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SAR Compliace 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 : 2006 7/10 ~ 8/11
Test Site : ESTECH Co., Ltd. Korea

Test Device :

Models : MG320d

FCC ID : BEJMG320D

TYPE : GSM Phone with Bluetooth (Prototype)

Test report no :	ESTSAR0608-002	Number of page :	25
Contact person :	Bong Hyo, Han	Responsible test Engineer :	K.H.Kang
Testing has been Carried out in Accordance with :	IEEE P1528-200X Draft 6.4 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 recept in full, without written approval of the laboratory.		

Date and Signatures : 2006/8/11
Report Prepared By : Engineer/ K.H.Kang
(Signature)
Manager Engineer/ Jay Kim
(Signature)

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1. SUMMARY FOR TEST REPORT

FCC ID	BEJMG320D
Date of test	2006/7/10 ~ 2006/8/11
Responsible test engineer	Jay Kim
Measurement performed by	K.H.Kang
EUT Type	GSM Phone with Bluetooth (Prototype)
Tx Frequency	824.2 ~ 848.8MHz(GSM850), 1850.2 ~ 1909.8 MHz(PCS1900)
Rx Frequency	869.2 ~ 893.8MHz(GSM850), 1930.2 ~ 1989.8 MHz(PCS1900)
Max. RF Output Power	GSM : GSM850(33 dBm) PCS1900 (30 dBm) GPRS : GSM850(39 dBm) PCS1900 (36 dBm)

Maximum Results Found During SAR Evaluation under phone call and bluetooth function enable

1.1 Head Configuration

Max. SAR Measurement

FREQUENCY		Modulation	Conducted Power(dBm)		Device test position	Antenna position	SAR (W/kg)
MHz	Ch		dBm	Battery			
848.8	251	GSM	33	Standard	Right Touch	–	0.494
1909.8	810	GSM	30	Standard	Left Tilt	–	0.58

1.2 Body Worn Configuration

Max. SAR Measurement

FREQUENCY		Modulation	Conducted Power(dBm)		Separation test position	Antenna position	SAR (W/kg)
MHz	Ch		dBm	Battery			
824.2	128	GSM	39	Standard	1.5cm [w/o Holster]	–	1.21
1850.2	512	GSM	36	Standard	1.5cm [w/o Holster]	–	1.11

1.3 Measurement Uncertainty

Combine Standard Uncertainty	± 10.81 (k=1)
Extended Standard Uncertainty	± 21.62 (k=2, 95% CONFIDENCE LEVEL)

2. INTRODUCATION

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 azards of RF emissions due to FCC-regulated portable device.[1]

The safety limits used for the environmental evaluation measurements arethe 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/ANSIC95.3-1992 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 radiationexposure 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 (NCRP) in Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields," NCRP Report No. 86 (c) NCRP, 1986, Bethesda, MD20814.[6] SAR is ameasure 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. 3.1.).

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

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/㎥)
ρ = Total RMS electric field strength (V/m)

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 sevices 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 : BEJMG320D
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 FreQuency Range(s)	824.2 ~ 848.8MHz(GSM850), 1850.2 ~ 1909.8 MHz(PCS1900)
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)	21
Tissue simulating liquid temperature (°C)	21
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) using manufacturers test codes.

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.

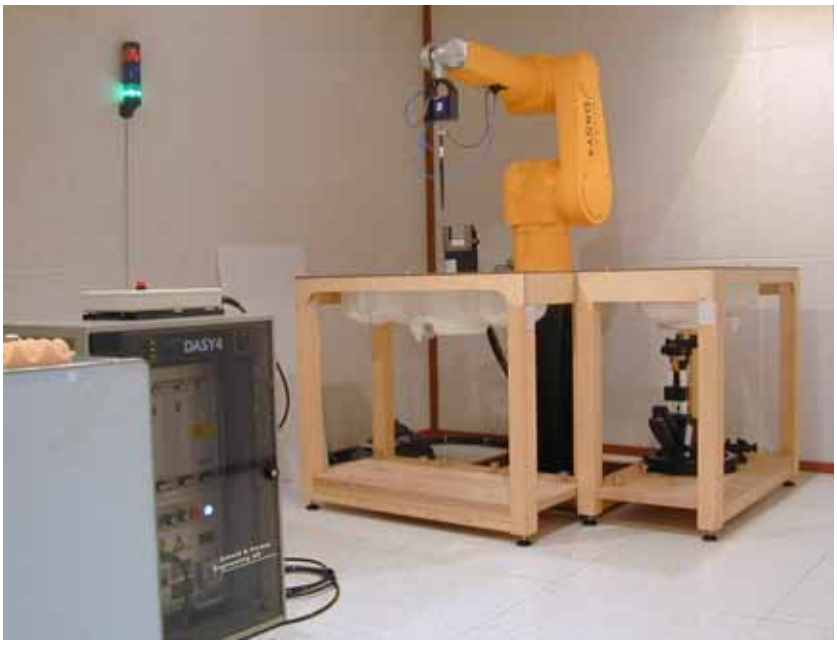

Fig. 4.1 SAR Measurement System

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. date
DAE	DAE4	551	2006-04-27
E-Field Probe	ET3DV6	1750	2006-01-24
Dipole validation kit	D1900V2	5d058	2005-01-27
	D835V2	475	2005-02-24
Network analyzer	8753ES	NONE	2005-10-17
Signal generator	E4432B	GB40050840	2006-03-03
RF Power meter	EPM-442A	GB37170412	2005-10-05
Power Sensor	8481A	3318A90368	2005-10-05
RF Power meter	E4418A	GB38272722	2006-03-03
Power Sensor	8481A	3318A96478	2006-03-08
Dielectric Probe	85070D	US01440154	-

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 Windows2000 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.

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.

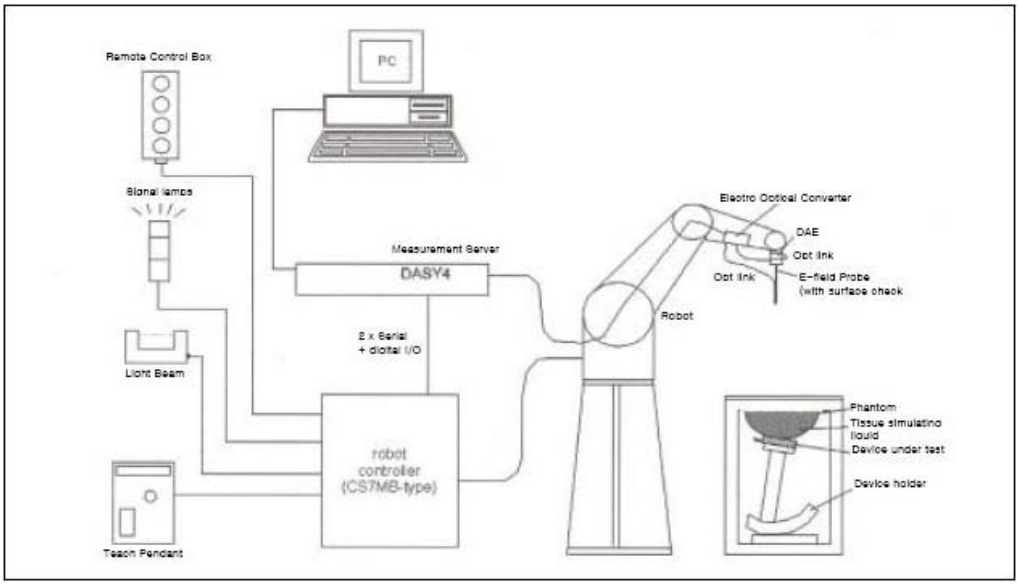

Fig. 5.1 SAR Measurement System Setup

The DAE3 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [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 Table. 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 ± 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 µW/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 hydroxethlcellullose(HEC) gelling agent and saline solution (see Table 5.1). 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 P1528 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)	εr	σ (S/m)	εr	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(diethyene 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±5%	55.2±5%	ε	40.0±5%	53.3±5%
σ	0.89±10%	0.97±10%	σ	1.45±10%	1.52±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].

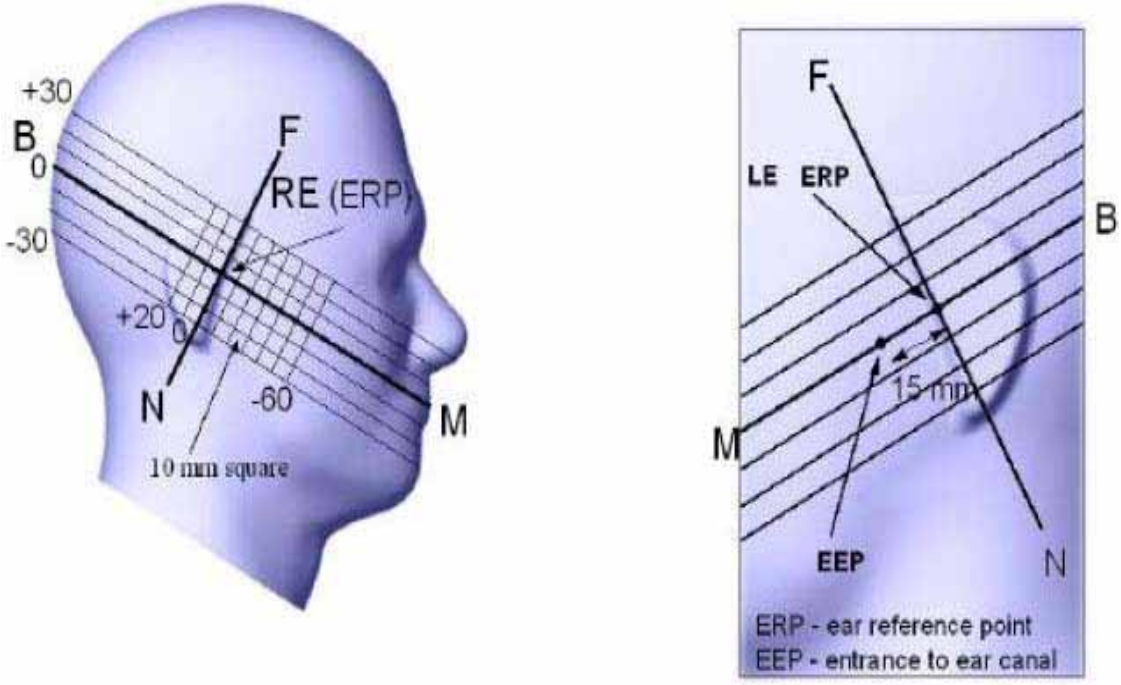

Figure 6.1 Close-up side view of ERP

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 than 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" 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)

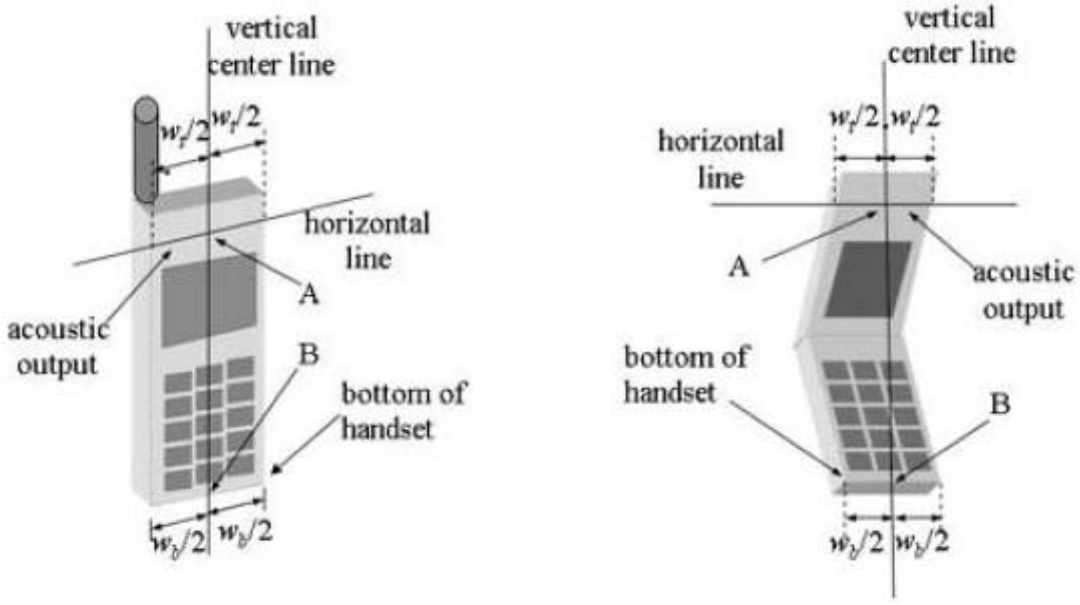

Figure 6.2 Handset Vertical Center & Horizontal Line Reference Points

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 wt of the handset at the level of the acoustic output (point A on Figures 6.2), and the midpoint of the width wb 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 ecessarily 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

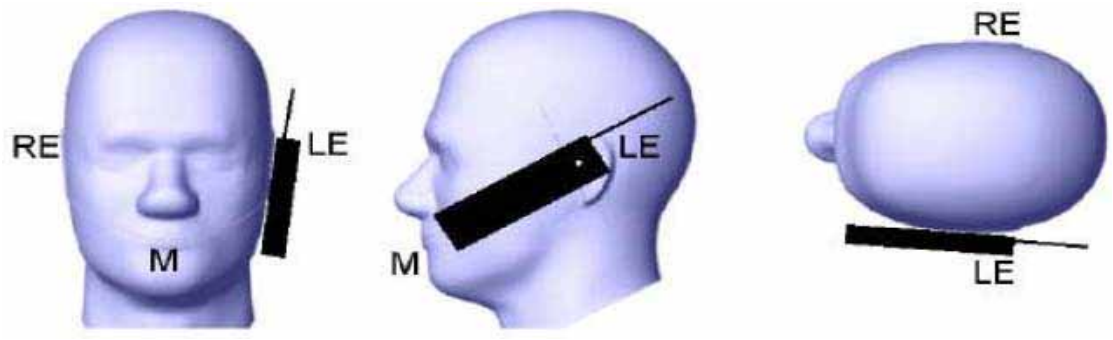

Figure 6.3 “Cheek” or “Touch” Position.

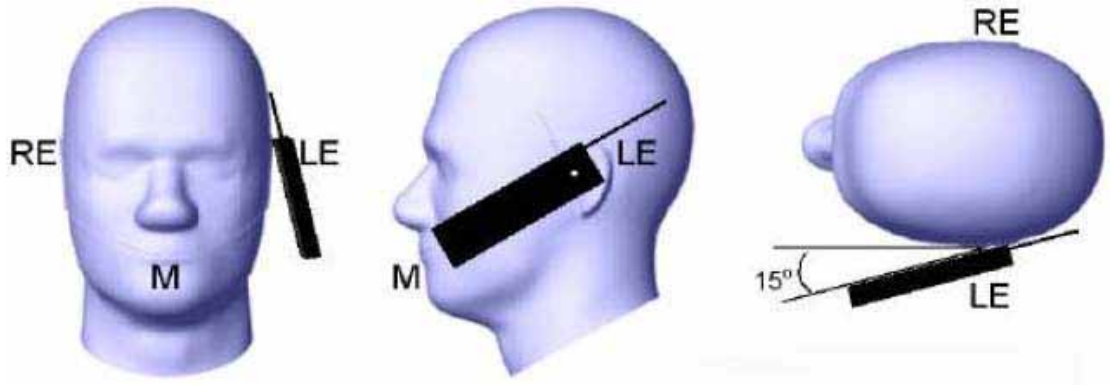

Figure 6.4 “Tilted” Position.

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.

