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SAR Compliance Test Report

APPLICANT NAME & ADDRESS :

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

DATA & LOCATION OF TESTING

Dates of testing : 2005 7/25 ~ 8/3
Test Site : ESTECH Co., Ltd. Korea

Test Device :

Models : LG-RD6230

FCC ID : BEJRD6230

TYPE : Single-Band Single - Mode CDMA Phone
(CDMA)

Test report no :

ESTSAR0508-001

Number of page :

22

Contact person :

Cheol-Goo Lee

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)

FCC Rule Part(s)

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

Test results :

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

Date and Signatures : 2005/8/3

Report Prepared By : Engineer/ K.H.Kang

(Signature)

Manager Engineer/ Jay Kim

(Signature)

Test report no : ESTSAR0508-001

FCC ID : BEJRD6230

Web : www. estech. co. kr

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1. SUMMARY FOR TEST REPORT

FCC ID	BEJRD6230
Date of test	2005/7/25 ~ 2005/8/3
Responsible test engineer	Jay Kim
Measurement performed by	K.H.Kang
EUT Type	Single-Band Single - Mode CDMA Phone (CDMA)
Tx Frequency	824.70 ~ 848.31 MHz (CDMA)
Rx Frequency	869.70 ~ 893.31 MHz (CDMA)
Max. RF Output Power	CDMA (24.5 dBm)

Maximum Results Found During SAR Evaluation

1.1 Head Configuration

Max. SAR Measurement

FREQUENCY		Modulation	Conducted Power(dBm)		Device test position	Antenna position	SAR (W/kg)
MHz	Ch		dBm	Battery			
848.31	777	CDMA	24.5	Standard	Left Touch	—	1.25

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			
835.89	363	CDMA	24.5	Standard	1.5cm [w/o Holster]	—	1.17

1.3 Measurement Uncertainty

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



2. INTRODUCTION

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

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

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). it is also defined as the rate of rf energy absorption per unit mass at a point in an absorbing body (see Fig. 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/m³)

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



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3. DESCRIPTION OF THE DEVICE UNDER TEST

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

2.1 Antenna Description

Type	Built-in Antenna
Location	Internal, the top of the device
Radiator Material	Copper

2.2 Device Description

	FCC ID	FCC ID : BEJRD6230
	Serial numbers	—
	Exposure environment	Uncontrolled exposure
	Device category	Portable device
	Mode(s) of Operation	CDMA
	Modulation Mode(s)	CDMA
	Duty Cycle	1
	Transmitting Frequency Range(s)	824.70 ~ 848.31 MHz (CDMA)

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 (%)	47

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 (800MHz CDMA 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.

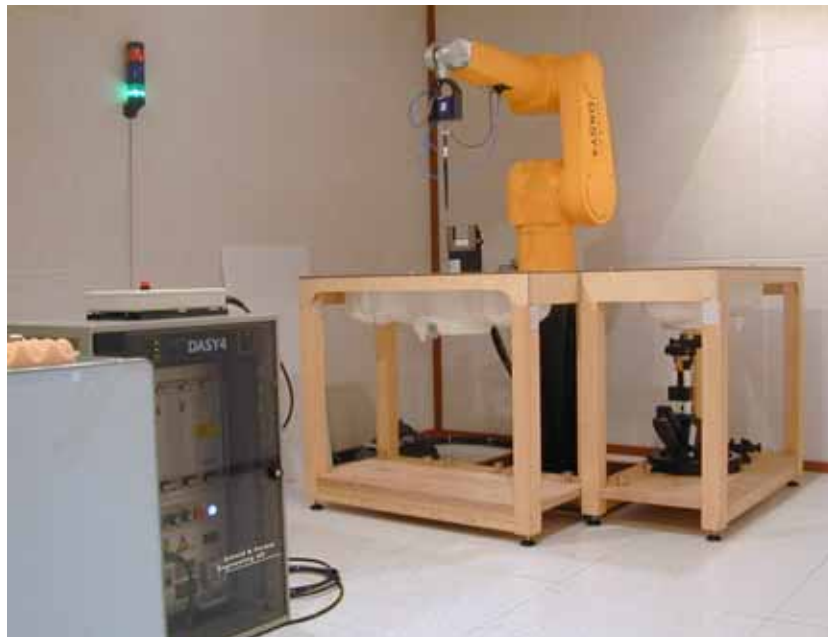


Fig. 4.1 SAR Measurement System



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	DAE3	551	2004-04-28
E-Field Probe	ET3DV6	1748	2005-01-21
Dipole validation kit	D835V2	475	2005-02-24
Network analyzer	8753ES	NONE	2004-10-12
Signal generator	E4421B	GB40052295	2004-10-12
RF Power meter	EPM-442A	GB37170412	2004-10-12
Power Sensor	8481A	3318A90368	2004-10-14
RF Power meter	E4418A	GB38272722	2005-03-03
Power Sensor	8481A	3318A96478	2005-03-03
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.

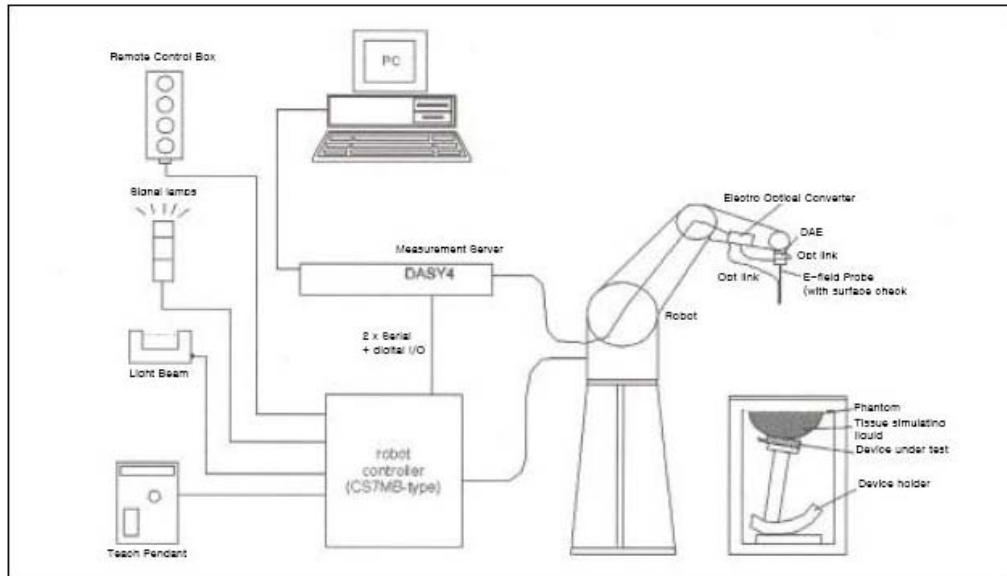


Fig. 5.1 SAR Measurement System Setup

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 $\pm 8\%$) Calibration for other liquids and frequencies upon request
	Frequency	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
	Directivity	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.3 dB in brain tissue (rotation normal to probe axis)
	Dynamic Range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
	Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.7 mm

Fig. 5.2 Probe Specifications



5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

5.4 Phantom & Equivalent Tissues

SAM Phantom

The SAM Twin Phantom V4.0 is constructed of the fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [11][12]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Head & Muscle simulation Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose(HEC) gelling agent and saline solution (see 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)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800-2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73
5800	35.3	5.27	48.2	6

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



5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

835MHz			1900MHz		
	Head	Body		Head	Body
Sugar	47.31%	34.31%	DGBE(diethylene Glycol butyl 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 (hydroxyethyl cellulose)	0.24%				
Preventol	0.24%	0.10%			
ϵ	$41.0 \pm 5\%$	$55.2 \pm 5\%$	ϵ	$40.0 \pm 5\%$	$53.3 \pm 5\%$
σ	$0.89 \pm 10\%$	$0.97 \pm 10\%$	σ	$1.45 \pm 10\%$	$1.52 \pm 10\%$

