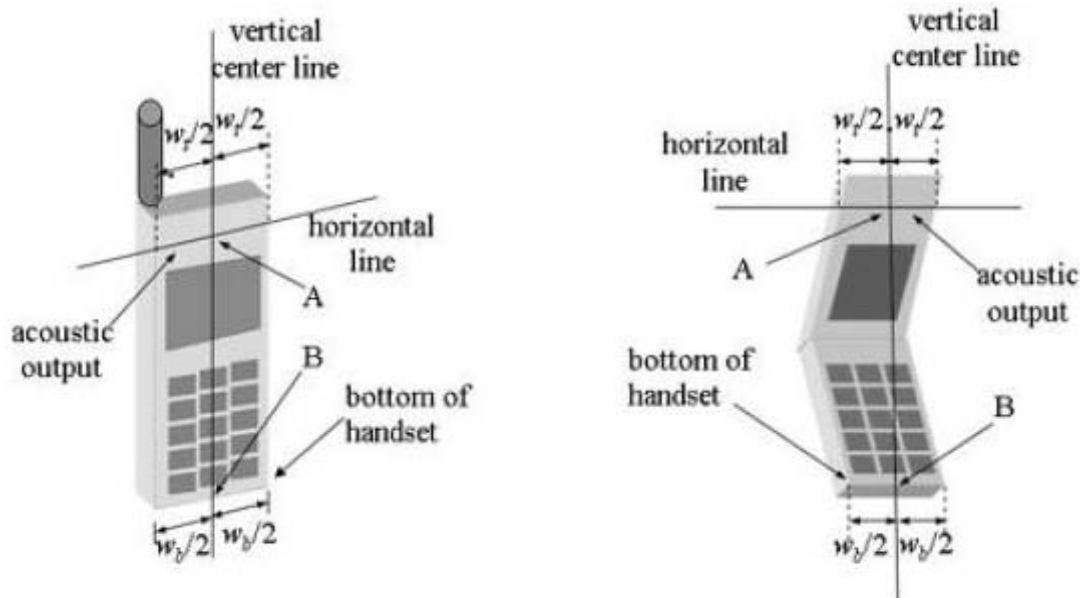


Figure 6.2 Handset Vertical Center & Horizontal Line Reference Points

6.2 Test Configuration Positions

Positioning for Cheek/Touch

- 1) Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover . (If the phone can also be used with the cover closed ,both configurations must be tested.)
- 2) Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width w_t of the handset at the level of the acoustic output (point A on Figures 6.2), and the midpoint of the width w_b of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 6.2). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 6.2), especially for clamshell handsets, handsets with lip pieces, and other irregularly-shaped handsets.
- 3) Position the handset close to the surface of the phantom touch that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6.3), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.



6. DESCRIPTION OF THE TEST PROCEDURE(continued)

- 4) Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the ear.
- 5) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).
- 6) Rotate the phone around the vertical centerline until the phone (horizontal line) is symmetrical with respect to the line NF.
- 7) While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, rotate the handset about the line NF until any point on the handset is in contact with a phantom point

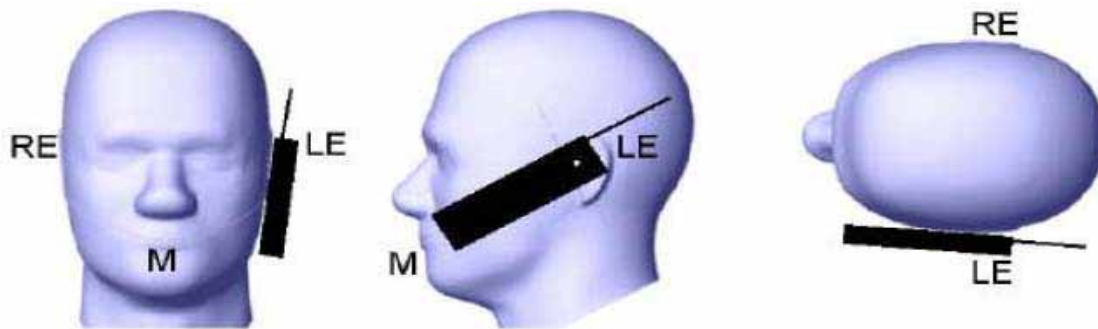


Figure 6.3 "Cheek" or "Touch" Position.

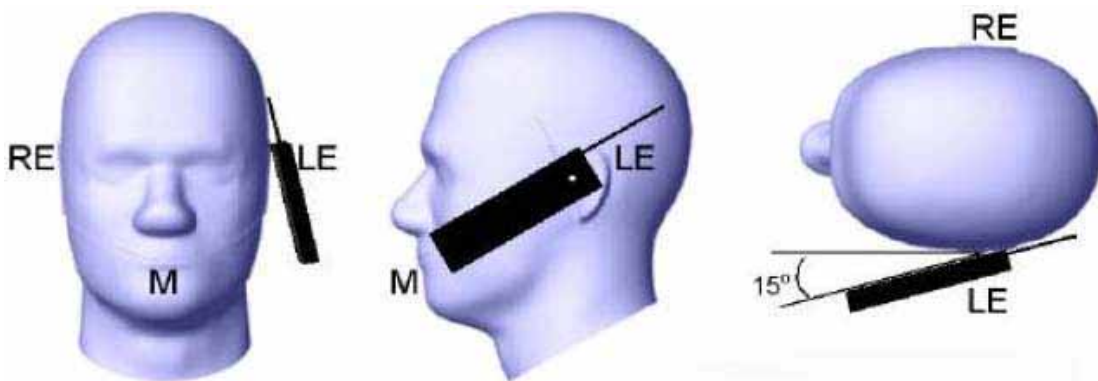


Figure 6.4 "Tilted" Position.



6. DESCRIPTION OF THE TEST PROCEDURE(continued)

Positioning for Ear / 15° Tilted

- 1) Repeat steps 1 to 7 of 6.2(Positioning for Cheek/Touch) to place the device in the "cheek position."
- 2) While maintaining the orientation of the phone retract the phone parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.
- 3) Rotate the phone around the horizontal line by 15 degree.
- 4) While maintaining the orientation of the phone, move the phone parallel to the reference plane until any part of the phone touches the head. (In this position, point A will be located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, the angle of the phone shall be reduced. The tilted position is obtained if any part of the phone is in contact of the ear as well as a second part of the phone is contact with the head.

Body Holder / Belt Clip Configurations

Body-worn operation configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied of available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used. All test position spacings are documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration. In all case SAR measurements are performed to investigate the worst case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.

In order for users to be aware of the body-worn operation requirements for meeting RF exposure compliance, operation instructing instructions and cautions statements are included in the user's manual.



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6. DESCRIPTION OF THE TEST PROCEDURE(continued)

6.3 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Nest cube scan, 5x5x7 points; spacing between each point 5x5x5 mm, is performed around the highest E-field value to determine the averaged SAR-distribution over 1g.

6.4 SAR Averaging Methods

The maximum SAR value is averaged over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a Knot" condition [W.Gander, Computermathematik, p. 141-150](x, y and z directions) [Numerical Recipes in C, Second Edition, p 123].

The extrapolation is based on least square algorithm [W.Gander, Computermathematik, p. 168-180]. Through the points in the first 30 mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points calculated from the surface, have a distance of 1mm from one another.



7. MEASUREMENT UNCERTAINTY

According to CENELEC [17], typical worst-case uncertainty of field measurements is 5 dB.

For well-defined modulation characteristics the uncertainty can be reduced to 3 dB.

ERROR Description	Uncertainty	Probability	Divisor	ci 1	Standard unc.	vi or
	value ±%	Distribution		1g	(1g)	Veff
MEASUREMENT SYSTEM						
Probe Calibration	± 11.7 %	normal	1	1	± 4.8 %	∞
Axial Isotropy	± 4.7	rectangular	√3	(1-cp) ^{1/2}	± 1.9%	∞
Hemispherical Isotropy	± 9.6	rectangular	√3	(cp) ^{1/2}	± 3.9%	∞
Boundary Effects	± 1.0	rectangular	√3	1	± 0.6%	∞
Linearity	± 4.7	rectangular	√3	1	± 2.7%	∞
System Detection Limits	± 1.0	rectangular	√3	1	± 0.6%	∞
Readout Electronics	± 1.0	normal	1	1	± 1.0%	∞
Response time	± 0.8	rectangular	√3	1	± 0.5%	∞
Integration time	± 2.6	rectangular	√3	1	± 1.5%	∞
RF Amnient Conditions	± 3.0	rectangular	√3	1	± 1.7%	∞
Probe Positioner Mechanical Tolerance	± 0.4	rectangular	√3	1	± 0.2%	∞
Probe Positioning with respect to Phantom Shell	± 2.9	rectangular	√3	1	± 1.7%	∞
Extrapolation, Interpolation and Integration Algorithms for Max. SAR Evaluation	± 1.0	rectangular	√3	1	± 0.6%	∞
Test Sample Related						
Test Sample Positioning	± 2.9	normal	1	1	± 2.97%	145
Device Holder Uncertainty	± 3.6	normal	0.84	1	± 3.69%	5
Output Power Validation – SAR drift measurement	± 5.0	rectangular	√3	1	± 2.9%	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	± 4.0	rectangular	√3	1	± 2.3%	∞
Liquid conductivity Target – tolerance	± 5.0	rectangular	√3	0.64	± 1.8%	∞
Liquid Conductivity – measurement uncertainty	± 5.0	normal	1	0.64	± 3.2%	∞
Liquid permittivity Target – tolerance	± 5.0	rectangular	√3	0.6	± 1.7%	∞
Liquid Permittivity – measurement uncertainty	± 5.0	normal	1	0.6	± 3.0%	∞
Combined Standard Uncertainty					±11.00 %	330
Coverage Factor for 95%				K = 2		
Expanded Standard Uncertainty					± 22.00 %	



8. SYSTEM VERIFICATION

Tissue Verification

Table 8.1 Simulated Tissue Verification [5]

MEASURED TISSUE PARAMETERS										
Liquid Temperature (°C)		22		Liquid Depth(mm)		150				
Date	2007-01-10	2007-01-10		2007-01-10		2007-01-10				
Tissue	1900MHz Brain	1900MHz Muscle		835MHz Brain		835MHz Muscle				
	Target	Measured	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ϵ	40	39.3	53.3	51.2	40	40.9	55.2	53.63		
Conductivity: σ	1.45	1.44	1.52	1.55	0.9	0.917	0.97	0.966		
Deviation (%)	ϵ : -1.75% σ : -0.69%		ϵ : -3.94% σ : -0.66%		ϵ : 2.25% σ : 1.89%		ϵ : -2.84% σ : -0.41%			

Test System Validation

- Prior to assessment, the system is verified to the $\pm 10\%$ of the specifications at 835MHz, 1900MHz (Graphic Plots Attached)
- The results are nominalized to 1W input power

Table 8.2 System Validation [5]

SYSTEM DIPOLE VALIDATION TARGET & MEASURED						
Tissue	System Validation Kit:	Forward Power (W)	Targeted SAR1g (mW/g)	Measured SAR1g (mW/g)	Deviation (%)	Test Date
1900MHz Brain	D1900V2(S/N :5d058)	1.0	39.7	38.2	-3.78%	2007-01-10
835MHz Brain	D835V2(S/N:475)	1.0	9.5	9.52	0.21%	2007-01-10

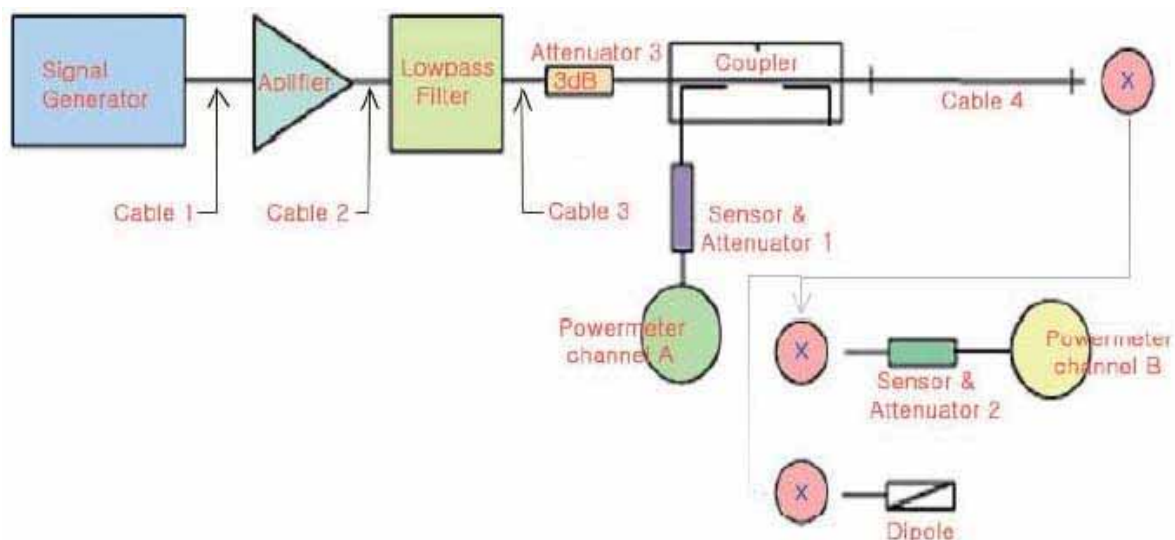


Figure 12.1 Dipole Validation Test Setup

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : **22.0**Relative HUMIDITY (%) : **43**Mixture Type : **835MHz Brain**Dielectric Constant : **40.9**Conductivity: **0.917**

Measurement Results (GSM Head SAR)

ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Brain 1.6 W/kg (mW/g) averaged over 1 gram
---	--

MEASUREMENT RESULTS (GSM Head SAR)										
Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Slider	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
836.60	190	GSM	33.00	32.89	Standard	Left Touch	-	-	Fixed	1.060
836.60	190	GSM	33.00	32.98	Standard	Right Touch	-	-	Fixed	1.250
836.60	190	GSM	33.00	33.11	Standard	Left Tilt	-	-	Fixed	0.308
836.60	190	GSM	33.00	32.97	Standard	Right Tilt	-	-	Fixed	0.355
824.20	128	GSM	33.00	32.91	Standard	Left Touch	-	-	Fixed	0.841
824.20	128	GSM	33.00	32.99	Standard	Right Touch	-	-	Fixed	0.948
848.80	251	GSM	33.00	32.88	Standard	Left Touch	-	-	Fixed	0.821
848.80	251	GSM	33.00	32.94	Standard	Right Touch	-	-	Fixed	1.020

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.

2. All modes of operation were investigated and the worst-case are reported.

3. Battery Type : **Standard**

Radiated measurements indicate that the Standard-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.

Justification for reduced test configuration: Per FCC/OET Bulletin 65 Supplement C[July 2001], if the SAR measured at the middle channel for each test configuration (left,light,cheek/touch,tilt/ear, extended and retracted)is at least 3.0dB lower than the SAR limit, testing at the hiah and low channels is optional for such test configuration(s).

4. Power Measured : **Conducted**

5. SAR Measurement System : **SPEAG**

6. SAR Configuration : **Head**

Engineer I.K.Hona

(Signature)

Test report no : ESTSAR0701-001

FCC ID : BEJMG225D

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : **22.0**

Relative HUMIDITY (%) : **43**

Mixture Type : **835MHz Body**

Dielectric Constant : **53.63**

Conductivity: **0.966**

Measurement Results (GSM BODY SAR without Holster)

ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Brain 1.6 W/kg (mW/g) averaged over 1 gram
---	--

MEASUREMENT RESULTS (GSM Body SAR Without Holster)										
Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Slider	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
836.60	190	GSM	33.00	33.04	Standard	1.5[w/o Holster]	-	-	Fixed	0.663
824.20	128	GSM	33.00	33.01	Standard	1.5[w/o Holster]	-	-	Fixed	0.645
848.80	251	GSM	33.00	32.93	Standard	1.5[w/o Holster]	-	-	Fixed	0.640

MEASUREMENT RESULTS (GSM Body SAR Without Holster – GPRS)										
Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Slider	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
836.60	190	GSM	33.00	32.88	Standard	1.5[w/o Holster]	-	-	Fixed	1.000

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.

2. All modes of operation were investigated and the worst-case are reported.

3. Battery Type : **Standard**

Radiated measurements indicate that the Standard-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.

Justification for reduced test configuration: Per FCC/OET Bulletin 65 Supplement C[July 2001], if the SAR measured at the middle channel for each test configuration (left,light,cheek/touch,tilt/ear, extended and retracted)is at least 3.0dB lower than the SAR limit, testing at the hiah and low channels is optional for such test configuration(s).

4. Power Measured : **Conducted**

5. SAR Measurement System : **SPEAG**

6. SAR Configuration : **Body, GPRS mode function enable, Class 10 (multi slot mode)**

Engineer I.K.Hong

(Signature)

Test report no : ESTSAR0701-001

FCC ID : BEJMG225D

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : **22.0**Relative HUMIDITY (%) : **43**Mixture Type : **1900MHz Brain**Dielectric Constant : **39.3**Conductivity: **1.44**

Measurement Results (GSM Head SAR)

ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Brain 1.6 W/kg (mW/g) averaged over 1 gram
---	--

MEASUREMENT RESULTS (GSM Head SAR)										
Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Slider	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
1880.00	661	GSM	30.00	29.99	Standard	Left Touch	–	–	Fixed	0.595
1880.00	661	GSM	30.00	29.93	Standard	Right Touch	–	–	Fixed	0.775
1880.00	661	GSM	30.00	30.08	Standard	Left Tilt	–	–	Fixed	0.203
1880.00	661	GSM	30.00	30.08	Standard	Right Tilt	–	–	Fixed	0.171

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.