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, 7x7x7 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, Computerma-thematik, 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 value ±%	Probability Distribution	Divisor	ci 1 1g	Standard unc. (1g)	vi or 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	± 2.5	normal	1	0.64	± 1.6%	∞
Liquid permittivity Target - tolerance	± 5.0	rectangular	√3	0.6	± 1.7%	∞
Liquid Permittivity - measurement uncertainty	± 2.5	normal	1	0.6	± 1.5%	∞
Combined Standard Uncertainty					±11.32 %	330
Coverage Factor for 95%				K = 2		
Expanded Standard Uncertainty					± 22.64 %	

8. SYSTEM VERIFICATION

Tissue Verification

Table 8.1 Simulated Tissue Verification [5]

MEASURED TISSUE PARAMETERS										
Liquid Temperature (°C)			21		Liquid Depth(mm)		150			
Date	2006-8-9		2006-8-9		2006-8-10		2006-8-10			
Tissue	1900MHz Brain		1900MHz Muscle		835MHz Brain		835MHz Muscle			
	Target	Measured	Target	Measured	Target	Measured	Target	Measured		
Dielectric Constant: ε	40	38.4	53.3	54.8	41.5	41.1	55.2	53.7		
Conductivity: σ	1.45	1.41	1.52	1.51	0.9	0.906	0.97	0.954		
Deviation (%)	ε : -4.00% σ : -2.76%		ε : 2.81% σ : -0.66%		ε : -0.96% σ : 0.67%		ε : -2.71% σ : -1.65%			

Test System Validation

- Prior to assessment, the system is verified to the ±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	39.2	39.16	0.10%	2006-8-9
835MHz Brain	D835V2(S/N :475)	1.0	9.5	9.4	1.05%	2006-8-10

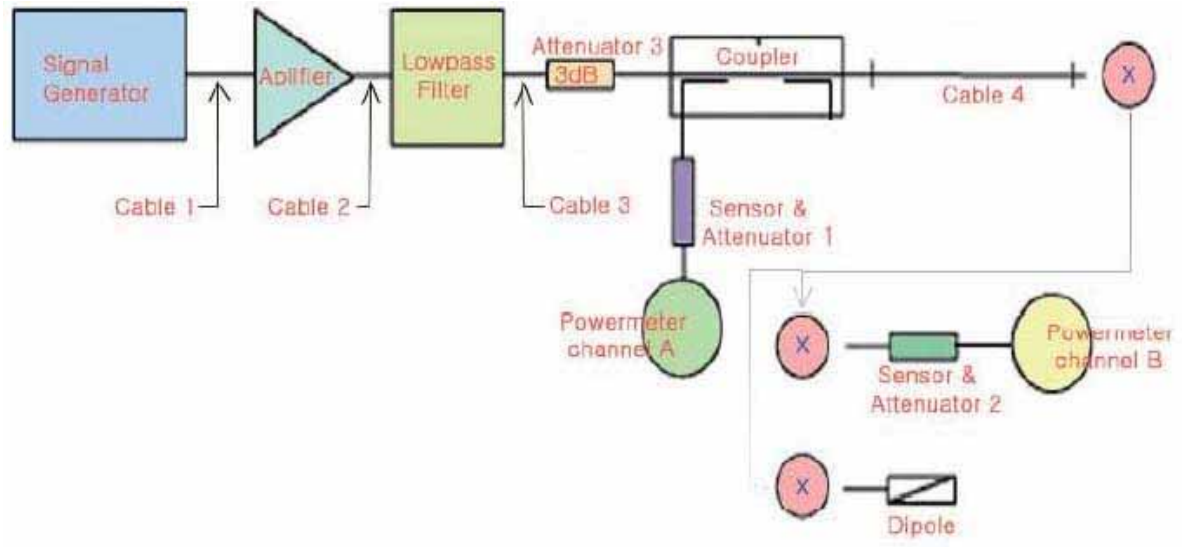

Figure 12.1 Dipole Validation Test Setup

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 21.0
Relative HUMIDITY (%) : 43
Mixture Type : 835MHz Brain
Dielectric Constant : 41.1
Conductivity: 0.906

Measurement Results (GSM Head SAR-Touch)

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 Left Head SAR - Touch)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.20	128	GSM	33.00	32.96	Standard	Cheek Touch	-	0.386
836.60	190	GSM	33.00	32.94	Standard	Cheek Touch	-	0.431
848.80	251	GSM	33.00	32.89	Standard	Cheek Touch	-	0.489

MEASUREMENT RESULTS (GSM Right Head SAR - Touch)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.20	128	GSM	33.00	32.94	Standard	Cheek Touch	-	0.405
836.60	190	GSM	33.00	33.02	Standard	Cheek Touch	-	0.433
848.80	251	GSM	33.00	32.89	Standard	Cheek Touch	-	0.494

MEASUREMENT RESULTS (GSM Right Head SAR - Touch - BT)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
848.80	251	GSM	33.00	32.92	Standard	Cheek Touch	-	0.444

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 Extended-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.

4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Head, Bluetooth function enable

Engineer K.H.Kang
(Signature)

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 21.0
Relative HUMIDITY (%) : 43
Mixture Type : 835MHz Brain
Dielectric Constant : 41.1
Conductivity: 0.906

Measurement Results (GSM Head SAR-Tilt)

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 Left Head SAR - Tlit)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
836.60	190	GSM	33.00	32.94	Standard	Cheek Touch	-	0.299

MEASUREMENT RESULTS (GSM Right Head SAR - Tilt)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
836.60	190	GSM	33.00	33.04	Standard	Cheek Touch	-	0.291

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 Extended-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Head

Engineer K.H.Kang (Signature)

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 21
Relative HUMIDITY (%) : 43
Mixture Type : 835MHz Body
Dielectric Constant : 53.7
Conductivity: 0.954

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		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.20	128	GSM	33.00	33.02	Standard	1.5[w/o Holster]	–	0.786
836.60	190	GSM	33.00	32.92	Standard	1.5[w/o Holster]	–	0.770
848.80	251	GSM	33.00	32.88	Standard	1.5[w/o Holster]	–	0.483

MEASUREMENT RESULTS (GSM Body SAR Without Holster – GPRS – BT)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.20	128	GSM	39.00	38.92	Standard	1.5[w/o Holster]	–	1.210

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 Extended-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Body, Bluetooth function enable and GPRS mode

Engineer K.H.Kang (Signature)

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 20.0
Relative HUMIDITY (%) : 48
Mixture Type : 1900MHz Brain
Dielectric Constant : 38.4
Conductivity: 1.41

Measurement Results (PCS Head SAR-Touch)

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 (PCS Left Head SAR - Touch)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1880.00	661	GSM	30.00	29.89	Standard	Cheek Touch	-	0.416

MEASUREMENT RESULTS (PCS Right Head SAR - Touch)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1880.00	661	GSM	30.00	29.88	Standard	Cheek Touch	-	0.330

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 Extended-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Head

Engineer K.H.Kang
(Signature)

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 20.0
Relative HUMIDITY (%) : 48
Mixture Type : 1900MHz Brain
Dielectric Constant : 38.4
Conductivity: 1.41

Measurement Results (PCS Head SAR-Tilt)

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 (PCS Left Head SAR - Tlit)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1850.20	512	GSM	30.00	29.97	Standard	Cheek Touch	-	0.485
1880.00	661	GSM	30.00	29.92	Standard	Cheek Touch	-	0.545
1909.80	810	GSM	30.00	30.00	Standard	Cheek Touch	-	0.580

MEASUREMENT RESULTS (PCS Right Head SAR - Tilt)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1850.20	512	GSM	30.00	29.95	Standard	Cheek Touch	-	0.481
1880.00	661	GSM	30.00	29.94	Standard	Cheek Touch	-	0.509
1909.80	810	GSM	30.00	29.95	Standard	Cheek Touch	-	0.567

MEASUREMENT RESULTS (PCS Left Head SAR - Tilt - BT)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1909.80	810	GSM	30.00	29.96	Standard	Cheek Touch	-	0.572

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 Extended-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.

4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Head, Bluetooth function enable

Engineer K.H.Kang (Signature)

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 20
Relative HUMIDITY (%) : 45
Mixture Type : 1900MHz Body
Dielectric Constant : 54.8
Conductivity: 1.51

Measurement Results (PCS 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 (PCS Body SAR Without Holster)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1850.20	512	GSM	30.00	29.95	Standard	1.5[w/o Holster]	–	0.696
1880.00	661	GSM	30.00	29.96	Standard	1.5[w/o Holster]	–	0.667
1909.80	810	GSM	30.00	29.93	Standard	1.5[w/o Holster]	–	0.627

MEASUREMENT RESULTS (PCS Body SAR Without Holster – GPRS – BT)

Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
1850.20	512	GSM	36.00	36.06	Standard	1.5[w/o Holster]	–	1.110

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 Extended-life battery produces lower ERP and EIRP, therefore the Standard-life battery is used in SAR testing.
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Body, Bluetooth function enable and GPRS mode

Engineer K.H.Kang (Signature)

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APPENDIX A : Validation Test Data of Tissue

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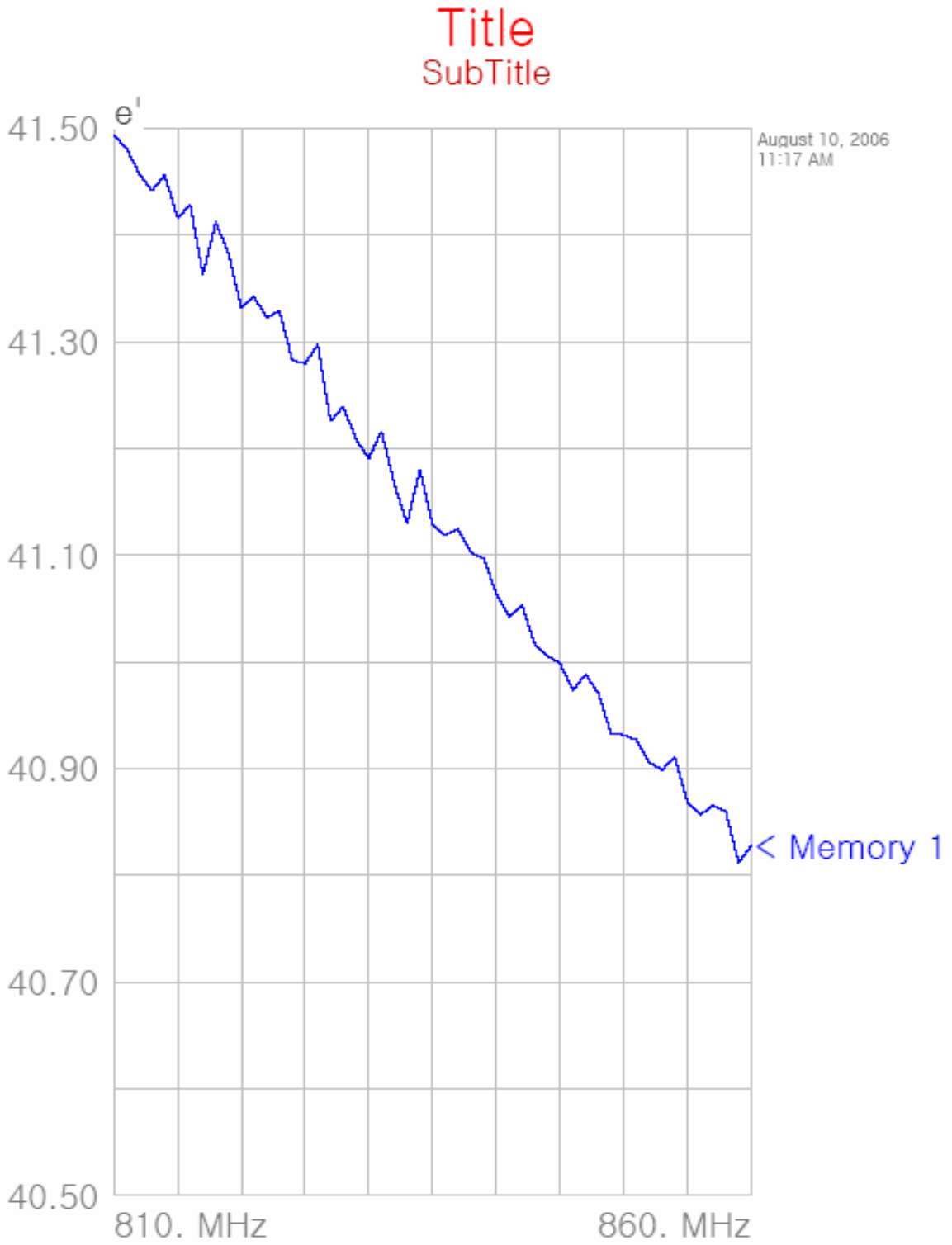
- GSM850 Head Tissue



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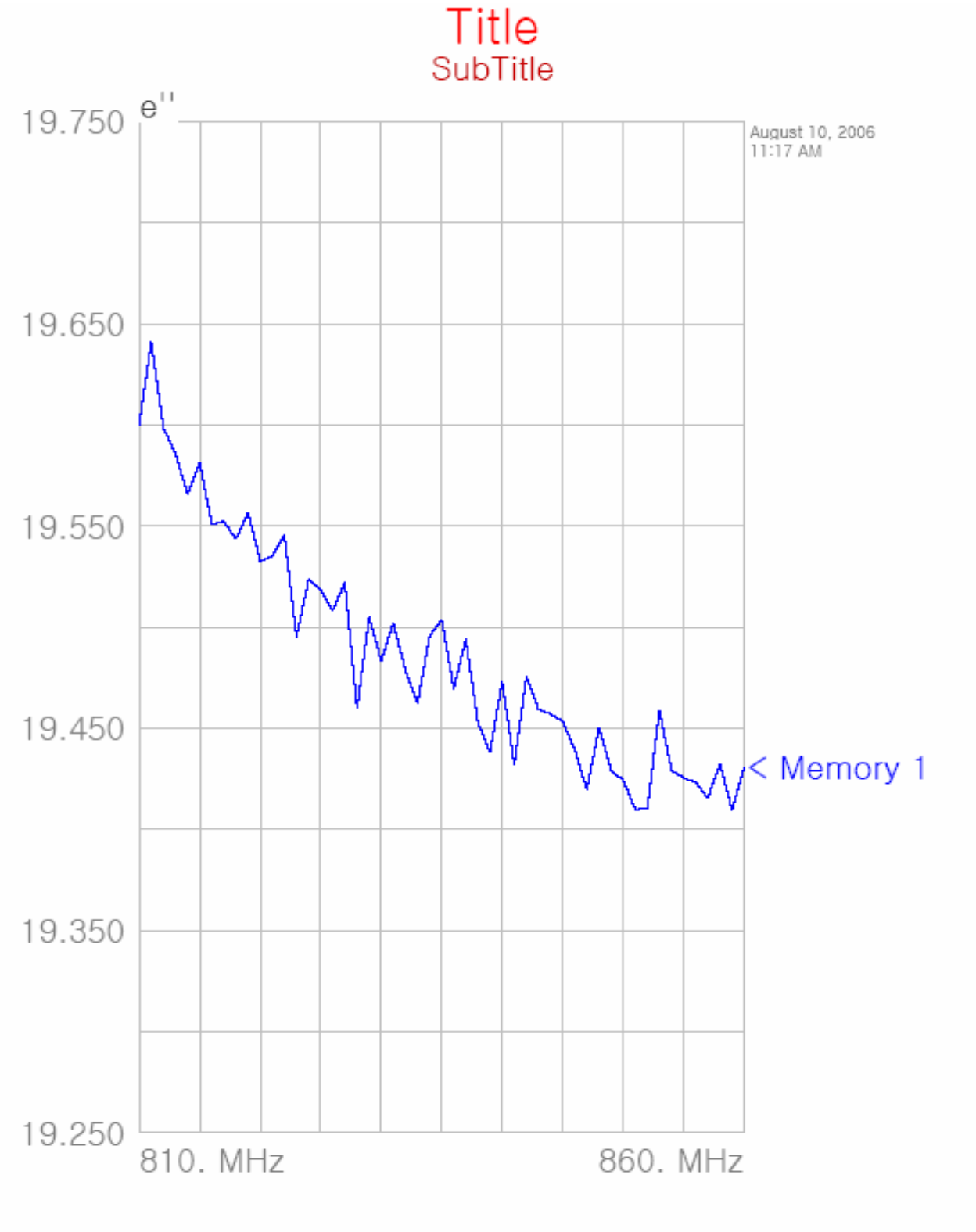