Fig. 5.4 Composition of the Tissue Equivalent Matter

Device Holder for Transmitters

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

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



6. DESCRIPTION OF THE TEST PROCEDURE

6.1 Definition of Reference Point

EAR Reference point

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

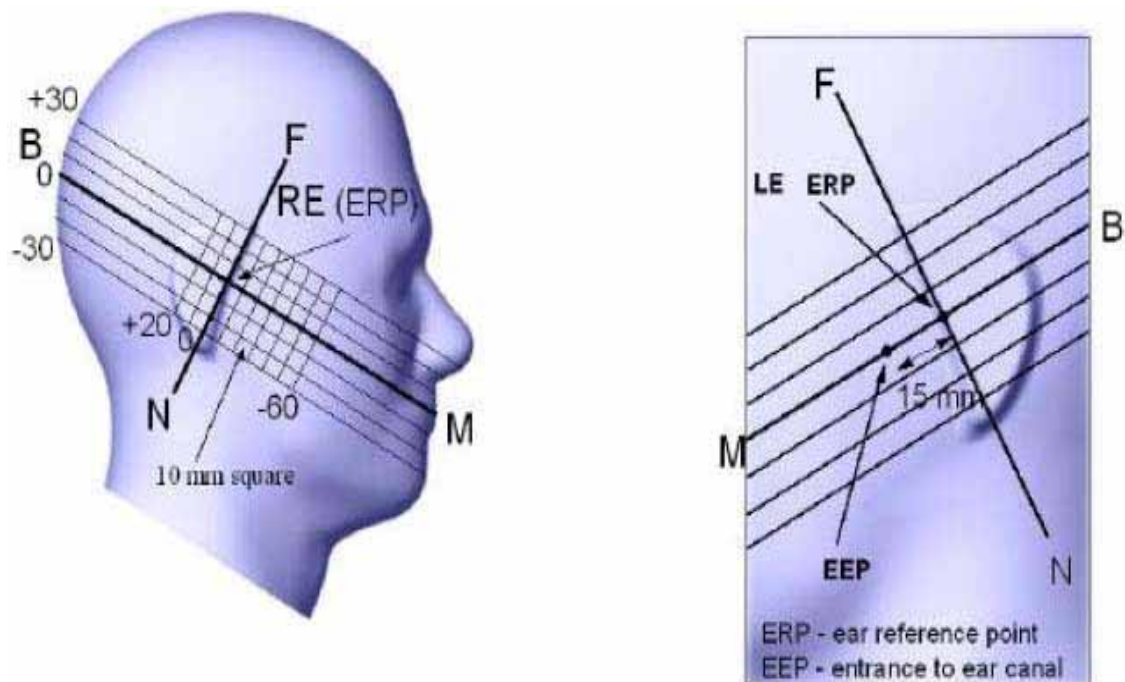


Figure 6.1 Close-up side view of ERP

Handset Reference Points

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

6. DESCRIPTION OF THE TEST PROCEDURE(continued)

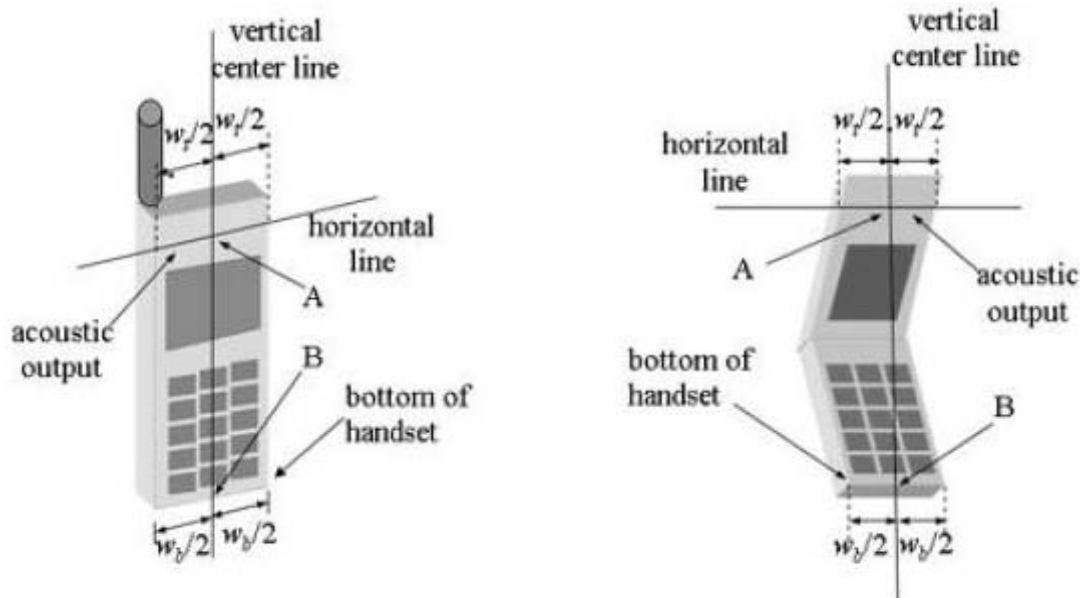


Figure 6.2 Handset Vertical Center & Horizontal Line Reference Points

6.2 Test Configuration Positions

Positioning for Cheek/Touch

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



6. DESCRIPTION OF THE TEST PROCEDURE(continued)

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

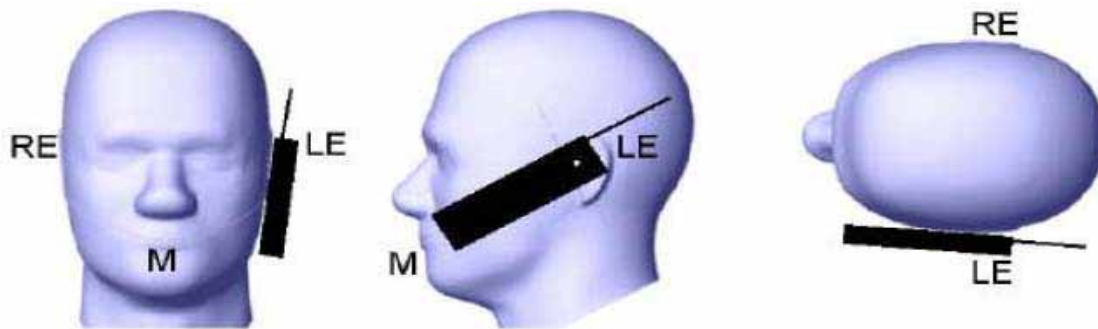


Figure 6.3 "Cheek" or "Touch" Position.

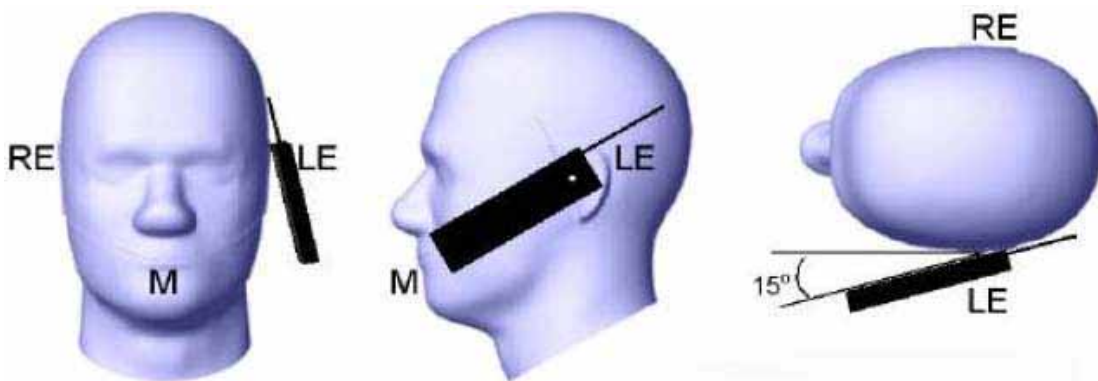


Figure 6.4 "Tilted" Position.



6. DESCRIPTION OF THE TEST PROCEDURE(continued)

Positioning for Ear / 15° Tilted

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

Body Holder / Belt Clip Configurations

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

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

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

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



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6. DESCRIPTION OF THE TEST PROCEDURE(continued)

6.3 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Nest cube scan, 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, Computermathematik, p. 141-150](x, y and z directions) [Numerical Recipes in C, Second Edition, p 123].

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



7. MEASUREMENT UNCERTAINTY

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

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

ERROR Description	Uncertainty	Probability	Divisor	ci 1	Standard unc.	vi or
	value ±%	Distribution		1g	(1g)	Veff
MEASUREMENT SYSTEM						
Probe Calibration	± 11.7 %	normal	1	1	± 4.8 %	∞
Axial Isotropy	± 4.7	rectangular	√3	(1-cp) ^{1/2}	± 1.9%	∞
Hemispherical Isotropy	± 9.6	rectangular	√3	(cp) ^{1/2}	± 3.9%	∞
Boundary Effects	± 1.0	rectangular	√3	1	± 0.6%	∞
Linearity	± 4.7	rectangular	√3	1	± 2.7%	∞
System Detection Limits	± 1.0	rectangular	√3	1	± 0.6%	∞
Readout Electronics	± 1.0	normal	1	1	± 1.0%	∞
Response time	± 0.8	rectangular	√3	1	± 0.5%	∞
Integration time	± 2.6	rectangular	√3	1	± 1.5%	∞
RF Amnient Conditions	± 3.0	rectangular	√3	1	± 1.7%	∞
Probe Positioner Mechanical Tolerance	± 0.4	rectangular	√3	1	± 0.2%	∞
Probe Positioning with respect to Phantom Shell	± 2.9	rectangular	√3	1	± 1.7%	∞
Extrapolation, Interpolation and Integration Algorithms for Max. SAR Evaluation	± 1.0	rectangular	√3	1	± 0.6%	∞
Test Sample Related						
Test Sample Positioning	± 2.9	normal	1	1	± 2.97%	145
Device Holder Uncertainty	± 3.6	normal	0.84	1	± 3.69%	5
Output Power Validation – SAR drift measurement	± 5.0	rectangular	√3	1	± 2.9%	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	± 4.0	rectangular	√3	1	± 2.3%	∞
Liquid conductivity Target – tolerance	± 5.0	rectangular	√3	0.64	± 1.8%	∞
Liquid Conductivity – measurement uncertainty	± 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	2005-07-26		2005-07-26				/ /			
Tissue	835MHz Brain		835MHz Muscle							
	Target	Measured	Target	Measured						
Dielectric Constant: ϵ	41.5	40.6	55.2	54.1						
Conductivity: σ	0.9	0.889	0.97	0.956						
Deviation (%)	ϵ : -2.17%		ϵ : -1.99%							
	σ : -1.22%		σ : -1.44%							

Test System Validation

- Prior to assessment, the system is verified to the $\pm 10\%$ of the specifications at 835MHz (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
835MHz Brain	D835V2(S/N :475)	1.0	9.5	9.72	-2.32%	2005-07-26

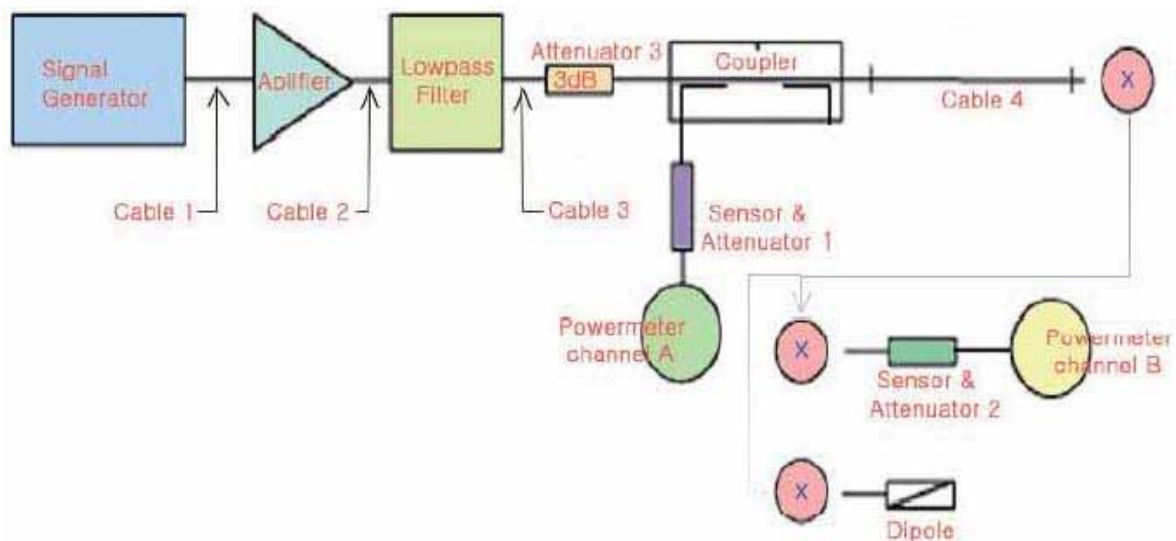


Figure 12.1 Dipole Validation Test Setup

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426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, KoreaTEL: 82-2-867-3201
FAX: 82-2-867-3204**9. RESULTS(continued)**Ambient TEMPERATURE (C) : **21.0**Relative HUMIDITY (%) : **47**Mixture Type : **835MHz Brain**Dielectric Constant : **40.6**Conductivity: **0.889****Measurement Results (CDMA 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 (CDMA Left Head SAR – Touch)								
Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.70	1013	CDMA	24.50	24.41	Standard	Cheek Touch	—	0.543
835.89	363	CDMA	24.50	24.46	Standard	Cheek Touch	—	1.240
848.31	777	CDMA	24.50	24.43	Standard	Cheek Touch	—	1.250