2. All modes of operation were investigated and the worst-case are reported.

3. Battery Type : **Standard**

Radiated measurements indicate that the Standard-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.

Justification for reduced test configuration: Per FCC/OET Bulletin 65 Supplement C[July 2001], if the SAR measured at the middle channel for each test configuration (left,light,cheek/touch,tilt/ear, extended and retracted)is at least 3.0dB lower than the SAR limit, testing at the hiah and low

4. Power Measured : **Conducted**

5. SAR Measurement System : **SPEAG**

6. SAR Configuration : **Head**

Engineer I.K.Hong

(Signature)

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : 22

Relative HUMIDITY (%) : 43

Mixture Type : 1900MHz Body

Dielectric Constant : 51.2

Conductivity: 1.55

Measurement Results (GSM BODY SAR without Holster)

ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Body 1.6 W/kg (mW/g) averaged over 1 gram
---	---

MEASUREMENT RESULTS (GSM Body SAR Without Holster)										
Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Slider	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
1880.00	661	GSM	30.00	29.95	Standard	1.5[w/o Holster]	–	–	Fixed	0.487
1850.20	512	GSM	30.00	29.99	Standard	1.5[w/o Holster]	–	–	Fixed	0.660
1909.80	810	GSM	30.00	30.07	Standard	1.5[w/o Holster]	–	–	Fixed	0.313

MEASUREMENT RESULTS (GSM Body SAR Without Holster–GPRS)										
Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Slider	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
1880.00	661	GSM	30.00	29.91	Standard	1.5[w/o Holster]	–	–	Fixed	1.010

NOTES:

1. The test data were reported the worst-case SAR value with the antenna-head position set in a typical configuration.

2. All modes of operation were investigated and the worst-case are reported.

3. Battery Type : Standard

Radiated measurements indicate that the Standard-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.

Justification for reduced test configuration: Per FCC/OET Bulletin 65 Supplement C[July 2001], if the SAR measured at the middle channel for each test configuration (left,light,cheek/touch,tilt/ear, extended and retracted)is at least 3.0dB lower than the SAR limit, testing at the hiah and low channels is optional for such test configuration(s).

4. Power Measured : Conducted

5. SAR Measurement System : SPEAG

6. SAR Configuration : Body, GPRS mode function enable, Class 10 (multi slot mode)

Engineer I.K.Hong (Signature)

Test report no : ESTSAR0701-001

FCC ID : BEJMG225D

Web : www.estech.co.kr

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10. REFERENCE

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APPENDIX A : Validation Test Data of Tissue



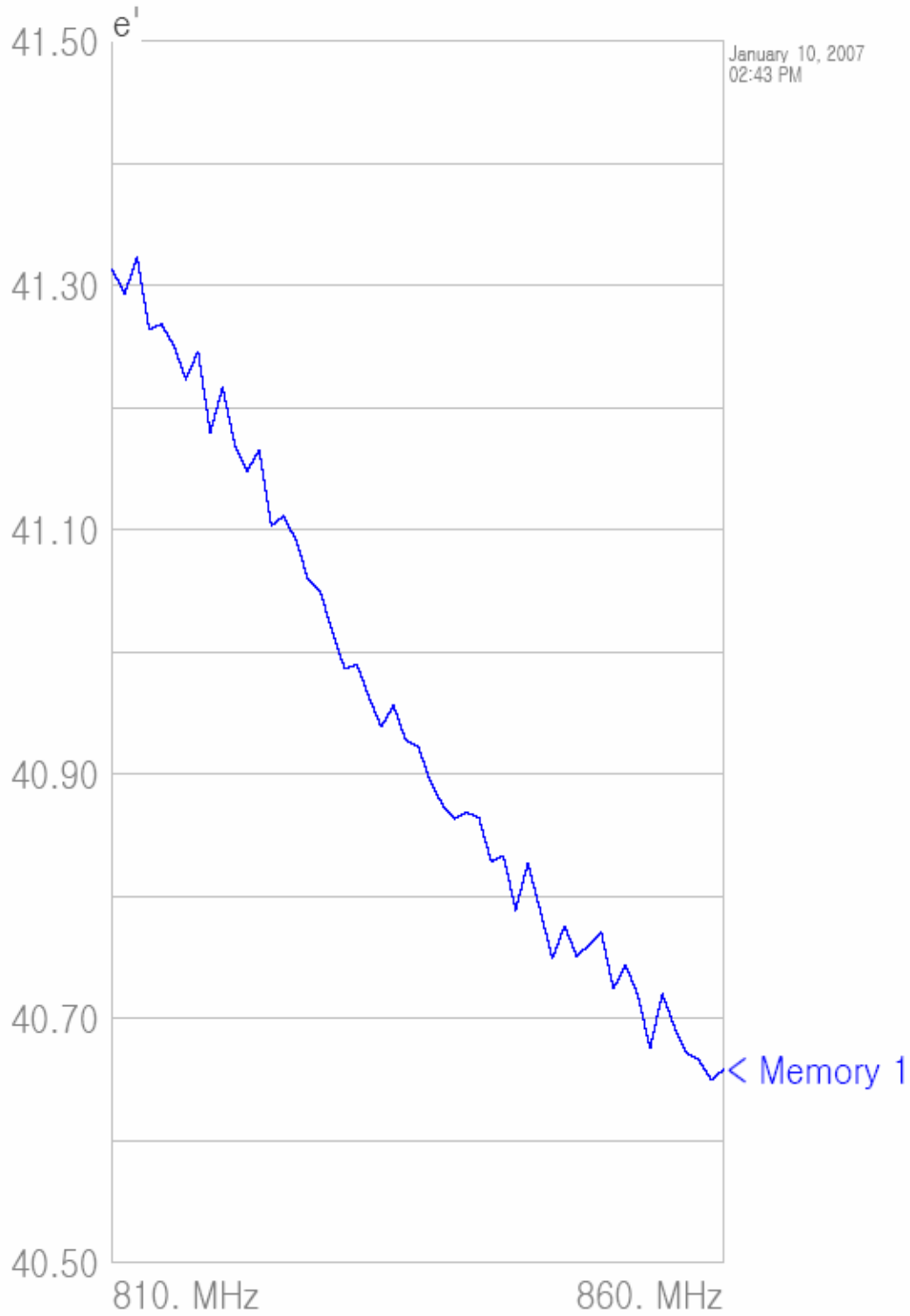
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– Head Tissue(GSM850)

Title
SubTitle



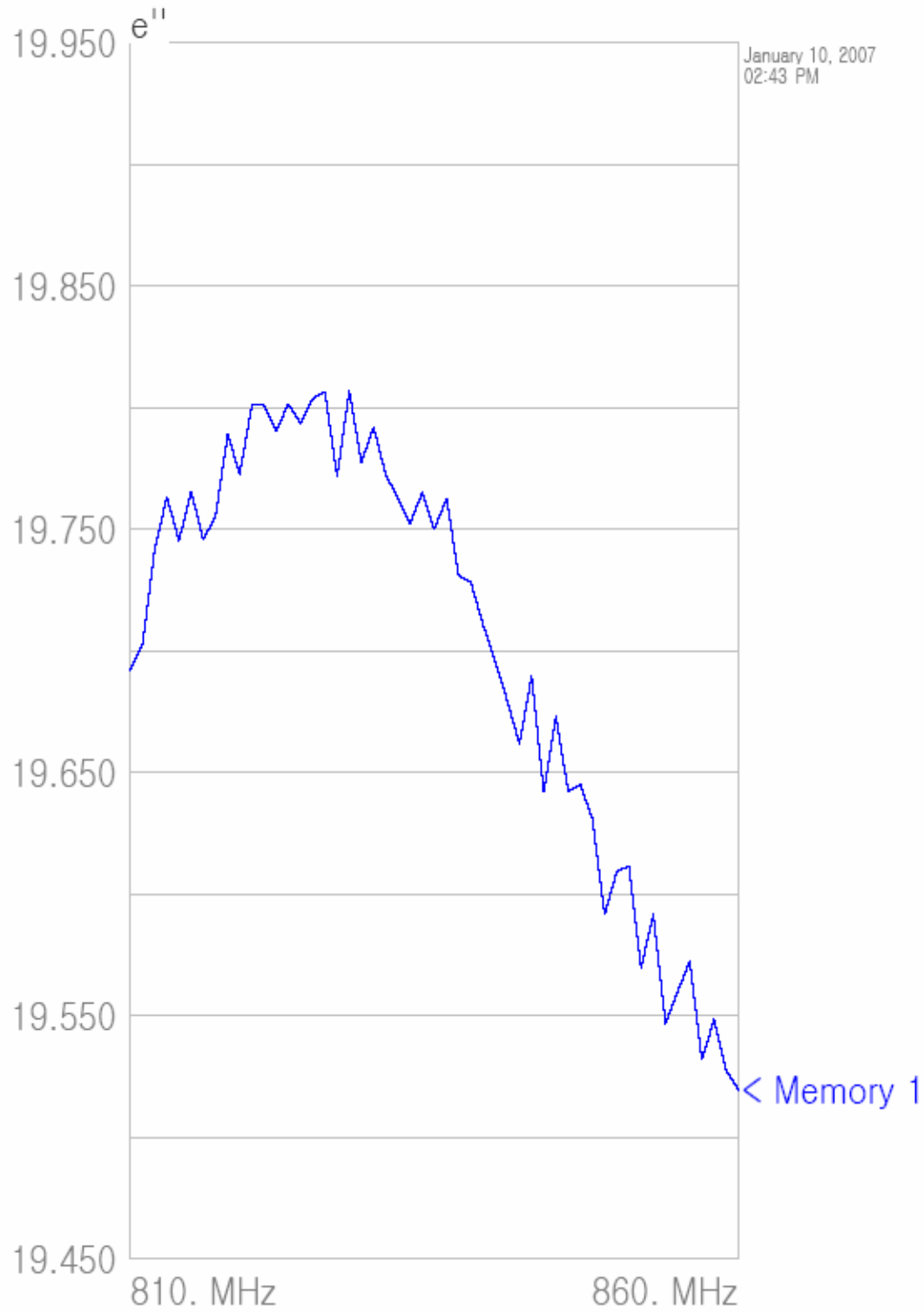


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Title

SubTitle

January 10, 2007 02:42 PM

Frequency	e'	e''
810.000000 MHz	41.3132	19.6922
810.973262 MHz	41.2931	19.7025
811.946524 MHz	41.3241	19.7422
812.919785 MHz	41.2640	19.7633
813.893047 MHz	41.2687	19.7454
814.866309 MHz	41.2515	19.7656
815.845418 MHz	41.2236	19.7459
816.824527 MHz	41.2465	19.7553
817.803636 MHz	41.1796	19.7890
818.782745 MHz	41.2170	19.7729
819.761854 MHz	41.1702	19.8012
820.746845 MHz	41.1480	19.8013
821.731836 MHz	41.1655	19.7907
822.716828 MHz	41.1037	19.8017
823.701819 MHz	41.1114	19.7937
824.686810 MHz	41.0921	19.8038
825.677719 MHz	41.0602	19.8067
826.668628 MHz	41.0500	19.7718
827.659537 MHz	41.0165	19.8070
828.650446 MHz	40.9866	19.7776
829.641354 MHz	40.9900	19.7921
830.638216 MHz	40.9630	19.7726
831.635078 MHz	40.9387	19.7630
832.631941 MHz	40.9564	19.7524
833.628803 MHz	40.9278	19.7651
834.625665 MHz	40.9232	19.7501
835.628516 MHz	40.8947	19.7628
836.631367 MHz	40.8751	19.7310
837.634218 MHz	40.8635	19.7265
838.637068 MHz	40.8688	19.7109
839.639919 MHz	40.8644	19.6960
840.648795 MHz	40.8282	19.6795
841.657671 MHz	40.8335	19.6620
842.666547 MHz	40.7887	19.6897
843.675423 MHz	40.8275	19.6421
844.684299 MHz	40.7890	19.6733
845.693236 MHz	40.7490	19.6424
846.714173 MHz	40.7757	19.6451
847.729110 MHz	40.7508	19.6309
848.744047 MHz	40.7605	19.5916
849.758984 MHz	40.7706	19.6093
850.780018 MHz	40.7245	19.6115
851.801053 MHz	40.7438	19.5696
852.822087 MHz	40.7189	19.5918
853.843122 MHz	40.6754	19.5469
854.864157 MHz	40.7203	19.5598
855.891325 MHz	40.6930	19.5724
856.918494 MHz	40.6714	19.5319
857.945663 MHz	40.6659	19.5486
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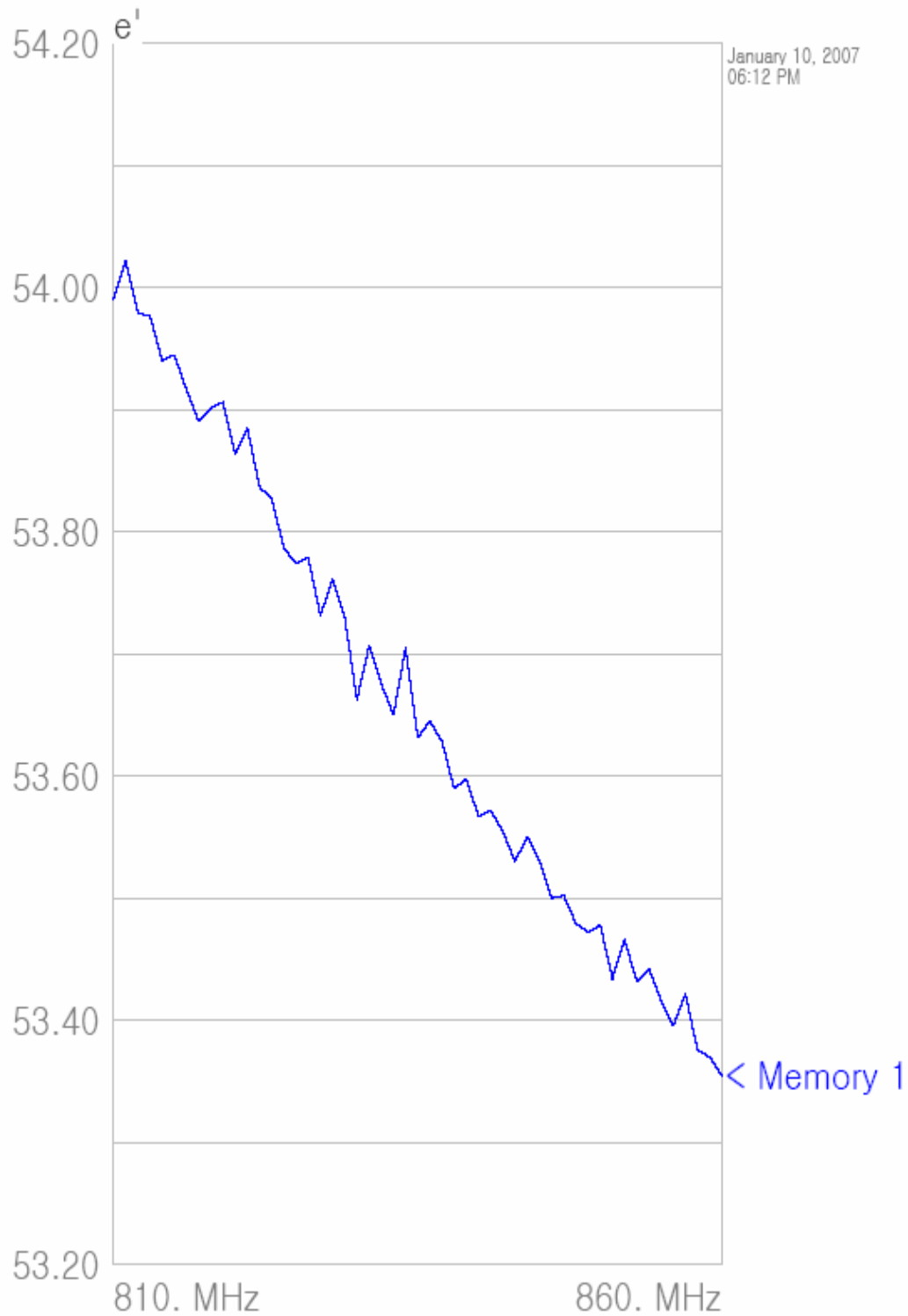
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– GSM850 Body Tissue