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Title

SubTitle

Monday, 2005 11 07 AM

Frequency	e'	e''
810.000000 MHz	41.4934	19.6003
811.000000 MHz	41.4813	19.6409
812.000000 MHz	41.4575	19.5984
813.000000 MHz	41.4419	19.5960
814.000000 MHz	41.4563	19.5655
815.000000 MHz	41.4163	19.5814
816.000000 MHz	41.4280	19.5509
817.000000 MHz	41.3627	19.5523
818.000000 MHz	41.4125	19.5436
819.000000 MHz	41.3827	19.5567
820.000000 MHz	41.3321	19.5327
821.000000 MHz	41.3422	19.5349
822.000000 MHz	41.3225	19.5453
823.000000 MHz	41.3289	19.4952
824.000000 MHz	41.2823	19.5236
825.000000 MHz	41.2798	19.5186
826.000000 MHz	41.2971	19.5082
827.000000 MHz	41.2256	19.5222
828.000000 MHz	41.2392	19.4598
829.000000 MHz	41.2083	19.5051
830.000000 MHz	41.1908	19.4832
831.000000 MHz	41.2162	19.5022
832.000000 MHz	41.1666	19.4787
833.000000 MHz	41.1296	19.4622
834.000000 MHz	41.1800	19.4954
835.000000 MHz	41.1290	19.5039
836.000000 MHz	41.1187	19.4697
837.000000 MHz	41.1247	19.4940
838.000000 MHz	41.1021	19.4527
839.000000 MHz	41.0973	19.4381
840.000000 MHz	41.0645	19.4731
841.000000 MHz	41.0420	19.4320
842.000000 MHz	41.0535	19.4756
843.000000 MHz	41.0171	19.4593
844.000000 MHz	41.0055	19.4571
845.000000 MHz	40.9988	19.4535
846.000000 MHz	40.9736	19.4394
847.000000 MHz	40.9883	19.4195
848.000000 MHz	40.9705	19.4502
849.000000 MHz	40.9332	19.4293
850.000000 MHz	40.9314	19.4243
851.000000 MHz	40.9270	19.4098
852.000000 MHz	40.9061	19.4103
853.000000 MHz	40.8988	19.4587
854.000000 MHz	40.9109	19.4292
855.000000 MHz	40.8683	19.4255
856.000000 MHz	40.8572	19.4232
857.000000 MHz	40.8652	19.4156
858.000000 MHz	40.8595	19.4324
859.000000 MHz	40.8119	19.4097
860.000000 MHz	40.8280	19.4306

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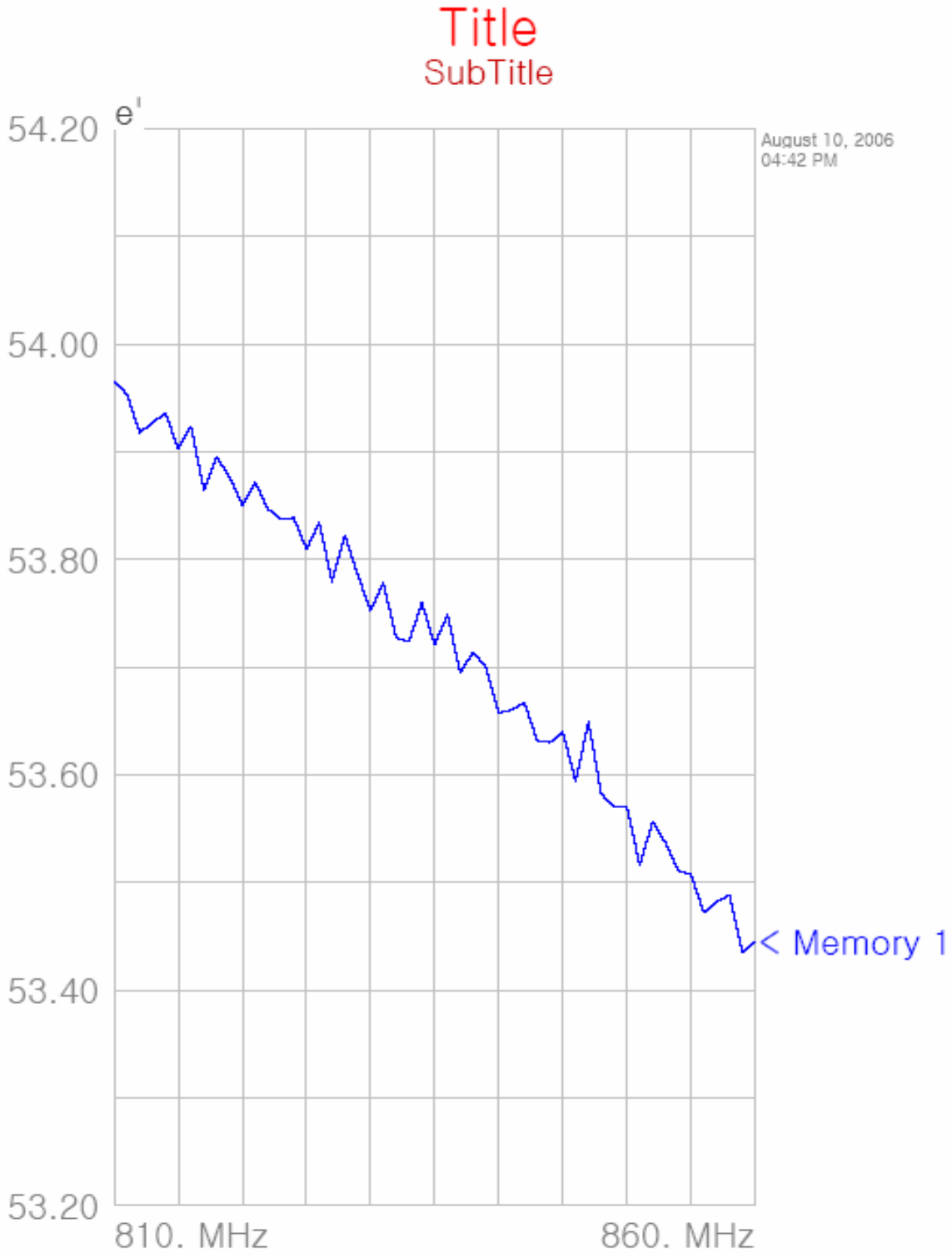
- GSM850 Body Tissue



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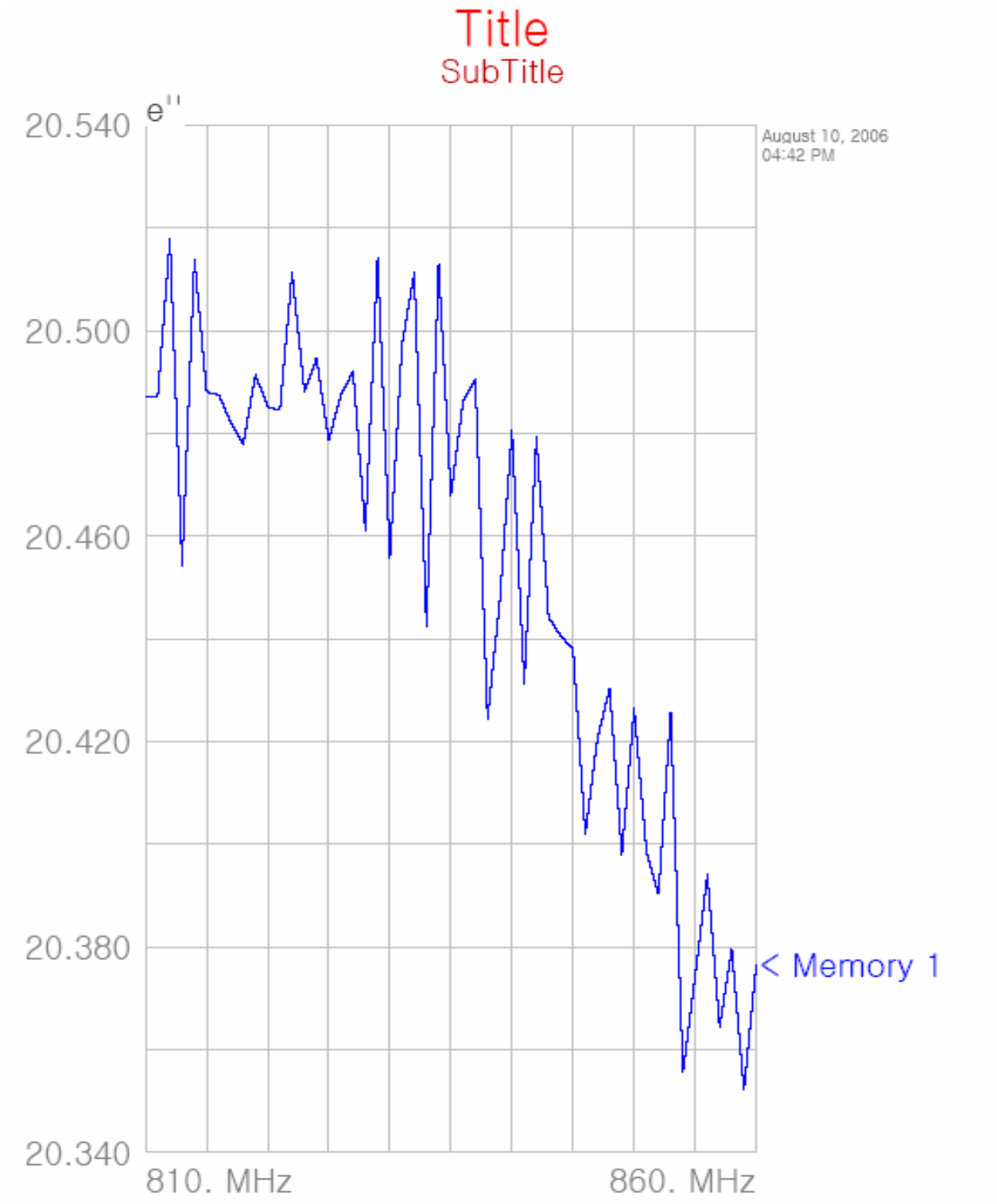

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Title
SubTitle

Frequency	e'	e''
810.000000 MHz	53.9658	20.4870
811.000000 MHz	53.9531	20.4872
812.000000 MHz	53.9177	20.5179
813.000000 MHz	53.9271	20.4543
814.000000 MHz	53.9358	20.5140
815.000000 MHz	53.9027	20.4880
816.000000 MHz	53.9235	20.4875
817.000000 MHz	53.8644	20.4820
818.000000 MHz	53.8951	20.4779
819.000000 MHz	53.8764	20.4914
820.000000 MHz	53.8507	20.4852
821.000000 MHz	53.8716	20.4845
822.000000 MHz	53.8468	20.5114
823.000000 MHz	53.8374	20.4882
824.000000 MHz	53.8386	20.4946
825.000000 MHz	53.8097	20.4786
826.000000 MHz	53.8341	20.4876
827.000000 MHz	53.7794	20.4920
828.000000 MHz	53.8226	20.4610
829.000000 MHz	53.7858	20.5142
830.000000 MHz	53.7527	20.4556
831.000000 MHz	53.7781	20.4972
832.000000 MHz	53.7274	20.5113
833.000000 MHz	53.7236	20.4424
834.000000 MHz	53.7597	20.5129
835.000000 MHz	53.7207	20.4679
836.000000 MHz	53.7487	20.4862
837.000000 MHz	53.6950	20.4906
838.000000 MHz	53.7141	20.4245
839.000000 MHz	53.7000	20.4473
840.000000 MHz	53.6571	20.4806
841.000000 MHz	53.6605	20.4313
842.000000 MHz	53.6669	20.4793
843.000000 MHz	53.6318	20.4442
844.000000 MHz	53.6302	20.4405
845.000000 MHz	53.6399	20.4381
846.000000 MHz	53.5937	20.4020
847.000000 MHz	53.6493	20.4206
848.000000 MHz	53.5822	20.4303
849.000000 MHz	53.5701	20.3980
850.000000 MHz	53.5697	20.4264
851.000000 MHz	53.5161	20.3987
852.000000 MHz	53.5563	20.3903
853.000000 MHz	53.5370	20.4257
854.000000 MHz	53.5110	20.3555
855.000000 MHz	53.5073	20.3743
856.000000 MHz	53.4717	20.3941
857.000000 MHz	53.4823	20.3644
858.000000 MHz	53.4882	20.3795
859.000000 MHz	53.4352	20.3521
860.000000 MHz	53.4446	20.3766

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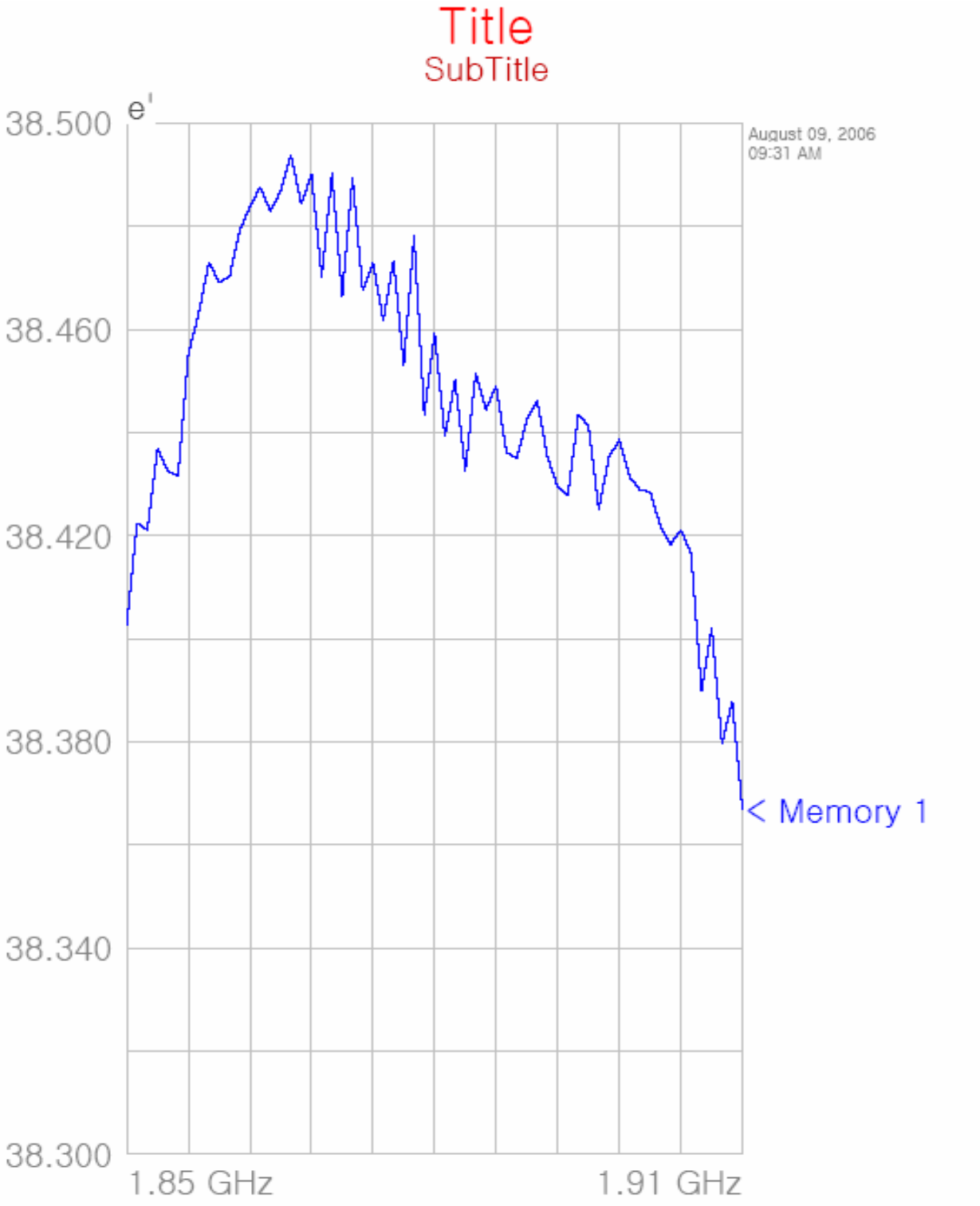
- PCS1900 Head Tissue