MEASUREMENT RESULTS (CDMA Right Head SAR – Touch)								
Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.70	1013	CDMA	24.50	24.47	Standard	Cheek Touch	—	0.500
835.89	363	CDMA	24.50	24.51	Standard	Cheek Touch	—	1.140
848.31	777	CDMA	24.50	24.42	Standard	Cheek Touch	—	1.130

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)

Test report no : ESTSAR0508-001

FCC ID : BEJRD6230

Web : www. estech. co. kr

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : **21.0**

Relative HUMIDITY (%) : **47**

Mixture Type : **835MHz Brain**

Dielectric Constant : **40.6**

Conductivity: **0.889**

Measurement Results (CDMA 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 (CDMA Left Head SAR – Tilt – Slide IN)								
Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
835.89	363	CDMA	24.50	24.49	Standard	Tilt	—	0.693

MEASUREMENT RESULTS (CDMA Right Head SAR – Tilt)								
Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
835.89	363	CDMA	24.50	24.46	Standard	Tilt	—	0.668

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)

Test report no : ESTSAR0508-001

FCC ID : BEJRD6230

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : 22

Relative HUMIDITY (%) : 55

Mixture Type : 835MHz Body

Dielectric Constant : 54.1

Conductivity: 0.956

Measurement Results (CDMA BODY SAR with Holster)

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

MEASUREMENT RESULTS (CDMA Body SAR With Holster)								
Frequency		Moudulation	Conducted Power(dBm)		battery	Device Test position	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.70	1013	CDMA	24.50	24.47	Standard	1.5[w/o Holster]	—	0.727
835.89	363	CDMA	24.50	24.41	Standard	1.5[w/o Holster]	—	1.170
848.31	777	CDMA	24.50	24.40	Standard	1.5[w/o Holster]	—	1.160

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

Engineer K.H.Kang

(Signature)

Test report no : ESTSAR0508-001

FCC ID : BEJRD6230

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10. REFERENCE

- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, Aug. 1996.
- [2] ANSI/IEEE C95.1 – 1991, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz, New York: IEEE, Aug. 1992
- [3] ANSI/IEEE C95.3 – 1991, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.
- [4] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.
- [5] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [6] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 120-124.
- [7] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.
- [8] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [9] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Head Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.
- [10] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [11] G. Hartsgrrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.
- [12] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
- [13] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.
- [14] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.
- [15] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to RadioFrequency Electromagnetic Fields. Supplement C, Dec. 1997.
- [16] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [17] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.
- [18] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.



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APPENDIX A : Validation Test Data of Tissue



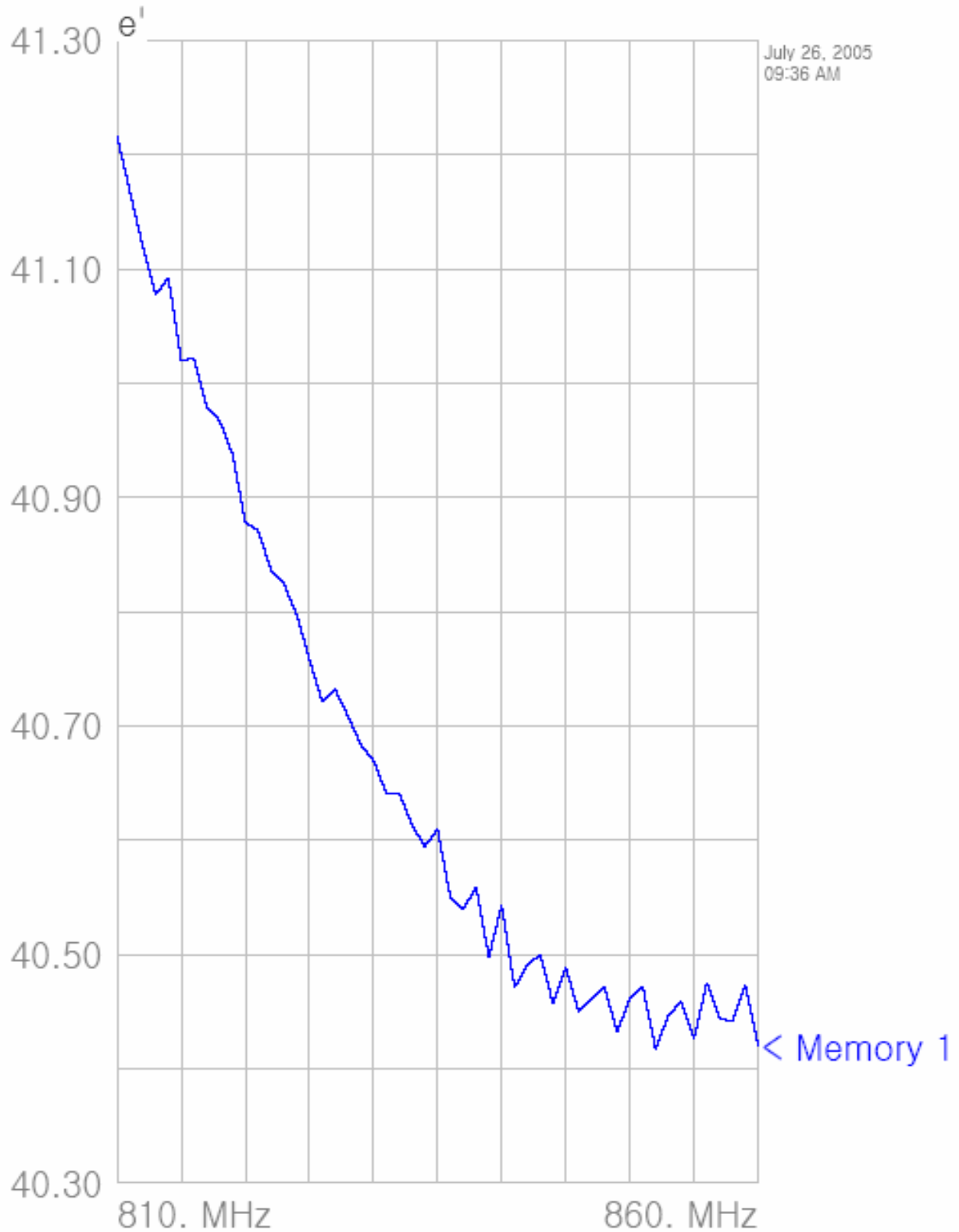
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– Head Tissue

Title
SubTitle





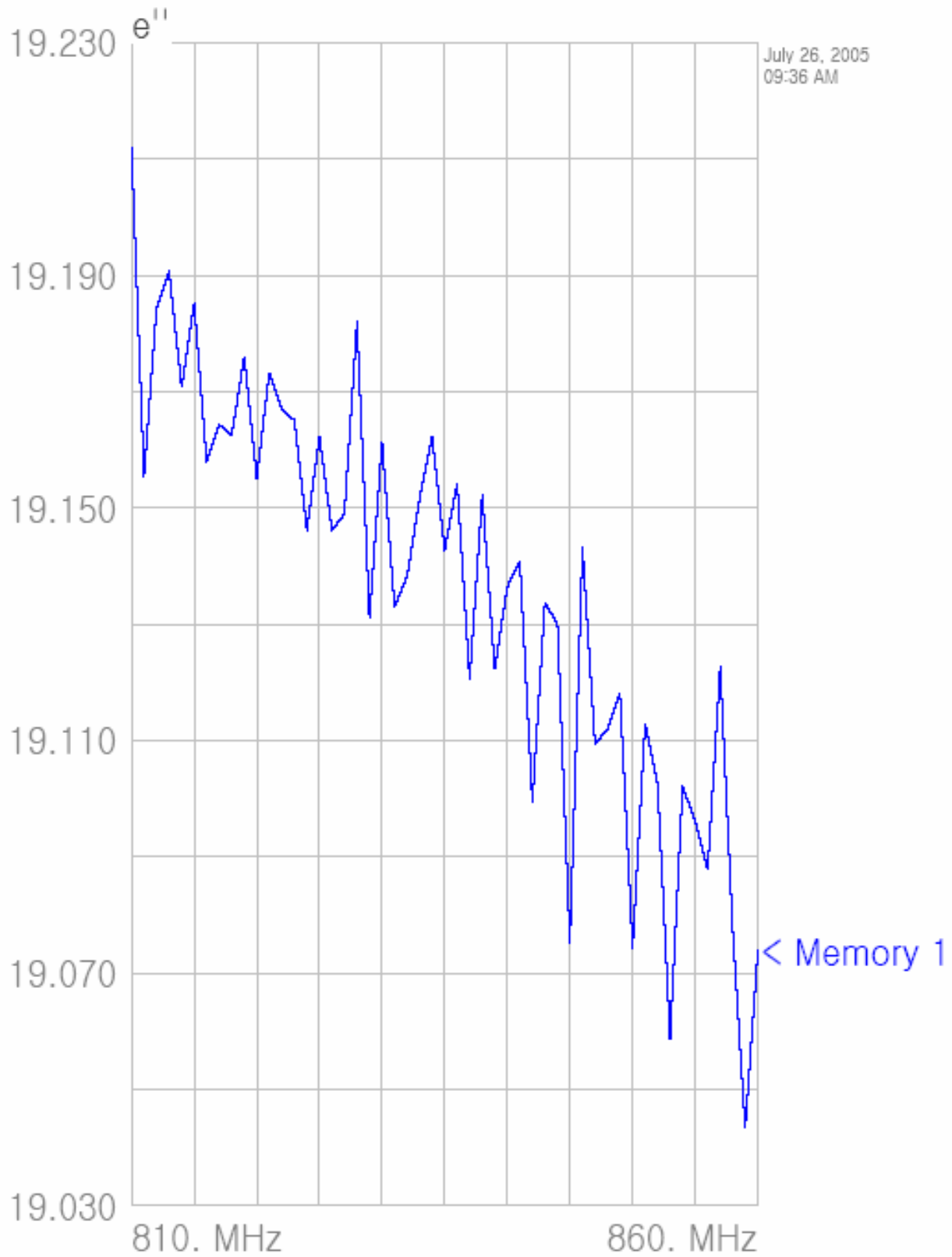
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Title**SubTitle**