Title
SubTitle



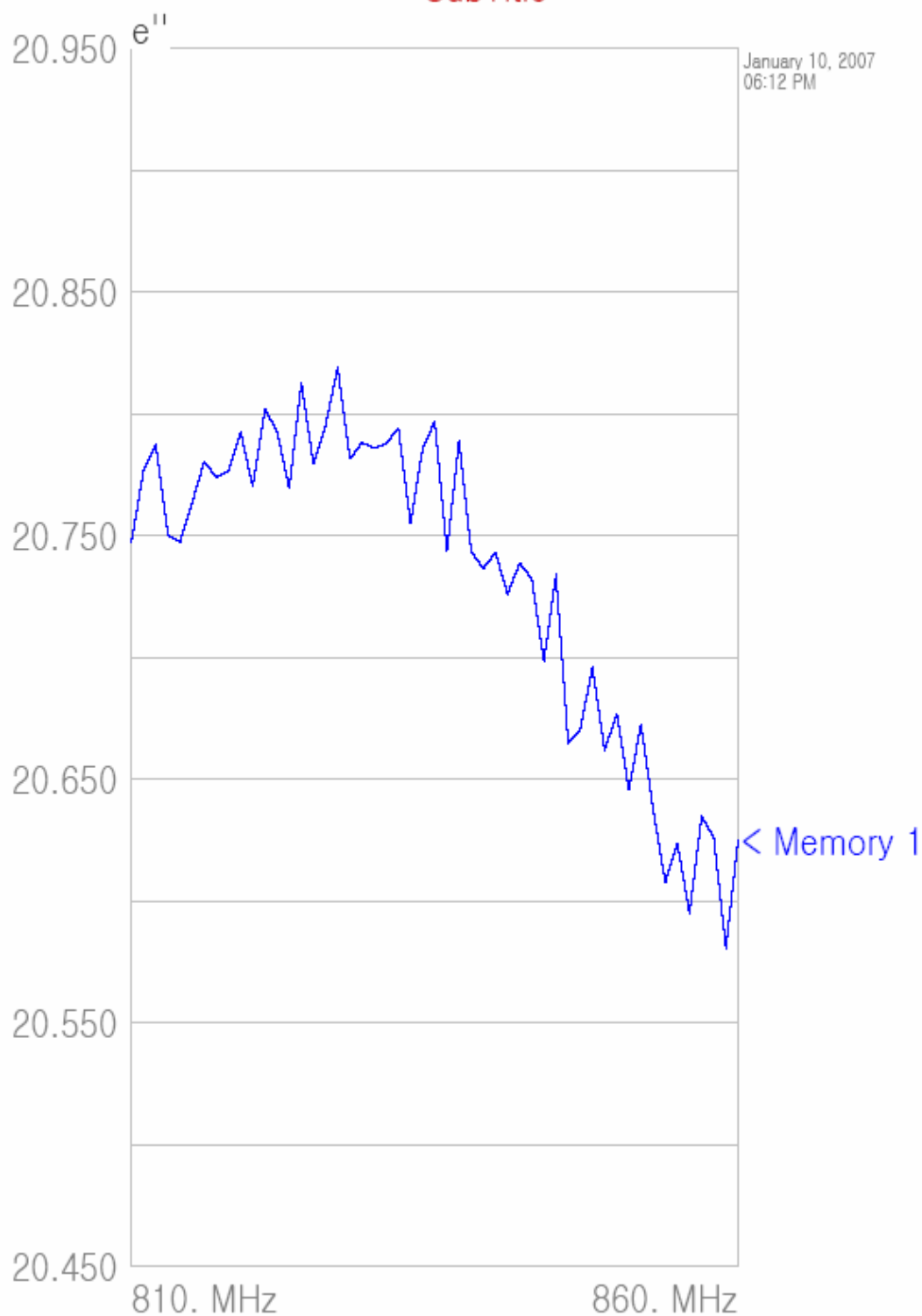


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SubTitle

January 10, 2007 05:12 PM

Frequency	e'	e''
810.000000 MHz	53.9910	20.7477
810.973262 MHz	54.0224	20.7769
811.946524 MHz	53.9799	20.7875
812.919785 MHz	53.9766	20.7504
813.893047 MHz	53.9406	20.7475
814.866309 MHz	53.9452	20.7637
815.845418 MHz	53.9165	20.7806
816.824527 MHz	53.8907	20.7741
817.803636 MHz	53.9017	20.7767
818.782745 MHz	53.9064	20.7928
819.761854 MHz	53.8638	20.7701
820.746845 MHz	53.8856	20.8022
821.731836 MHz	53.8368	20.7929
822.716828 MHz	53.8275	20.7695
823.701819 MHz	53.7868	20.8129
824.686810 MHz	53.7740	20.7796
825.677719 MHz	53.7791	20.7954
826.668628 MHz	53.7315	20.8191
827.659537 MHz	53.7616	20.7816
828.650446 MHz	53.7303	20.7883
829.641354 MHz	53.6627	20.7862
830.638216 MHz	53.7070	20.7877
831.635078 MHz	53.6759	20.7945
832.631941 MHz	53.6502	20.7552
833.628803 MHz	53.7050	20.7858
834.625665 MHz	53.6317	20.7970
835.628516 MHz	53.6450	20.7437
836.631367 MHz	53.6284	20.7891
837.634218 MHz	53.5897	20.7439
838.637068 MHz	53.5978	20.7365
839.639919 MHz	53.5672	20.7432
840.648795 MHz	53.5718	20.7261
841.657671 MHz	53.5546	20.7389
842.666547 MHz	53.5303	20.7324
843.675423 MHz	53.5506	20.6986
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845.693236 MHz	53.5001	20.6648
846.714173 MHz	53.5023	20.6705
847.729110 MHz	53.4793	20.6963
848.744047 MHz	53.4723	20.6619
849.758984 MHz	53.4781	20.6771
850.780018 MHz	53.4341	20.6456
851.801053 MHz	53.4661	20.6727
852.822087 MHz	53.4318	20.6377
853.843122 MHz	53.4426	20.6077
854.864157 MHz	53.4165	20.6238
855.891325 MHz	53.3954	20.5949
856.918494 MHz	53.4214	20.6348
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860.000000 MHz	53.3547	20.6250



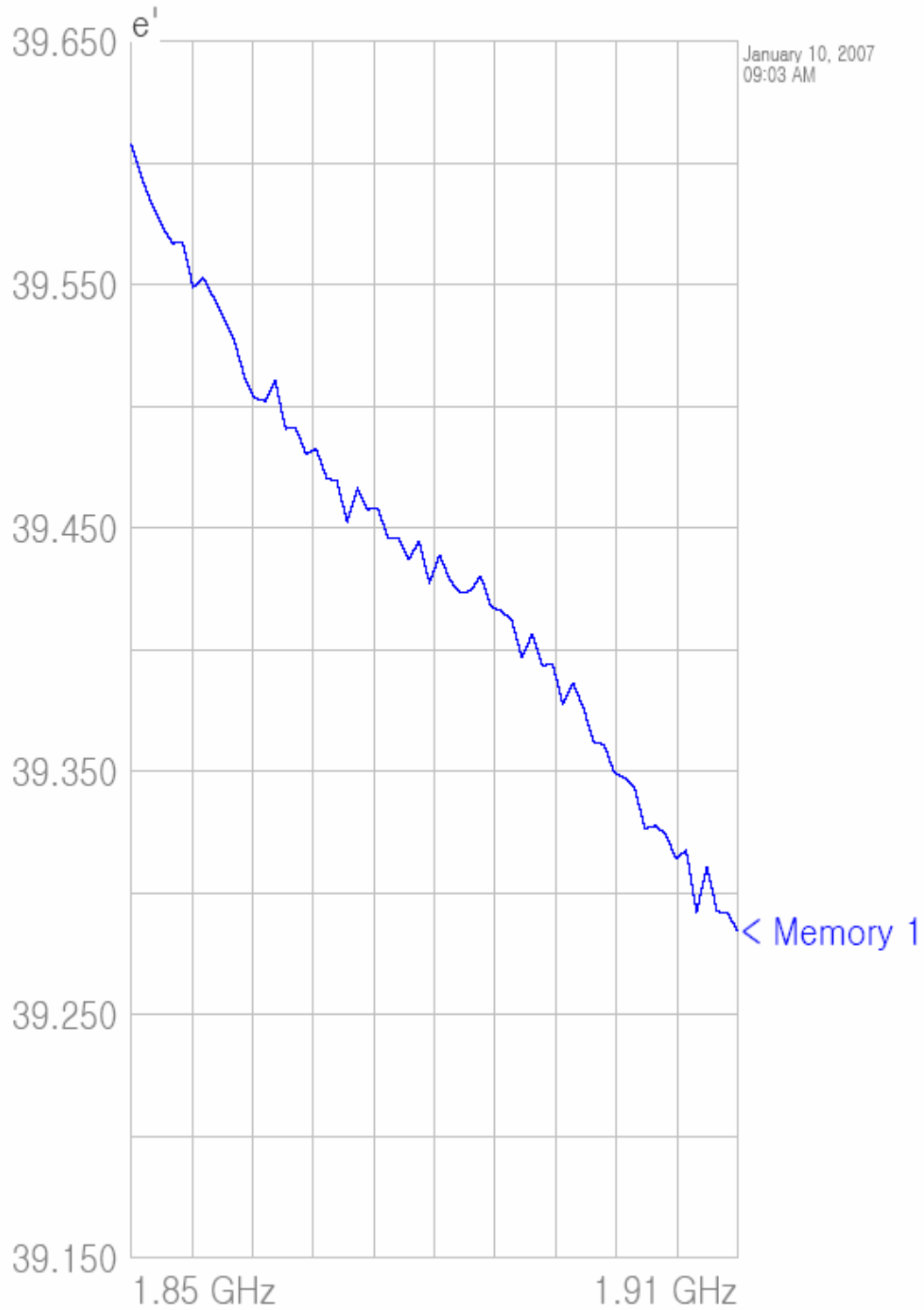
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– Head Tissue(PCS1900)

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SubTitle

January 10, 2007 09:03 AM

Frequency	e'	e''
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1.854067797 GHz	39.5672	13.4945
1.855084746 GHz	39.5675	13.5031
1.856101695 GHz	39.5491	13.5204
1.857118644 GHz	39.5529	13.5058
1.858135593 GHz	39.5448	13.5106
1.859152542 GHz	39.5365	13.5246
1.860169492 GHz	39.5274	13.5181
1.861186441 GHz	39.5124	13.5213
1.862203390 GHz	39.5035	13.5296
1.863220339 GHz	39.5023	13.5212
1.864237288 GHz	39.5107	13.5188
1.865254237 GHz	39.4909	13.5190
1.866271186 GHz	39.4913	13.5275
1.867288136 GHz	39.4806	13.5280
1.868305085 GHz	39.4826	13.5296
1.869322034 GHz	39.4706	13.5279
1.870338983 GHz	39.4695	13.5435
1.871355932 GHz	39.4526	13.5149
1.872372881 GHz	39.4666	13.5449
1.873389831 GHz	39.4578	13.5293
1.874406780 GHz	39.4580	13.5469
1.875423729 GHz	39.4458	13.5305
1.876440678 GHz	39.4460	13.5481
1.877457627 GHz	39.4373	13.5325
1.878474576 GHz	39.4448	13.5425
1.879491525 GHz	39.4276	13.5561
1.880508475 GHz	39.4391	13.5488
1.881525424 GHz	39.4286	13.5492
1.882542373 GHz	39.4233	13.5673
1.883559322 GHz	39.4242	13.5576
1.884576271 GHz	39.4304	13.5654
1.885593220 GHz	39.4178	13.5672
1.886610169 GHz	39.4160	13.5861
1.887627119 GHz	39.4122	13.5734
1.888644068 GHz	39.3969	13.6037
1.889661017 GHz	39.4064	13.5886
1.890677966 GHz	39.3935	13.6085
1.891694915 GHz	39.3942	13.5840
1.892711864 GHz	39.3776	13.6122
1.893728814 GHz	39.3864	13.6005
1.894745763 GHz	39.3760	13.6338
1.895762712 GHz	39.3620	13.6097
1.896779661 GHz	39.3611	13.6249
1.897796610 GHz	39.3495	13.6232
1.898813559 GHz	39.3475	13.6273
1.899830508 GHz	39.3428	13.6271
1.900847458 GHz	39.3265	13.6462
1.901864407 GHz	39.3276	13.6364
1.902881356 GHz	39.3241	13.6473
1.903898305 GHz	39.3141	13.6387
1.904915254 GHz	39.3175	13.6512
1.905932203 GHz	39.2921	13.6464
1.906949153 GHz	39.3110	13.6550
1.907966102 GHz	39.2925	13.6517
1.908983051 GHz	39.2918	13.6669
1.910000000 GHz	39.2845	13.6625



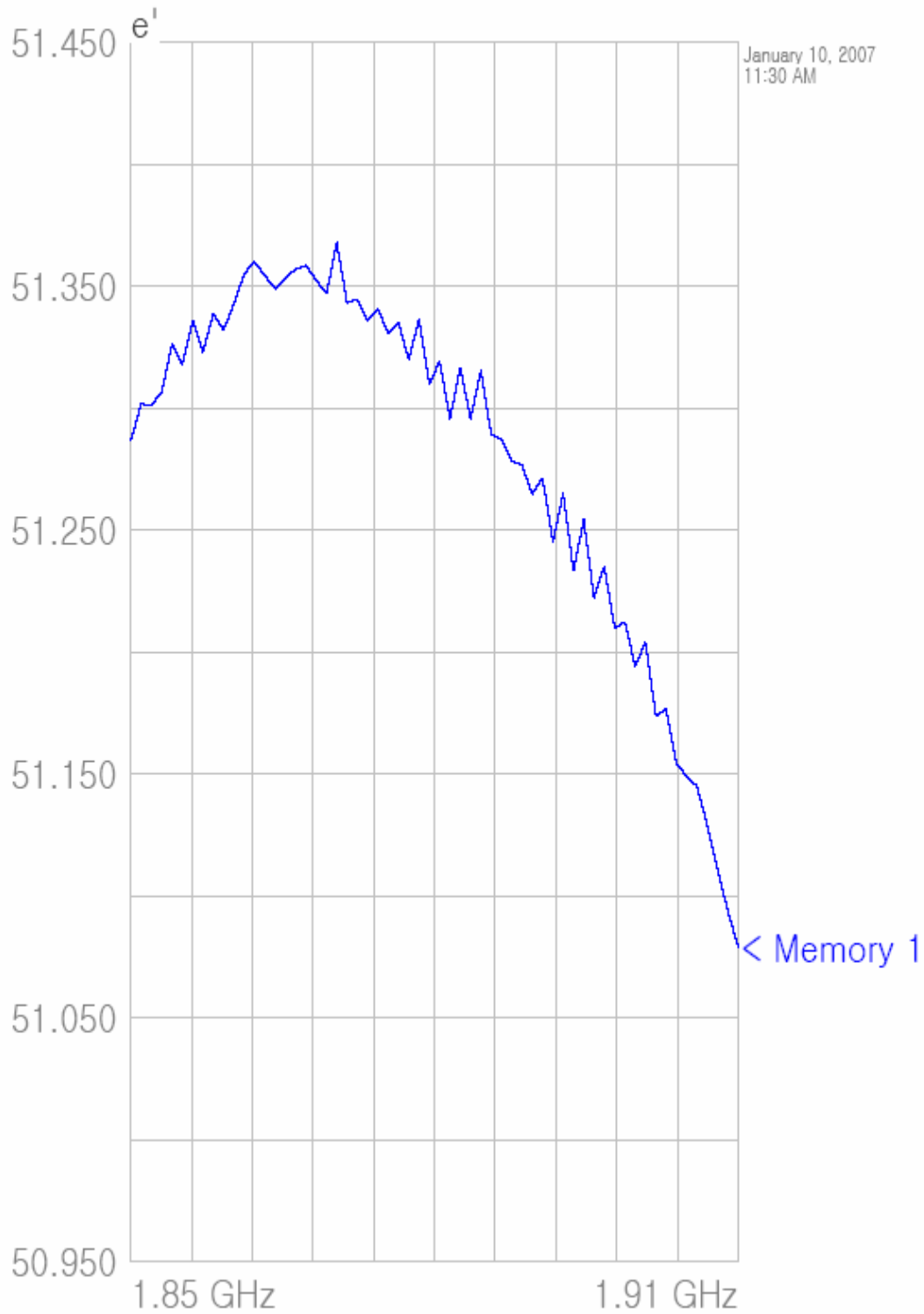
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– PCS1900 Body Tissue