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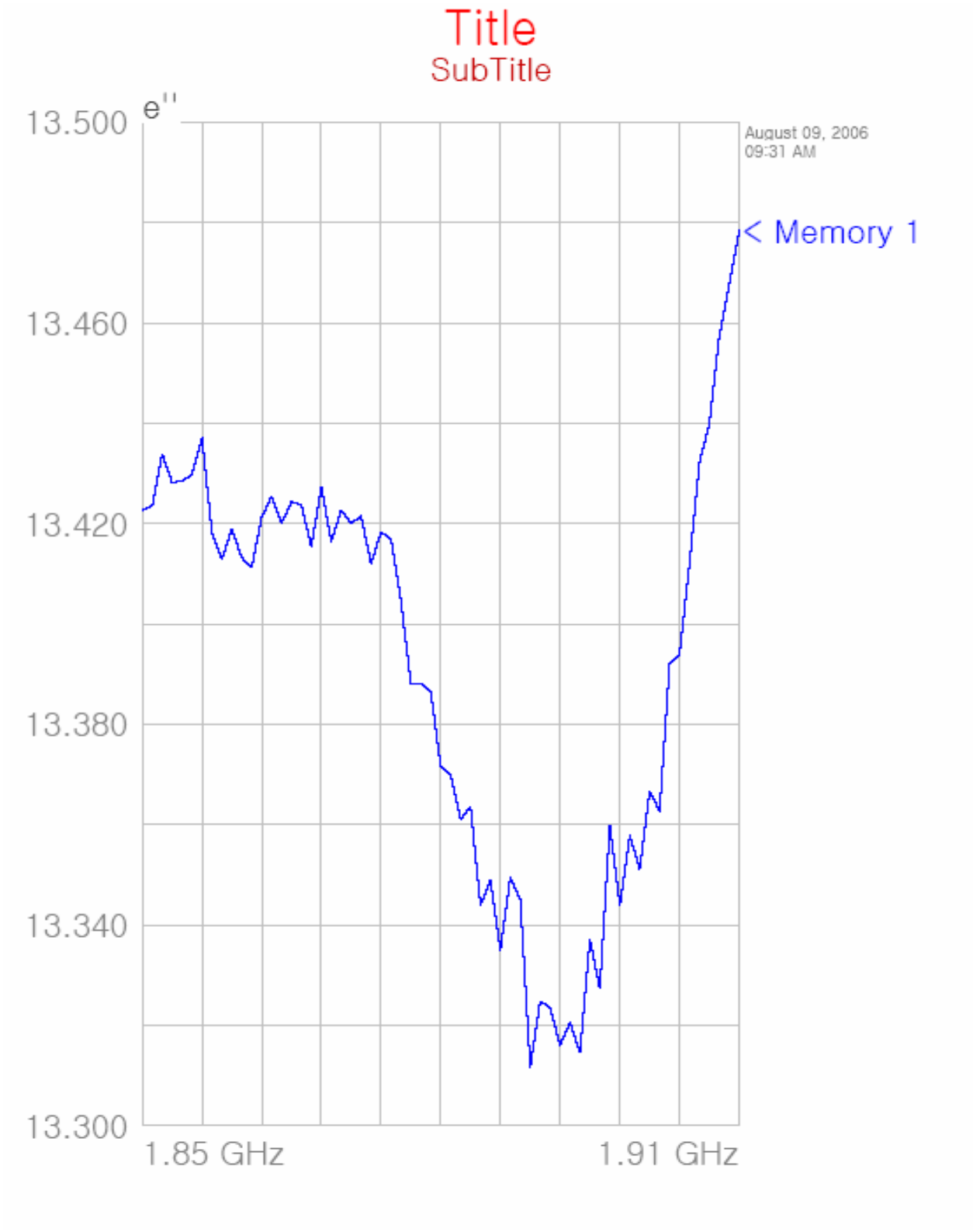

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Title

SubTitle

Frequency	e'	e''
1.850000000 GHz	38.4028	13.4226
1.851000000 GHz	38.4224	13.4235
1.852000000 GHz	38.4211	13.4339
1.853000000 GHz	38.4368	13.4282
1.854000000 GHz	38.4325	13.4285
1.855000000 GHz	38.4316	13.4298
1.856000000 GHz	38.4552	13.4371
1.857000000 GHz	38.4630	13.4183
1.858000000 GHz	38.4730	13.4129
1.859000000 GHz	38.4692	13.4189
1.860000000 GHz	38.4701	13.4132
1.861000000 GHz	38.4792	13.4113
1.862000000 GHz	38.4837	13.4212
1.863000000 GHz	38.4876	13.4254
1.864000000 GHz	38.4829	13.4201
1.865000000 GHz	38.4869	13.4243
1.866000000 GHz	38.4939	13.4237
1.867000000 GHz	38.4843	13.4154
1.868000000 GHz	38.4901	13.4273
1.869000000 GHz	38.4702	13.4165
1.870000000 GHz	38.4902	13.4227
1.871000000 GHz	38.4665	13.4201
1.872000000 GHz	38.4895	13.4215
1.873000000 GHz	38.4675	13.4120
1.874000000 GHz	38.4729	13.4183
1.875000000 GHz	38.4617	13.4169
1.876000000 GHz	38.4734	13.4046
1.877000000 GHz	38.4531	13.3882
1.878000000 GHz	38.4783	13.3882
1.879000000 GHz	38.4434	13.3866
1.880000000 GHz	38.4594	13.3716
1.881000000 GHz	38.4393	13.3699
1.882000000 GHz	38.4501	13.3610
1.883000000 GHz	38.4326	13.3636
1.884000000 GHz	38.4515	13.3439
1.885000000 GHz	38.4444	13.3490
1.886000000 GHz	38.4491	13.3350
1.887000000 GHz	38.4362	13.3495
1.888000000 GHz	38.4350	13.3451
1.889000000 GHz	38.4425	13.3117
1.890000000 GHz	38.4463	13.3248
1.891000000 GHz	38.4353	13.3235
1.892000000 GHz	38.4294	13.3160
1.893000000 GHz	38.4279	13.3206
1.894000000 GHz	38.4434	13.3146
1.895000000 GHz	38.4414	13.3371
1.896000000 GHz	38.4252	13.3273
1.897000000 GHz	38.4352	13.3599
1.898000000 GHz	38.4386	13.3438
1.899000000 GHz	38.4314	13.3578
1.900000000 GHz	38.4289	13.3512
1.901000000 GHz	38.4285	13.3667
1.902000000 GHz	38.4219	13.3627
1.903000000 GHz	38.4183	13.3920
1.904000000 GHz	38.4211	13.3939
1.905000000 GHz	38.4165	13.4120
1.906000000 GHz	38.3998	13.4322
1.907000000 GHz	38.4021	13.4399
1.908000000 GHz	38.3796	13.4574
1.909000000 GHz	38.3878	13.4677
1.910000000 GHz	38.3669	13.4784

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- PCS1900 Body Tissue

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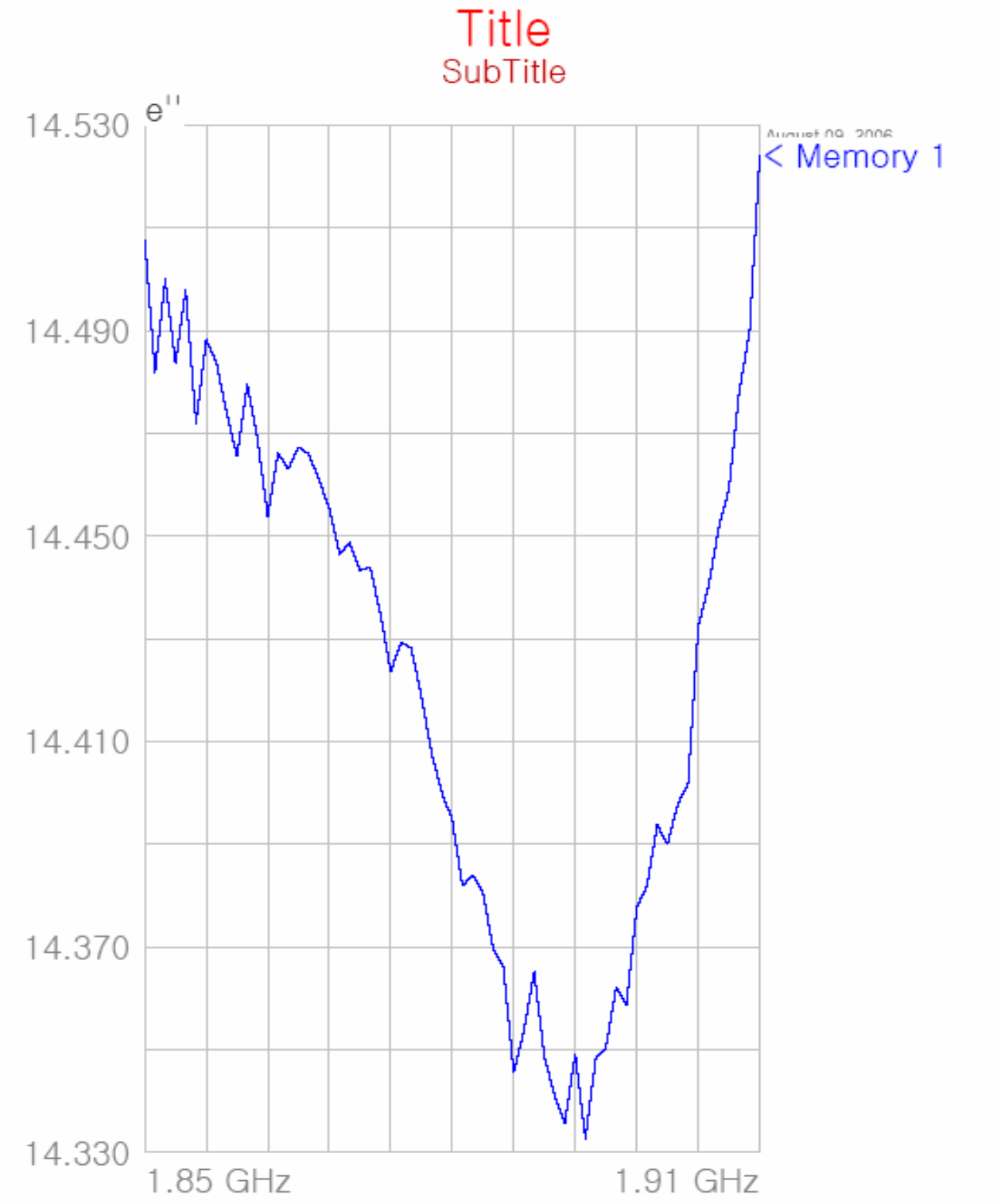

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Title

SubTitle

Aug 09, 2005 02:37 PM

Frequency	e'	e''
1.850000000 GHz	54.7432	14.5077
1.851000000 GHz	54.7605	14.4819
1.852000000 GHz	54.7588	14.5000
1.853000000 GHz	54.7737	14.4837
1.854000000 GHz	54.7722	14.4979
1.855000000 GHz	54.7894	14.4720
1.856000000 GHz	54.7897	14.4882
1.857000000 GHz	54.8120	14.4837
1.858000000 GHz	54.7880	14.4739
1.859000000 GHz	54.8105	14.4655
1.860000000 GHz	54.8090	14.4796
1.861000000 GHz	54.8179	14.4689
1.862000000 GHz	54.8115	14.4538
1.863000000 GHz	54.8198	14.4662
1.864000000 GHz	54.8246	14.4630
1.865000000 GHz	54.8216	14.4673
1.866000000 GHz	54.8244	14.4660
1.867000000 GHz	54.8313	14.4610
1.868000000 GHz	54.8228	14.4554
1.869000000 GHz	54.8297	14.4465
1.870000000 GHz	54.8210	14.4487
1.871000000 GHz	54.8201	14.4433
1.872000000 GHz	54.8250	14.4440
1.873000000 GHz	54.8242	14.4348
1.874000000 GHz	54.8217	14.4236
1.875000000 GHz	54.8013	14.4293
1.876000000 GHz	54.8158	14.4282
1.877000000 GHz	54.8074	14.4188
1.878000000 GHz	54.8049	14.4076
1.879000000 GHz	54.7907	14.4000
1.880000000 GHz	54.7976	14.3948
1.881000000 GHz	54.8009	14.3819
1.882000000 GHz	54.7846	14.3839
1.883000000 GHz	54.7972	14.3807
1.884000000 GHz	54.7947	14.3696
1.885000000 GHz	54.7959	14.3661
1.886000000 GHz	54.7993	14.3455
1.887000000 GHz	54.8040	14.3537
1.888000000 GHz	54.7857	14.3651
1.889000000 GHz	54.8005	14.3486
1.890000000 GHz	54.7865	14.3410
1.891000000 GHz	54.7972	14.3358
1.892000000 GHz	54.7809	14.3492
1.893000000 GHz	54.7995	14.3327
1.894000000 GHz	54.7965	14.3482
1.895000000 GHz	54.7957	14.3504
1.896000000 GHz	54.7927	14.3622
1.897000000 GHz	54.7901	14.3586
1.898000000 GHz	54.7795	14.3777
1.899000000 GHz	54.7844	14.3819
1.900000000 GHz	54.7891	14.3937
1.901000000 GHz	54.7789	14.3900
1.902000000 GHz	54.7800	14.3978
1.903000000 GHz	54.7773	14.4018
1.904000000 GHz	54.7628	14.4323
1.905000000 GHz	54.7639	14.4402
1.906000000 GHz	54.7535	14.4516
1.907000000 GHz	54.7394	14.4592
1.908000000 GHz	54.7213	14.4781
1.909000000 GHz	54.7186	14.4897
1.910000000 GHz	54.7231	14.5242

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APPENDIX B : Validation Test Data

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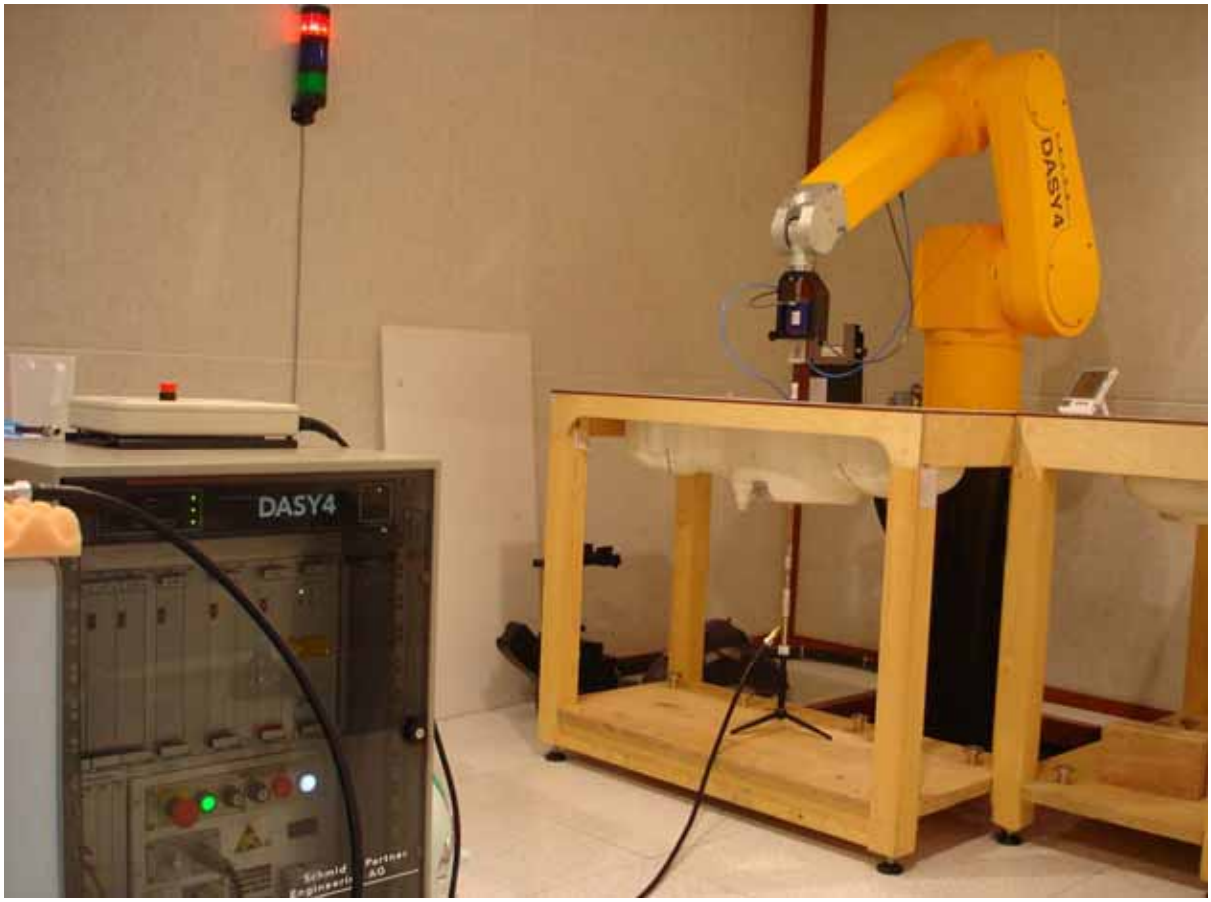
Dipole Validation