July 15, 2015 10:25 AM

Frequency	e^I	e^{II}
810.000000 MHz	41.2162	19.2120
811.000000 MHz	41.1673	19.1555
812.000000 MHz	41.1200	19.1844
813.000000 MHz	41.0774	19.1907
814.000000 MHz	41.0921	19.1708
815.000000 MHz	41.0197	19.1852
816.000000 MHz	41.0218	19.1580
817.000000 MHz	40.9796	19.1643
818.000000 MHz	40.9673	19.1625
819.000000 MHz	40.9378	19.1760
820.000000 MHz	40.8779	19.1552
821.000000 MHz	40.8711	19.1732
822.000000 MHz	40.8366	19.1669
823.000000 MHz	40.8245	19.1651
824.000000 MHz	40.7973	19.1462
825.000000 MHz	40.7585	19.1623
826.000000 MHz	40.7216	19.1462
827.000000 MHz	40.7321	19.1489
828.000000 MHz	40.7087	19.1820
829.000000 MHz	40.6836	19.1311
830.000000 MHz	40.6701	19.1614
831.000000 MHz	40.6407	19.1329
832.000000 MHz	40.6416	19.1382
833.000000 MHz	40.6131	19.1516
834.000000 MHz	40.5945	19.1622
835.000000 MHz	40.6097	19.1427
836.000000 MHz	40.5495	19.1542
837.000000 MHz	40.5399	19.1205
838.000000 MHz	40.5587	19.1523
839.000000 MHz	40.4979	19.1223
840.000000 MHz	40.5431	19.1364
841.000000 MHz	40.4711	19.1409
842.000000 MHz	40.4907	19.0994
843.000000 MHz	40.4998	19.1336
844.000000 MHz	40.4571	19.1302
845.000000 MHz	40.4884	19.0752
846.000000 MHz	40.4500	19.1432
847.000000 MHz	40.4612	19.1094
848.000000 MHz	40.4721	19.1119
849.000000 MHz	40.4323	19.1181
850.000000 MHz	40.4614	19.0742
851.000000 MHz	40.4720	19.1129
852.000000 MHz	40.4175	19.1026
853.000000 MHz	40.4465	19.0588
854.000000 MHz	40.4586	19.1021
855.000000 MHz	40.4260	19.0961
856.000000 MHz	40.4751	19.0878
857.000000 MHz	40.4437	19.1226
858.000000 MHz	40.4414	19.0774
859.000000 MHz	40.4729	19.0433
860.000000 MHz	40.4201	19.0738



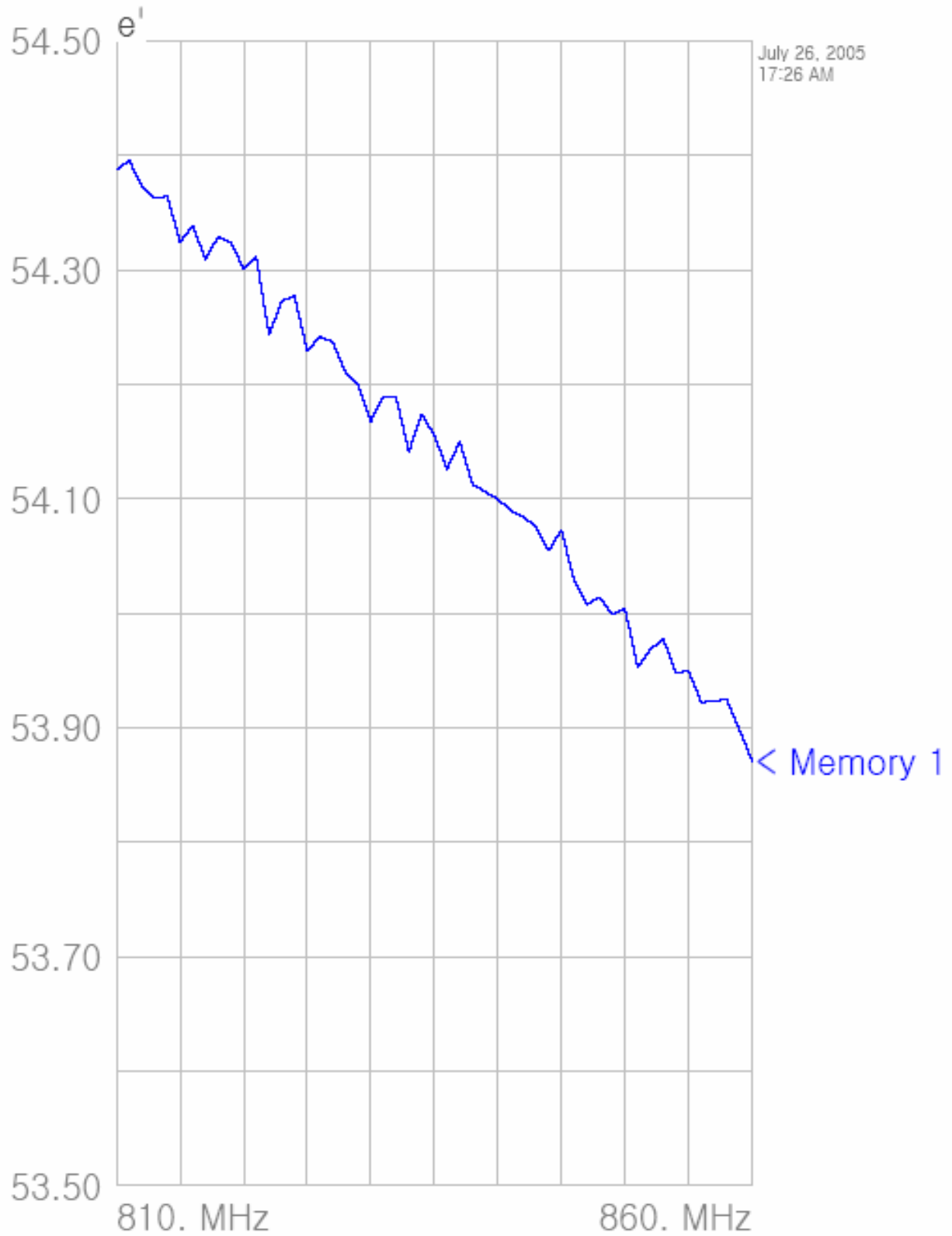
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– Body Tissue

Title
SubTitle





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Title**SubTitle**

July 25, 2005 17:25 AM

Frequency	e^i	$e^{i\pi}$
810.000000 MHz	54.3873	20.5502
811.000000 MHz	54.3955	20.5313
812.000000 MHz	54.3732	20.5683
813.000000 MHz	54.3629	20.5449
814.000000 MHz	54.3642	20.5846
815.000000 MHz	54.3243	20.5719
816.000000 MHz	54.3384	20.5845
817.000000 MHz	54.3093	20.6014
818.000000 MHz	54.3289	20.5673
819.000000 MHz	54.3242	20.6201
820.000000 MHz	54.3007	20.5904
821.000000 MHz	54.3113	20.5929
822.000000 MHz	54.2433	20.6240
823.000000 MHz	54.2727	20.5863
824.000000 MHz	54.2772	20.6022
825.000000 MHz	54.2290	20.6261
826.000000 MHz	54.2415	20.5724
827.000000 MHz	54.2372	20.6247
828.000000 MHz	54.2106	20.5853
829.000000 MHz	54.1993	20.6179
830.000000 MHz	54.1675	20.6248
831.000000 MHz	54.1898	20.5677
832.000000 MHz	54.1884	20.5967
833.000000 MHz	54.1410	20.6203
834.000000 MHz	54.1739	20.5925
835.000000 MHz	54.1557	20.6054
836.000000 MHz	54.1259	20.5567
837.000000 MHz	54.1502	20.5650
838.000000 MHz	54.1128	20.5850
839.000000 MHz	54.1060	20.5389
840.000000 MHz	54.0999	20.6132
841.000000 MHz	54.0896	20.5575
842.000000 MHz	54.0840	20.5440
843.000000 MHz	54.0758	20.5532
844.000000 MHz	54.0546	20.5564
845.000000 MHz	54.0730	20.5339
846.000000 MHz	54.0285	20.5621
847.000000 MHz	54.0076	20.5217
848.000000 MHz	54.0140	20.5255
849.000000 MHz	53.9991	20.5155
850.000000 MHz	54.0038	20.5145
851.000000 MHz	53.9532	20.4962
852.000000 MHz	53.9681	20.5077
853.000000 MHz	53.9782	20.4776
854.000000 MHz	53.9480	20.4842
855.000000 MHz	53.9499	20.4897
856.000000 MHz	53.9222	20.4739
857.000000 MHz	53.9229	20.4474
858.000000 MHz	53.9249	20.4528
859.000000 MHz	53.8986	20.4689
860.000000 MHz	53.8711	20.4531



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APPENDIX B : Validation Test Data