Title
SubTitle

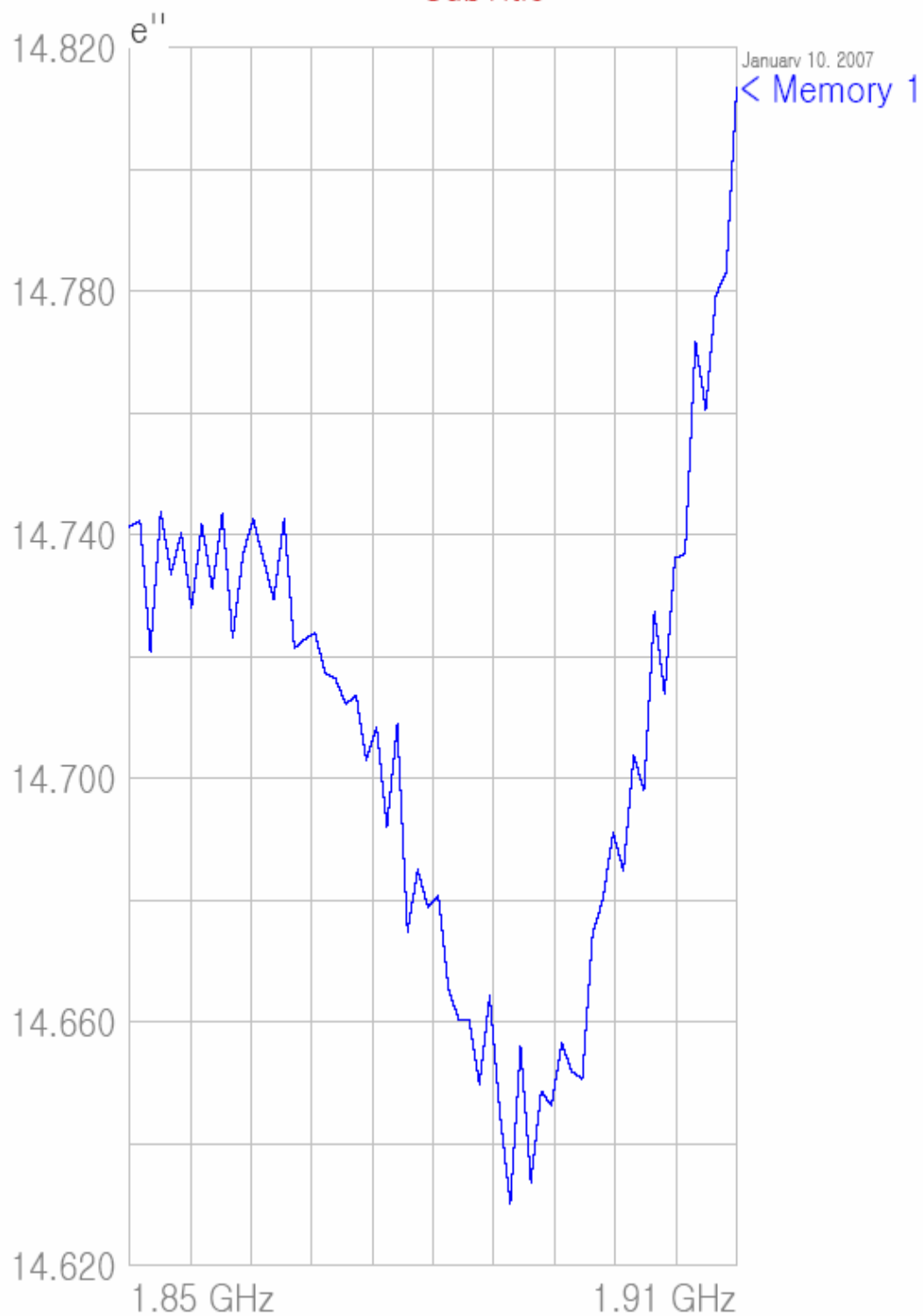


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Title
SubTitle

January 10, 2007 11:30 AM

Frequency	e ⁱ	e ⁱⁱ
1.850000000 GHz	51.2869	14.7414
1.851016949 GHz	51.3019	14.7423
1.852033898 GHz	51.3014	14.7207
1.853050847 GHz	51.3070	14.7439
1.854067797 GHz	51.3267	14.7336
1.855084746 GHz	51.3182	14.7403
1.856101695 GHz	51.3361	14.7279
1.857118644 GHz	51.3232	14.7418
1.858135593 GHz	51.3391	14.7312
1.859152542 GHz	51.3321	14.7436
1.860169492 GHz	51.3430	14.7230
1.861186441 GHz	51.3552	14.7369
1.862203390 GHz	51.3602	14.7426
1.863220339 GHz	51.3547	14.7360
1.864237288 GHz	51.3492	14.7294
1.865254237 GHz	51.3537	14.7427
1.866271186 GHz	51.3570	14.7214
1.867288136 GHz	51.3586	14.7229
1.868305085 GHz	51.3526	14.7239
1.869322034 GHz	51.3471	14.7173
1.870338983 GHz	51.3680	14.7164
1.871355932 GHz	51.3433	14.7122
1.872372881 GHz	51.3449	14.7137
1.873389831 GHz	51.3360	14.7030
1.874406780 GHz	51.3411	14.7085
1.875423729 GHz	51.3307	14.6920
1.876440678 GHz	51.3351	14.7089
1.877457627 GHz	51.3202	14.6749
1.878474576 GHz	51.3365	14.6850
1.879491525 GHz	51.3102	14.6788
1.880508475 GHz	51.3194	14.6808
1.881525424 GHz	51.2957	14.6653
1.882542373 GHz	51.3168	14.6604
1.883559322 GHz	51.2958	14.6603
1.884576271 GHz	51.3155	14.6497
1.885593220 GHz	51.2897	14.6644
1.886610169 GHz	51.2872	14.6447
1.887627119 GHz	51.2786	14.6302
1.888644068 GHz	51.2768	14.6560
1.889661017 GHz	51.2650	14.6337
1.890677966 GHz	51.2715	14.6487
1.891694915 GHz	51.2451	14.6463
1.892711864 GHz	51.2653	14.6565
1.893728814 GHz	51.2334	14.6518
1.894745763 GHz	51.2543	14.6507
1.895762712 GHz	51.2225	14.6744
1.896779661 GHz	51.2353	14.6802
1.897796610 GHz	51.2101	14.6911
1.898813559 GHz	51.2124	14.6849
1.899830508 GHz	51.1942	14.7038
1.900847458 GHz	51.2041	14.6981
1.901864407 GHz	51.1739	14.7275
1.902881356 GHz	51.1768	14.7138
1.903898305 GHz	51.1547	14.7362
1.904915254 GHz	51.1491	14.7369
1.905932203 GHz	51.1451	14.7718
1.906949153 GHz	51.1290	14.7606
1.907966102 GHz	51.1110	14.7794
1.908983051 GHz	51.0940	14.7832
1.910000000 GHz	51.0790	14.8135



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APPENDIX B : Validation Test Data

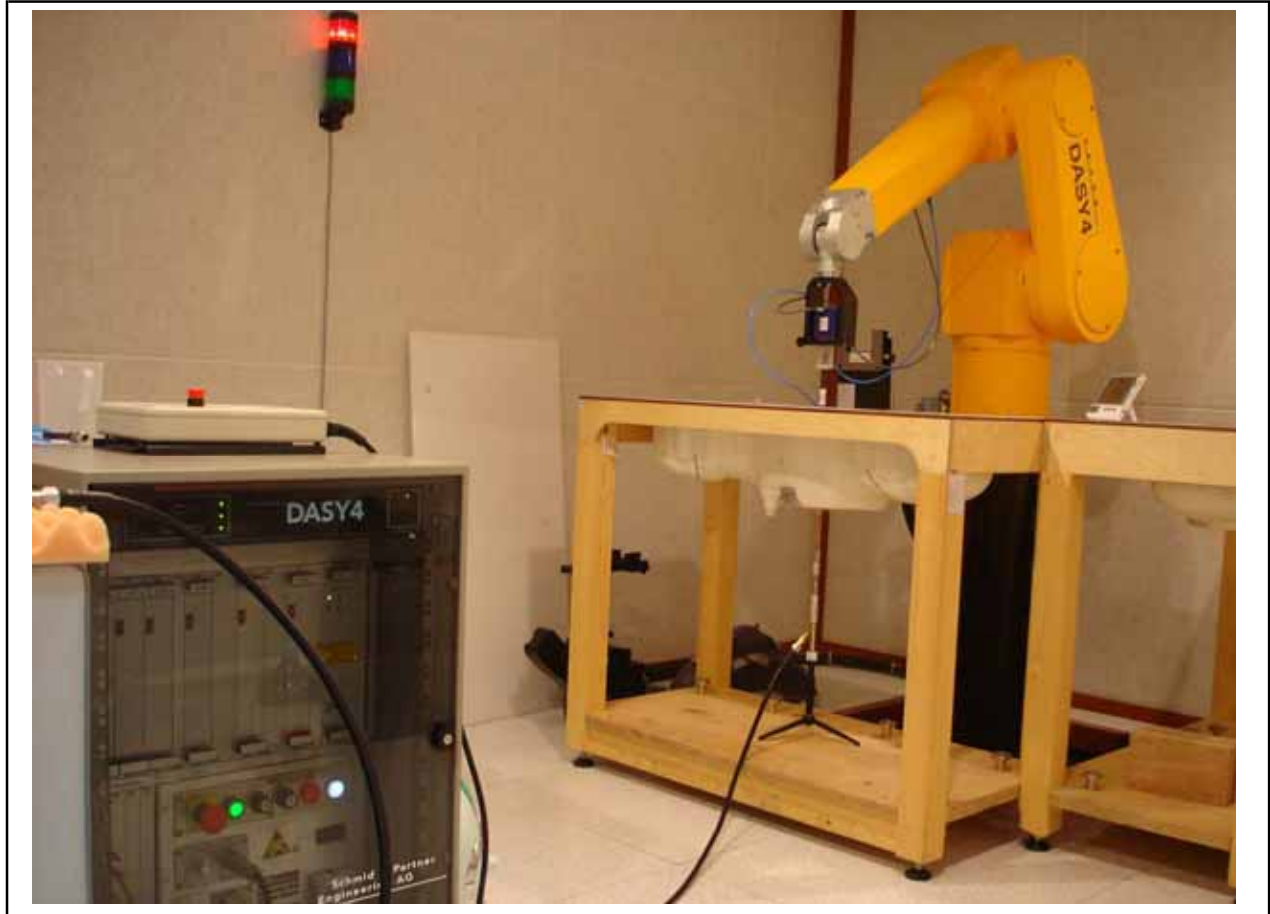


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Dipole Validation



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– GSM850 Validation

Date: 2007-01-10

Test Laboratory: ESTECH

VALIDATION

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:xxx

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.917 \text{ mho/m}$; $\epsilon_r = 40.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (61x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 2.56 mW/g

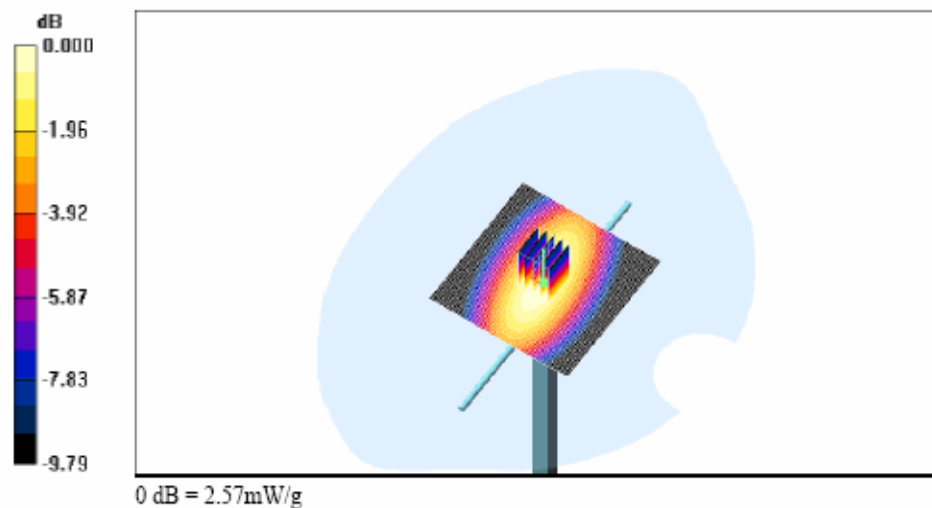
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.5 V/m; Power Drift = -0.038 dB

Peak SAR (extrapolated) = 3.54 W/kg

SAR(1 g) = 2.38 mW/g

Maximum value of SAR (measured) = 2.57 mW/g



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- PCS1900 Validation

Date: 2007-01-10

Test Laboratory: ESTECH

Validation

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:xxx

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

Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 39.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 11.6 mW/g

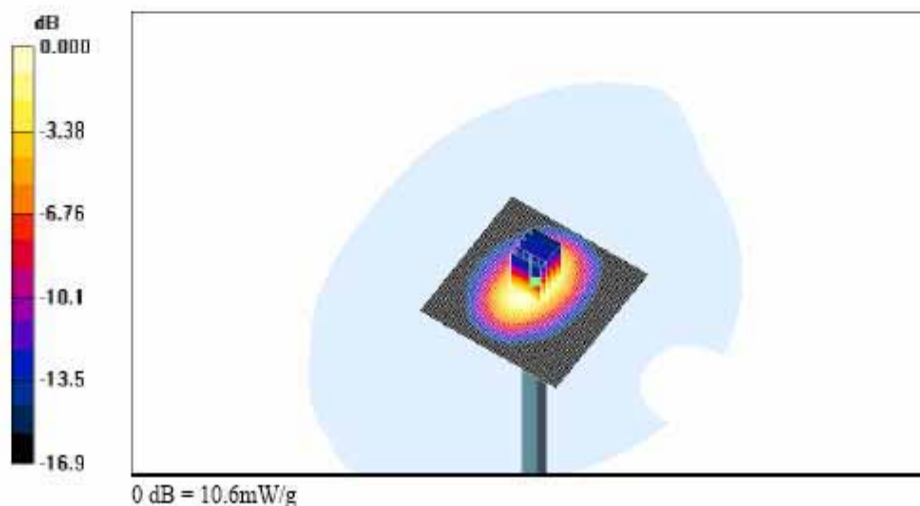
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 85.0 V/m; Power Drift = -0.022 dB

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 9.55 mW/g

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





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APPENDIX C : SAR Test Data

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– GSM850

Date: 2007-01-10

Test Laboratory: ESTECH

LEFT TOUCH 190

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 837$ MHz; $\sigma = 0.919$ mho/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.15 mW/g

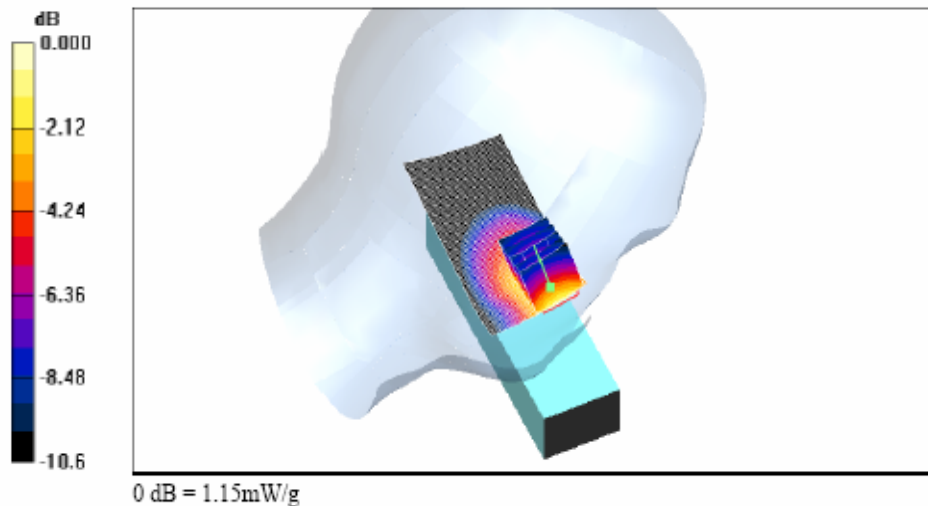
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 8.28 V/m; Power Drift = -0.114 dB

Peak SAR (extrapolated) = 1.58 W/kg

SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.689 mW/g

Maximum value of SAR (measured) = 1.15 mW/g



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Date: 2007-01-10

Test Laboratory: ESTECH

RIGHT TOUCH 190

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 837$ MHz; $\sigma = 0.919$ mho/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.33 mW/g

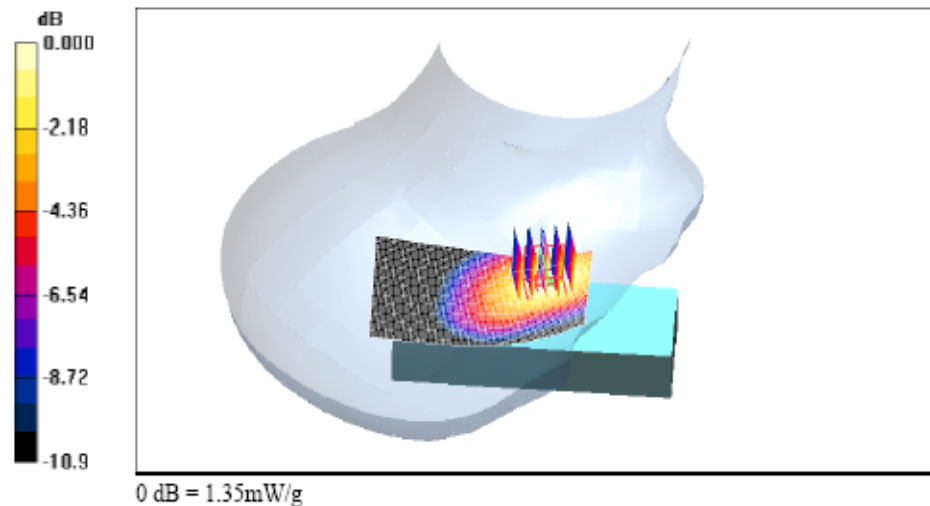
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 8.12 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 1.95 W/kg

SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.786 mW/g

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



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Date: 2007-01-10

Test Laboratory: ESTECH

RIGHT TOUCH 190

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

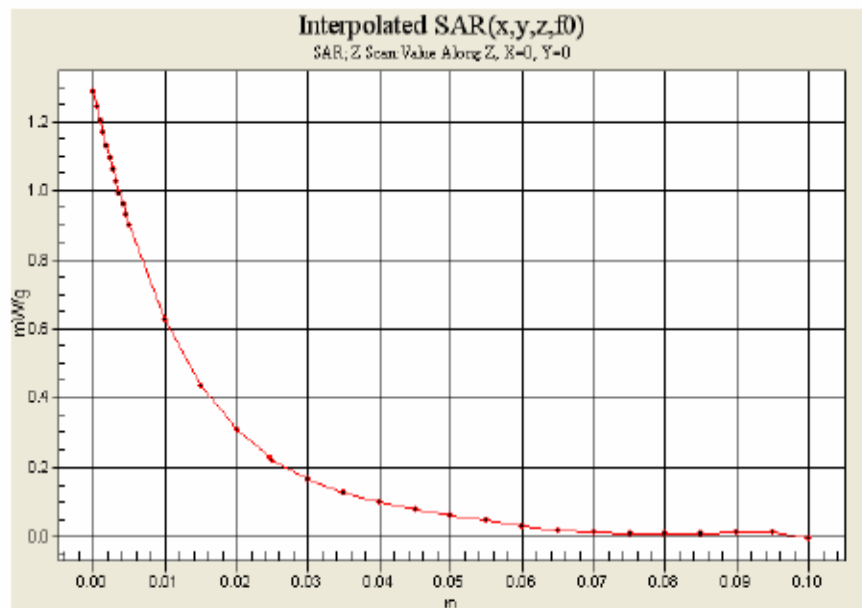
Medium parameters used: $f = 837$ MHz; $\sigma = 0.919$ mho/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection) Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%



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Date: 2007-01-10

Test Laboratory: ESTECH

LEFT TILT 190

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 837$ MHz; $\sigma = 0.919$ mho/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22℃, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

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

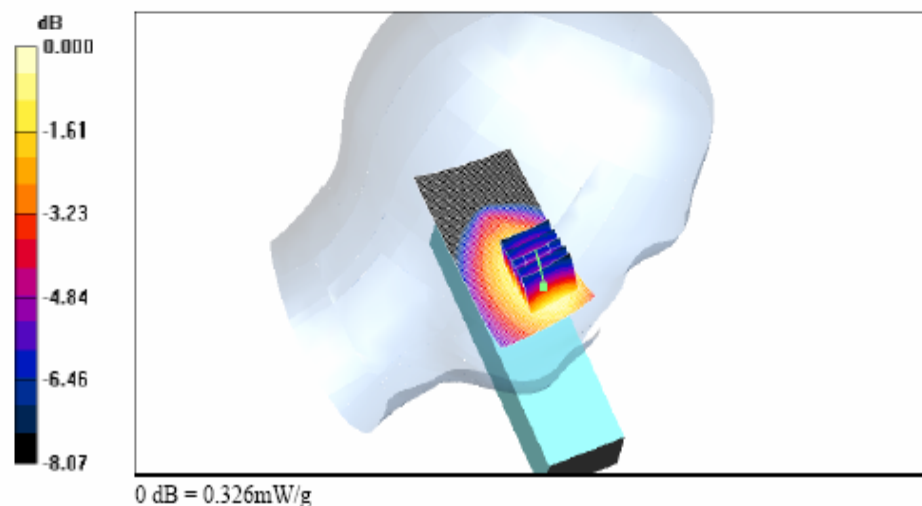
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 9.67 V/m; Power Drift = 0.106 dB

Peak SAR (extrapolated) = 0.393 W/kg

SAR(1 g) = 0.308 mW/g; SAR(10 g) = 0.229 mW/g

Maximum value of SAR (measured) = 0.326 mW/g



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Date: 2007-01-10

Test Laboratory: ESTECH

RIGHT TILT 190

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 837$ MHz; $\sigma = 0.919$ mho/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.377 mW/g

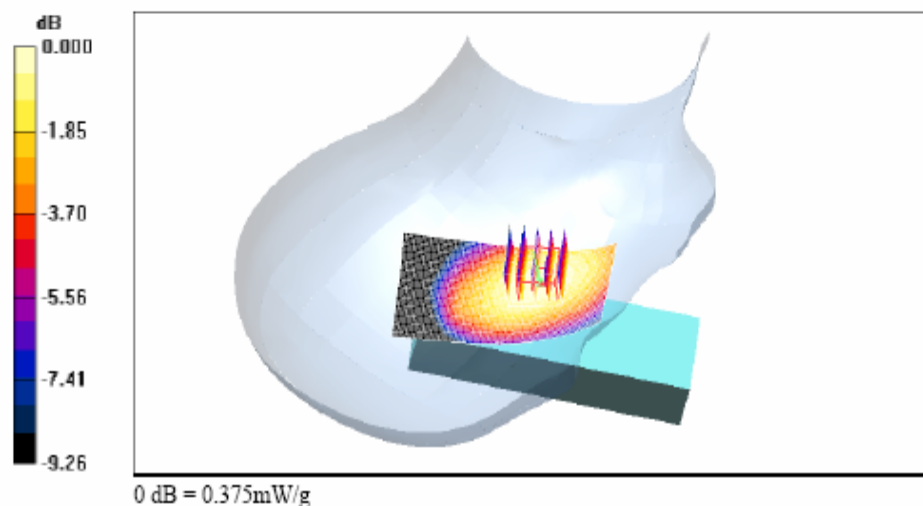
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 11.6 V/m; Power Drift = -0.032 dB

Peak SAR (extrapolated) = 0.449 W/kg

SAR(1 g) = 0.355 mW/g; SAR(10 g) = 0.263 mW/g

Maximum value of SAR (measured) = 0.375 mW/g



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Seoul, 153-803, Korea

Date: 2007-01-10

Test Laboratory: ESTECH

LEFT TOUCH 128

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.908$ mho/m; $\epsilon_r = 41.1$; $\rho = 1000$

kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.916 mW/g

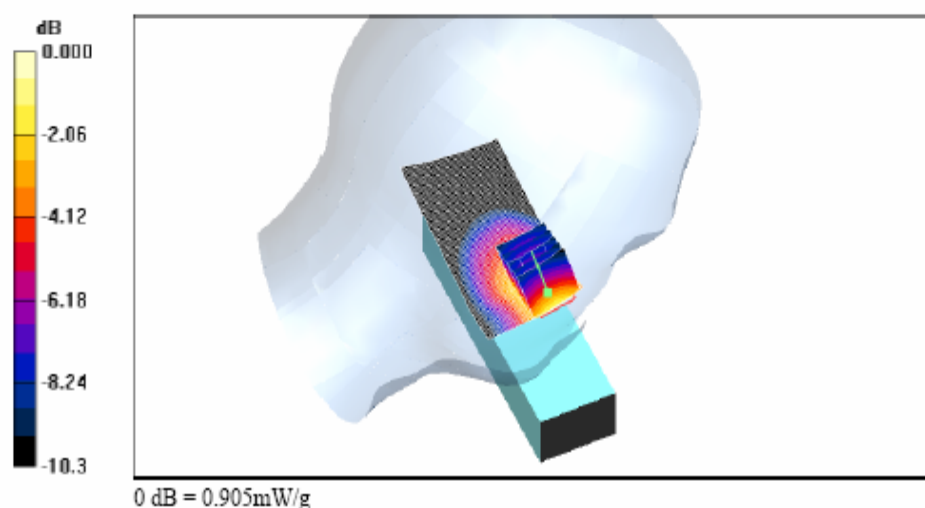
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 7.41 V/m; Power Drift = -0.090 dB

Peak SAR (extrapolated) = 1.24 W/kg

SAR(1 g) = 0.841 mW/g; SAR(10 g) = 0.552 mW/g

Maximum value of SAR (measured) = 0.905 mW/g



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Date: 2007-01-10

Test Laboratory: ESTECH

RIGHT TOUCH 128

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.908$ mho/m; $\epsilon_r = 41.1$; $\rho = 1000$

kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.03 mW/g

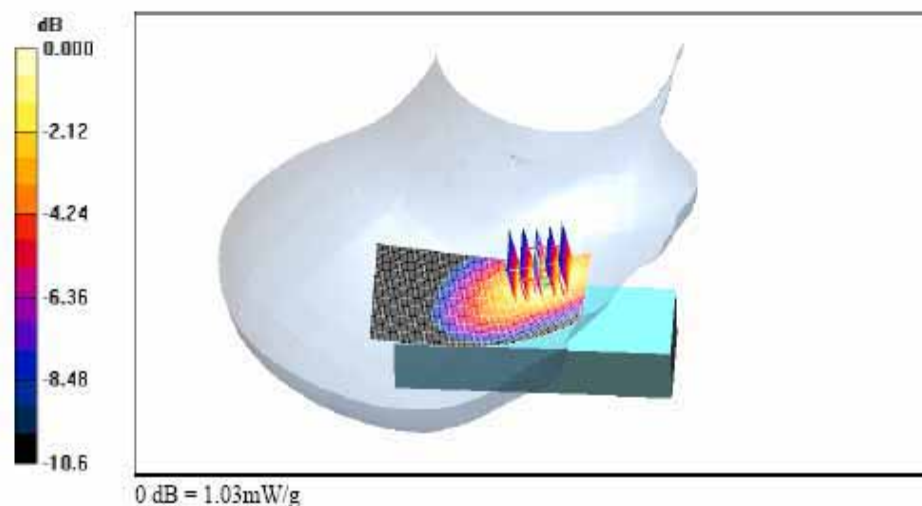
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 8.28 V/m; Power Drift = -0.008 dB

Peak SAR (extrapolated) = 1.44 W/kg

SAR(1 g) = 0.948 mW/g; SAR(10 g) = 0.610 mW/g

Maximum value of SAR (measured) = 1.03 mW/g



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LEFT TOUCH 251

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 849 \text{ MHz}$; $\sigma = 0.925 \text{ mho/m}$; $\epsilon_r = 40.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.903 mW/g

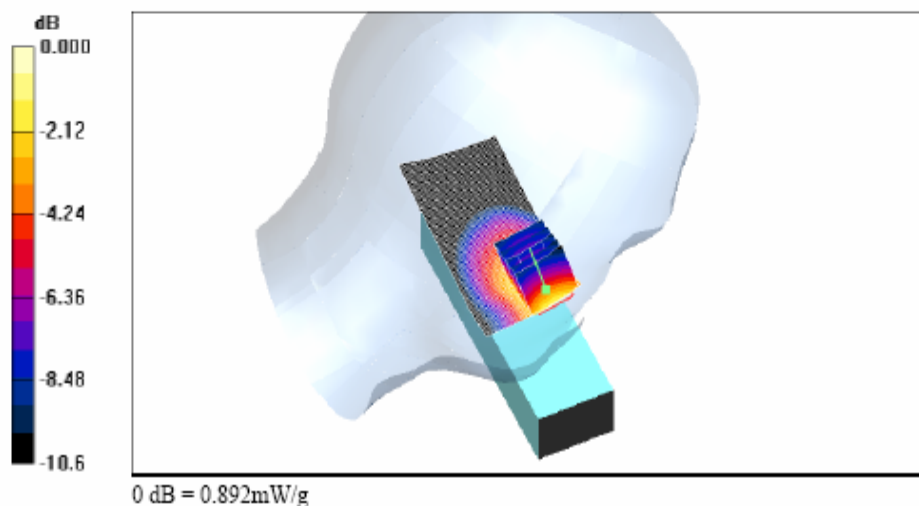
Zoom Scan (5x5x6)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=6\text{mm}$

Reference Value = 6.89 V/m; Power Drift = -0.116 dB

Peak SAR (extrapolated) = 1.21 W/kg

SAR(1 g) = 0.821 mW/g; SAR(10 g) = 0.534 mW/g

Maximum value of SAR (measured) = 0.892 mW/g



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RIGHT TOUCH 251

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 849$ MHz; $\sigma = 0.925$ mho/m; $\epsilon_r = 40.8$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.11 mW/g

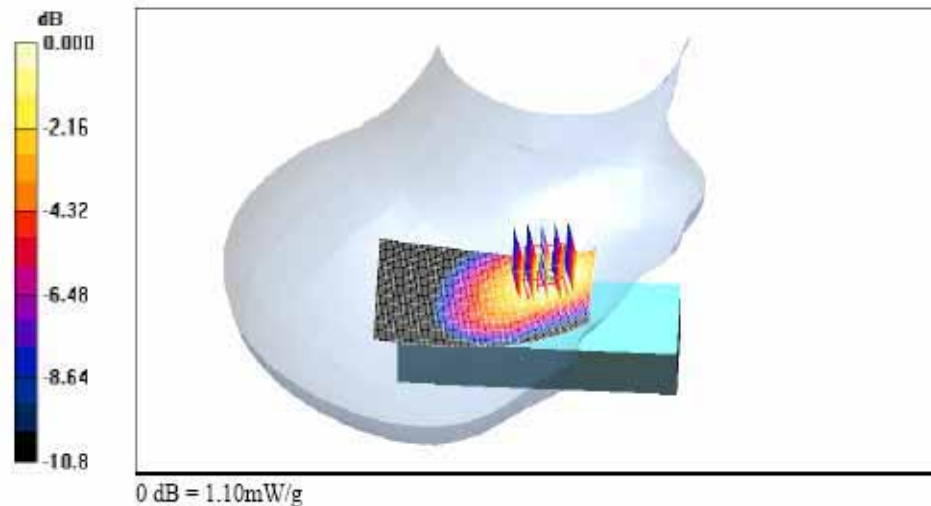
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 8.53 V/m; Power Drift = -0.055 dB

Peak SAR (extrapolated) = 1.56 W/kg

SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.650 mW/g

Maximum value of SAR (measured) = 1.10 mW/g



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BODY 190

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 837$ MHz; $\sigma = 0.968$ mho/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.704 mW/g

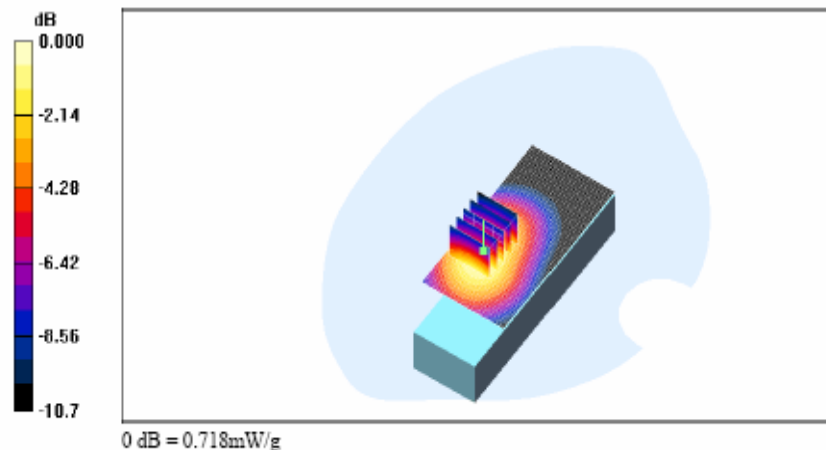
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 18.5 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 0.958 W/kg

SAR(1 g) = 0.663 mW/g; SAR(10 g) = 0.442 mW/g

Maximum value of SAR (measured) = 0.718 mW/g



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BODY 128

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.954$ mho/m; $\epsilon_r = 53.8$; $\rho = 1000$

kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.692 mW/g

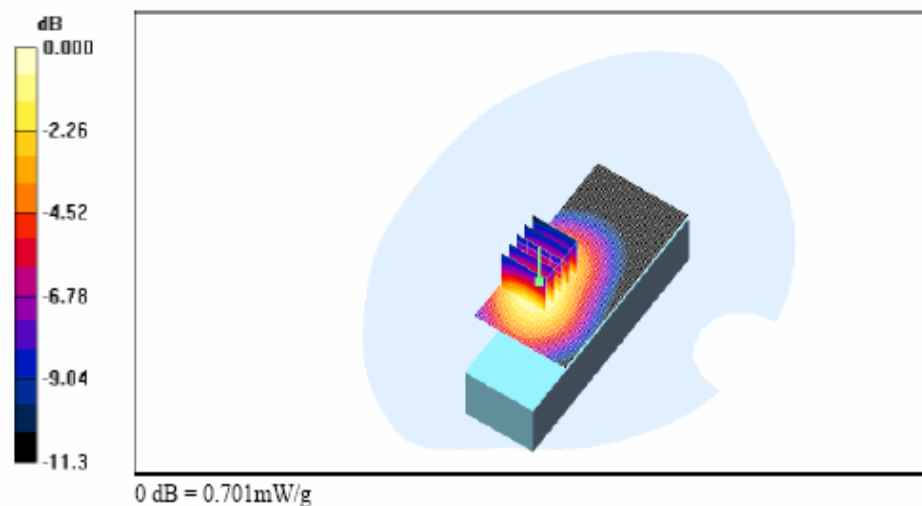
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 17.6 V/m; Power Drift = 0.011 dB

Peak SAR (extrapolated) = 0.956 W/kg

SAR(1 g) = 0.645 mW/g; SAR(10 g) = 0.424 mW/g

Maximum value of SAR (measured) = 0.701 mW/g



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BODY 251

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 849$ MHz; $\sigma = 0.976$ mho/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.684 mW/g