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- GSM850 Validation

Date/Time: 2006-08-10 13:41:06

Test Laboratory: ESTECH

VALIDATION 0810

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

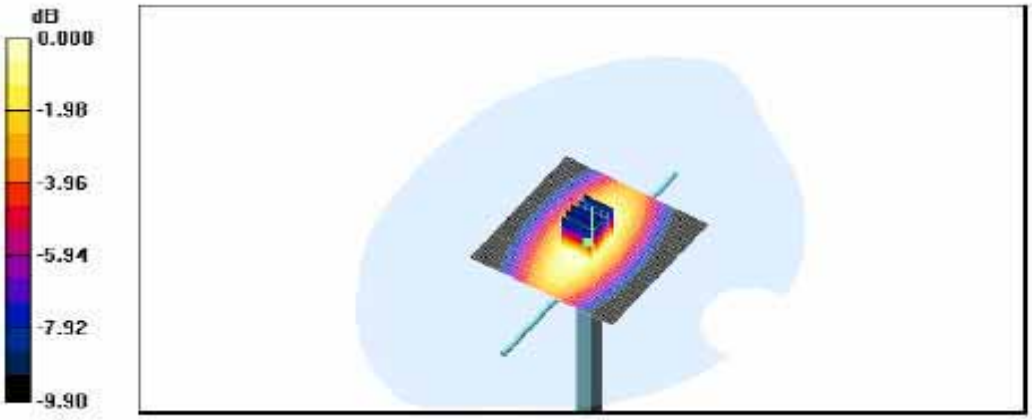
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.906 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 43%

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.51 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.3 V/m; Power Drift = 0.024 dB
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 2.35 mW/g
Maximum value of SAR (measured) = 2.52 mW/g



0 dB = 2.52mW/g

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Date/Time: 2006-08-09 10:02:08

Test Laboratory: ESTECH

VALIDATION 0809

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

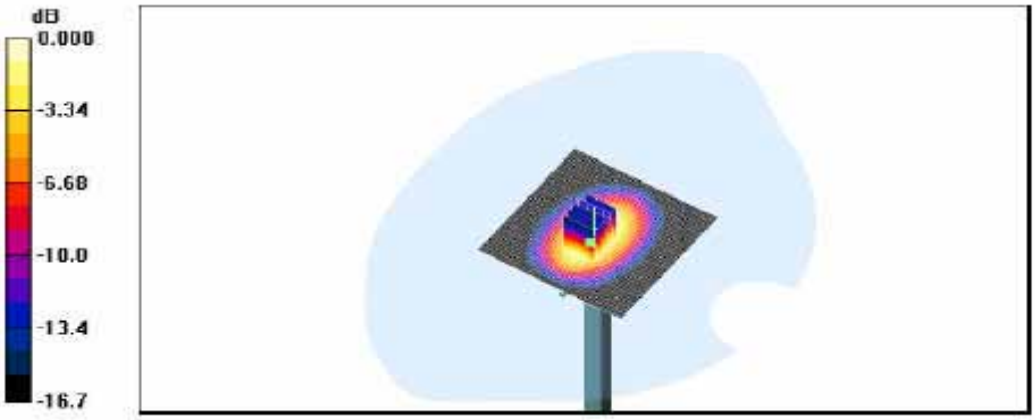
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.41 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 48%

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.0 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.3 V/m; Power Drift = 0.004 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.79 mW/g
Maximum value of SAR (measured) = 11.1 mW/g



0 dB = 11.1mW/g

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APPENDIX C : SAR Test Data

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– GSM850

Date/Time: 2006-08-10 15:33:44

Test Laboratory: ESTECH

CH128 LEFT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

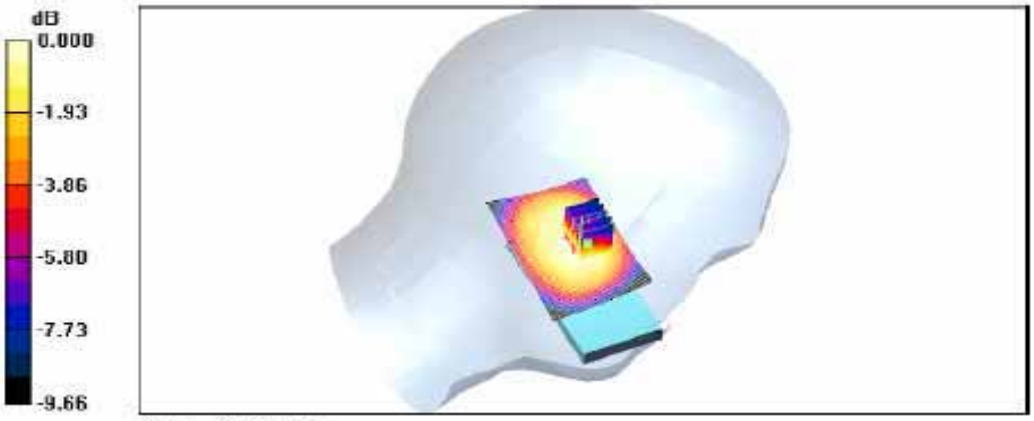
Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.895 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 42%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.418 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.0 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 0.557 W/kg
SAR(1 g) = 0.386 mW/g
Maximum value of SAR (measured) = 0.410 mW/g



0 dB = 0.410mW/g

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FAX: 82-2-867-3204

Date/Time: 2006-08-10 14:01:54

Test Laboratory: ESTECH

CH190 LEFT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

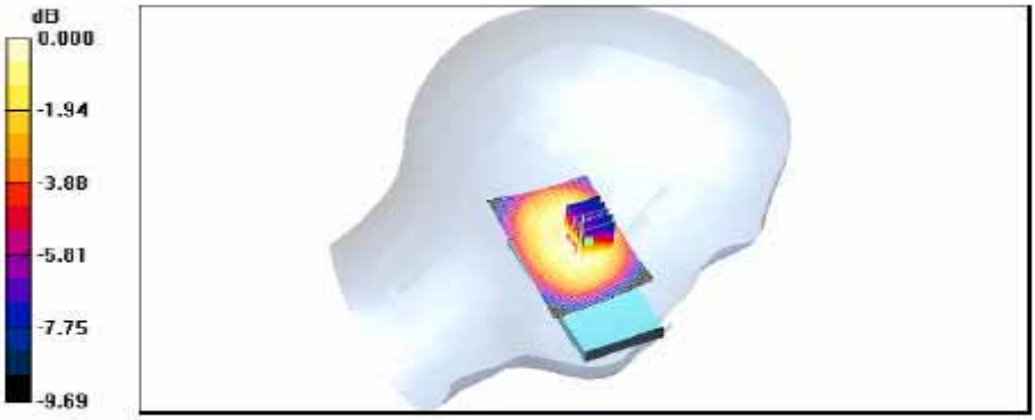
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 837 MHz; σ = 0.908 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 44%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.469 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.9 V/m; Power Drift = -0.059 dB
Peak SAR (extrapolated) = 0.613 W/kg
SAR(1 g) = 0.431 mW/g
Maximum value of SAR (measured) = 0.458 mW/g



0 dB = 0.458mW/g

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Date/Time: 2006-08-10 15:22:54

Test Laboratory: ESTECH

CH251 LEFT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

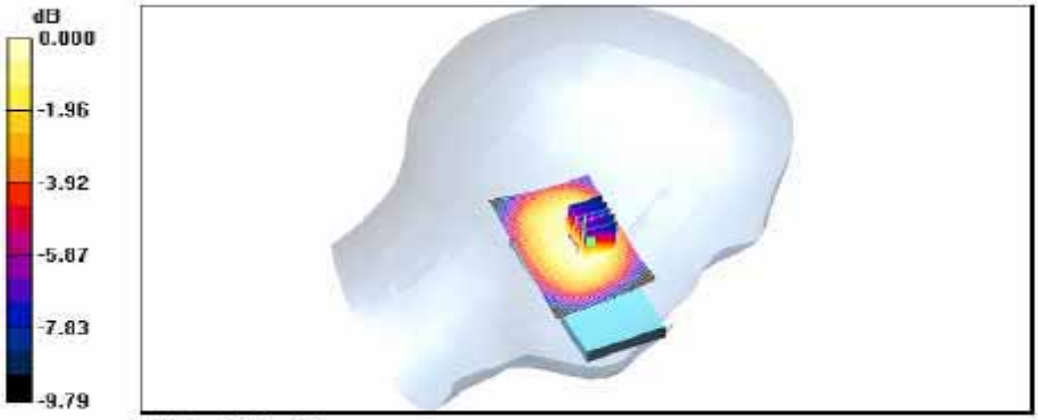
Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 849 MHz; σ = 0.918 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 43%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.536 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.8 V/m; Power Drift = -0.106 dB
Peak SAR (extrapolated) = 0.718 W/kg
SAR(1 g) = 0.489 mW/g
Maximum value of SAR (measured) = 0.519 mW/g



0 dB = 0.519mW/g

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Date/Time: 2006-08-10 14:49:42

Test Laboratory: ESTECH

CH128 RIGHT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

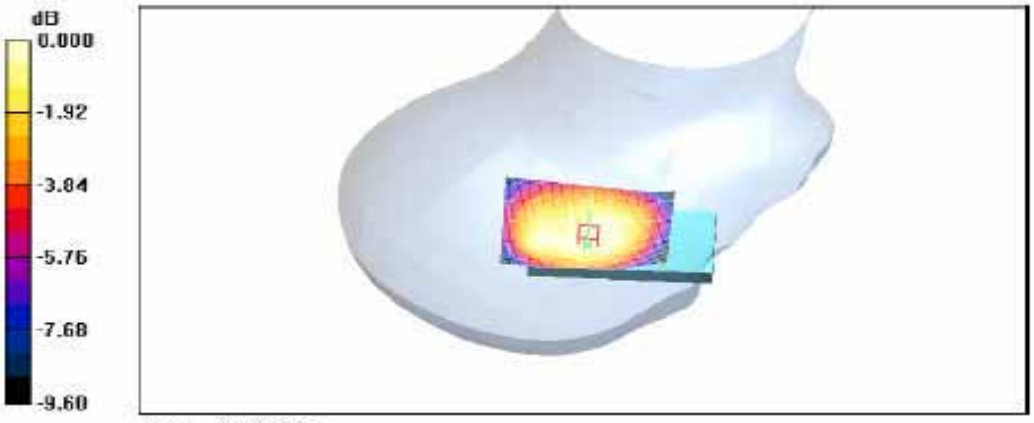
Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.895 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 42%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.441 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.0 V/m; Power Drift = -0.060 dB
Peak SAR (extrapolated) = 0.577 W/kg
SAR(1 g) = 0.405 mW/g
Maximum value of SAR (measured) = 0.426 mW/g



0 dB = 0.426mW/g

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Date/Time: 2006-08-10 14:24:08

Test Laboratory: ESTECH

CH190 RIGHT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

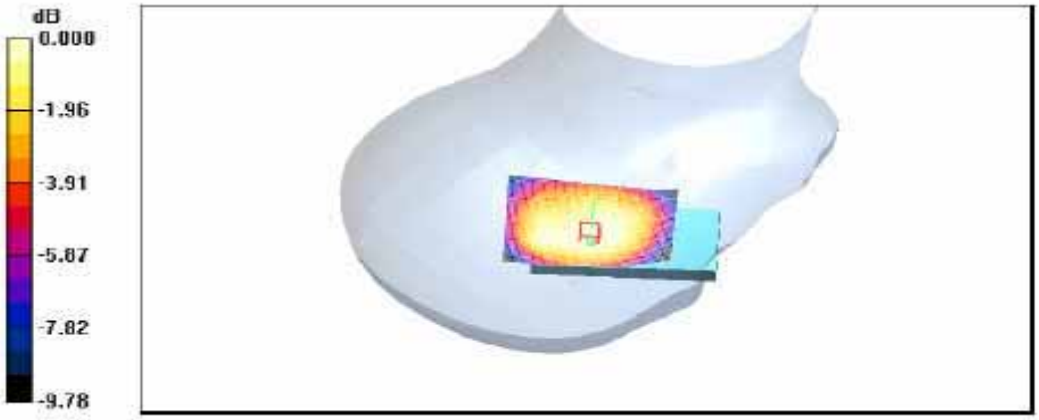
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 837 MHz; σ = 0.908 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.474 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.5 V/m; Power Drift = 0.019 dB
Peak SAR (extrapolated) = 0.619 W/kg
SAR(1 g) = 0.433 mW/g
Maximum value of SAR (measured) = 0.458 mW/g



0 dB = 0.458mW/g

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Date/Time: 2006-08-10 15:11:00

Test Laboratory: ESTECH

CH251 RIGHT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

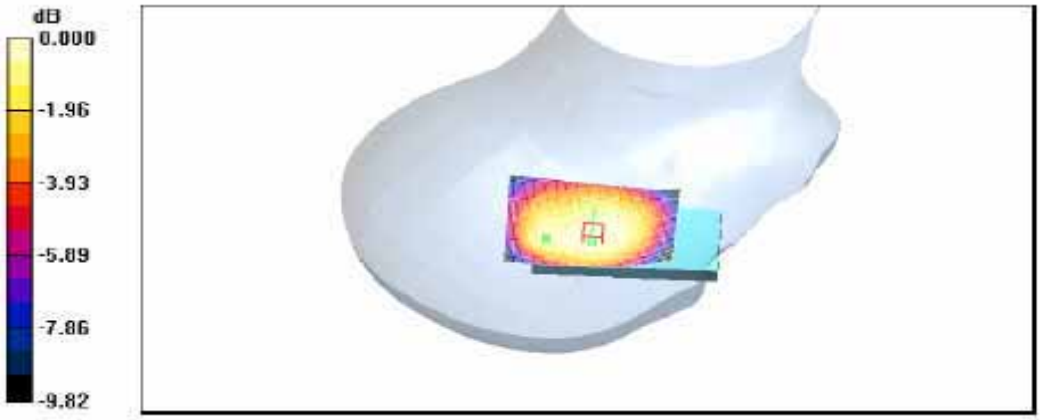
Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 849 MHz; σ = 0.918 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 43%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.545 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.6 V/m; Power Drift = -0.108 dB
Peak SAR (extrapolated) = 0.719 W/kg
SAR(1 g) = 0.494 mW/g
Maximum value of SAR (measured) = 0.521 mW/g



0 dB = 0.521mW/g

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Date/Time: 2006-08-10 14:12:35