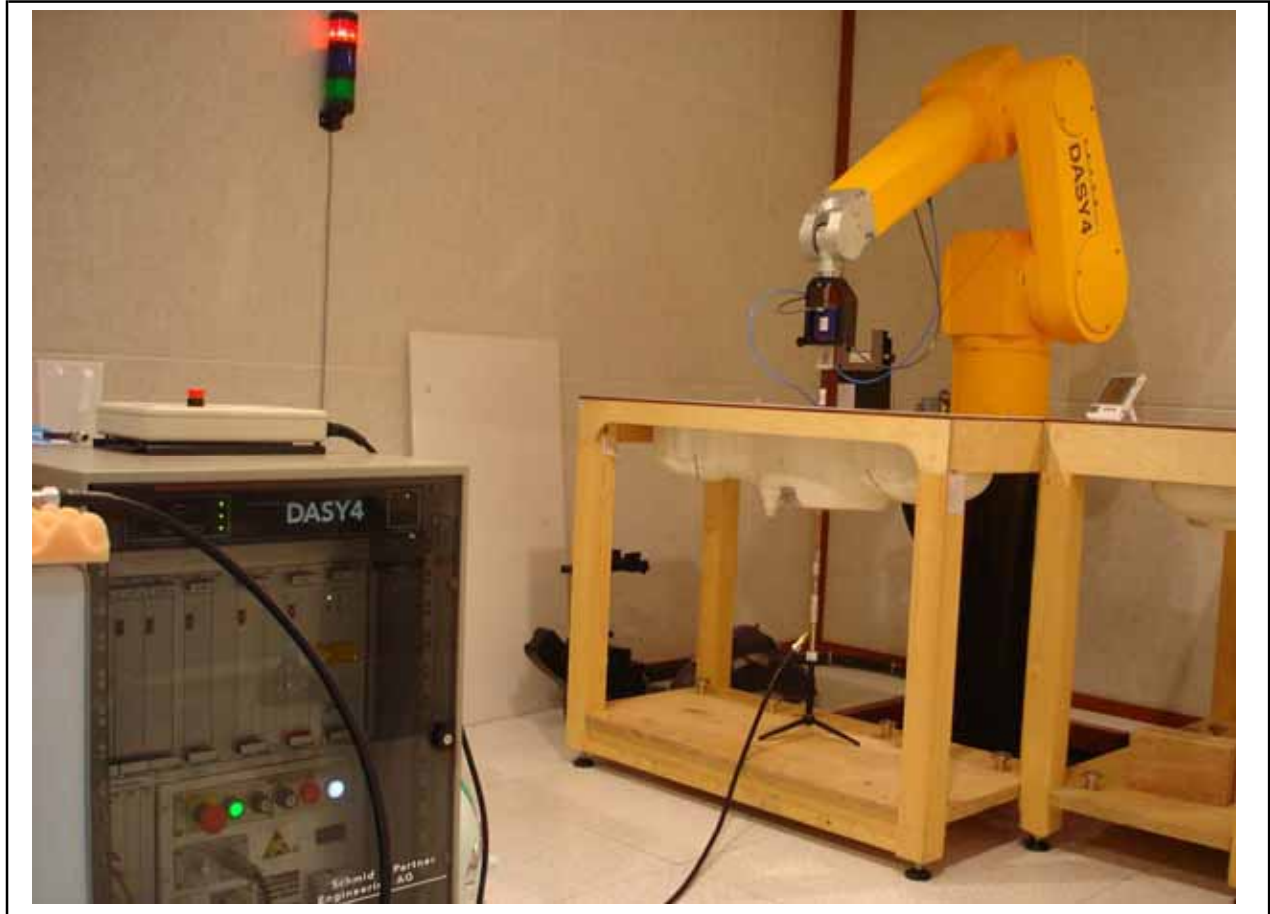


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835MHz Dipole Validation





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FAX: 82-2-867-3204

Date/Time: 07/26/05 10:18:40

Test Laboratory: ESTECH

validation - 0726

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

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

Medium: HSL 835MHz Medium parameters used: $f = 835$ MHz; $\sigma = 0.889$ mho/m; $\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 47%

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

Maximum value of SAR (interpolated) = 2.61 mW/g

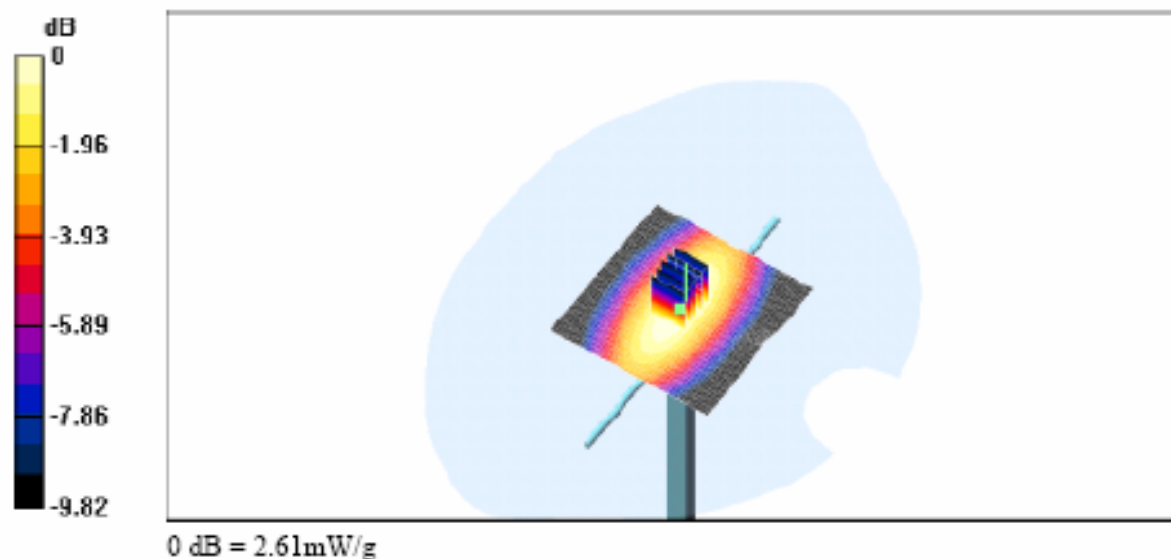
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.9 V/m; Power Drift = -0.003 dB

Peak SAR (extrapolated) = 3.64 W/kg

SAR(1 g) = 2.43 mW/g

Maximum value of SAR (measured) = 2.61 mW/g





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APPENDIX C : SAR Test Setup Photographs

Left Hand –Touch Position



Right Hand –Touch Position





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Left Hand –Tilt Position



Right Hand –Tilt Position





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Flat – Body Side Configuration (With Holster)





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APPENDIX D : SAR Test Data



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TEL: 82-2-867-3201
FAX: 82-2-867-3204

Date/Time: 07/26/05 14:56:43

Test Laboratory: ESTECH

CH1013-LEFT-TOUCH

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.879 \text{ mho/m}$;
 $\epsilon_r = 40.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 51%

Area Scan (41x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: [Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 0.587 mW/g

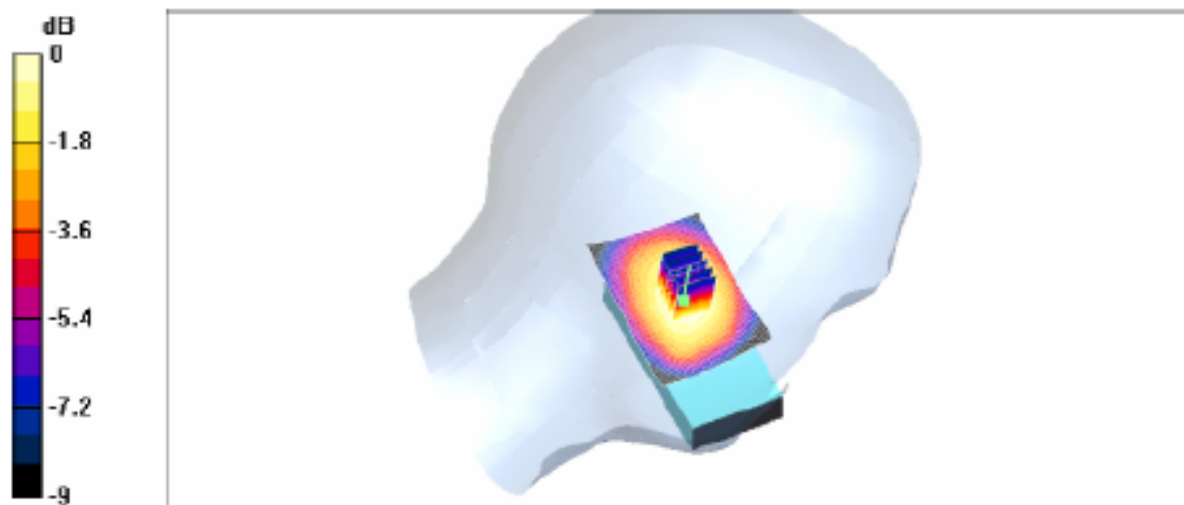
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.7 V/m; Power Drift = -0.2 dB

Peak SAR (extrapolated) = 0.709 W/kg

SAR(1 g) = 0.543 mW/g

Maximum value of SAR (measured) = 0.576 mW/g



0 dB = 0.576mW/g



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FAX: 82-2-867-3204

Date/Time: 07/26/05 11:15:37

Test Laboratory: ESTECH

CH363-LEFT-TOUCH

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.891$ mho/m;
 $\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22°C, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 1.36 mW/g

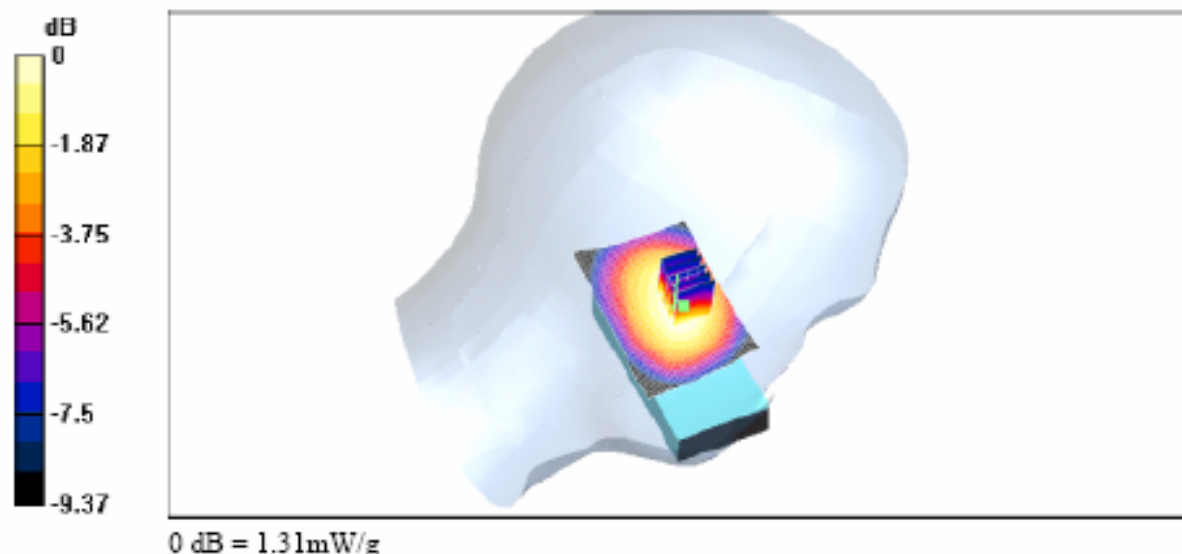
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 30.3 V/m; Power Drift = -0.1 dB

Peak SAR (extrapolated) = 1.68 W/kg

SAR(1 g) = 1.24 mW/g

Maximum value of SAR (measured) = 1.31 mW/g





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Date/Time: 07/26/05 15:56:58

Test Laboratory: ESTECH

CH777-LEFT-TOUCH

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 848.31 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.903$ mho/m;