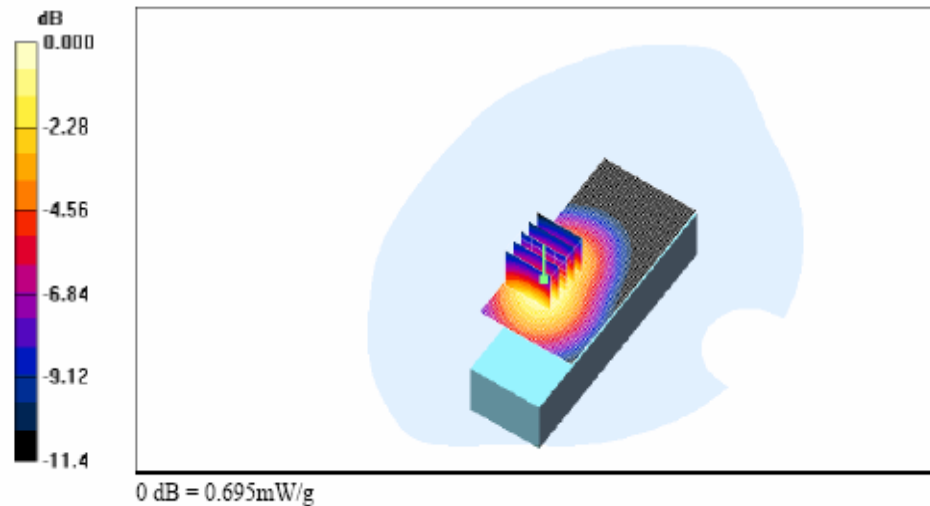
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 17.1 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 0.962 W/kg

SAR(1 g) = 0.640 mW/g; SAR(10 g) = 0.417 mW/g

Maximum value of SAR (measured) = 0.695 mW/g



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Test Laboratory: ESTECH

BODY 190-GPRS

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium parameters used: $f = 837$ MHz; $\sigma = 0.968$ mho/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.08 mW/g

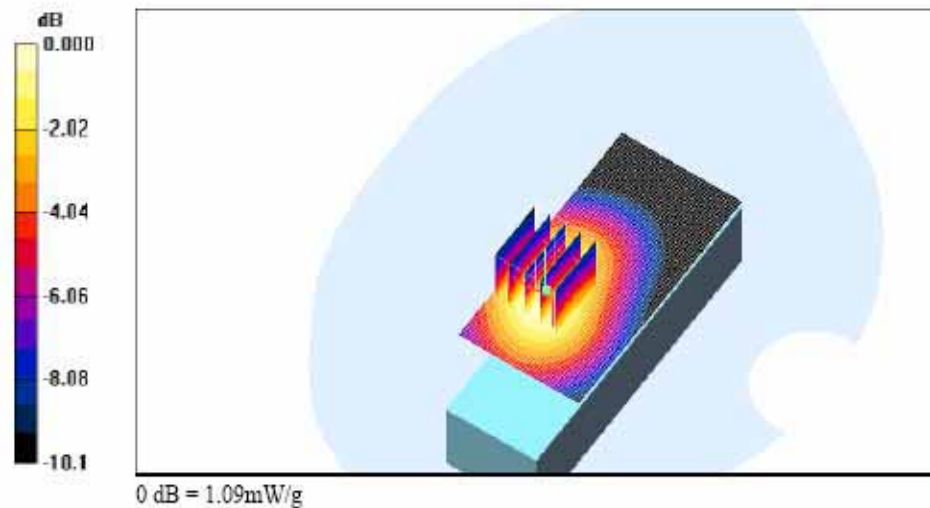
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 23.2 V/m; Power Drift = -0.121 dB

Peak SAR (extrapolated) = 1.39 W/kg

SAR(1 g) = 1 mW/g; SAR(10 g) = 0.683 mW/g

Maximum value of SAR (measured) = 1.09 mW/g



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BODY 190-GPRS

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:4.15

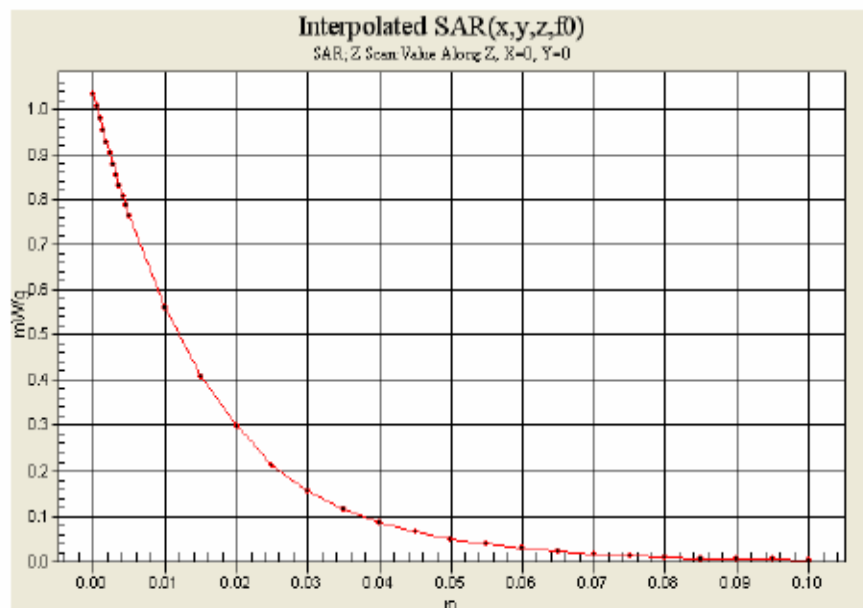
Medium parameters used: $f = 837$ MHz; $\sigma = 0.968$ mho/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection) Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%



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LEFT TOUCH 661

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.594 mW/g

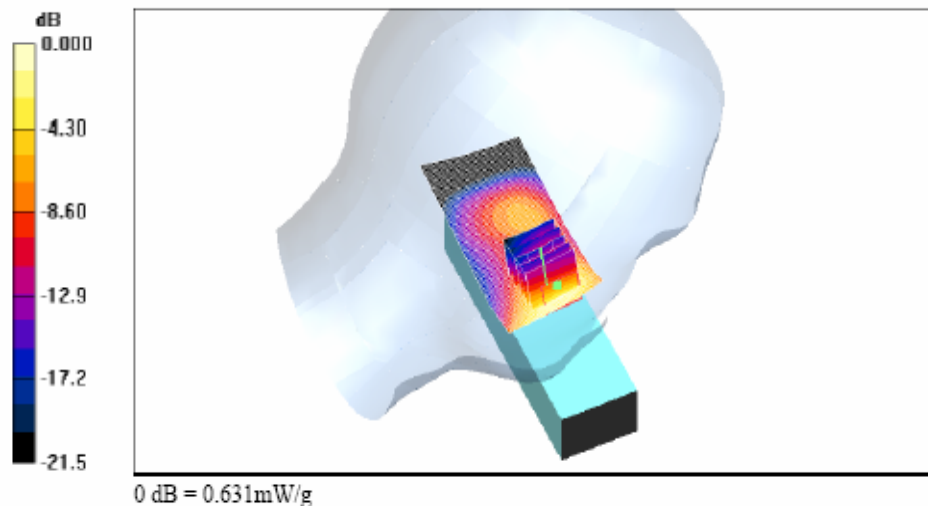
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 6.58 V/m; Power Drift = -0.012 dB

Peak SAR (extrapolated) = 1.20 W/kg

SAR(1 g) = 0.595 mW/g; SAR(10 g) = 0.285 mW/g

Maximum value of SAR (measured) = 0.631 mW/g



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RIGHT TOUCH 661

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.797 mW/g

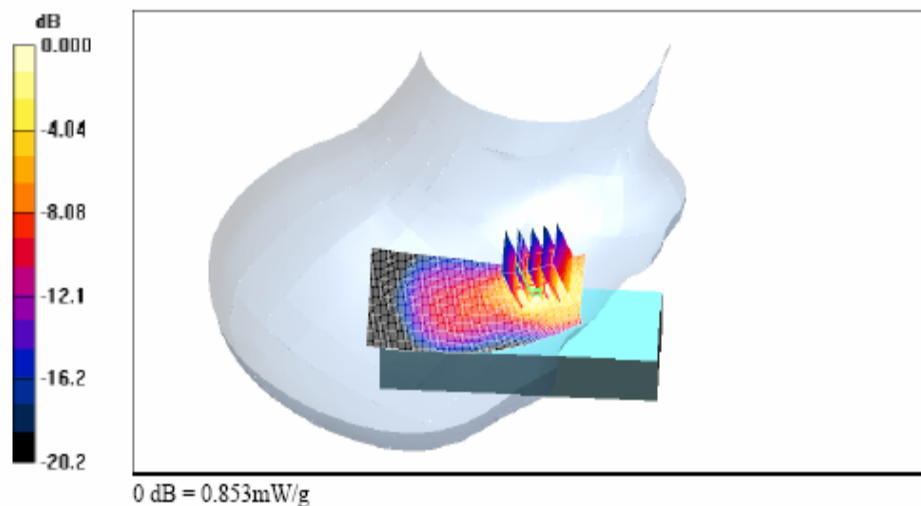
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 4.53 V/m; Power Drift = -0.071 dB

Peak SAR (extrapolated) = 1.58 W/kg

SAR(1 g) = 0.775 mW/g; SAR(10 g) = 0.359 mW/g

Maximum value of SAR (measured) = 0.853 mW/g



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RIGHT TOUCH 661

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

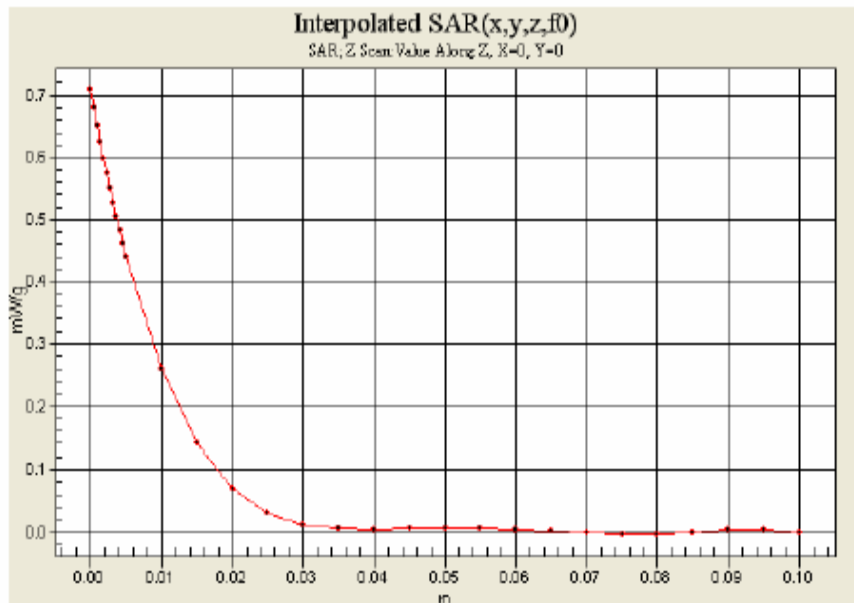
Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection) Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%



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LEFT TILT 661

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.258 mW/g

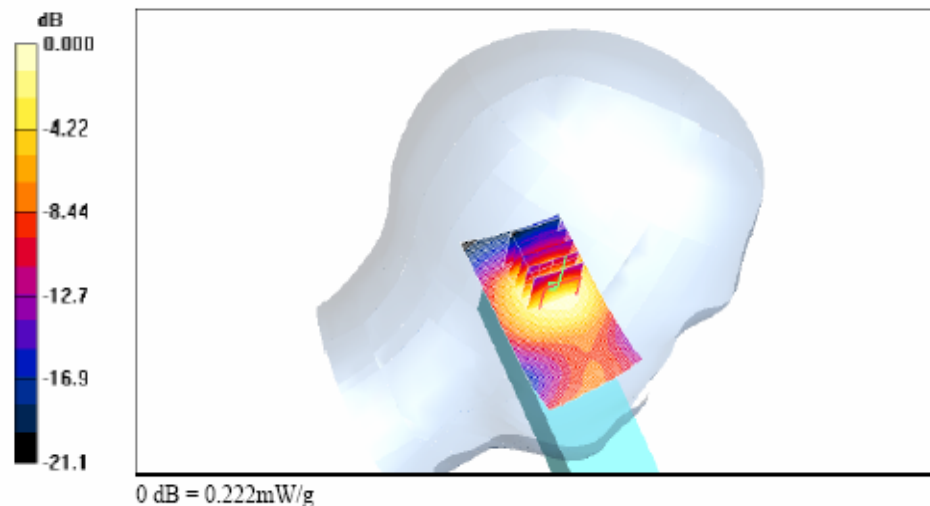
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 10.3 V/m; Power Drift = 0.083 dB

Peak SAR (extrapolated) = 0.327 W/kg

SAR(1 g) = 0.203 mW/g; SAR(10 g) = 0.117 mW/g

Maximum value of SAR (measured) = 0.222 mW/g



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RIGHT TILT 661

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.203 mW/g

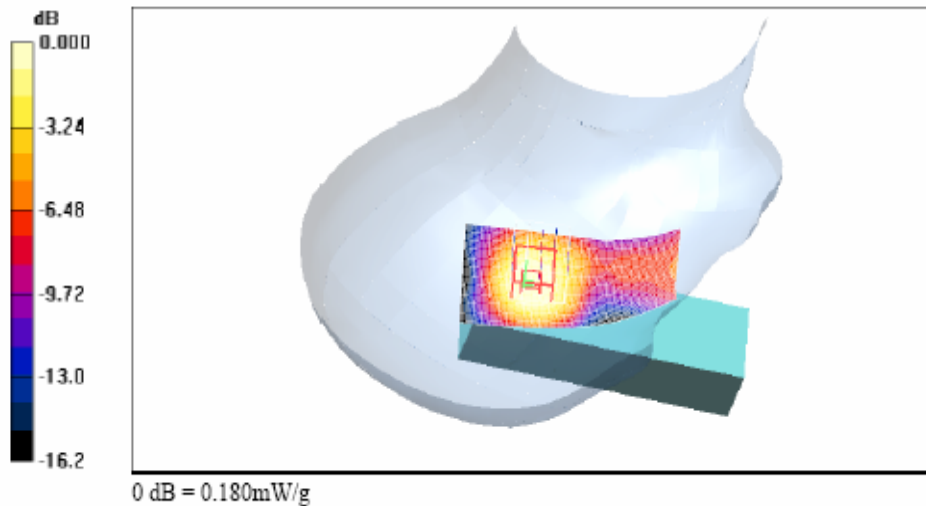
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 8.43 V/m; Power Drift = 0.079 dB

Peak SAR (extrapolated) = 0.261 W/kg

SAR(1 g) = 0.171 mW/g; SAR(10 g) = 0.104 mW/g

Maximum value of SAR (measured) = 0.180 mW/g



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BODY 661

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: DCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.528 mW/g

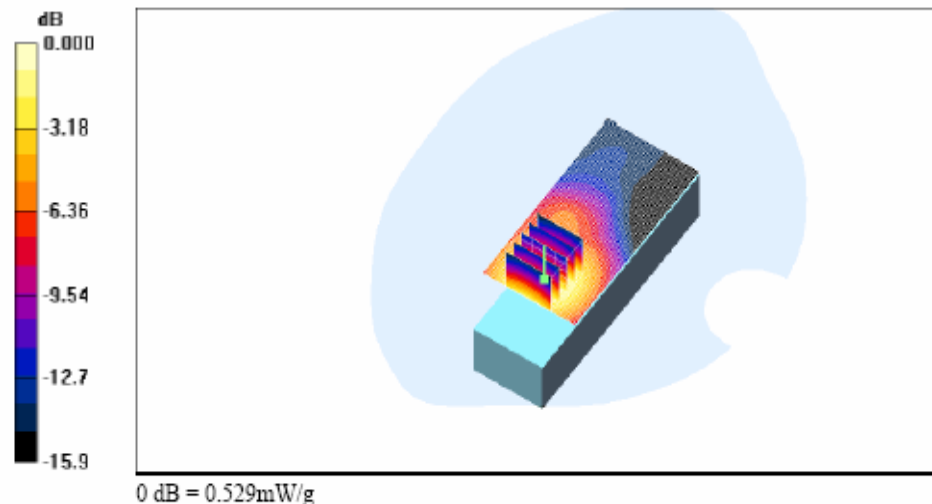
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 7.21 V/m; Power Drift = -0.050 dB

Peak SAR (extrapolated) = 0.772 W/kg

SAR(1 g) = 0.487 mW/g; SAR(10 g) = 0.293 mW/g

Maximum value of SAR (measured) = 0.529 mW/g



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Test Laboratory: ESTECH

BODY 512

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: DCS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$

kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.712 mW/g

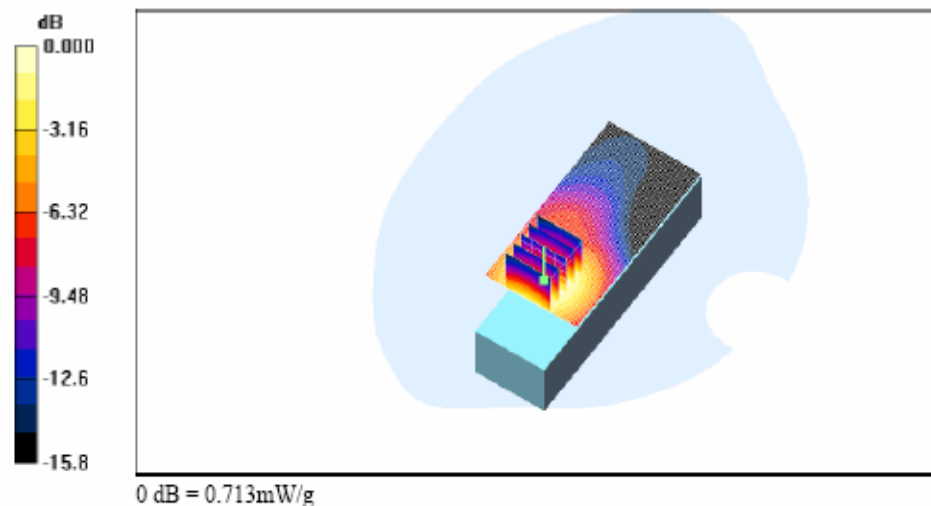
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 7.88 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 1.03 W/kg