Test Laboratory: ESTECH

CH190 LEFT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

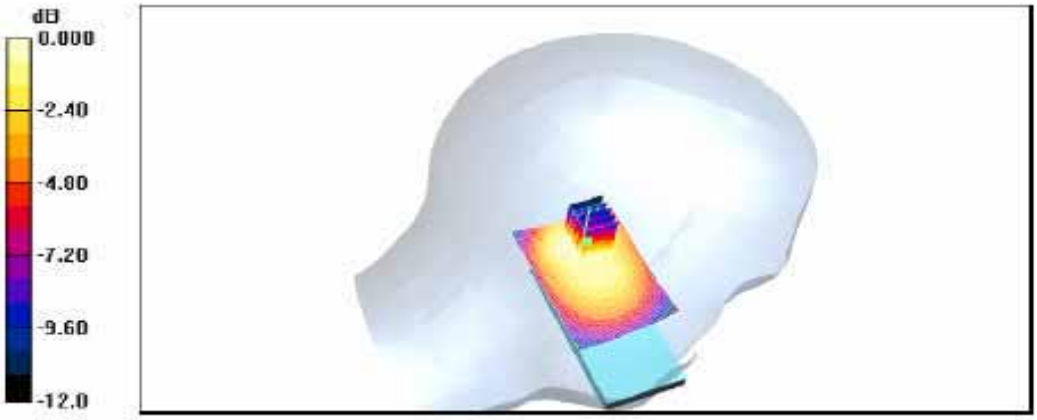
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 837 MHz; σ = 0.908 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.333 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.1 V/m; Power Drift = -0.063 dB
Peak SAR (extrapolated) = 0.541 W/kg
SAR(1 g) = 0.299 mW/g
Maximum value of SAR (measured) = 0.326 mW/g



0 dB = 0.326mW/g

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Date/Time: 2006-08-10 14:36:22

Test Laboratory: ESTECH

CH190 RIGHT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 837 MHz; σ = 0.908 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 43%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.362 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.3 V/m; Power Drift = 0.043 dB
Peak SAR (extrapolated) = 0.512 W/kg
SAR(1 g) = 0.291 mW/g
Maximum value of SAR (measured) = 0.321 mW/g

0 dB = 0.321mW/g

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CH251 RIGHT TOUCH-BT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

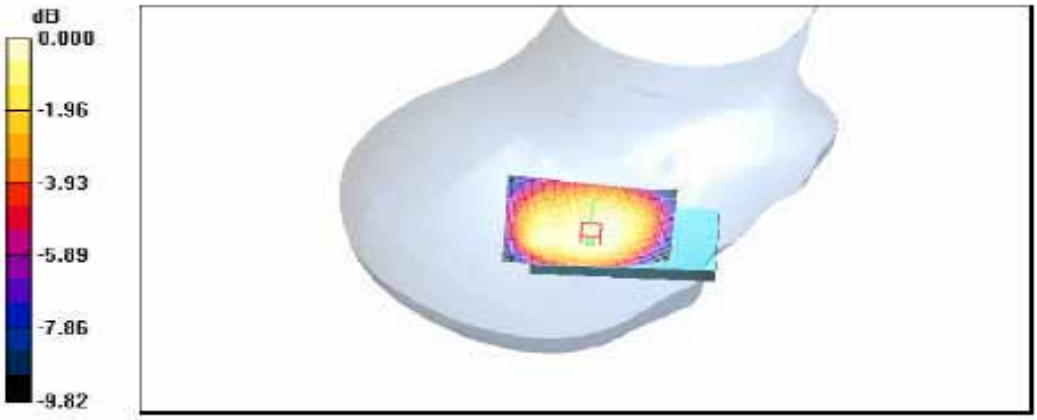
Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 849 MHz; σ = 0.918 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 44%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.488 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.6 V/m; Power Drift = -0.080 dB
Peak SAR (extrapolated) = 0.631 W/kg
SAR(1 g) = 0.444 mW/g
Maximum value of SAR (measured) = 0.467 mW/g



0 dB = 0.467mW/g

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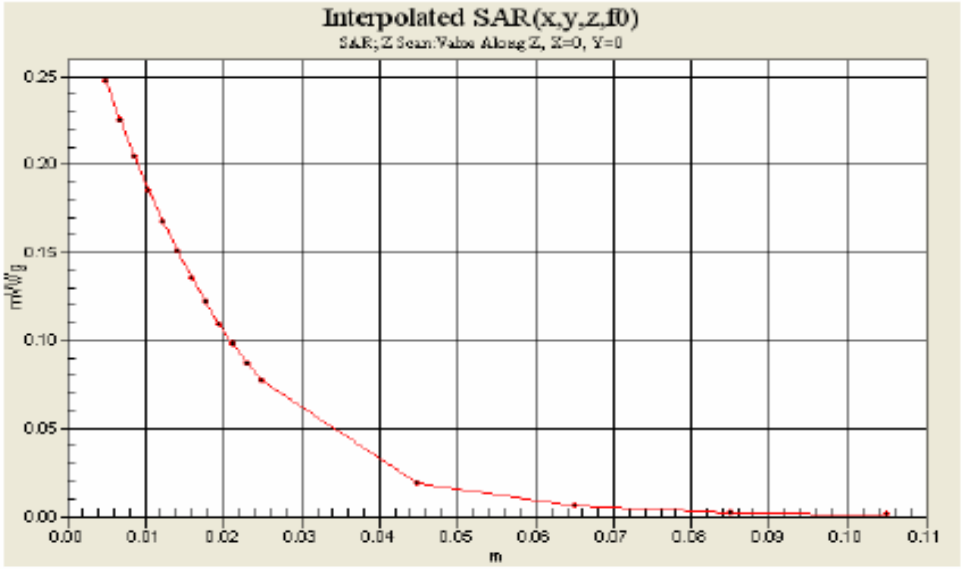
CH251 RIGHT TOUCH-ZSCAN

DUT: MG320d; Type: BAR TYPE; Serial: NONE

Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 849 MHz; σ = 0.918 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.57, 6.57, 6.57); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 43%



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Test Laboratory: ESTECH

CH128 BODY

DUT: MG320d; Type: BAR TYPE; Serial: NONE

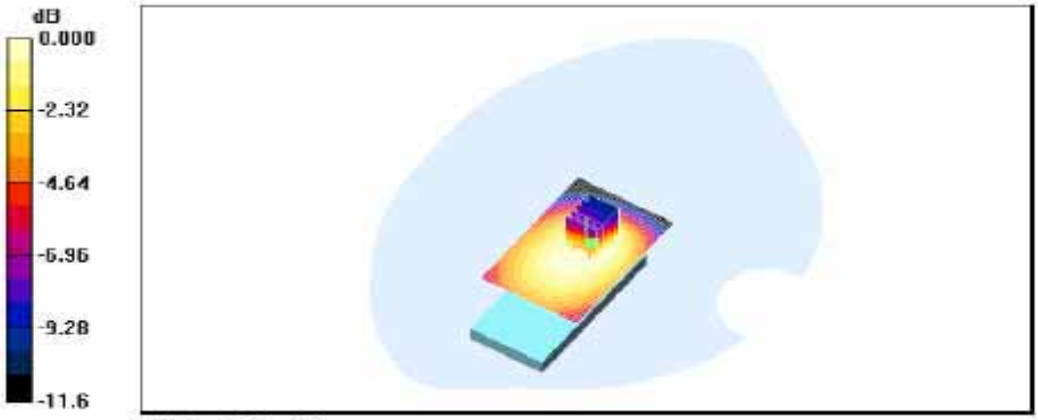
Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.94 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.17, 6.17, 6.17); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 44%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.873 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.5 V/m; Power Drift = 0.020 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.786 mW/g
Maximum value of SAR (measured) = 0.839 mW/g



0 dB = 0.839mW/g

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CH190 BODY

DUT: MG320d; Type: BAR TYPE; Serial: NONE

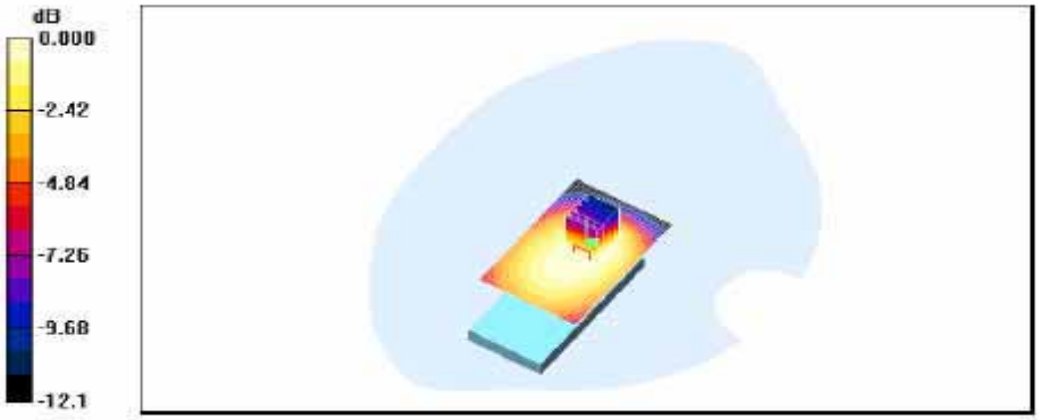
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 837 MHz; σ = 0.954 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.17, 6.17, 6.17); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.862 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.8 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.770 mW/g
Maximum value of SAR (measured) = 0.822 mW/g



0 dB = 0.822mW/g

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CH251 BODY

DUT: MG320d; Type: BAR TYPE; Serial: NONE

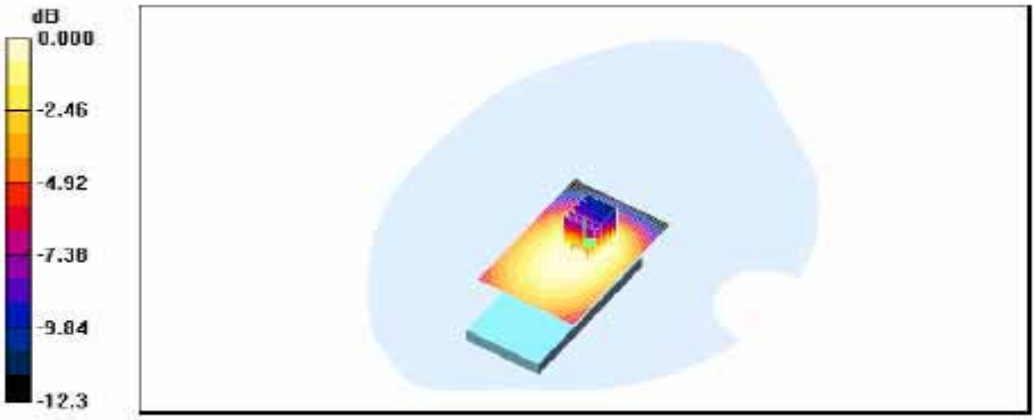
Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 849 MHz; σ = 0.963 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.17, 6.17, 6.17); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 44%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.547 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.1 V/m; Power Drift = -0.121 dB
Peak SAR (extrapolated) = 0.777 W/kg
SAR(1 g) = 0.483 mW/g
Maximum value of SAR (measured) = 0.516 mW/g



0 dB = 0.516mW/g

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CH128 BODY-GPRS-BT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

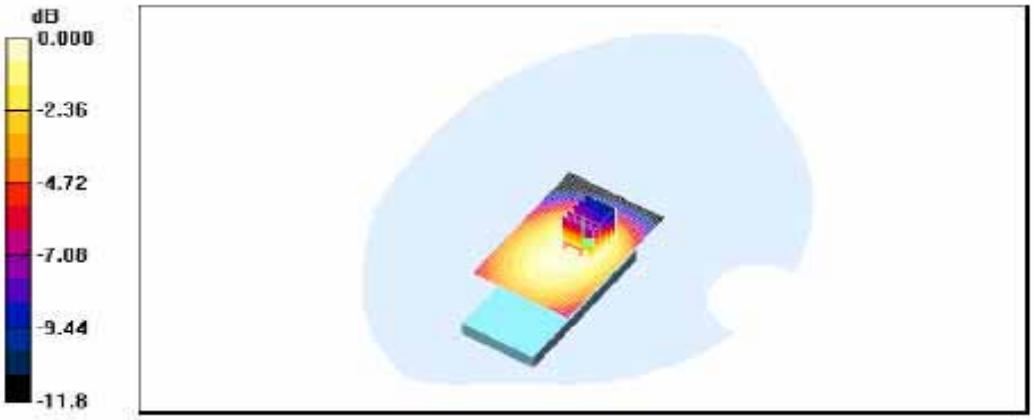
Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:4.15
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.94 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.17, 6.17, 6.17); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 43%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.31 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 25.7 V/m; Power Drift = -0.083 dB
Peak SAR (extrapolated) = 1.71 W/kg
SAR(1 g) = 1.21 mW/g
Maximum value of SAR (measured) = 1.29 mW/g



0 dB = 1.29mW/g

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Test Laboratory: ESTECH

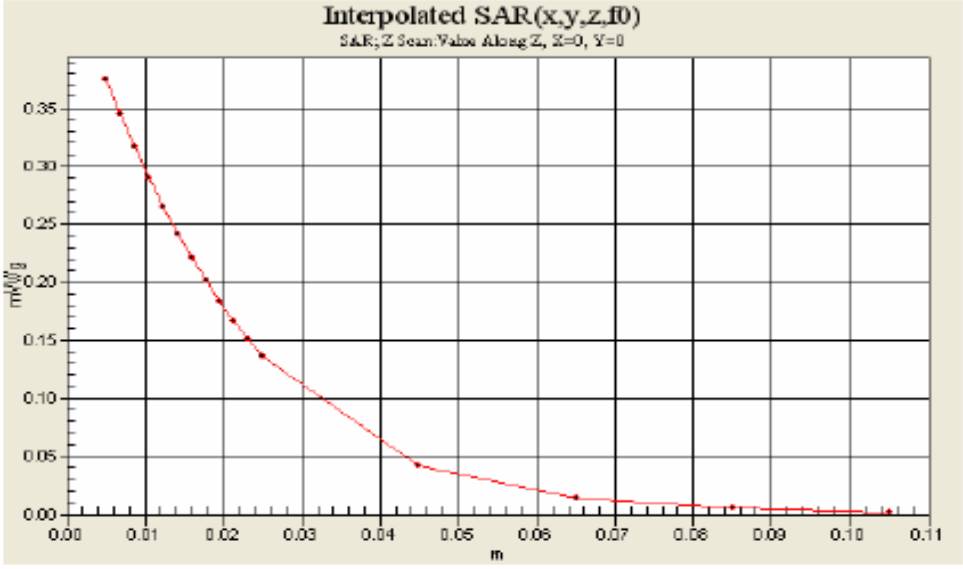
CH128 BODY-GPRS-BT-ZSCAN

DUT: MG320d; Type: BAR TYPE; Serial: NONE

Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:4.15
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.94 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(6.17, 6.17, 6.17); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 43%



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Test Laboratory: ESTECH

CH661 LEFT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

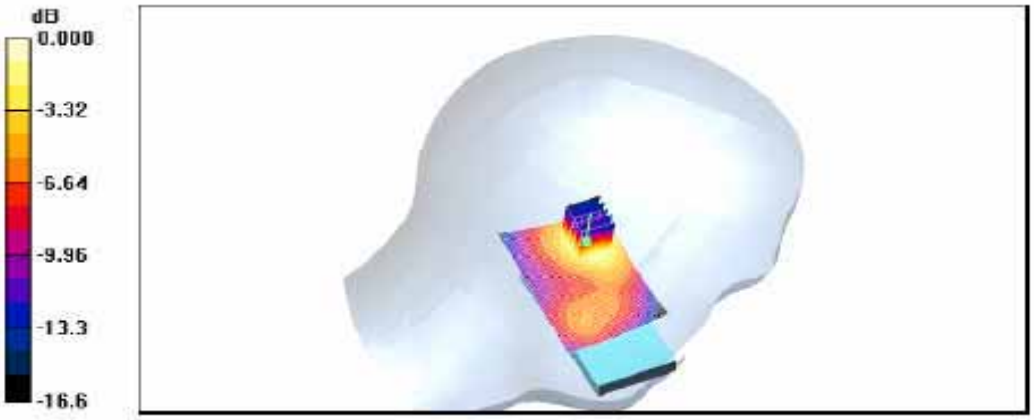
Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.4 mho/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 49%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.501 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.2 V/m; Power Drift = -0.113 dB
Peak SAR (extrapolated) = 0.731 W/kg
SAR(1 g) = 0.416 mW/g
Maximum value of SAR (measured) = 0.473 mW/g