$\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 55%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

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

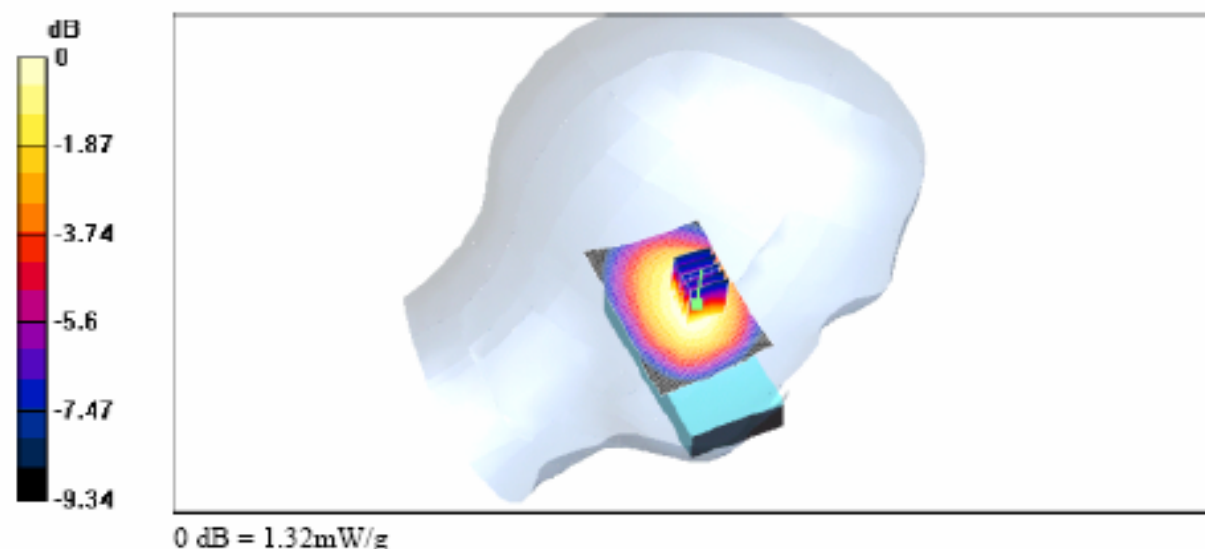
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 30.2 V/m; Power Drift = -0.1 dB

Peak SAR (extrapolated) = 1.7 W/kg

SAR(1 g) = 1.25 mW/g

Maximum value of SAR (measured) = 1.32 mW/g





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Test Laboratory: ESTECH

CH1013-RIGHT-TOUCH

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.879 \text{ mho/m}$;

$\epsilon_r = 40.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22°C, Humidity : 53%

Area Scan (41x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: Interpolated medium parameters used for SAR evaluation!

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

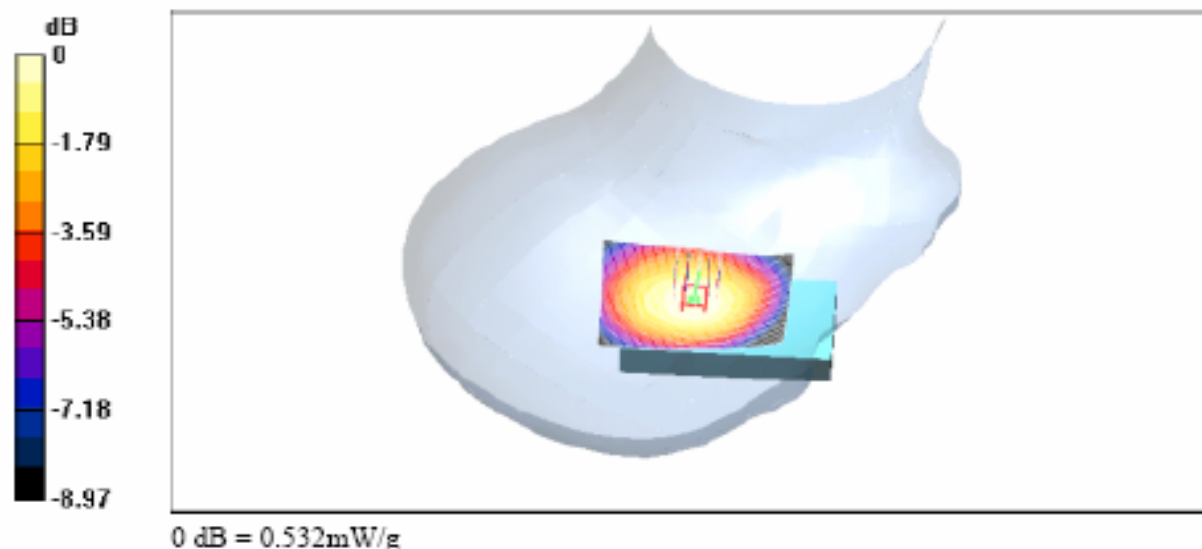
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.2 V/m; Power Drift = -0.1 dB

Peak SAR (extrapolated) = 0.664 W/kg

SAR(1 g) = 0.500 mW/g

Maximum value of SAR (measured) = 0.532 mW/g





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Test Laboratory: ESTECH

CH363-RIGHT-TOUCH

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.891$ mho/m;

$\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation!](#)

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

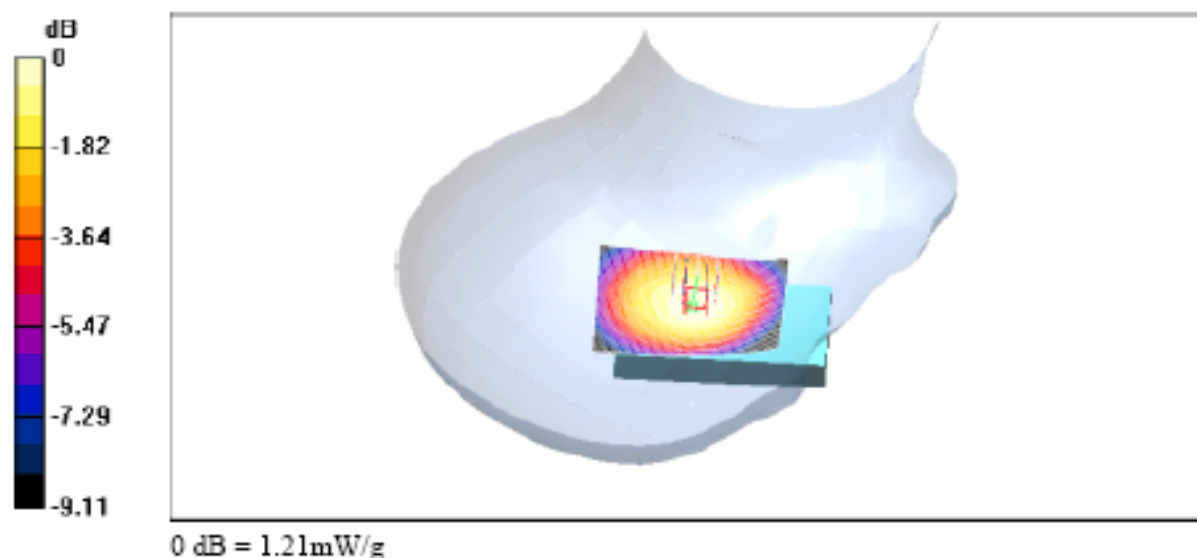
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 28.5 V/m; Power Drift = 0.0006 dB

Peak SAR (extrapolated) = 1.51 W/kg

SAR(1 g) = 1.14 mW/g

Maximum value of SAR (measured) = 1.21 mW/g





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Test Laboratory: ESTECH

CH777-RIGHT-TOUCH

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 848.31 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.903$ mho/m;

$\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 54%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation!](#)

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

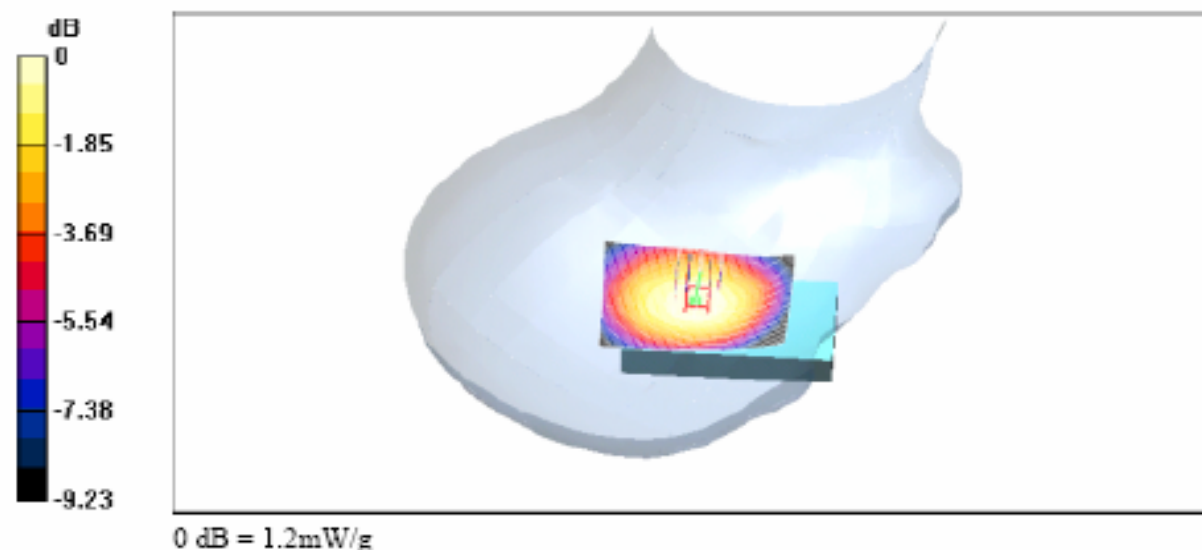
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 29.5 V/m; Power Drift = -0.1 dB

Peak SAR (extrapolated) = 1.53 W/kg

SAR(1 g) = 1.13 mW/g

Maximum value of SAR (measured) = 1.2 mW/g





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Test Laboratory: ESTECH

CH363-LEFT-TILT

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.891$ mho/m;

$\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22°C, Humidity : 45%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.733 mW/g