SAR(1 g) = 0.660 mW/g; SAR(10 g) = 0.401 mW/g

Maximum value of SAR (measured) = 0.713 mW/g



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Seoul, 153-803, Korea

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FAX: 82-2-867-3204

Date: 2007-01-10

Test Laboratory: ESTECH

BODY 810

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: DCS 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 1910$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.340 mW/g

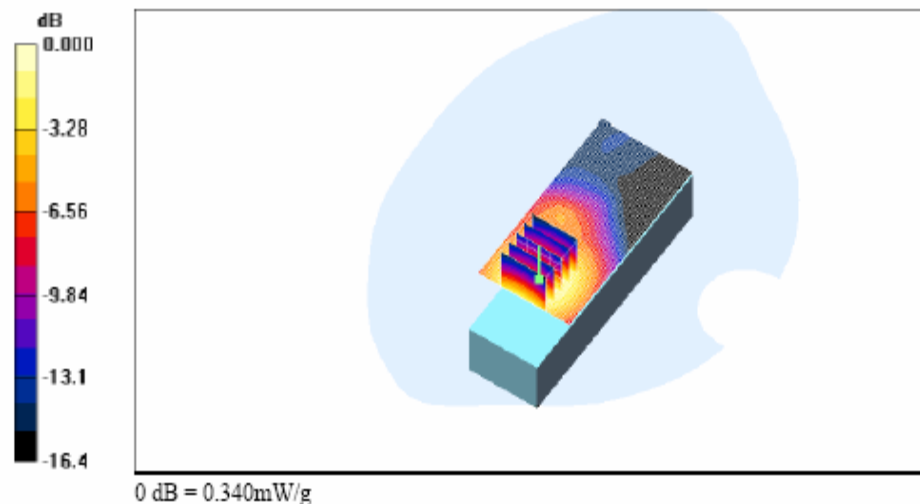
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 5.94 V/m; Power Drift = 0.065 dB

Peak SAR (extrapolated) = 0.501 W/kg

SAR(1 g) = 0.313 mW/g; SAR(10 g) = 0.187 mW/g

Maximum value of SAR (measured) = 0.340 mW/g



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Seoul, 153-803, Korea

Date: 2007-01-10

Test Laboratory: ESTECH

BODY 512-GPRS

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: DCS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:4.15

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$

kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800MHz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22 °C, Humidity : 43%

Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.10 mW/g

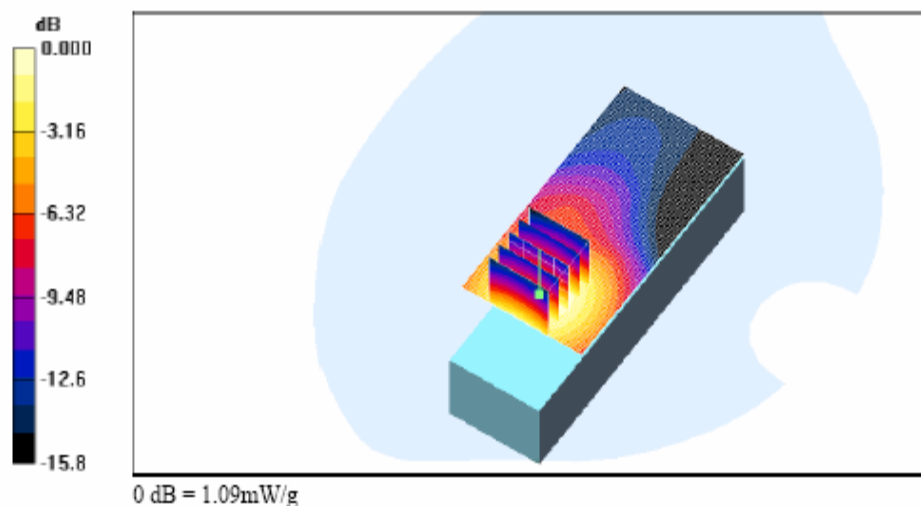
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm

Reference Value = 9.59 V/m; Power Drift = -0.094 dB

Peak SAR (extrapolated) = 1.59 W/kg

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.616 mW/g

Maximum value of SAR (measured) = 1.09 mW/g



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FAX: 82-2-867-3204

Date: 2007-01-10

Test Laboratory: ESTECH

BODY 512-GPRS

DUT: MG225d; Type: FOLDER TYPE; Serial: XXXX

Communication System: DCS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:4.15

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$

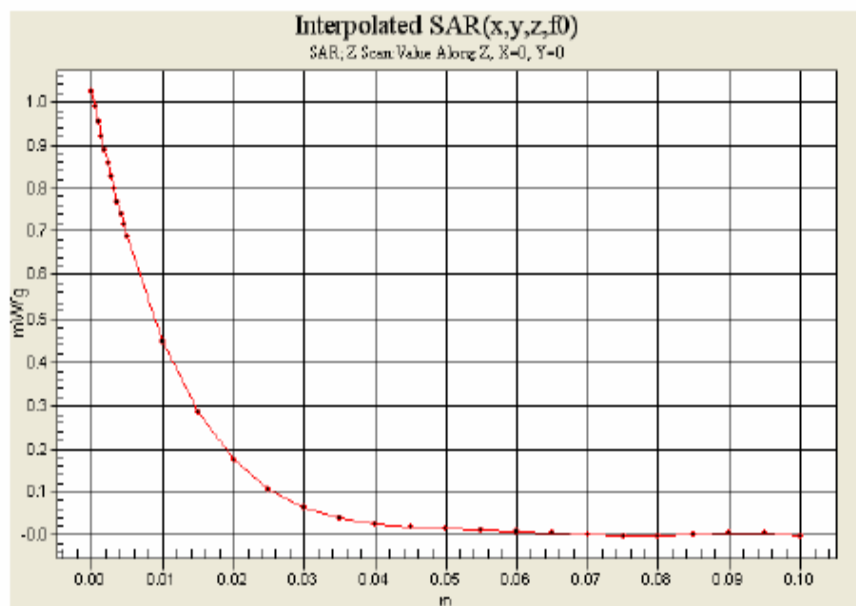
kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection) Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 22°C, Humidity : 43%





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APPENDIX D : Calibration Certificates

IMPORTANT NOTICE

USAGE OF PROBES IN ORGANIC SOLVENTS

Diethylene Glycol Monobutyl Ether (the basis for liquids above 1 GHz), as many other organic solvents, is a very effective softener for synthetic materials. These solvents can cause irreparable damage to certain SPEAG products, except those which are explicitly declared as compliant with organic solvents.

Compatible Probes:

- ET3DV6
- ET3DV6R
- ES3DVx
- EX3DVx
- ER3DV6
- H3DV6

Important Note for ET3DV6 Probes:

The ET3DV6 probes shall not be exposed to solvents longer than necessary for the measurements and shall be cleaned daily after use with warm water and stored dry.



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Schmid & Partner Engineering AG



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Estech (Dymstec)**

Certificate No: **ES3-3123_Oct06**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3123**

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

Calibration date: **October 17, 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 (M&TE 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: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (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: 654	21-Jun-06 (SPEAG, No. DAE4-654_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	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

Calibrated by: **Katja Pokovic** **Technical Manager**

Approved by: **Niels Kuster** **Quality Manager**

Issued: October 17, 2006

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- 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_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * *frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: 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_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3123

Manufactured:	July 11, 2006
Calibrated:	October 17, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3123

Sensitivity in Free Space^A

Diode Compression^B

NormX	1.31 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	96 mV
NormY	1.34 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	94 mV
NormZ	1.10 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	96 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 _{be} [%]	Without Correction Algorithm	5.7	2.3
SAR _{be} [%]	With Correction Algorithm	0.0	0.1

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	3.8	1.5
SAR _{be} [%]	With Correction Algorithm	0.0	0.2

Sensor Offset

Probe Tip to Sensor Center **2.0 mm**

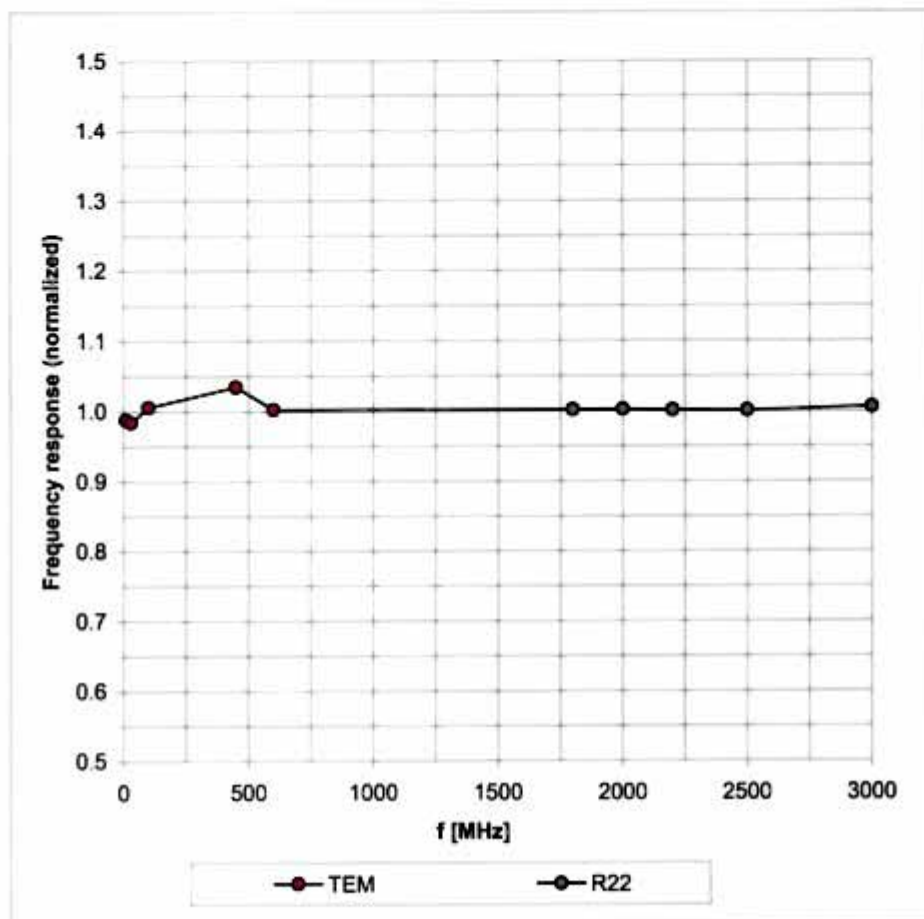
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

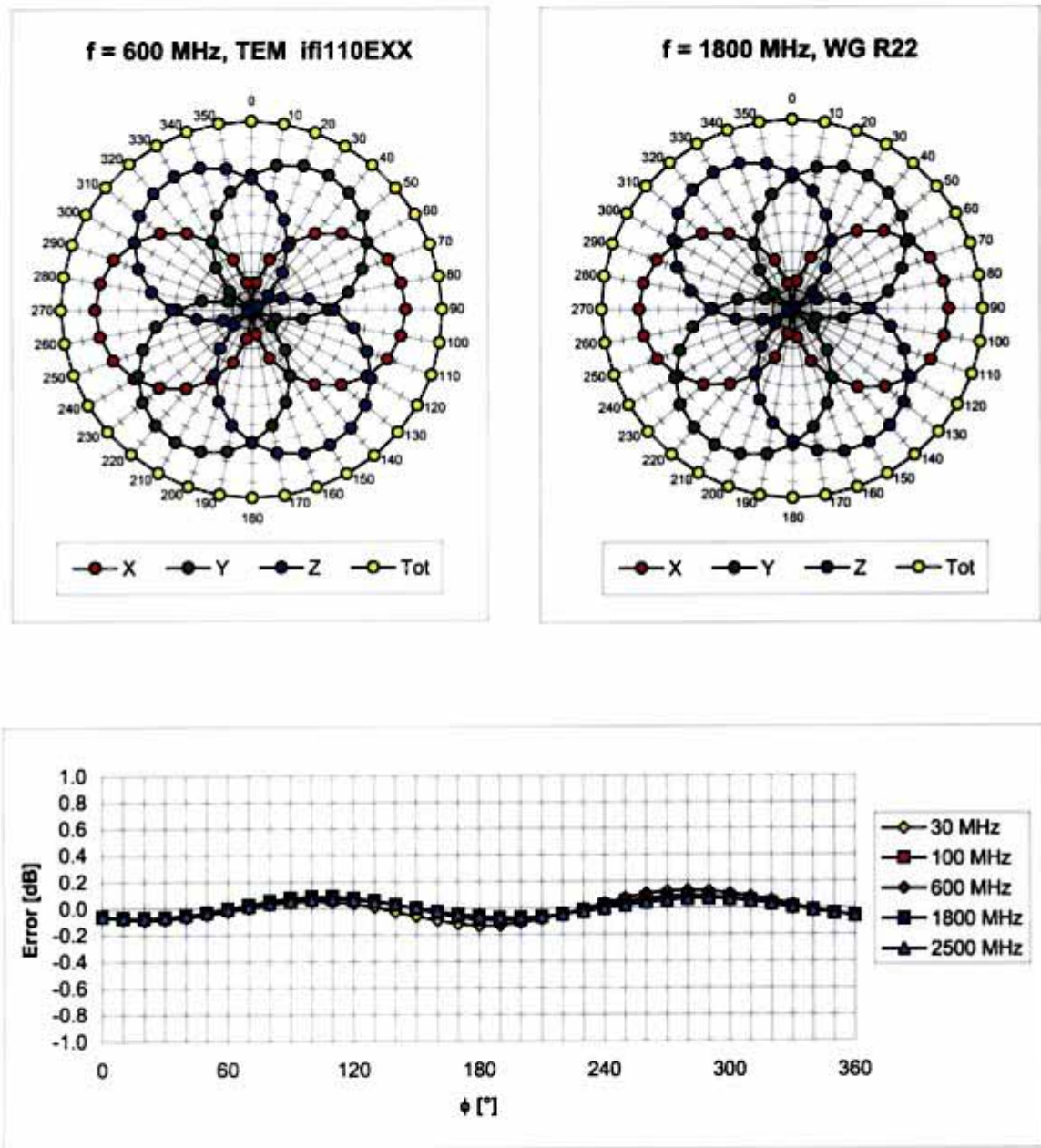
Frequency Response of E-Field

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



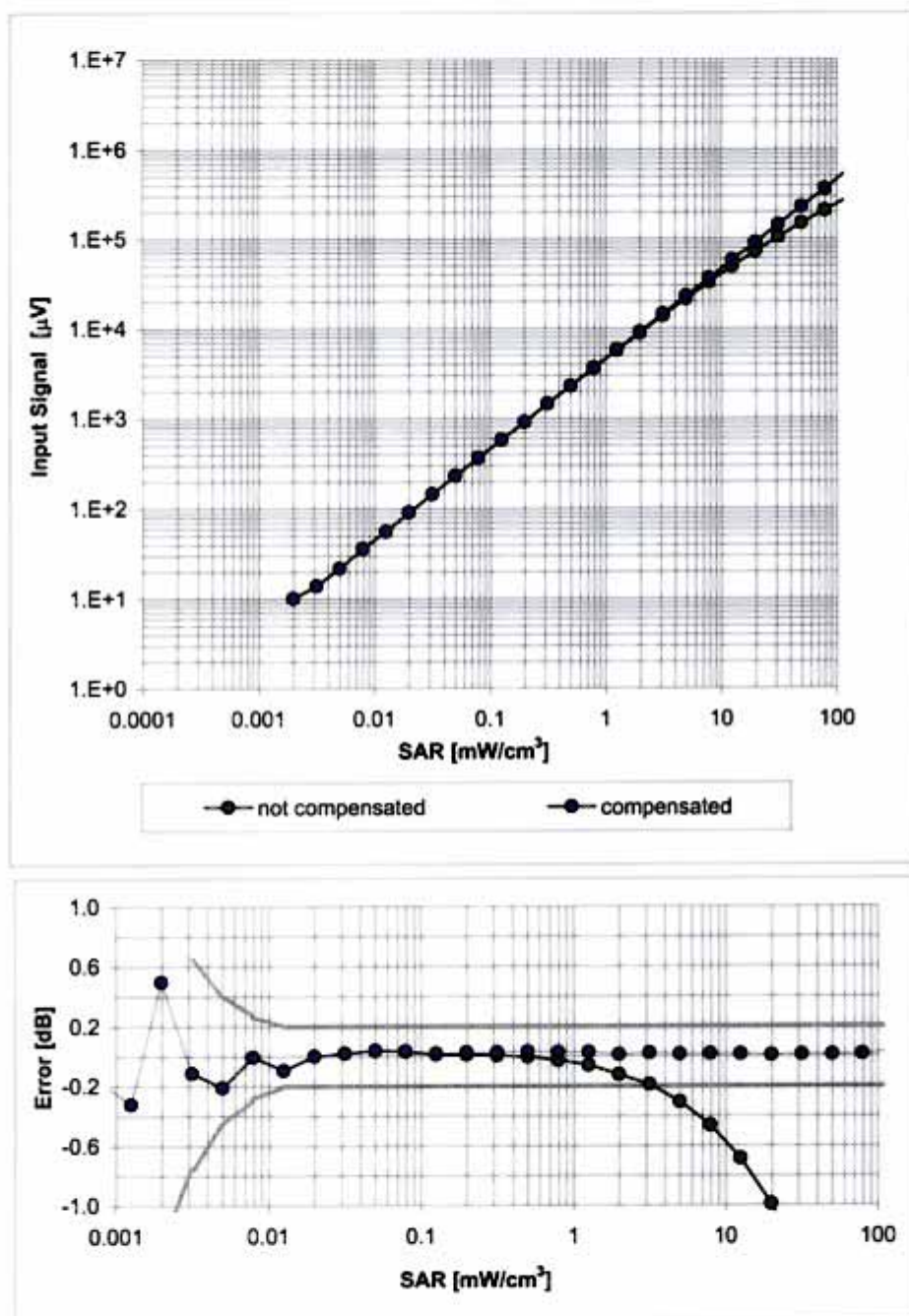
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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