0 dB = 0.473mW/g

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Test Laboratory: ESTECH

CH661 RIGHT TOUCH

DUT: MG320d; Type: BAR TYPE; Serial: NONE

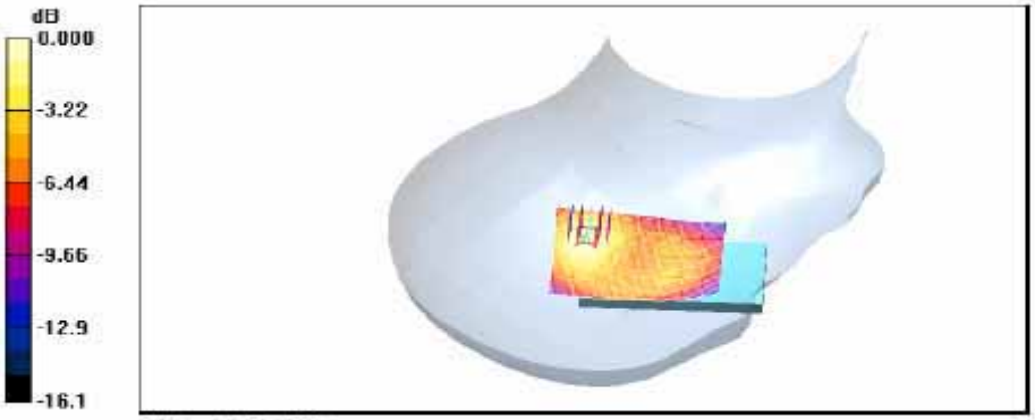
Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.4 mho/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 48%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.385 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.1 V/m; Power Drift = -0.124 dB
Peak SAR (extrapolated) = 0.569 W/kg
SAR(1 g) = 0.330 mW/g
Maximum value of SAR (measured) = 0.374 mW/g



0 dB = 0.374mW/g

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Test Laboratory: ESTECH

CH512 LEFT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

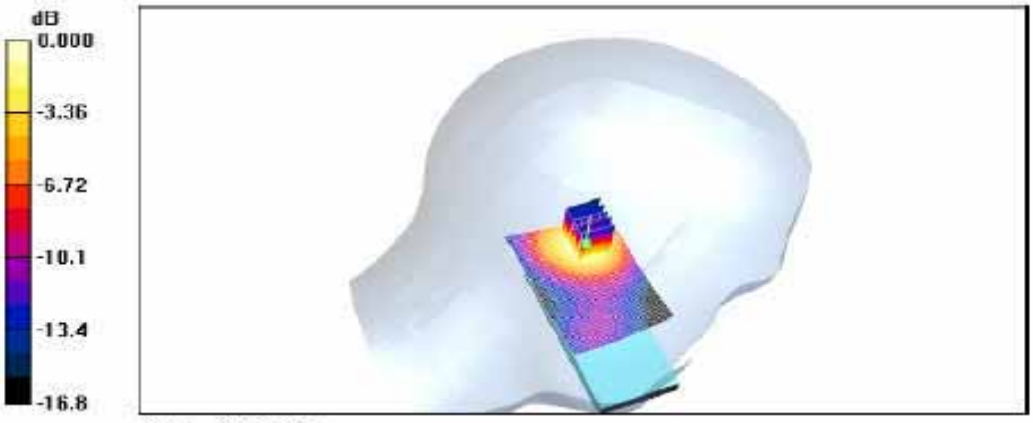
Communication System: GSM1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.38 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.575 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.2 V/m; Power Drift = -0.025 dB
Peak SAR (extrapolated) = 0.852 W/kg
SAR(1 g) = 0.485 mW/g
Maximum value of SAR (measured) = 0.557 mW/g



0 dB = 0.557mW/g

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Test Laboratory: ESTECH

CH661 LEFT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

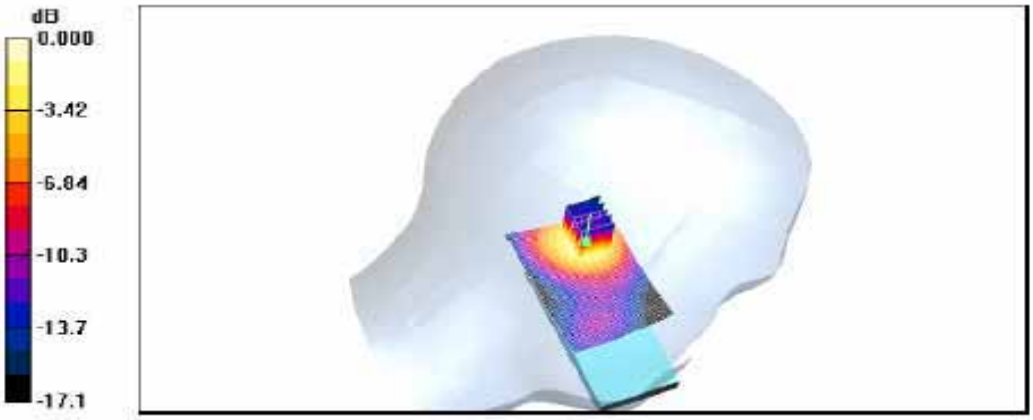
Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.4 mho/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 48%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.673 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.1 V/m; Power Drift = -0.085 dB
Peak SAR (extrapolated) = 0.968 W/kg
SAR(1 g) = 0.545 mW/g
Maximum value of SAR (measured) = 0.626 mW/g



0 dB = 0.626mW/g

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Date/Time: 2006-08-09 13:38:43

Test Laboratory: ESTECH

CH810 LEFT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

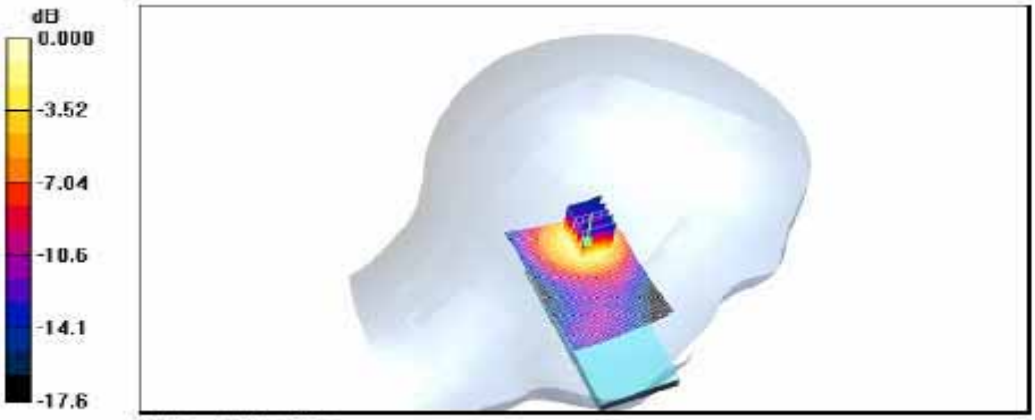
Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1910 MHz; σ = 1.43 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.695 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.8 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.580 mW/g
Maximum value of SAR (measured) = 0.664 mW/g



0 dB = 0.664mW/g

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FAX: 82-2-867-3204

Date/Time: 2006-08-09 13:14:42

Test Laboratory: ESTECH

CH512 RIGHT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

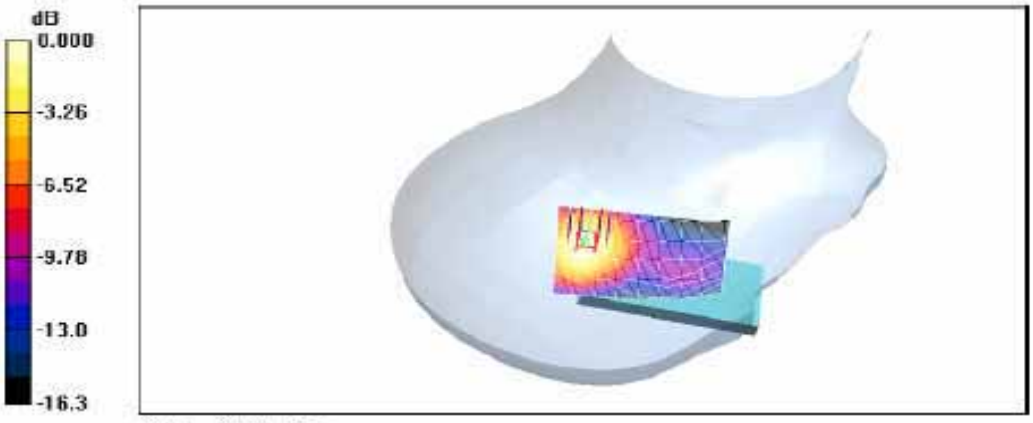
Communication System: GSM1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.38 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 47%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.565 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.4 V/m; Power Drift = -0.050 dB
Peak SAR (extrapolated) = 0.814 W/kg
SAR(1 g) = 0.481 mW/g
Maximum value of SAR (measured) = 0.540 mW/g



0 dB = 0.540mW/g

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Date/Time: 2006-08-09 12:03:05

Test Laboratory: ESTECH

CH661 RIGHT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

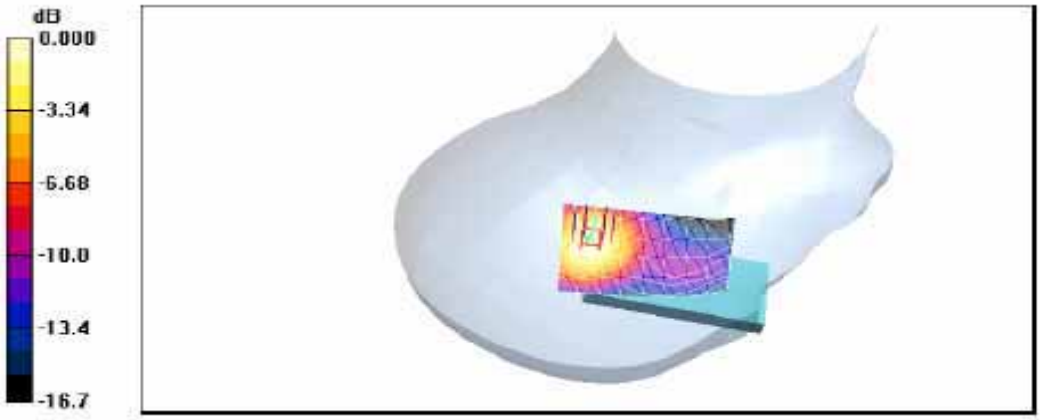
Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.4 mho/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 48%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.591 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.0 V/m; Power Drift = -0.061 dB
Peak SAR (extrapolated) = 0.875 W/kg
SAR(1 g) = 0.509 mW/g
Maximum value of SAR (measured) = 0.572 mW/g



0 dB = 0.572mW/g

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Date/Time: 2006-08-09 13:26:17

Test Laboratory: ESTECH

CH810 RIGHT TILT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

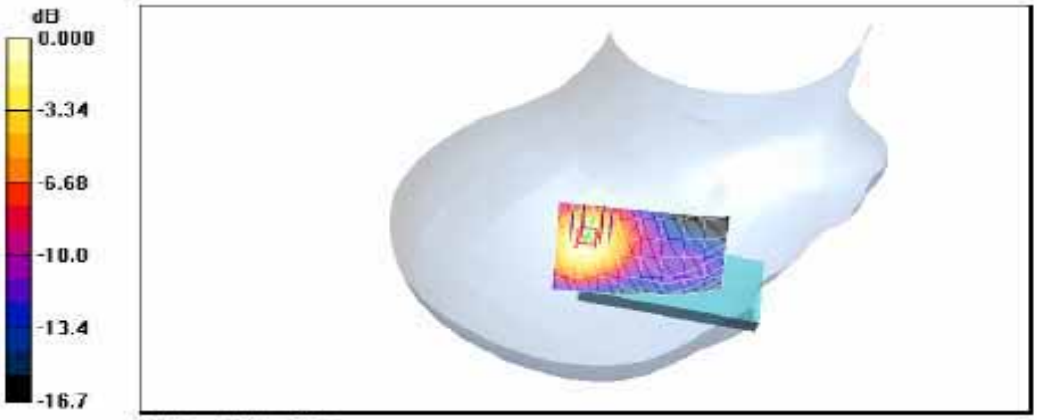
Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1910 MHz; σ = 1.43 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.652 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.0 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 0.996 W/kg
SAR(1 g) = 0.567 mW/g
Maximum value of SAR (measured) = 0.639 mW/g



0 dB = 0.639mW/g

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Date/Time: 2006-08-09 14:01:32

Test Laboratory: ESTECH

CH810 LEFT TILT-BT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

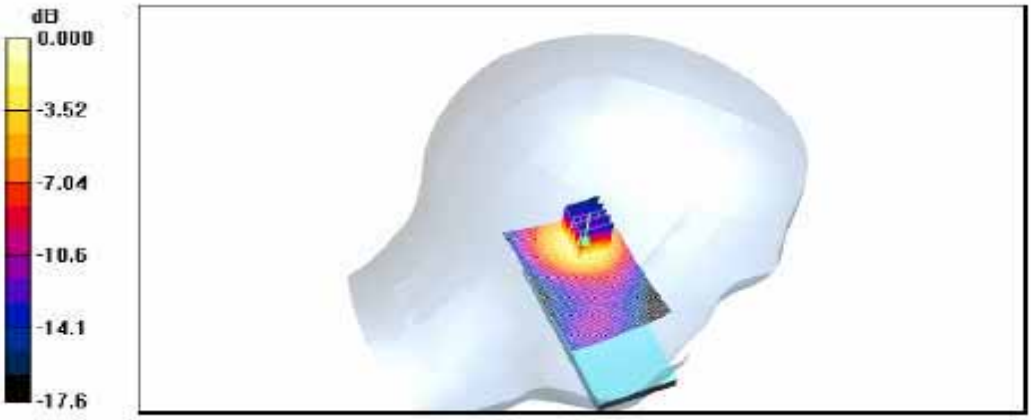
Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1910 MHz; σ = 1.43 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.696 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.7 V/m; Power Drift = -0.041 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.572 mW/g
Maximum value of SAR (measured) = 0.651 mW/g



0 dB = 0.651mW/g

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Date/Time: 2006-08-09 13:38:43

Test Laboratory: ESTECH

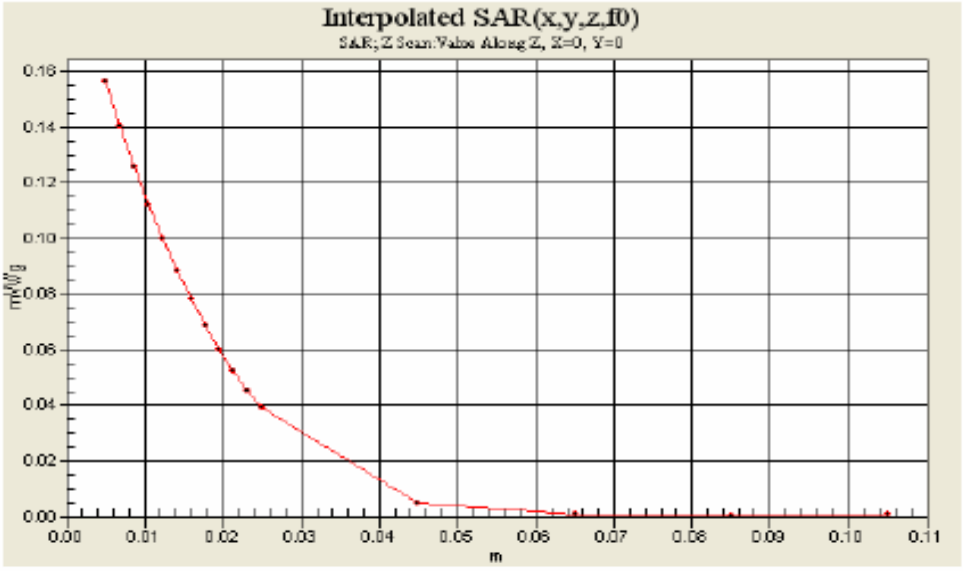
CH810 LEFT TILT-ZSCAN

DUT: MG320d; Type: BAR TYPE; Serial: NONE

Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1910 MHz; σ = 1.43 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(5.14, 5.14, 5.14); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%