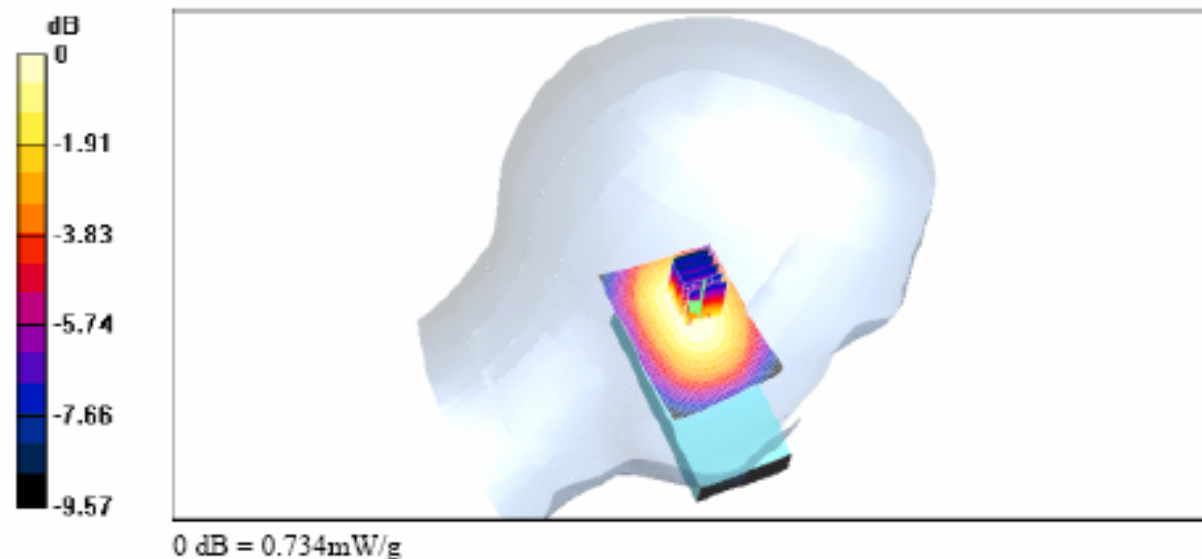
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 27.3 V/m; Power Drift = -0.0 dB

Peak SAR (extrapolated) = 0.910 W/kg

SAR(1 g) = 0.693 mW/g

Maximum value of SAR (measured) = 0.734 mW/g





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Test Laboratory: ESTECH

CH363-RIGHT-TILT

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.891$ mho/m;

$\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 46%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.716 mW/g

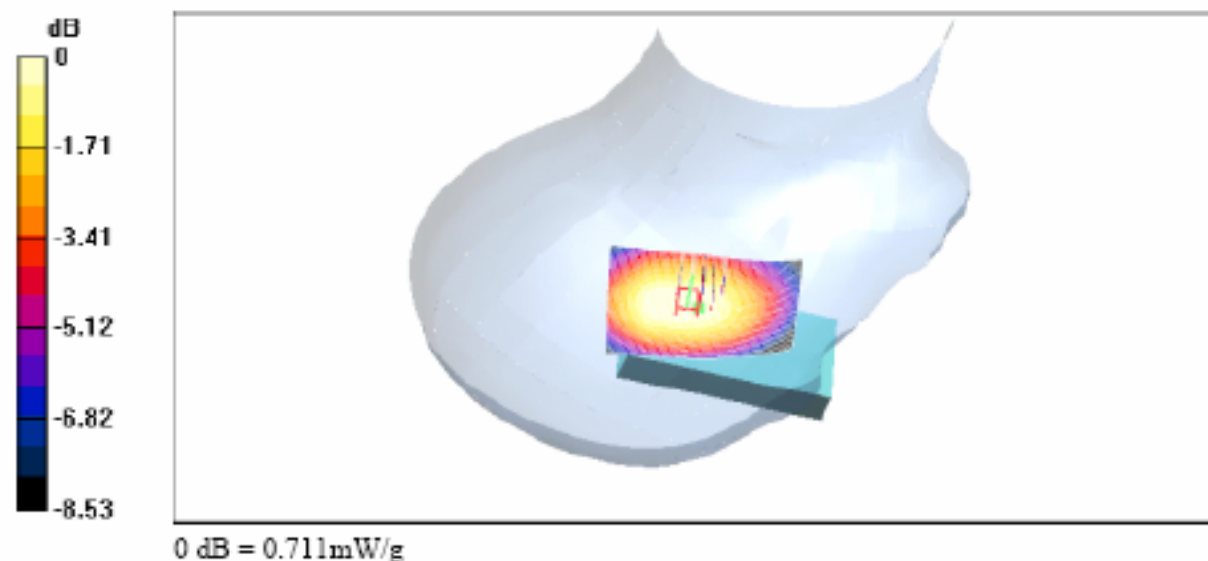
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 26.8 V/m; Power Drift = -0.0 dB

Peak SAR (extrapolated) = 0.891 W/kg

SAR(1 g) = 0.668 mW/g

Maximum value of SAR (measured) = 0.711 mW/g





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Test Laboratory: ESTECH

CH777-LEFT-TOUCH-ZSCAN

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 848.31 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.903$ mho/m;

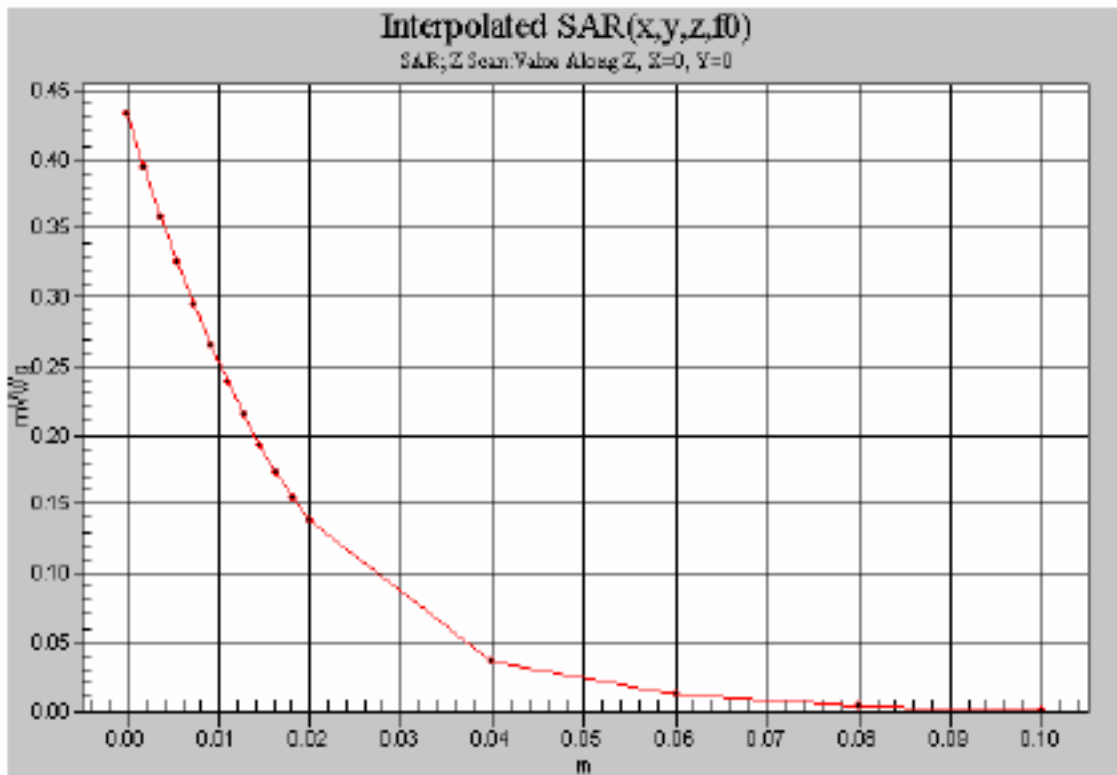
$\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.57, 6.57, 6.57); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 21 °C, Humidity : 55%





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Date/Time: 07/26/05 18:15:11

Test Laboratory: ESTECH

CH1013-BODY

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.946$ mho/m;

$\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.03, 6.03, 6.03); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22 °C, Humidity : 55%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.775 mW/g

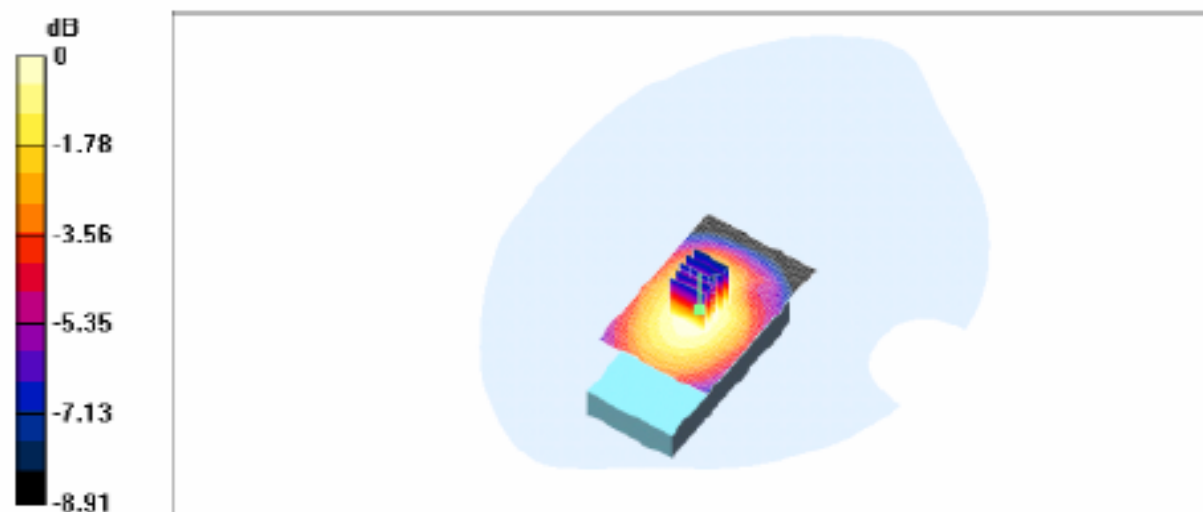
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.6 V/m; Power Drift = -0.0 dB

Peak SAR (extrapolated) = 0.954 W/kg

SAR(1 g) = 0.727 mW/g

Maximum value of SAR (measured) = 0.773 mW/g



0 dB = 0.773mW/g



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Date/Time: 07/26/05 17:40:37

Test Laboratory: ESTECH

CH363-BODY

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.956$ mho/m;

$\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.03, 6.03, 6.03); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22 °C, Humidity : 55%

Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 1.26 mW/g

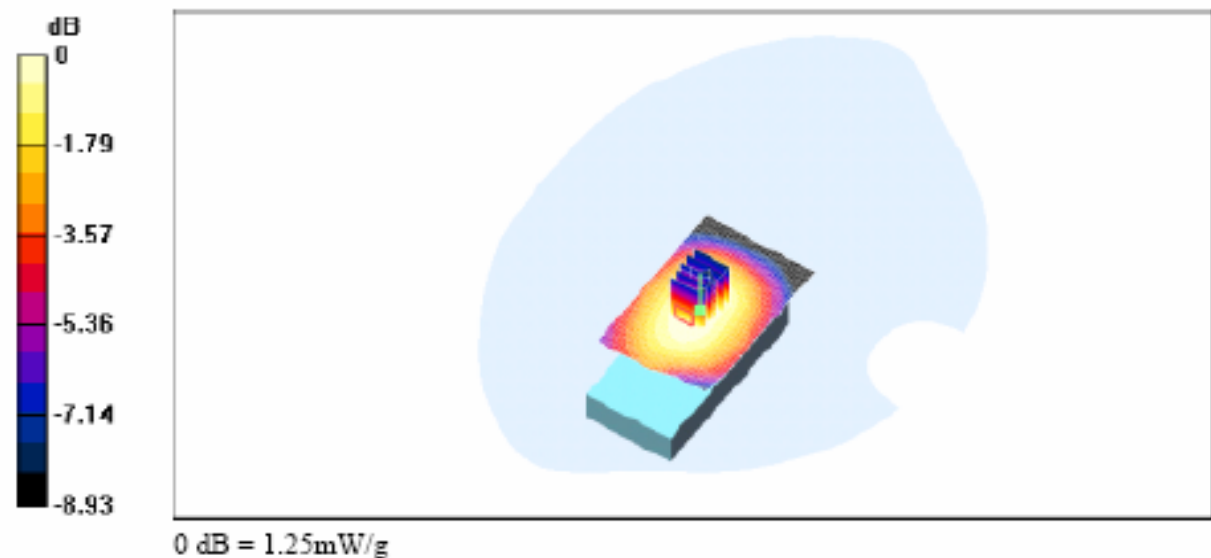
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.5 V/m; Power Drift = -0.1 dB

Peak SAR (extrapolated) = 1.56 W/kg

SAR(1 g) = 1.17 mW/g

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





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Test Laboratory: ESTECH

CH777-BODY

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 848.31 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 848.31 \text{ MHz}$; $\sigma = 0.969 \text{ mho/m}$;

$\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.03, 6.03, 6.03); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22 °C, Humidity : 55%

Area Scan (41x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: Interpolated medium parameters used for SAR evaluation!

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

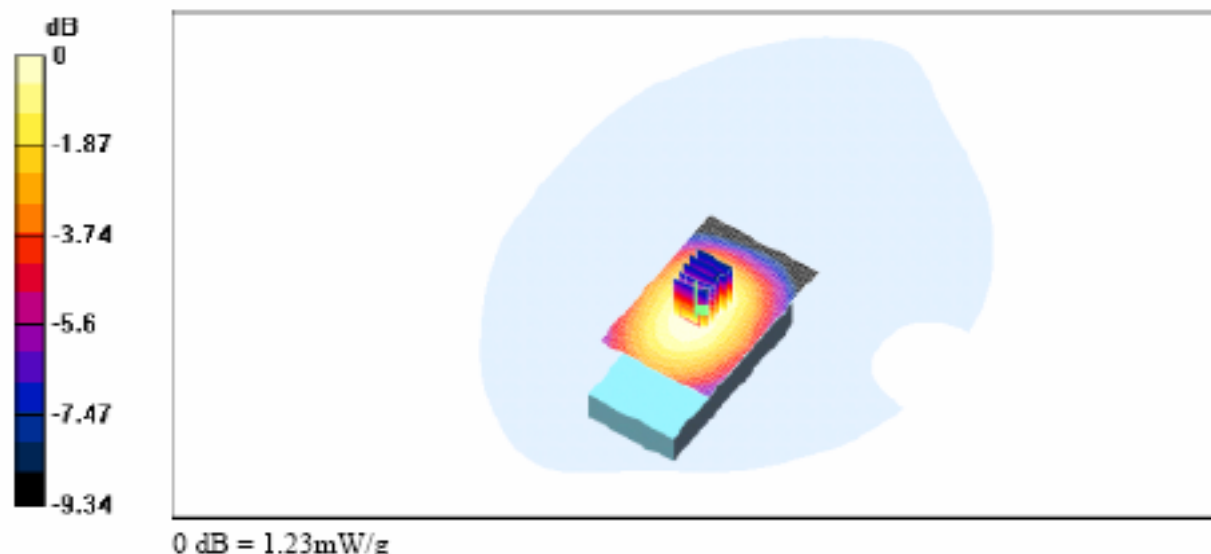
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 22 V/m; Power Drift = -0.2 dB

Peak SAR (extrapolated) = 1.53 W/kg

SAR(1 g) = 1.16 mW/g

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





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Date/Time: 07/26/05 17:40:37

Test Laboratory: ESTECH

CH363-BODY-ZSCAN

DUT: LG-RD6230; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1

Medium: HSL 835MHz Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.956$ mho/m;

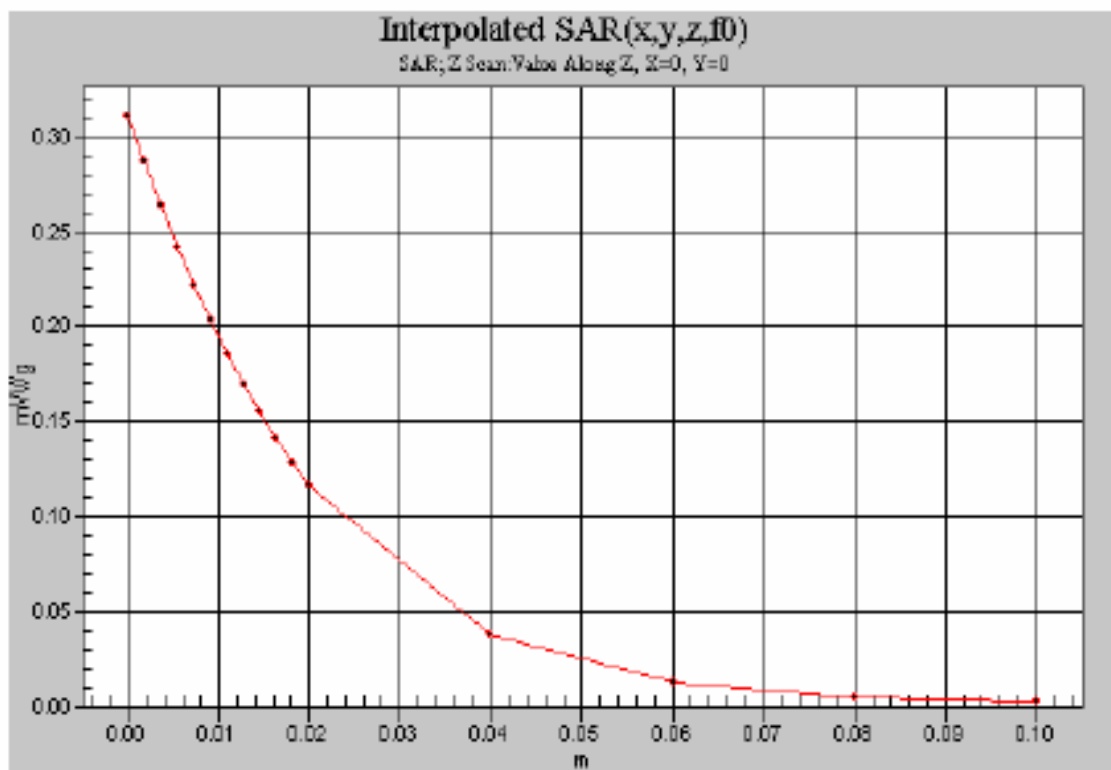
$\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1748; ConvF(6.03, 6.03, 6.03); Calibrated: 2005-01-21
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn551; Calibrated: 2004-04-28
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130
- Temperature : 22°C, Humidity : 55%





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APPENDIX E : Calibration Certificates



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**

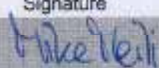
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter 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

Calibrated by:	Name Mika Mesli	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 25, 2005

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

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



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S Servizio svizzero di taratura
S Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY4	V4.5
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 $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	42.2 $\pm$ 6 %	0.91 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	2.25 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 $\pm$ 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 $\pm$ 16.5 % (k=2)

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω - 2.4 j Ω
Return Loss	- 29.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.384 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	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; $\sigma = 0.91$ mho/m; $\epsilon_r = 42.2$; $\rho = 1000$ kg/m³

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

CH1 S11 1 U F5

1:52.414 α -2.3535 α 88.987 pF

835.000 000 MHz

*

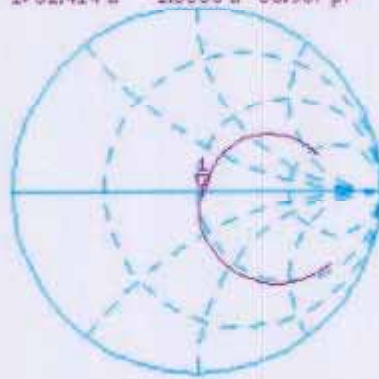
De1

Cor

Avg

16

↑



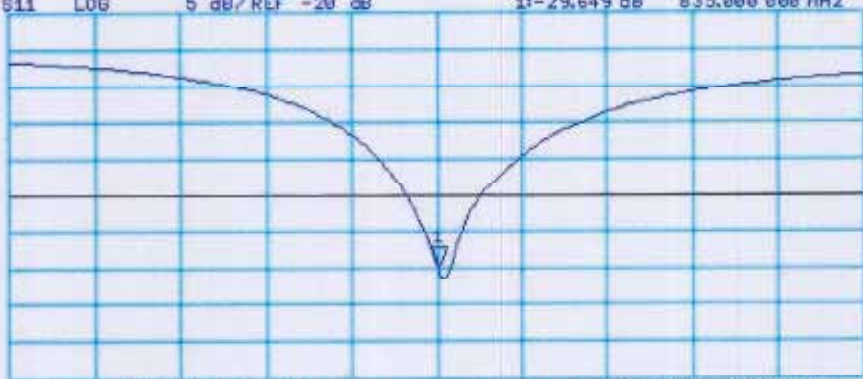
CH2 S11 LOG 5 dB/ REF -20 dB 1:-29.649 dB 835.000 000 MHz

Cor

Avg

16

↑



CENTER 835.000 000 MHz

SPAN 400.000 000 MHz