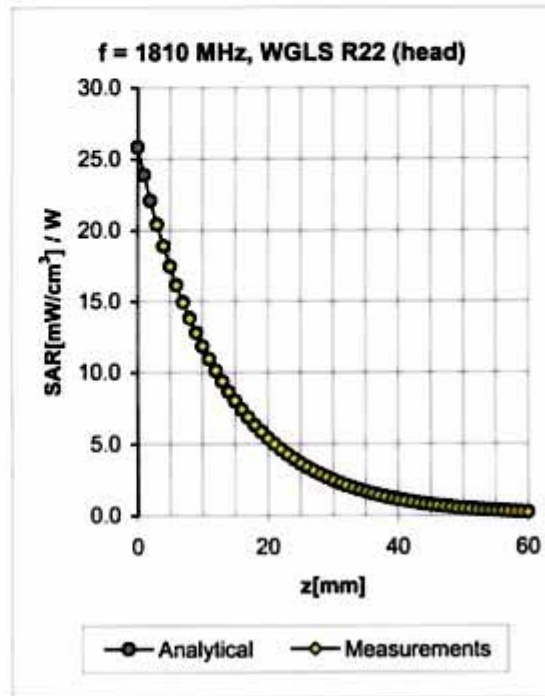
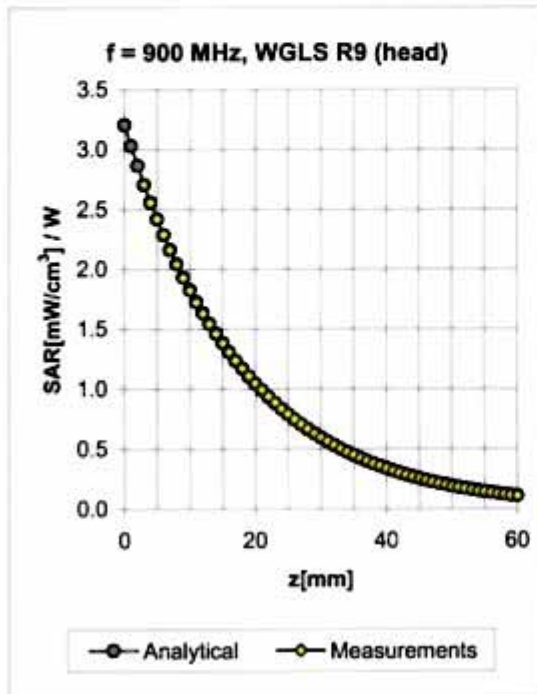
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800$ MHz)



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

Conversion Factor Assessment

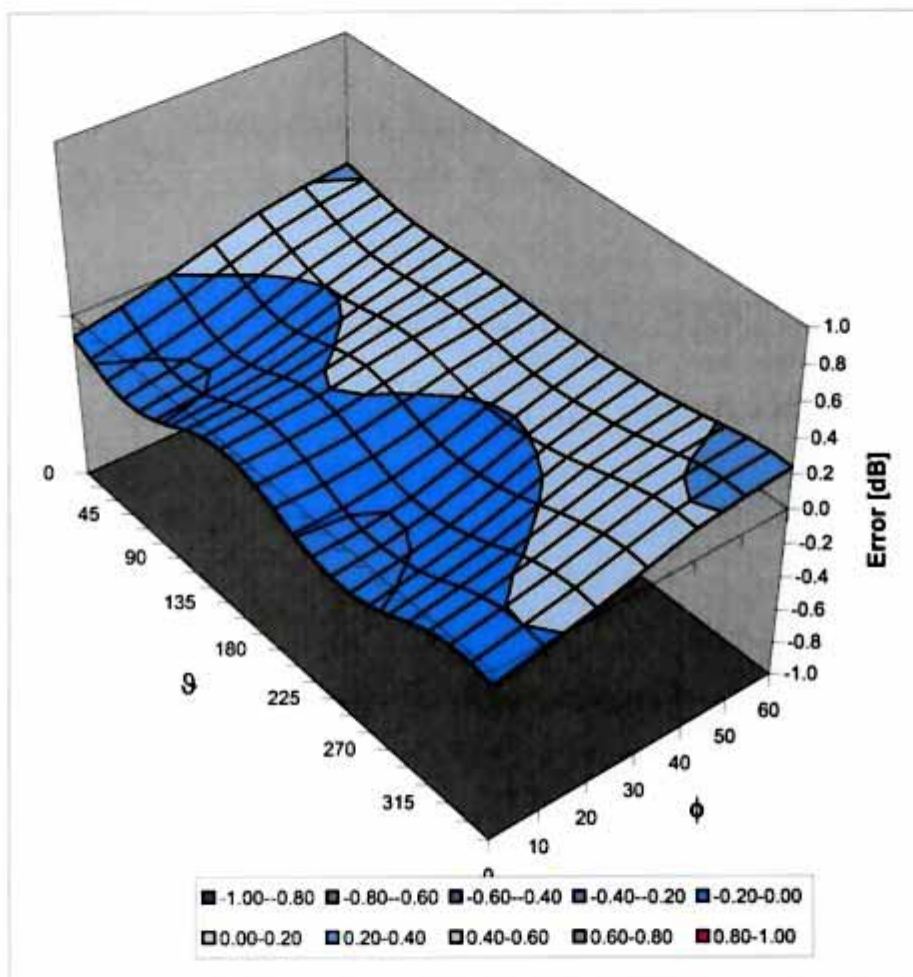


f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	1.00	1.09	6.42 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.92	1.16	5.23 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.79	1.29	5.08 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.87	1.17	4.66 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	1.00	1.17	6.32 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.85	1.26	4.81 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.75	1.37	4.65 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.87	0.91	4.32 ± 11.8% (k=2)

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



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



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Accreditation No.: **SCS 108**

Client **Estech (Dymstec)**

Certificate No: **D835V2-475_Sep06**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 475**

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

Calibration date: **September 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
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	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	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	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

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

Issued: September 13, 2006

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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 V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.7 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
Head TSL temperature during test	(23.6 $\pm$ 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	2.29 mW / g
SAR normalized	normalized to 1W	9.16 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	9.25 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.49 mW / g
SAR normalized	normalized to 1W	5.96 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	6.00 mW / g $\pm$ 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 0.5 j Ω
Return Loss	- 35.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.383 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	November 15, 2002

DASY4 Validation Report for Head TSL

Date/Time: 12.09.2006 18:38:05

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 475

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

Medium: HSL 900 MHz;

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.893 \text{ mho/m}$; $\epsilon_r = 42.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(6.09, 6.09, 6.09); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0:

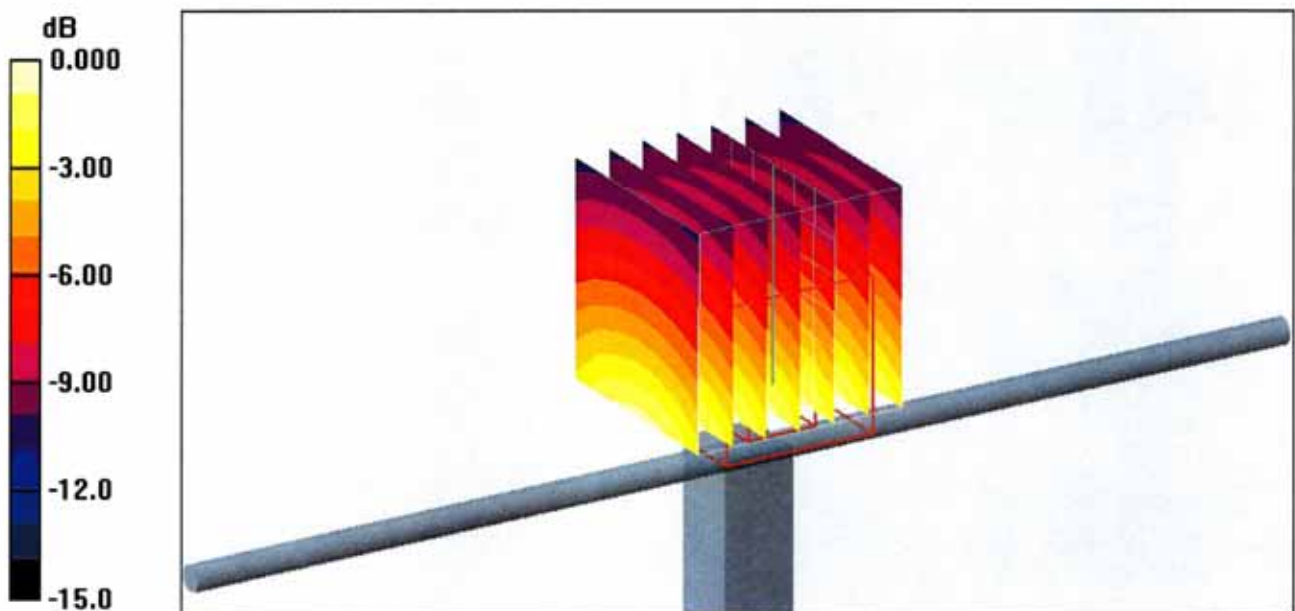
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.6 V/m; Power Drift = -0.033 dB

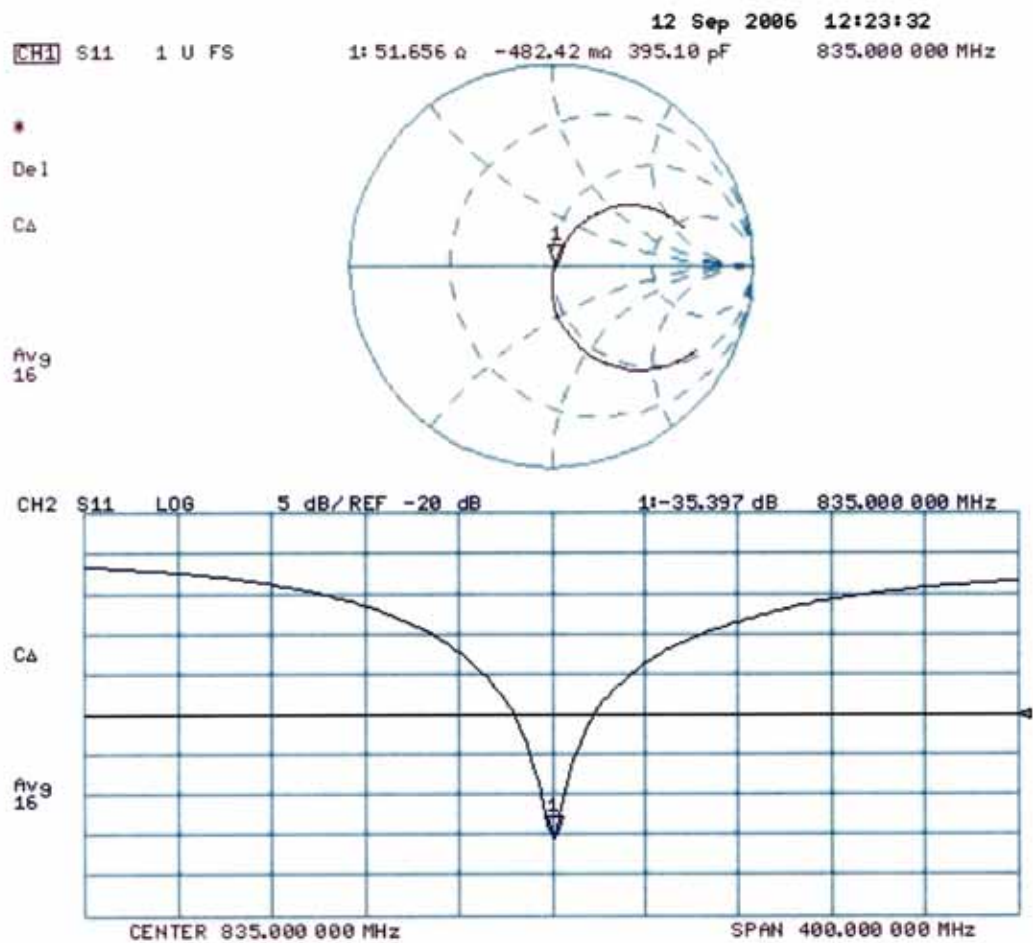
Peak SAR (extrapolated) = 3.41 W/kg

SAR(1 g) = 2.29 mW/g; SAR(10 g) = 1.49 mW/g

Maximum value of SAR (measured) = 2.48 mW/g



Impedance Measurement Plot for Head TSL





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Accreditation No.: **SCS 108**

Client **Estech (Dymstec)**

Certificate No: **D1900V2-5d058_Sep06**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d058**

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

Calibration date: **September 13, 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
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	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN: 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	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	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

Calibrated by: **Name** **Marcel Fehr** **Function** **Laboratory Technician**

Signature

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

Issued: September 20, 2006

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



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
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
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	38.6 $\pm$ 6 %	1.41 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.4 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.33 mW / g
SAR normalized	normalized to 1W	37.3 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	36.5 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.95 mW / g
SAR normalized	normalized to 1W	19.8 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	19.5 mW / g $\pm$ 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.9\ \Omega + 3.4\ j\Omega$
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 19, 2004

DASY4 Validation Report for Head TSL

Date/Time: 13.09.2006 15:41:51

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d058

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

Medium: HSL U10 BB;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.41$ mho/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.74, 4.74, 4.74); Calibrated: 28.10.2005
- 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/Zoom Scan (7x7x7)/Cube 0:

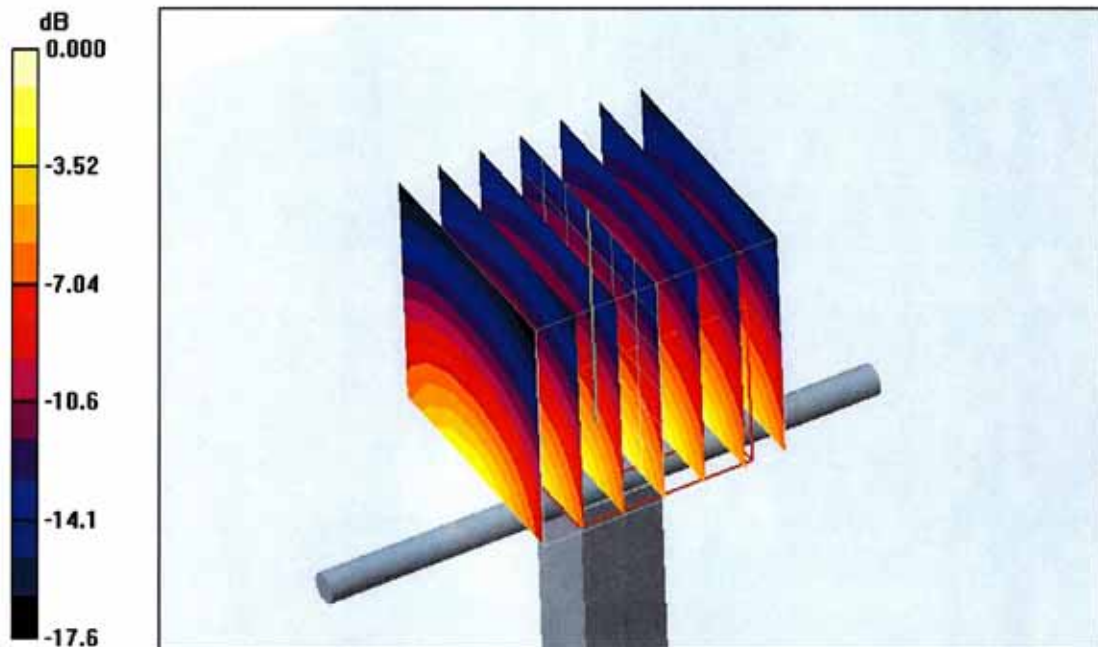
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.6 V/m; Power Drift = -0.015 dB

Peak SAR (extrapolated) = 15.8 W/kg

SAR(1 g) = 9.33 mW/g; SAR(10 g) = 4.95 mW/g

Maximum value of SAR (measured) = 10.5 mW/g



0 dB = 10.5mW/g

Impedance Measurement Plot for Head TSL