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FAX: 82-2-867-3204

Date/Time: 2006-08-09 15:41:06

Test Laboratory: ESTECH

CH512 BODY

DUT: MG320d; Type: BAR TYPE; Serial: NONE

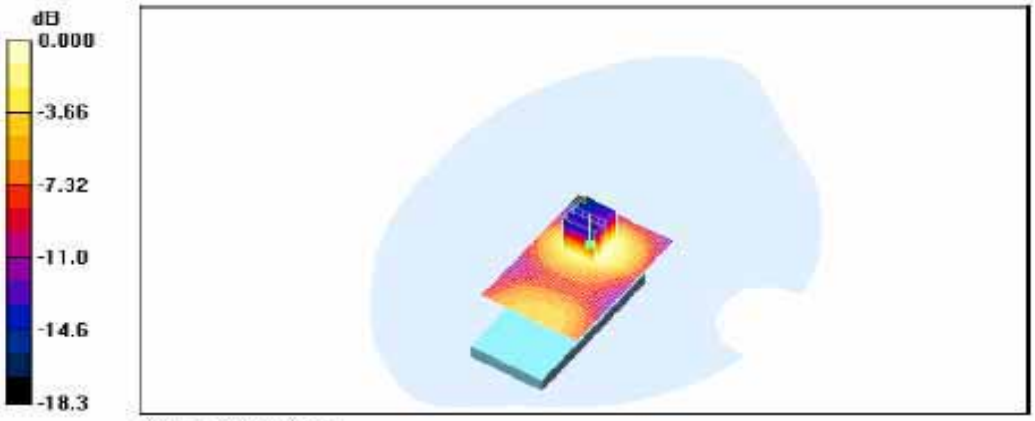
Communication System: GSM1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.49 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(4.54, 4.54, 4.54); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.756 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.4 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.696 mW/g
Maximum value of SAR (measured) = 0.784 mW/g



0 dB = 0.784mW/g

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Date/Time: 2006-08-09 15:30:27

Test Laboratory: ESTECH

CH661 BODY

DUT: MG320d; Type: BAR TYPE; Serial: NONE

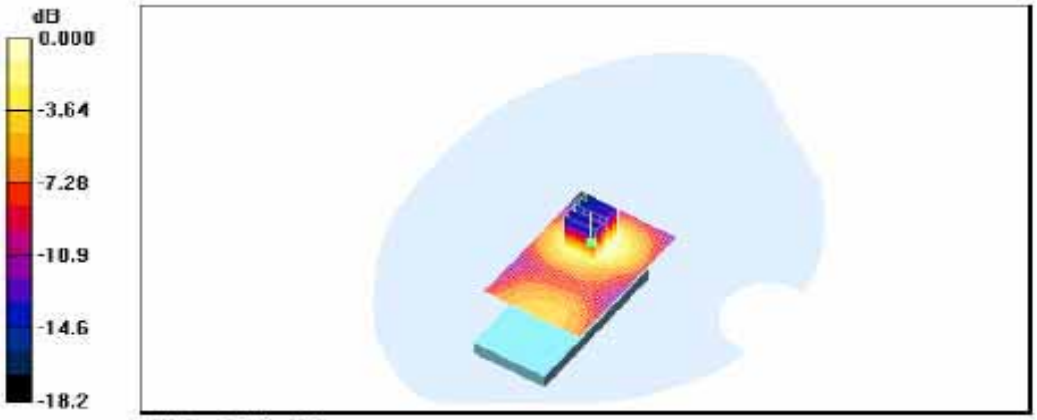
Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.51 mho/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(4.54, 4.54, 4.54); Calibrated: 2006-01-24
- 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 : 21℃, Humidity : 48%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.738 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.9 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.667 mW/g
Maximum value of SAR (measured) = 0.749 mW/g



0 dB = 0.749mW/g

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Date/Time: 2006-08-09 15:53:43

Test Laboratory: ESTECH

CH810 BODY

DUT: MG320d; Type: BAR TYPE; Serial: NONE

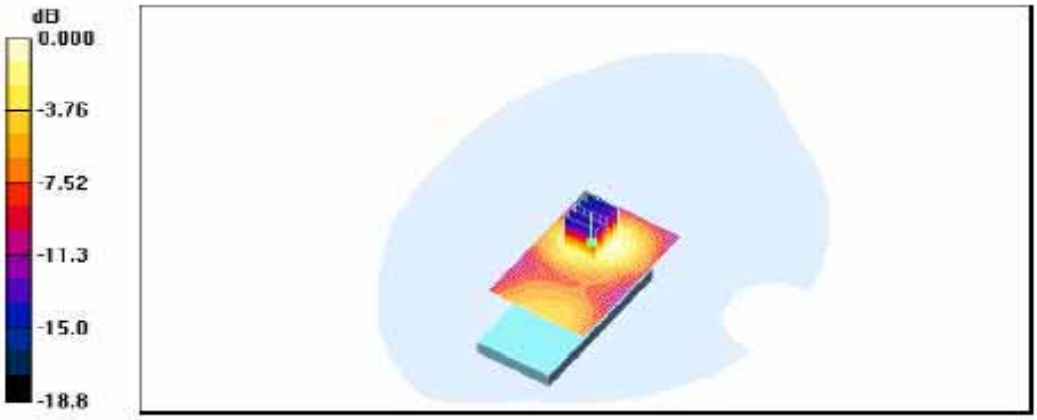
Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1910 MHz; σ = 1.54 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(4.54, 4.54, 4.54); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.688 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.7 V/m; Power Drift = -0.069 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.627 mW/g
Maximum value of SAR (measured) = 0.699 mW/g



0 dB = 0.699mW/g

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Date/Time: 2006-08-09 16:57:54

Test Laboratory: ESTECH

CH512 BODY-GPRS-BT

DUT: MG320d; Type: BAR TYPE; Serial: NONE

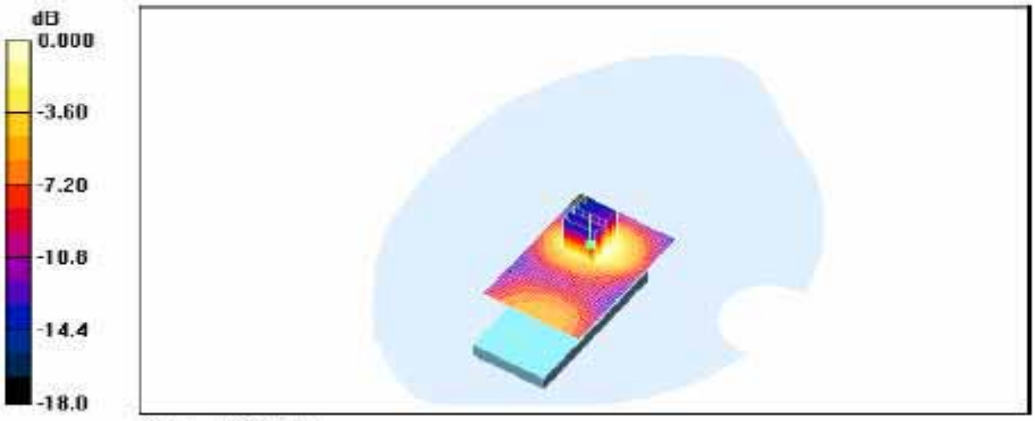
Communication System: GSM1900; Frequency: 1850.2 MHz;Duty Cycle: 1:4.15
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.49 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(4.54, 4.54, 4.54); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.18 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.0 V/m; Power Drift = 0.055 dB
Peak SAR (extrapolated) = 2.02 W/kg
SAR(1 g) = 1.11 mW/g
Maximum value of SAR (measured) = 1.26 mW/g



0 dB = 1.26mW/g

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FAX: 82-2-867-3204

Date/Time: 2006-08-09 16:57:54

Test Laboratory: ESTECH

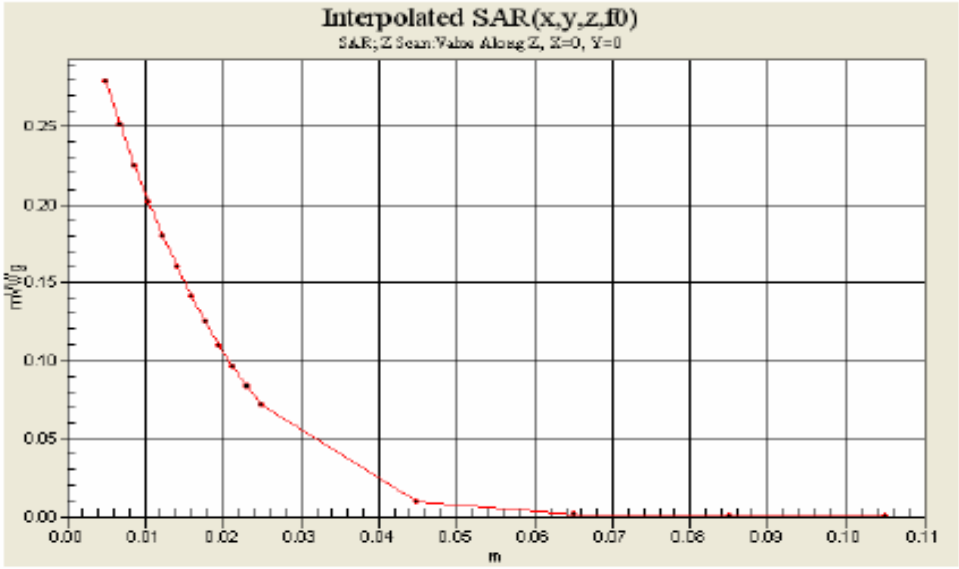
CH512 BODY-GPRS-BT-ZSCAN

DUT: MG320d; Type: BAR TYPE; Serial: NONE

Communication System: GSM1900; Frequency: 1850.2 MHz;Duty Cycle: 1:4.15
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.49 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1750; ConvF(4.54, 4.54, 4.54); Calibrated: 2006-01-24
- 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 : 20℃, Humidity : 46%



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FAX: 82-2-867-3204

APPENDIX D : Calibration Certificates

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

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

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

Accreditation No.: SCS 108

Client Estech (Dymstec)

Certificate No: D835V2-475_Feb05

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 475

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

Calibration date: February 24, 2005

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 E442	GB37480704	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Power sensor HP 8481A	US37292783	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference Probe ET3DV6	SN 1507	26-Oct-04 (SPEAG, No. ET3-1507_Oct04)	Oct-05
DAE4	SN 601	07-Jan-05 (SPEAG, No. DAE4-601_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-03)	In house check: Oct-05
RF generator R&S SML-03	100698	27-Mar-02 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov-05

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

Issued: February 25, 2005

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) 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
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4 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	V4.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 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 ± 0.2) °C	42.2 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 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	2.25 mW / g
SAR normalized	normalized to 1W	9.00 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**9.02 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.48 mW / g
SAR normalized	normalized to 1W	5.92 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**5.93 mW / g ± 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	52.4 Ω - 2.4 jΩ
Return Loss	- 29.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.384 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: 24.02.2005 12:21:57

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN475

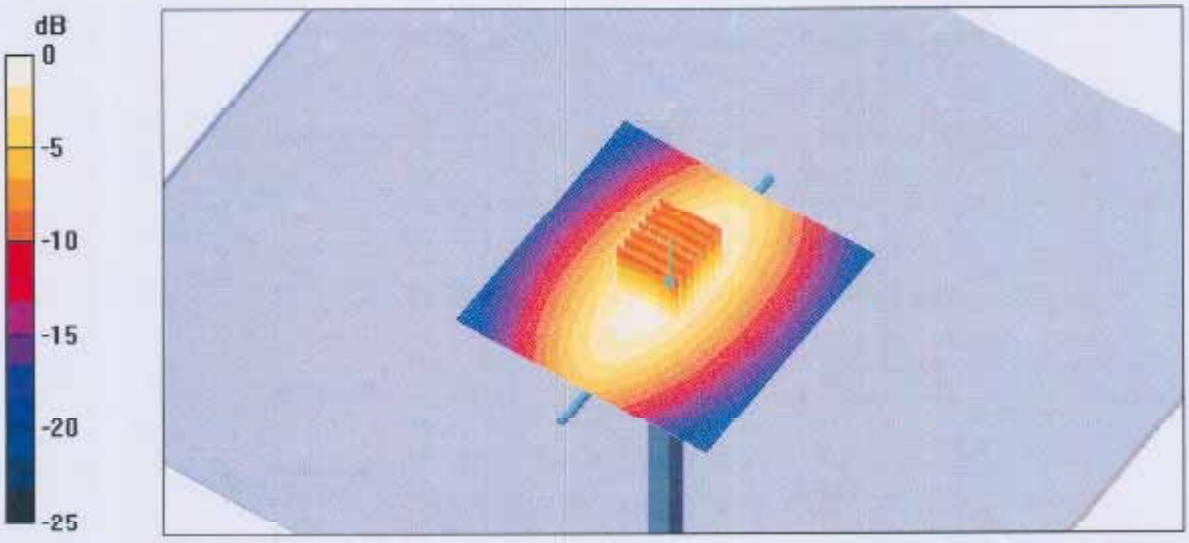
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL 900 MHz;
Medium parameters used: f = 835 MHz; σ = 0.91 mho/m; ε_r = 42.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

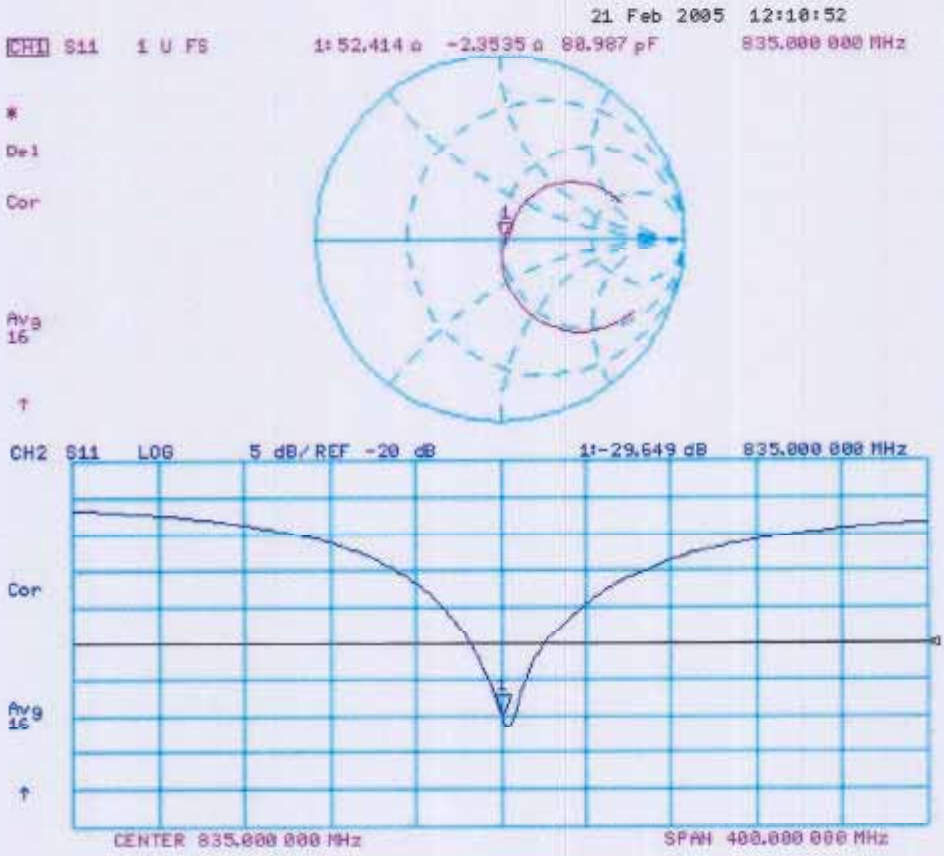
- Probe: ET3DV6 - SN1507; ConvF(6.24, 6.24, 6.24); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 17; Postprocessing SW: SEMCAD, V1.8 Build 144

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.43 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.1 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 3.27 W/kg
SAR(1 g) = 2.25 mW/g; SAR(10 g) = 1.48 mW/g
Maximum value of SAR (measured) = 2.44 mW/g



0 dB = 2.44 mW/g


21 Feb 2005 12:10:52
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835.000 000 MHz
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Del
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF -20 dB
1: -29.649 dB 835.000 000 MHz
Cor
Avg
16
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz